UNIVERSITY OF NICOSIA

Impact of Military Service on Eating Behaviours, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military

Nicoletta Ntorzi

A thesis submitted to the University of Nicosia
In accordance with the requirements of the degree of
PhD (Doctor of Philosophy) in Nutrition/ Dietetics
School of Life and Health Sciences

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Abstract

Background: The operational effectiveness of the Armed Forces is significantly influenced by the health and fitness of its personnel, which are affected by dietary habits and physical activity. Understanding these factors is crucial for developing effective training and nutrition programs.

Purpose: This study aims to evaluate the dietary habits, nutritional needs, and weight fluctuations of new recruits in the Cyprus Army across three phases of their service (0-6 months, 6-9 months, and 9-12 months). The objective is to align these findings with the General Rule of Food Supply and Dietary Value (DV) guidelines of the Cyprus Armed Forces and propose necessary dietary modifications to prevent weight gain during military service.

Methods: Data were collected from 583 new recruits, including dietary preferences, physical activity levels, and personal metrics (age, height, weight, waist circumference, body composition), along with medical and dietary histories. Assessments were conducted at three key points: upon recruitment, six months later during basic combat training, and immediately before demobilization, twelve months after recruitment. A pilot study was also conducted to validate the methodology.

Results: The study found significant differences between the General Rule of Food Supply and Daily Values (DV) in the Cyprus Armed Forces and the National Dietary Guidelines for Adults. A notable outcome was the increase in body weight and Body Mass Index (BMI) among recruits, with a trend towards higher BMI categories indicating overweight status ($p<0.0001$). The mean BMI increased from 24.89 (SD = 4.12) in the first phase (0-6 months) to 26.01 (SD = 4.78) in the third phase (9-12 months). Similarly, the mean body fat percentage increased from 17.89% (SD = 6.45%) to 19.12% (SD = 6.89%) over the same periods. The study also observed that recruits generally failed to follow dietary guidelines before, during, and after their recruitment period.

Conclusion: The findings suggest that comprehensive dietary adjustments are required across the military command to optimize the nutritional status and health of soldiers. Implementing targeted interventions during the early months of service could promote healthy body composition and improve overall fitness levels.

Keywords: Dietary habits, Physical activity, BMI, Food supply guidelines, Cyprus Armed Forces, Nutritional needs, Weight management, Military health.

Περίληψη

Ιστορικό: Η επιχειρησιακή αποτελεσματικότητα των Ενόπλων Δυνάμεων επηρεάζεται σημαντικά από την υγεία και τη φυσική κατάσταση του προσωπικού τους, οι οποίες επηρεάζονται από τις διατροφικές συνήθειες και τη σωματική δραστηριότητα. Η κατανόηση αυτών των παραγόντων είναι κρίσιμη για την ανάπτυξη αποτελεσματικών προγραμμάτων εκπαίδευσης και διατροφής.

Σκοπός: Η παρούσα μελέτη στοχεύει στην αξιολόγηση των διατροφικών συνηθειών, των διατροφικών αναγκών και των διακυμάνσεων του βάρους των νέων στρατιωτών στον Κυπριακό Στρατό κατά τη διάρκεια τριών φάσεων της υπηρεσίας τους (0-6 μήνες, 6-9 μήνες και 9-12 μήνες). Ο στόχος είναι να ευθυγραμμιστούν αυτά τα ευρήματα με τον Γενικό Κανόνα Εφοδιασμού Τροφίμων και τις Κατευθυντήριες Αξίες Διατροφής (DV) των Κυπριακών Ενόπλων Δυνάμεων και να προταθούν οι απαραίτητες διατροφικές τροποποιήσεις για την πρόληψη της αύξησης του βάρους κατά τη διάρκεια της στρατιωτικής υπηρεσίας.

Μέθοδοι: Συλλέχθηκαν δεδομένα από 583 νέους στρατιώτες, συμπεριλαμβανομένων των διατροφικών προτιμήσεων, των επιπέδων σωματικής δραστηριότητας και των προσωπικών μετρήσεων (ηλικία, ύψος, βάρος, περίμετρος μέσης, σύσταση σώματος), καθώς και των ιατρικών και διατροφικών ιστορικών. Οι αξιολογήσεις πραγματοποιήθηκαν σε τρία βασικά σημεία: κατά την πρόσληψη, έξι μήνες αργότερα κατά τη διάρκεια της βασικής εκπαίδευσης μάχης και αμέσως πριν από την αποστράτευση, δώδεκα μήνες μετά την πρόσληψη. Διεξήχθη επίσης μια πιλοτική μελέτη για την επικύρωση της μεθοδολογίας.

Αποτελέσματα: Η μελέτη βρήκε σημαντικές διαφορές μεταξύ του Γενικού Κανόνα Εφοδιασμού Τροφίμων και των Καθημερινών Αξιών (DV) στις Κυπριακές Ένοπλες Δυνάμεις και των Εθνικών Κατευθυντήριων Γραμμών Διατροφής για Ενήλικες. Ένα αξιοσημείωτο αποτέλεσμα ήταν η αύξηση του σωματικού βάρους και του Δείκτη Μάζας Σώματος (BMI) μεταξύ των στρατιωτών, με μια τάση προς υψηλότερες κατηγορίες BMI που υποδεικνύουν κατάσταση υπέρβαρου ($p<0.0001$). Ο μέσος BMI αυξήθηκε από 24.89 (SD = 4.12) στην πρώτη φάση (0-6 μήνες) σε 26.01 (SD = 4.78) στην τρίτη φάση (9-12 μήνες). Ομοίως, το μέσο ποσοστό σωματικού λίπους αυξήθηκε από 17.89% (SD = 6.45%) σε 19.12% (SD = 6.89%) κατά τις ίδιες περιόδους. Η μελέτη παρατήρησε επίσης ότι οι στρατιώτες γενικά δεν ακολουθούσαν τις διατροφικές κατευθυντήριες γραμμές πριν, κατά τη διάρκεια και μετά την περίοδο της πρόσληψής τους.

Συμπέρασμα: Τα ευρήματα υποδεικνύουν ότι απαιτούνται συνολικές διατροφικές προσαρμογές σε όλη τη στρατιωτική διοίκηση για τη βελτιστοποίηση της διατροφικής κατάστασης και της υγείας των στρατιωτών. Η εφαρμογή στοχευμένων παρεμβάσεων κατά τους πρώτους μήνες της υπηρεσίας θα μπορούσε να προάγει την υγιή σύσταση σώματος και να βελτιώσει τα συνολικά επίπεδα φυσικής κατάστασης.

Λέξεις-κλειδιά: Διατροφικές συνήθειες, Σωματική δραστηριότητα, BMI, Κατευθυντήριες γραμμές εφοδιασμού τροφίμων, Κυπριακές Ένοπλες Δυνάμεις, Διατροφικές ανάγκες, Διαχείριση βάρους, Στρατιωτική υγεία.

Dedication

To my treasures, Fedon and Myronas

and

To the memory of my father Apostolos

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Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Nicosia. This thesis has been composed solely by myself except where stated otherwise by reference or acknowledgment. It has not been previously submitted, in whole or in part, to this or any other institution for a degree, diploma or other qualifications.

Signed …Nicoletta Ntorzi…….. Date …13/6/2024……

DECLARATION

This dissertation/thesis (please circle one) is submitted in partial fulfilment of the requirements for the University of Nicosia University Degree of __PhD (Doctor of Philosophy) in Nutrition and Dietetics___________
The regulations for the degree are set out in the University of Nicosia Calendar and are elaborated in a practice manual known as House Rules for the Study of Doctor of Philosophy or Masters Degrees at University of Nicosia.

Supervisor's Declaration

I confirm that, to the best of my knowledge:
√☐ the research was carried out and the dissertation was prepared under my direct supervision;
☐ except where otherwise approved by the Academic Administration Committee of University of Nicosia, the research was conducted in accordance with the degree regulations and house rules;
☐ the dissertation/thesis (please circle one) represents the original research work of the candidate;
☐ the contribution made to the research by me, by other members of the supervisory team, by other members of staff of the University and by others was consistent with normal supervisory practice.
☐ external contributions to the research are acknowledged. (Delete if not applicable)

Supervisor ________Eleni P Andreou________ Date __13/6/2024____________

Candidate's Declaration

I confirm that:
√ this dissertation/thesis (please circle one) represents my own work;
√ the contribution of any supervisors and others to the research and to the dissertation/thesis (please circle one) was consistent with normal supervisory practice.
√ external contributions to the research are acknowledged. (Delete if not applicable)
Candidate ________Nicoletta Ntorzi________________ Date _______13/06/2024________________

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In this case, please set out on a separate page information on:
☐ which sections have been submitted, which have been accepted and which have appeared;
☐ which journals they have been submitted to;
☐ who are the co-authors.
Candidate ____________________ ____________________ Date _____________________
Supervisor ____ Date ______________________________

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Abbreviation Index

AHEI	Alternate Healthy Eating Index
AI	Adequate Intake
AMR	Active Metabolic Rate
ANOVA	Analysis of Variance
AR	Average Requirement
ARFS	Australian Recommended Food Score
A.S. Larnaka	Antrea Souroukli in Larnaka A.S. Larnaka
BIA	Bioelectrical Impedance Analysis
BF	Body Fat
BMI	Body Mass Index
BMR	Basal Metabolic Rate
CHD	Coronary Heart Disease
CHO	Carbohydrates
CO	Central obesity
CVD	Cardiovascular Disease
CyDNA	Cyprus Association of Dietitians and Nutritionists
DGAs	Dietary Guidelines for Americans
DL	Dislipidemia
DP	Dietary Pattern
DRI	Dietary Reference Intakes
DRVs	Dietary Reference Values
DV	Daily Value

EARs	Estimated Average Requirements
EAT	Eating Among Teens
EFSA	European Food Safety Authority
EPIC	European Prospective Investigation into Cancer
EPPM	Extended Parallel Process Model
ER	Energy Requirement
EU	European Union
FAO	Food and Agriculture Organization
FFA	Free fatty acids
FFQ	Food Frequency Questionnaire
FMI	Fat Mass Index
HBP	High Blood Pressure
HDI	Human Development Index
HDL	High Density Lipoprotein
HEI	Healthy Eating Index
HWL	Healthy Weight for Living
IPAQ	International Physical Activity Questionnaire
KDs	Ketogenic diets
LDL	Low Density Lipoprotein
LRNIs	Lower Reference Nutrient Intakes
MBKW	My Body Knows When Program
MDRIs	Military Dietary Reference Intakes
MDRVs	Military Dietary Reference Values

MET	Metabolic Equivalent
MUFA	Monounsaturated Fatty Acids
NC	Neck Circumference
NHANES	National Health and Nutrition Examination Survey
NONT	Non-Operational/Non-Training military personnel
PA	Physical Activity
P.P. Famagusta	Photi Pitta & Dimitraki Christodoulou -Famagusta
PRI	Population Reference Intake
PRO	Protein
RDA	Recommended Daily Allowances
RED-S	Relative Energy Deficiency in Sports
RI	Reference Intake range for macronutrients
RMR	Resting Metabolic Rate
RNIs	Reference Nutrient Intake
SACN	Scientific Advisory Committee on Nutrition
SAFA	Saturated Fatty Acids
SD	Standard Deviation
SOF	Special Operation Forces
TDEE	Total Daily Energy Expenditure
T&O	Training and operational military personnel
T.M. Nicosia	Tassou Markou in Nicosia
UK	United Kingdom
UL	Tolerable Upper intake Level
UPF	Ultra Processed Food

USA	United States of America
USDA	United States Department of Agriculture
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist-to-Hip Ratio
WHtR	Waist-to-Height Ratio

CHAPTER 1 INTRODUCTION

1.0 Introduction

Healthy nutrition is a field that has gained impressive attention the last decades, due to the significance and impact it has on individuals' lives. Healthy diet behaviour is one of the most essential parameters that have an effect on a list of food related illnesses and morbidities which are likely to show in the person's lifetime. The term "dietary behaviour" incorporates methods, habits and beliefs regarding to food choice and consumption of the population.

Moreover, this thesis focuses on the correlation between dietary habits and physical activity of the Armed Forces in Cyprus. The latter is based on the notion and the fact that the fighting strength of the Armed Forces depends not only on the expertise and the value of training, but also on the good health of the young soldiers.

The unique environment of military service poses distinct challenges and stressors that can influence the health behaviors of soldiers, particularly in terms of nutrition and physical fitness. This narrative review explores how military service impacts soldiers' eating behaviors, body weight, and body fat, integrating findings from various studies to provide a comprehensive understanding of these dynamics within military populations, specifically focusing on the Cyprus military as a case study. (Smith, D. & Lee, J. 2017).

The physical demands of military training initially promote improved physical fitness and body composition. However, as soldiers progress in their careers, there is a noticeable shift. Career advancement often leads to less physically demanding roles and potentially more sedentary duties. Combined with the dietary patterns described, this transition can lead to weight gain and increased body fat percentages over time.

Johnson and Anderson's (2018) review supports this, noting that the initial improvements in body composition seen in new recruits often reverse for career soldiers, particularly those in less active roles or those who have adapted to the energy-dense dietary environment with reduced physical activity levels. This trend raises concerns about the long-term health implications for soldiers, especially as they approach retirement and their physical activity levels might decrease further. (Johnsons and Andersons 2018).

The topic explores and calculates the impact of healthy and unhealthy dietary habits related to physical activity. It should not be neglected that young people in this crucial time for their lives are in danger of gaining weight and tend to have unhealthy dietary habits and are likely to be overweight or obese. This factor is alarming and draws the attention, since in modern times the continued increase in overweight and obesity, is making obesity a worldwide problem and the foremost risk factor for many chronic diseases.

As regards to this thesis' topic, the global problem of obesity expanded and deeply affected military world. The worldwide increase of food consumption combined with the decline of daily physical activity have inspired fears about their negative effect of the military population. Excess body fat has been noted to have adverse effects on the performance of military personnel in their activities. On the contrary, healthy body weight, gives stamina, alertness, and overall health that is essential and sine qua non, a prerequisite for the military activities.

1.1 Theoretical Background

In this chapter the main researcher gives the theoretical background necessary to understand the topic. The theoretical background is based on already existing literature in the areas of dietary habits and nutrition in the army. It has been noticed that there is a huge and substantial research gap in literature review regarding to Cypriot military population in the scientific subject of Diet and Nutrition in all aspects generally. Moreover, in this chapter obesity, healthy diet, nutrition and dietary habits in Army and military recruitments globally and over the years will be examined and studied thoroughly.

Military environments typically enforce structured meal times and offer limited food selections, which can significantly influence the eating habits of service members. Studies indicate that these constraints may lead to more regimented eating patterns but also a reliance on readily available, often calorie-dense, processed foods. For example, research conducted by Smith and Lee (2017) highlights that the rigidity of meal schedules in military settings can discourage snacking between meals but may encourage overconsumption during regular meal times due to uncertainty about the next meal's availability (Smith and Lee 2017).

The quality of food offered in military dining facilities also plays a crucial role. While these facilities often aim to provide nutritious options, the palatability and variety of healthier choices can be limited, which might deter their consumption among soldiers who then turn to less healthy alternatives for greater satisfaction. (Smith and Lee 2017). This dietary pattern, characterized by high energy intake and poor nutrient density, is observed consistently across various military cohorts, including those stationed in diverse geographic and operational contexts. (Smith and Lee 2017).

Onwards, in this chapter of introduction the researcher examines the theoretical background, presents the gaps in pertinent research and states the research aims, the objectives, the rationale, as well as the research questions focusing on the novelty and highlighting the significance of the present study.

Addressing these issues requires targeted nutrition interventions that consider both the unique environmental constraints of military life and the specific needs of soldiers at various stages of their careers. Gonzalez and Reynolds (2020) suggest that nutrition education should be a continuous component of military training, not just at the onset of a soldier's career but integrated regularly to adapt to changing roles and health needs (Gonzalez and Reynolds 2020).

Moreover, enhancing the quality and appeal of healthy food options in military dining facilities could help shift dietary habits towards more nutritious choices. Harris et al. (2021) propose that initiatives to improve the nutritional environment in military settings should include regular updates to dining menus, incorporating feedback from soldiers to increase the acceptance and consumption of healthy meals (Harris et al. 2021).

1.2 Aim, Objectives, Rational

Background

There is a notable gap in the scientific literature concerning the diet and nutrition of the Cypriot military population. This thesis specifically focuses on military recruits, aiming to explore their demographic, socioeconomic, and lifestyle behaviors, and how these factors correlate with their nutritional status and health outcomes during their service.

The current study aimed to examine the dietary habits and needs, weight fluctuation and blood sugar and lipid profile of the new recruits in Cyprus Army during their service. The key objective is to aid them comply with the General Rule of Food Supply and Dietary Value (DV) in the Cyprus Armed Forces. Furthermore, to suggest and focus on the alterations and adjustments that are necessary to fill the needs of the soldiers and prevent weight gain during Military Service. As far as we know, there is a huge and substantial research gap in literature review regarding to Cypriot military population in the scientific subject of Diet and Nutrition in all aspects generally. Moreover, this thesis is centered and focused specifically on military recruits.

The primary objective of this study is to analyze the demographic, socioeconomic, and lifestyle behaviors of army recruits in Cyprus. The study aims to link the anthropometric status and nutritional habits of the military population at three stages of examination: entrance, four months, and twelve months.

Additionally, a secondary objective is to examine the prevalence of obesity and overweight among the Cypriot military population. This will be connected to lifestyle and dietary behaviors, including breakfast consumption, fruit and vegetable intake, and physical activity (PA) levels.

The specific research questions to be addressed are:

- Weight Variation: Assess the weight changes of soldiers across the three different periods of the study.
- Nutritional Preferences: Evaluate the modification of soldiers' nutritional preferences throughout their military service.

To examine the possibility of weight gaining inclination after entering the military. The topic of this thesis is in the general area of examination of dietary and nutritional factors related to disease occurrence at a population level. It is focused on the dietary behaviour of the new recruits in Cyprus Army during their service.

1.2.1 Aim

The primary aim of this study is to evaluate the impact of military service on the physical health, eating habits, and nutritional status of soldiers in the Cyprus military. This includes assessing changes in body weight, body composition and nutritional habits throughout their service and identifying the dietary behaviors contributing to these changes.

1.2.2 Objectives

The study is structured around five main objectives:

1. To assess the baseline somatometric indicators (such as body weight, body mass index, body fat percentage) of soldiers at the commencement of their military service.
2. To evaluate the eating behaviors of soldiers before and during military service, focusing on dietary patterns, meal frequency, and food preferences.
3. To identify the prevalence of obesity and overweight among soldiers and any correlation with their service duration and intensity.
4. To examine the role of military training and lifestyle on the nutritional status and health behaviors of soldiers.

1.2.3 Rational

The rationale for this study stems from the need to understand the unique physical and dietary challenges faced by military personnel. The demanding nature of military service, characterized by intense physical training, irregular meal times, and potentially limited food choices, can significantly impact a soldier's health and nutritional status. By identifying these impacts, the study aims to provide insights that could lead to necessary interventions or policy changes to enhance soldier health and performance. Additionally, this study addresses a significant gap in the literature by focusing on the less-studied context of the Cyprus military.

1.3 Research Questions

The research questions are designed to articulate the objectives and help organize the study. The current study aims to answer the following questions:

1. How do somatometric indicators and eating behaviors of soldiers change as a result of military service?
2. What is the impact of military service on soldiers' body weight, body fat percentage, and BMI?
3. How does military service influence the lipid and glycaemic profiles of soldiers?
4. What are the main dietary challenges faced by soldiers during their service, and how do these affect their health?
5. Can any observed changes in somatometric indicators and eating behaviors be directly attributed to aspects of military training and lifestyle?

1.4 Innovative parts of the present study

To our knowledge, studies focused on the dietary habits of military personnel are limited. Moreover, the military context is unique in every country and is a multifactorial issue that requires attention, given the fact that dietary habits are essential for soldiers' performance and health. A literature review reveals a significant gap in research regarding studies focused on military dietary habits.

This study addresses these gaps in research identified through the literature review and aims to advance knowledge in this area. Based on the above, the present research is both original and novel. The following four factors underscore the novelty and necessity of this study:

- Focus on the Cyprus Military: This is the first study to specifically examine the dietary habits, nutritional needs, and weight fluctuations of new recruits in the Cyprus Military. Given that most research in this area has focused on the militaries of larger countries, studying the Cyprus

Military adds new geographical and cultural perspectives to the body of knowledge. This unique focus provides insights that are directly relevant to the Cyprus Armed Forces and can inform tailored interventions.

- Comprehensive Health Assessment: Unlike many previous studies that primarily focus on somatometric indicators such as BMI and weight, this study includes a detailed examination of lipid and glycemic profiles. This comprehensive health assessment provides a deeper understanding of the internal health impacts of military service, offering a more holistic view of soldiers' health.
- Behavioral Analysis: This study goes beyond traditional metrics by investigating eating behaviors in conjunction with physical health metrics. This holistic approach acknowledges the importance of both diet and physical activity in maintaining soldier health. By examining these behaviors, the study provides valuable insights into how dietary habits and physical activity levels interact to influence overall health and performance.
- Longitudinal Aspect: The study design allows for tracking changes over time, providing valuable longitudinal data on how military service impacts health metrics and behaviors. This longitudinal aspect is crucial for understanding the dynamic nature of health and nutrition in a military context and for identifying trends and patterns that may not be apparent in cross-sectional studies.

For all the reasons mentioned above, the innovative aspects of the present study are explicitly demonstrated. By thoroughly examining these aspects, the study aims to contribute valuable insights into the health and nutritional status of soldiers, potentially influencing military policies and practices to support soldier well-being.

1.5 Significance of the Study

<u>Relevance to Public Health:</u>

Military personnel often face unique physical and psychological demands that can significantly impact their eating behaviors, body weight, and body fat. Understanding these impacts is crucial for developing effective health interventions and policies aimed at improving the overall well-being of soldiers.

Contribution to Military Health Research:

This study provides valuable insights into the specific health challenges faced by soldiers in the Cyprus Military. By identifying patterns and correlations between military service and health outcomes, the research can inform targeted strategies to mitigate negative health effects.

Policy Implications:

The findings of this study can be used to inform military health policies and programs. For instance, if certain eating behaviors or weight management issues are identified, the military can implement tailored nutritional programs and physical training regimens to address these concerns.

Broader Implications for Similar Populations:

While the study focuses on soldiers in the Cyprus Military, the results may have broader implications for military personnel in other countries with similar service conditions. This can help in generalizing the findings and applying them to improve the health and fitness of soldiers globally.

Foundation for Future Research:

This study lays the groundwork for future research on the health impacts of military service. By highlighting key areas of concern, it encourages further investigation into the long-term effects of military life on physical health, potentially leading to more comprehensive studies and interventions.

Enhancing Soldier Readiness and Performance:

Understanding how military service affects eating behaviors and body composition can help in designing programs that enhance soldier readiness and performance. Healthy soldiers are more likely to perform better in their duties, which is critical for military effectiveness and operational success.

1.6 Conclusion

Certain conclusions are derived from Chapter 1 as follows:

The theoretical background as presented in the previous paragraphs (section 1.1) highlights the fundamental role of healthy nutrition in the military field. Precisely, dietary habits and needs, weight fluctuation and blood sugar and lipid profile of the new recruits in Cyprus Army during their service.

The study aims to contribute valuable insights into the health and nutritional status of soldiers, potentially influencing military policies and practices to support soldier well-being.

In section 1.2, the aim and the objective are clearly stated as, briefly, the evaluation of the effect of military service on the physical health, eating habits, and nutritional status of soldiers serving in the Cyprus military.

In section 1.3 the research questions were shown, in a few words focusing on somatometric indicators and eating behaviours of soldiers and their relevance with military service, the impact of the latter on soldiers' body weight, body fat percentage, and BMI. Moreover, the impact of military service in the lipid and glycaemic profiles of soldiers is to be examined. Another question has to do with the main dietary challenges of soldiers, the possible impact on their health, and finally whether any assessed changes in somatometric indicators and eating behaviours are directly attributed to aspects of military training and lifestyle.

In section 1.4 the novelty of the present study was discussed, based on four parameters: focus on the Cyprus Military, comprehensive health Assessment, behavioural analysis and longitudinal aspect. For all the above analysed parameters, it is established that the present study is significant, novel and aims to fill the literature gaps in this scientific field.

Furthermore, Chapter 2 reviews the literature surrounding the area of nutrition in the army and military field. Dietary habits, risk of gaining weight, overweight and obesity risk and effect on public health, studies in larger or smaller countries as regards to military world. In a few words, among others, nutrition of soldiers, daily expenditures and requirements were analysed.

Chapter 3 describes thoroughly the methodology followed at all steps of the research. These include the population sample, the instrument and means for data collection, data processing, analysis and synthesis.

Chapter 4 has to do with the outcome of the study. It presents the results, explains, and documents the statistical analysis performed.

In Chapter 5 the results are discussed as a novel piece of knowledge compared to existing knowledge. The author highlights and discusses the conclusions, summarises the strengths and limitations of the study and gives suggestions for future research and policy interventions.

In Chapter 6 the author presents the overall conclusion of the thesis highlighting its implications and contributions to the field.

The impact of military service on eating behaviors, body weight, and body fat is profound and multifaceted. As soldiers transition from active training to less physically demanding roles, the interplay between dietary intake and reduced physical activity becomes increasingly detrimental to their health. Effective interventions must therefore be dynamic, culturally sensitive, and responsive to the evolving needs of military personnel to promote long-term health and operational readiness.

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

World Health Organization (WHO) declares that diet related diseases are categorized in the top ten causes of mortality worldwide. Unhealthy diet and obesity are the basic causes of diet related diseases. Policies have been modified globally from most of the countries to guide people towards better and dietary habits, based on quality of nutrition. (Who 2018, 2021).

The present literature review describes and examines the role of nutrition and the healthy nutritional habits of young people in the General forces. The risk of gaining weight, the emotional and practical and social changes of their lives and their impact on food consuming. Moreover, nutritional adequacy is another factor to be examined since it is necessary for military population. Undoubtedly, it affects greatly military performance and service during training and expeditions (Lutz, Gaffney-Stomberg et al. 2019a).

Globally, recruits are prone and have extra chances of having energy deficit for a long-time span during their initial training. Carbohydrate, protein, fat intake will be reviewed since macronutrients are vital for health. On the whole, micronutrients and their deficiency will be also studied. Additionally, another parameter that should be mentioned and attention is needed to be paid is the fact that gaining weight by recruits is related to their tendency and preference of unhealthy food, (mostly salty snacks or unhealthy snacks with a higher energy density). (Sotello-Diaz et al., 2019).

The literature review investigates the revealed associations of nutrition, physical activity related to overweight and obesity. The literature review was conducted mainly through the platform of University of Nicosia, PubMed platform and through several authorized websites, for instance the website of the Ministry of Defence of Cyprus. The writings (articles, books etc.) used were mostly in English, having publication dates from 2018 onwards. Moreover, several articles were used that basically refer to regulations, laws, reports and vital knowledge that have been published before 2018.

2.1 Theoretical Background

The continued increase in overweight and obesity, is making obesity a worldwide problem (Lobstein, Baur et al. 2004a, White 2018a). According to WHO, since 1975 the prevalence of obesity has tripled, and in 2016 more than 1.9 billion adults were overweight, and from those 650 million were obese. Interestingly, in 2016 more than 41 million of children under the age of five and 360 million of children and adolescents aged between 5-19 years, were overweight or obese. (World Health Organization 2018a).

According to estimations, in the coming years, obesity will be the leading cause for morbidity and mortality globally (Chopra, Galbraith et al. 2002a ; Lepor, Fouchia et al. 2014a). Data which were provided by WHO, inform us that in 2022, 2.5 billion adults were overweight. Of these, 890 million were living with obesity. Furthermore, over 390 million children and adolescents aged 5–19 years were overweight in 2022, including 160 million who were obese (World Health Organization 2021).

Moreover, obesity is the leading risk factor for many chronic diseases such as cardiovascular disease, arterial hypertension (Livingstone, McNaughton 2016a), atherosclerosis, (Gasmi, Mujawdiya et al. 2020a), asthma (Bozkurt Yılmaz, Yılmaz et al. 2019a) and type 2 diabetes (Raghavan, Pachucki et al. 2016a).

Moreover, about 10% of cancer deaths in non- smokers are related to obesity (Zhang, S., Wang et al. 2020a, Danaei, Vander Hoorn et al. 2005).
In addition, to the physical health effects of obesity, it is worth noted the adverse effects of obesity on mental health due to difficulties of daily routines such as difficulties in moving and possible discrimination in their work or school (Gormley, Melby 2020a ; Saxena, Kaur 2015a).

Increased BMI beyond normal, is associated with low self- esteem, especially in adolescents. On the other hand, obese people, after significant weight loss had an important increase of their self-esteem (Gormley, Melby 2020a).

2.1.1. Obesity risk in ages between 18-25

The period from 18-25 years is marked by major and unprecedented social changes in the young person's life. (Nelson, Story et al. 2008). Such important changes are for example moving to their own home, environmental change (due to studies, obligation to military, work), increase of autonomy, and financial independence and responsibly. An important feature of this age is the development of his personal identity, and it is not easy for individuals to adjust and feel comfortable with their body, in case they are overweight or obese (Frost, Hammack et al. 2019).

According to studies, the transition from adolescence to adulthood is associated with increased risk of weight gain since most of individuals eat more when they are upset or anxious and tend to behave emotionally when it comes to food. They eat in order to feel better, and food is often a comfort in difficult situations. (Nelson, Story et al. 2008a, *Weight loss interventions in young people (18 to 25 year olds): a systematic review.* 2010a).

Data given by Add Health Study reveal that only 33,6% of teenagers in USA (which is approximately one to three teenagers) and a minority (12,7%) of young adults follow national recommendations and guidance for physical performance and action (Larson, Chen et al. 2018 ; Gordon-Larsen, Adair et al. 2004). One of the primary reasons for the above mentioned poor physical activity is the fact that young people spend excess time, much more than the recommended time playing video games, surfing on the internet, social media etc. Similar results as the ones by Add Health Study (Larson, Chen et al. 2018; Gordon-Larsen, Adair et al. 2004) are supported by EAT (Eating Among Teens) suggest that the fact that the hours in front of a screen have increased on a daily basis, is discouraging for overall health and physical activity (Larson, Chen et al. 2018 ; Gordon-Larsen, Adair et al. 2004).

Remarkably, a study has shown that increased body weight at the age of 18 (BMI $\geq$ 30) is associated with an increased risk (~50%), of total mortality and myocardial infraction in men aged 45 to 59 years. (Yarnell, Patterson et al. 2000a ; Patterson, Ferrar et al. 2020a) Literature shows a parallel decline in the quality of eating habits with the changes that accompany adulthood. (Yarnell, Patterson et al. 2000a ; Patterson, Ferrar et al. 2020a).

Quality of eating habits is mostly affected by fast paced life, which is reflected on fast food consumption. The latter is strongly associated with body weight gain, appears to increase significantly at ages 20-39 years old (Powell, Nguyen 2013a).

Body weight gain is recorded as it is mentioned above, while breakfast consumption is reduced (Niemeier, Raynor et al. 2006a ; Koca, Akcam et al. 2017a). An increase is also observed in the consumption of sugary soft drinks at these ages (Garcia Ashdown-Franks, Vancampfort et al. 2019a).

It is worth noting that there is a decrease in fruit and vegetable consumption in young ages. Data from the NHANES show that most young adults (ages 20-29) consume less than one serving of fruits and vegetables per day (*Consumer segmentation based on the level and structure of fruit and vegetable intake: an empirical evidence for US adults from the National Health and Nutrition Examination Survey (NHANES) 2005–2006.* 2011). Similar results were shown by the EAT Project, where fruit and vegetable consumption were decreased by 0.7 portions in the same age group (Watts, Berge et al. 2018a).

Additionally, data from the Bogalusa Heart Study showed reduced consumption of fruit, juice and milk by young adults compared to childhood, as well an increase in consumption of salty snacks (Fortune, Harville et al. 2019a).

Besides the increase of caloric intake, a decline in physical activity is another reason that leads to obesity. Findings from the Add Health Study, show that only 33.6% of US adolescents follow the national guidelines for physical activity and exercise and only 12.7% of young adults (Larson, Chen et al. 2018a, Gordon-Larsen, Adair et al. 2004a). Similar findings were supported by the EAT (Eating Among Teens) Study showing an increase of computer time from 10.4 hours/ week to 14.2 hours per week in boys from 16-20 years (Yoon, Mason et al. 2020a).

The global problem of obesity cannot leave military unaffected. The worldwide increase of food consumption and the decline of daily physical activity have raised fears about their negative impact on the military world. The latter is planning strategies and trainings based on the optimal health and strength, as well as endurance of recruits (Popper, S. E., Yourkavitch et al. 1999 ; Nolte, Franckowiak et al. 2002a).

It is obvious that increased body fat has been shown to have adverse effects on the performance of military personnel in their activities. Based on data given, individuals with extra body fat were having serious difficulties, since extra weight makes them feel uncomfortable when they were in an expedition and they were given the command to run, let alone undertake missions that need great physical condition. On the contrary, healthy body weight gives stamina, alertness, is a boost in confidence and overall health that is required for the military activities (Powell, Nguyen 2013a).

According to Naghii (2006), good fitness is reflected in productivity, the quality of the outcome, and even the ability to survive on the battlefield. On the whole, military field is connected with the concept of surviving and being able to achieve great performance. It is not easy to be strong enough to face the challenges of a combat (Naghii 2006 ; Kessler, Heeringa et al. 2013a).
Briefly, military performance is correlated with body performance and excess body fat hinders and causes anxiety in the military world.

2.2 The role of nutrition during military service and the key points of nutritional factors for performance

Even though it is widely known that nutrition is one of the most essential elements in peoples' lives, since it affects physical and mental health and psychology, obesity is a worldwide problem (Lobstein, Baur et al. 2004b ; White 2018). A continued increase in affrighting rate in overweight and obesity is noted (Ataey, Jafarvand et al. 2020 ; Okati-Aliabad, Ansari-Moghaddam et al. 2022), according also to World Health Organization (WHO 2021).

Also, in 2016 more than 41 million of children under the age of five and 360 million of children and adolescents between 5-19 years old were either overweight or obese (World Health Organization 2018b). It is estimated that in years to come, obesity will be the leading cause for morbidity and mortality globally (Chopra, Galbraith et al. 2002b). Moreover, according to other assessments, given the escalating number of obese people, it is estimated that they will reach 537 million by 2030 (Hosseini-Amiri, Aliyari et al. 2018). Especially for adults, another calculation indicates that obese and overweight adults might extend to 2.7 billion adults in 2025 (Malkawi, Meertens et al. 2018).

Ataey et al. (2020) highlight that obesity is considered as one of the most superior health menaces globally. Their study attempted to examine the correlation between obesity and overweight and Human Development Index (HDI) and its mechanisms. The study concludes, firstly to the fact that obesity is affiliated with gender, since it was notably higher among women compared to men, while the overall national index per head was revealed to be notably higher for men compared to women ($p<0.05$), and secondly to the presence of an essential positive link (Cole, T. J., Faith et al. 2005) between HDI and obesity (Ataey, Jafarvand et al. 2020).

Based on WHO categorization, overweight and obese are considered individuals with a body mass index (BMI) between 25 and 30 and more than 30, respectively. (World Health Organization, 2021).

In addition, obesity is considered as the main risk factor for many chronic diseases, like arterial hypertension (Livingstone, McNaughton 2016b), cardiovascular disease (Rippe, James, Angelopoulos 2016) - association with cardiovascular risk expands to all ages (Rosário Rosário, Maria João Martins 2020). Type 2 diabetes (Raghavan, Pachucki et al. 2016b), atherosclerosis (Gasmi, Mujawdiya et al. 2020b), asthma (Bozkurt Yılmaz, Yılmaz et al. 2019b), coronary heart disease, cerebral vasculopathy, gallbladder lithiasis, arthropathy, ovarian polycytosis, sleep apnea syndrome, and some neoplasms hemodynamic, endothelial, or inflammatory disorders (Wan, Wang et al. 2020) and several types of cancer (Ataey, Jafarvand et al. 2020).

It should not be omitted that about 10% of cancer deaths in non- smokers are related to obesity (Zhang, S., Wang et al. 2020b).

In addition to the above-mentioned consequences of obesity, dull quality of life, decreased work productivity and joint and back disorders should be enlisted, since they have negative consequence on population. The latter issue is related to the fact that in modern world sedentary life increases health problems and abnormalities. (Malkawi, Meertens et al. 2018). After smoking, which is the first agent for premature mortality globally, obesity is the second cause for it (BANJEVIC, POPOVIC et al. 2020).

It should not be neglected that obesity has pathogenesis and is treated as a disease and even though numerous campaigns are conducted to fight obesity, numbers reveal that obesity is pervasive and invincible (Lorenzo, Gratteri et al. 2019).

Another interesting fact is the unreasonable and yet not well explained connection between overweight and short-term mortality. This phenomenon is defined as 'the obesity paradox' (Plečko, Bennett et al. 2021).
A combination of various parameters leads to obesity, like metabolism, genetics, socioeconomic status, environmental and behavioural parameters (Oussaada, van Galen et al. 2019).

Moreover, it should not be ignored that obesity evolves from the interconnection linking genotype and environment. It is a fact that overweight and obesity can occur simultaneously, since an obese human body is also overweight (*The practical guide [electronic resource]: identification, evaluation, and treatment of overweight and obesity in adults / National Institutes of Health, National Heart, Lung, and Blood Institute [and] North American Association for the Study of Obesity.* 2000).

The increase of obesity at an alarming rate is found especially in the affluent and industrialized countries, but it should be noted that all people no matter where they live, face this disease to some extent (BANJEVIC, POPOVIC et al. 2020). Numerous reasons are involved, such as luck of exercise combined with sedentary lifestyle, fast pace and exhausting way of life which causes stress. The latter is combined with over-eating, exaggeration in the use of commercially processed food, preference for fast food, diet high in calories, including elevated levels of sugar and fat. According to Banjevic et al. (2020), obesity is caused among others by the combination of insertion in nutrition food with high-energy amount and saturated fat that goes along with more and more inactive people in all ages. Undoubtedly, the body figure, strength and soldiers' healthiness is basic element, due to the relevance between the level of defence and safety of people and the level of recruitment capacity (BANJEVIC, POPOVIC et al. 2020).

It is worth mentioning that individuals recruited in the Armed Forces are a diverse group, with different individualities and basic needs. In Banjevic et al. (2020) study, the sample involved five anthropometric measures, which were required to estimate two resulting body composition parameters: Body Mass Index (BMI) and Body Fat Percentage (FAT %) (BANJEVIC, POPOVIC et al. 2020). The methodology of evaluating was based on the one-way ANOVA and Post Hoc test with Taki's model (Rouder, Engelhardt et al. 2016).

ANOVA (Analysis of Variance, is a statistical test used to analyse the difference between the means of more than two groups) (Weissgerber, Garcia-Valencia et al. 2018). Results of the study manifest that the body composition of Montenegrin soldiers shows a firm distinctiveness as opposed to other national military forces, since variances are shown in body composition parameters between Montenegrin soldiers and corps of other countries. This circumstance increases the issues of Montenegrin characteristic when it comes to body composition, mutually in general terms and in terms of distinguishing within specialized professional vocations (BANJEVIC, POPOVIC et al. 2020).

To conceptualize obesity, the most widespread form of obesity is *common obesity*, which is a complex disease caused by a combination of genetic and environ-mental risk factors (Eckdahl 2019).

Obesity in modern world is considered as a plaque, but the concept of it goes back in time and reaches the Palaeolithic era, and the famous Venus of Willendorf. Art of all times has been an indicator of common trends and beliefs. Obesity is banned by physicians for obvious reasons and almost condemned by today's society. Having as datum that obesity is a multifactorial problem and people are trying hard to fight it, Palaeolithic humans had another conception and point of view, the opposite opinion of the ideal female form. Nevertheless, it is without any doubt that Venus of Willendorf is evidence that obesity is a fact for several millennia. (Seshadri 2012).

On a bigger point of view, it is evident that most of the factors that endure the contemporary obesogenic world are the outcome of multiple correlative parameters, such as: built environment, transportation, agricultural regulations, global food market (Caballero 2019).
It is a fact that obesity greatly affects mental health, since it causes difficulties of daily routines, like difficulties in moving and possible discrimination in peoples' work or school (Saxena, Kaur 2015b ; Gormley, Melby 2020b).

The obesity trend is mostly alarming in children and adolescents and imposes a huge burden of illness and diseases (Branca, Nikogosian et al. 2007).

In an attempt to analyse the effectiveness of interventions using the World Health Organization Health Promoting Schools (HPSs) framework approach in increasing physical activity (PA) and improving the diet of 11–18-year-olds. According to a systematic review led by the National Health Services Centre for Reviews and Dissemination framework, some evidence is found that interventions are useful and healthy and quality is essential in adolescents' nutrition, combined necessarily with physical activity (McHugh, Hurst et al. 2020).

As it comes to young people, especially adolescents, increased BMI beyond normal, is affiliated with low self- esteem. Young people nowadays feel very uncomfortable with their body in cases of overweight and obesity. They have the wrong impression that people will not be able to love them and they do not deserve a great job or a decent, normal relationship (Gormley, Melby 2020a). According to studies, people in larger bodies face weight stigma among young people. Weight stigma is defined as the discriminatory acts and ideologies targeted towards people because of their weight and size. Weight stigma is related to weight bias connected to the negative ideologies associated with obesity (Pearl 2020).

All this pressure and social discrimination has consequences: their self-worth depends dramatically on their weight (Ferdinands, McHugh et al. 2021). Quite the opposite, obese people, after significant weight loss really improved their self-esteem, a fact that had a great impact on their life (Gormley, Melby 2020b).

Huge and unprecedented social changes occur in the young person's life during the period from 18 to 25 years old. In example, they experience important changes, like moving to their own home, or environmental changes (due to work or studies, obligation to military). All these dramatic changes lead to increase of autonomy, which goes along with financial independence and responsibly. A fundamental feature of this age is the development of his personal identity (Frost, Hammack et al. 2020).

Studies reveal that the transition from adolescence to adulthood is affiliated with increased risk of weight gain. (Nelson, Story et al. 2008b) It is remarkable that as regards to Yarnell at al. (2000) and Patterson et al. (2020) increased body weight at the age of 18 (BMI $\geq$ 30) is related to an increased risk (~50%), of total mortality and myocardial infraction in men aged 45 to 59 years (Yarnell, Patterson et al. 2000b ; Patterson, Ferrar et al. 2020b).

Literature shows an analogous decline in the quality of eating habits with the changes that go along with adulthood (Patterson, Ferrar et al. 2020b). Fast food consumption, which is closely related to body weight gain, appears to strongly increase at ages 20-39 years while breakfast consumption is actually reduced. An increase is also noted in the consumption of sugary soft drinks at these ages (Garcia Ashdown-Franks, Vancampfort et al. 2019b ; Powell, Nguyen 2013b).

Other than the increase of caloric intake, another factor that causes obesity is a decline in physical activity. According to the Add Health Study, only 33.6% of US adolescents and a minority of 12.7% of young adults follow the national guidelines for physical activity and exercise (Larson, Chen et al. 2018b ; Gordon-Larsen, Adair et al. 2004b). Similar outcome was supported by the EAT (Eating Among Teens) Study, pointing out a worthy to notice increase of computer time from 10.4 hours/ week to 14.2 hours per week in boys from 16-20 years (Larson, Chen et al. 2018; Gordon-Larsen, Adair et al. 2004).

Moreover, O'Kane, Murphy et al. (2022) discuss that even though the positive consequences of consistent physical activity are widely known (better physiological and mental health for adolescents, improved fitness and cardiometabolic health, increased muscle and bone strength and lessened risk of obesity), many adolescents (81%) worldwide fail to reach physical activity recommendations. Physical activity levels drop as children become adolescents and it is likely to affect the possibility of future chronic health issues. It is evident that parental collaboration and friendship affects adolescents' attitude towards physical activity, since friends play an important role in adolescents' mind setting, attitudes, and beliefs. They have a strong tension to mimic and do what their friends do. Moreover, effective interventions are needed, to aid adolescents stay active and improve their physical condition (O'Kane, Murphy et al. 2022).

Also, young people tend to neglect healthy nutrition, since a decrease in fruit and vegetable consumption in young ages was noted. Finds from the National Health and Nutrition Examination Survey (NHANES) show that most young adults (ages 20-29) eat less than one serving of vegetables and fruits per day (Consumer segmentation based on the level and structure of fruit and vegetable intake: an empirical evidence for US adults from the National Health and Nutrition Examination Survey (NHANES) 2005–2006. 2011).

Relatively, the EAT Project shows related results: specifically, fruit and vegetable consumption were decreased by 0.7 portions in the same age group (Watts, Berge et al. 2018b). Moreover, data from the Bogalusa Heart Study indicate a reduction in fruit, milk and juice consumption by young adults in comparison to childhood. On the contrary, an increase in consumption of salty snacks is noted (Fortune, Harville et al. 2019b).

In contemporary discussions, carbohydrates are frequently implicated in contributing to excess fat intake. Despite various interventions, the success rate of obesity treatments remains notably low. Food addiction has been identified as a potential underlying etiological factor with therapeutic implications. Lennerz et al. (2018) reviewed the relevant literature on food addiction, particularly focusing on the role of high-glycemic-index carbohydrates in triggering addictive symptoms (Lennerz et al. 2018).

Three key factors support the concept of food addiction:

1. Behavioral Responses: Behavioral responses to certain foods are similar to those observed with substances of abuse.

2. Neurobiological Circuits: The regulation of food intake and addiction involves similar neurobiological circuits.

3. Neurochemical and Brain Activation Models: Individuals suffering from obesity or addiction exhibit comparable neurochemical and brain activation patterns.

High-glycemic-index carbohydrates cause rapid changes in blood glucose and insulin levels, which are similar to the pharmacokinetics of addictive substances. This effect on the body and brain is akin to the impact of drugs. Sugar can induce addiction-like cravings, and self-reported problem foods are often rich in high-glycemic-index carbohydrates. According to Lennerz et al. (2018), food addiction is a plausible etiological factor influencing obesity (Lennerz et al. 2018).

Trying to analyse the leading factors and the causes of obesity, conclude that obesity is definitely a contemporary problem. Another study that attempts to investigate the reasons for obesity focuses on the interconnection between nutrition and specifically carbohydrates and obesity.

The specific study conducted by Hawkings (2021) highlights that Europeans colonized Pacific region from the early 19th century. Subsequently, New Zealand Māori were familiarized to European diet and nutritional patterns, a fact that has increased over the last 150 years. Data reveal the prevalence of obesity and the comorbidities and risks linked with obesity among New Zealand Māori worriers-soldiers (Hawkins 2021).
Precisely, obesity has evolved into an essential issue in New Zealand after the colonisation and the use of European food, potatoes and wheat for instance.
According to valid data, in 2012, New Zealand was the third most obese nation according to the Organisation for Economic Co-operation and Development (OECD). Figure 1 reveals statistics for the escalation of obesity between 1977 and 2012.

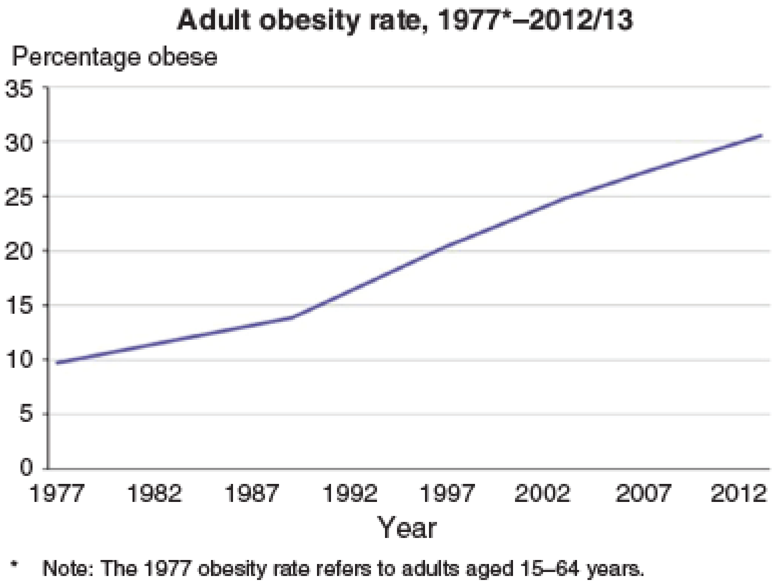

Figure 1.: New Zealand obesity numbers 1977–2012 for worriers. Understanding Excess Body Weight: New Zealand Health Survey. Ministry of Health 2015, Wellington.

(Hawkins 2021)

Hawkings also refers to the fact that Māori, before European colonisation, had no problem with obesity. Their dietary habits were based on fruits and vegetables. They cultivated vegetables and were probably having nutritional status low in carbohydrates. Since the establishment of the low-fat, high-carbohydrate dietary recommendations in the decade of 1970, a huge and unprecedented expansion in obesity was recorded. Conclusively, it is suggested that a useful tool to combat obesity is likely to be a diet concluding more whole, unprocessed foods, low in CHO (low carbohydrate healthy fat (LCHF) eating) (Hawkins 2021).

Military world faces new challenges affiliated with this globally rising trend of obesity. The effects of the plaque called obesity are noted in hindering the recruitment and maintenance of military manpower (Malkawi, Meertens et al. 2018). Undoubtedly, the global problem of obesity affects military. The increase of food consumption all over the world and the decline of daily physical activity have led to fears about their negative impact of the military world (Popper, Stephen E., Yourkavitch 1999 ; Nolte, Franckowiak et al. 2002b). According to a systematic review and meta-analysis about the prevalence of overweight and obesity among Iranian military personnel, conducted by Salimi et al. (2019), there is a high prevalence of overweight and obesity in the military personnel as a high-risk occupational group (Salimi, Taghdir et al. 2019).

New cross-sectional research in France indicated that 49% of French adults of the military personnel were classified as overweight and 17% as obese. Precisely, the research examined the prevalence of overweight and obesity among the French Armed Forces, focusing on the consequences on the army's operative response and military's capability to complete the demanding tasks or missions. Among the methods were an anonymous questionnaire, while the participants were 1,589 active-duty members serving in units reporting to the South-Eastern French Regional Military Health Department. The dominance of overweight recorded as 38,7% and 10% obese. Moreover, mean waist circumference was 78.2 ± 9.1 cm for females and 89.1 ± 10.5 cm for males. 33,3% of women military recruits and 20% of men military recruits calculated a measure bigger related to the standard International Diabetes Federation. Fewer than 5% of the study participants noted an identification of comorbidities: diabetes 2%, high blood pressure 1%, and dyslipidemia 1.5% (Quertier, Goudard et al. 2022).

Undoubtedly, obesity has negative effects in the French Army, and in all armies globally. Even though, comparing with the other Western Armies, the predominance of obesity seems to be in lower levels. Interestingly, in comparison to the general French people, less obesity and overweight in the French Armed Forces is recorded. The French study concludes that recruitment standards, military job-related activity, and a compulsory excessive level of physical fitness are the possible reasons for the different proportions of overweight and obesity (Quertier, Goudard et al. 2022).

2.3 Nutrition and the Army

Proper nutrition is vital for military personnel as it greatly influences their performance during both training and operational activities. Furthermore, a key aspect of health is maintaining good nutritional status, which is essential for having a force that is ready for missions. These factors are given high priority (Lutz, Gaffney-Stomberg et al. 2019a).

According to new approaches, based actually on the previous ones, diet and nutrition are vital constituents and reflect holistic theories about health, and the adequacy to meet the special military needs in military forces. This view is highlighted in the escalated inter-disciplinary filed of military nutrition research (Karl J. Philip, Margolis Lee et al. 2021).

Moreover, in extreme periods and situations of excess demand, war for instance, quality and nature of food is fundamental for the outcome of the fight and war in general (GREGORY, WAYNE 2020).

At a global level, army recruits have great possibility to have energy deficit for a long period during their initial training, with greater deficits in carbohydrate intake, in comparison to other macronutrients. (Baker, Cooke et al. 2020).

On the other hand, another factor that should not be omitted is the fact that military recruits have extra chances of weight gain, because they are prone to consuming unhealthy food (e.g., energy dense food). They have easier access to this kind of food. It seems more convenient, especially while they deploy and relocate. In addition, the ongoing military environment is not always helpful for exercise at a systematic base (Malkawi, Meertens et al. 2018).

Given the importance of nutrition for the military population and the unique dietary needs of war fighters, the Recommended Daily Allowances (RDA)—nutrient standards designed to meet the needs of 97-98% of healthy Americans—have been specifically adapted for this group (Lutz, Gaffney-Stomberg et al. 2019a).

Army Regulation 40-42, OPNAVINST 10110.1/MCO 10110.49, and AFI 44-141 (2017) establish the nutrition and menu standards aimed at optimizing human performance, referred to as "Military Dietary Reference Intakes" (MDRIs). Figure 2 illustrates the daily MDRIs for both men and women (Army regulation 2017).

Military dietary reference intakes[1] per day

Nutrient	Unit	Men	Women
Energy[2] General/routine[3]:	kcal/d	3400	2300
Light activity	kcal/d	3000	2100
Moderate activity	kcal/d	3400	2300
Heavy activity	kcal/d	3700	2700
Exceptionally-heavy activity	kcal/d	4700	3000
Protein[4]	g/d	102 (68–136)	83 (55–110)
Carbohydrate[5]	g/d	510 (340–680)	414 (276–552)
Fiber	g/d	34	28
Fat[6]	g/d	<113 (100–157)	<77 (70–100)
Linoleic acid	g/d	17	12
α-linolenic acid	g/d	1.6	1.1
Vitamin A[7]	µg RAE/d (IU/d)	900 (3000)	700 (2333)
Vitamin D[8]	µg/d	15	15
Vitamin E[9]	mg/d	15	15
Vitamin K	µg/d	120	90
Vitamin C	mg/d	90	75
Thiamin (B_1)	mg/d	1.2	1.1
Riboflavin (B_2)	mg/d	1.3	1.1
Niacin[10]	mg NE/d	16	14
Vitamin B_6	mg/d	1.3	1.3
Folate[11]	µg DFE/d	400	400
Vitamin B[12]	µg/d	2.4	2.4
Calcium[12]	mg/d	1000	1000
Phosphorus[13]	mg/d	700	700
Magnesium[14]	mg/d	420	320
Iron[15]	mg/d	8	18
Zinc	mg/d	11	8
Sodium[16]	mg/d	<2300	<2300
Iodine	µg/d	150	150
Selenium	µg/d	55	55
Fluoride[17]	mg/d	4	3
Potassium[18]	mg/d	4700	4700

Figure 2: Military Diet and Nutritional Standards per day (MDRIs)(Army Regulation, 40-42 OPNAVINST 10110.1/MCO 10110.49 AFI 44-141, 2017). (Army regulation 2017)

It is important to note that the United Kingdom (UK) has developed its own nutrition standards for the British military, known as "Military Dietary Reference Values" (MDRVs). These standards were established by the Scientific Advisory Committee on Nutrition (SACN). According to the "SACN Statement on Military Dietary Reference Values for Energy" (2016), MDRVs provide recommendations for energy and nutrient intakes tailored to different groups: training and operational (T&O) military personnel, non-operational/non-training (NONT) military personnel, and adolescents in military training. Figure 3 presents the MDRVs for macronutrients.

Figure 3. **Recommended proportions of macronutrients, as a percentage of total energy intake, for the general population and the three groupings of service personnel based on Physical Activity Level (PAL)[a]. Total energy intake is assumed to be the same as food energy intake; it excludes energy from alcohol since alcohol is not included in provisioning.**

Group	Level	Carbohydrate (%)	Total Fat (%)	Protein (%)
UK Population	1	50	35	15
Active Service	2	50 - 55	31.5 - 35	13.5 - 15
Military Training Courses A[b]	3	50 - 60	28 - 35	12 - 15
Military Training Courses B[c]	4	50 - 65	25 - 35	10 - 15

[a] The proportions for operational ration packs will be determined by risk managers due to the interaction of energy density and the weight of rations with respect to the implications for load carriage.
[b] Included the following training groups: the common military syllabus for recruits (CMS(R)); Royal Air Force (RAF) phase-1 recruits.
[c] Included the following training groups: Common Infantry Course (CIC) – paras and Guards; Commissioning Course for Officer Cadets (CCOC); Section Commander's Battle Course (SCBC)(army infantry soldiers phase-3 training)

Figure 3: Recommended proportions of macromutrients, as a percentage of total energy intake, for the general population and the three groupings of service personnel, based on Physical Activity Level (Scientific Advisory Committee on Nutrition 2016).

According to a cross-sectional study by Lutz et al. (2019a) in the United States Army, to search the dietary intake and relate it to Military Dietary Reference Values During Army Basic Combat Training, the results reveal that compared with MDRI standards, recruits consumed an adequate amount of vitamins A, C and K. Also, B-vitamins, and phosphorus, selenium, zinc, protein and carbohydrate were at desirable limits. On the other hand, a luck in Vitamin D was noted, since

55 and 70% of males and females, respectively consumed less than 33% of the MDRI (Lutz et al. 2019a).

The importance of vitamin D should be highlighted, since it is associated with various strength, power, and muscular and aerobic endurance components (Heileson, McGowen et al. 2022).

On the whole, research by Lutz et al (2019a) found inadequate intake of magnesium, α-linolenic acid, fiber, potassium male and female recruits inadequate vitamins D and E, magnesium, potassium, α-linolenic acid, and fiber were under consumed by male and female recruits while males also did not consume adequate linoleic acid and females did not consume adequate calcium and iron (Lutz et al. 2019a).

As for Calcium and Vitamin D, a study conducted by Gaffney-Stomberg, Nakayama et al. (2019) reveals that Army and Navy soldiers supplemented with everyday calcium and vitamin D (Ca + D) manifested increased bone strength and decreased stress breaks. The purpose of their study was to form an opinion whether Ca and vitamin D supplementation improves measures of bone health in recruits undergoing United States Marine Corps initial military training (IMT), and if the result of supplementation on guides of bone health diverse as regards to the season (Gaffney-Stomberg, Nakayama et al. 2019).

Overall, results suggest that Ca and vitamin D supplementation lowered some markers of bone formation and resorption and the decrease in 25OHD over training in volunteers that started training in the summer was thwarted by supplementation. Touchstone 25OHD and trajectory has strong chances to effect bone responses to IMT, but little aftermath of Ca and vitamin D supplementation was shown (Gaffney-Stomberg, Nakayama et al. 2019).

Additionally, study that attempts to associate nutrition and body composition with cardiovascular disease risk factors in soldiers, concludes that lower fiber consumption and a greater amount of body fat, were related to high total and LDL cholesterol concentrations (NYKÄNEN, PIHLAINEN et al. 2020).

A cross-sectional study by Karl et al. (2021) reveals that the strategies which reflect contemporary approaches to military nutrition have the following objectives: firstly, to upgrade food choices and diet quality of military recruits. The methods to achieve this involve enhancing approachability and easy access to proper healthy food options, for instance fruit, vegetables, and whole grains. Additionally, in order to achieve healthy choices, it is essential to lessen choices that include saturated fats, trans fats, added sugars, and refined grains (Karl J. Philip, Margolis Lee, et al. 2021).

Secondly, to acquire operative nutrition education programs for both military personnel and kitchen staff. These programs will help all persons involved to form long-term healthy eating habits. Moreover, to improve macronutrient structure to lessen energy inadequacy, alleviate the effects of energy deficit, enlarge protein quality and quantity. Thirdly, to determine new methods to estimate the physiologic demands of military operations, such as maximize beverage composition for the optimal hydration, reassure the optimal supplementation with basic nutrients to alleviate oxidative stress and avoid gastrointestinal barrier impairment and control usefulness of probiotics, prebiotics, so as to ameliorate immunity and gastrointestinal health due to environmental stress (Karl J. Philip, Margolis Lee, et al. 2021).

Military performance is often related to periods with limited access to fresh food. This fact led to a recent systematic review by Sotelo-Díaz et al. (2019). The latter review provides evidence regarding to military nutrition linked with military rations. When it comes to military nutrition, military rations are defined as food planned to be provided for military personnel and are usually used when fresh food is not available. The purpose of the study, based on scientific articles published from 1994 to 2017, was to appraise military rations, which are intended to nourish with high-quality food. The latter has to do with food which provides organization with vitamins, minerals and all the ingredients needed for a healthy life. Specifically, as regards to nutritional needs, patterns of military rations linked to energy and protein consumption and supplements (Sotelo-Díaz, Blanco-Lizarazo 2019).

The principles for providing food to military recruits involve diet quality (affected by nutritional status, raw ingredients, formulation, and storage), the option of healthy nutrition and the fulfilment of specific nutritional needs. The outcome of the review indicated that physical activity and environmental parameters straightforwardly have impact on evaluating energy requirements and carbohydrate intake while creating military rations. On the other hand, the upshot of the review did not reveal effect on protein, fat and/or sodium consumption. Moreover, Sotelo-Díaz et al. (2019) showed that military recruits get a high amount of dietary supplements and suggested: firstly, the possibility of military rations' inclusion into campaign rations (Sotelo-Díaz, Blanco-Lizarazo 2019).

Secondly, according to Sotelo-Diaz et al. (2019) based on the fact that soldiers' macro-nutrient and micro-nutrient requirements are related to physical performance and nutrient intake measurement techniques, research on nutritional requirements for military rations might focus on ameliorating the levels of macro-nutrients and micro-nutrients and their biological value (Sotelo-Díaz, Blanco-Lizarazo 2019).

Moreover, another related study by McClung et al. (2020) conducted on the US military Meal, Ready-to-Eat food ration, which is accepted as a nutritionally sufficient sole source of nutrition for less than 21 days. The randomized trial attempted to collate consumption of military rations to standard food consumption for 21 consecutive Days. The purpose was to examine the impact of the US Armed Services Meal intake, Ready-to-Eat ration for 21 days, related to typical diets, on nutrient intake, along with values of nutritional status and cardiometabolic health. The study reveals that a Meal, Ready-to-Eat ration diet could offer a more micronutrient-dense diet compared to typical dietary intake assisting in preservation of nourishment status over 21 days (McClung, Armstrong et al. 2020).

It is a fact stated by studies that dietary intakes in military recruits are incompatible with military and/or public health guidance. Precisely, according to an Australian study by Kullen et al. (2019) men military recruits, have poor in nutritional status diets combined with inferior extend of nutrition education. Moreover, body weight, BMI and Waist Circumference of Australian soldiers personnel has increased since the 1970s, highlighting they have elevated risk of evolving chronic conditions later in their life (Kullen, Prvan et al. 2019).

2.4 Military in Cyprus – Historical Background

In 1960, the Republic of Cyprus was recognized as an independent state. Following this proclamation, the Cypriot Army was formed, initially comprising 2,000 men, with 60% being Greek Cypriots and 40% Turkish Cypriots (Mod.gov.cy. 2021. History). At that time, military service was not mandatory. The inter-communal conflict that erupted in December 1963-64 led to the desertion of Turkish Cypriots from the legitimate army as a form of rebellion against the state. Concurrently, due to threats of military action from Turkey, a Greek Division was relocated to Cyprus, and the Supreme Military Command of Cyprus was established, operating until the end of 1967 (Mod.gov.cy. 2021. History).

In response, the Cypriot Parliament enacted Law 20 "On the National Guard" in June 1964. This law introduced compulsory military service and facilitated the effective formation of the army under the Republic of Cyprus, setting the duration of service at 18 months. Unfortunately, during the Turkish invasion in July 20-22 and August 14-16, 1974, the National Guard was called upon for the first time to defend the island's independence. Since then, the National Guard has evolved into a well-trained and effective deterrent force (General Staff of the National Guard, 2021, Ministry of defense, 2021).

Subsequently, the Law on the National Guard of 2011 (Law 19 (I) / 2011) (*Mod.gov.cy. 2021. (Law 19 (I) / 2011) G.G., Par. I (I), No.4271, 25/2/2011.* 2021) revised the National Guard regulations from 1964 to 2008, extending full military service to 24 months. In 2016, an amendment to the law reduced the duration of full military service to 14 months. To address the needs arising from this reduction, the establishment of Contract Hoplites was initiated.

2.5 Soldiers' Training, Physical Activity and Energy Expenditures

Physical activity (PA) seems to be a powerful tool to fight obesity. In other words, an effective regulation to lessen increased levels of obesity and the cardiovascular disease risk. Precisely, according to the *Rotterdam study*, a 15-y proposed follow-up of >5000 middle-age trialists revealed that there was not noted alteration in risk in the group of obese/overweight individuals who upheld a high level of PA compared to adults with normal BMI. One technique that alleviates the impact of obesity might be based on its effect on gene expression. A research found between PA and the fat mass and obesity associated (*FTO*) gene, a well-known obesity susceptibility gene. Precisely, the *human obesity susceptibility gene,* FTO, is linked to body mass and obesity in humans through control of energy consumption and intake (Yuzbashian, Asghari et al. 2021).

The occurrence of the *FTO* gene largely enhanced the likelihood for a human organism to result in obesity. Interestingly, according to Cabalero, this likelihood was lessened by almost 30% in physically active people (Caballero 2019).

It is in soldiers' nature to meet challenges in their career. Military workforce often meets challenges and expenditures that demand excellent physical and psychological condition. It should be indicated that military training has several similarities to athletes' training, regarding to extra requirements. On the other hand, soldiers have even more energy requirements, while military training diverges from sports training. The former needs an amalgamation of physical and cognitive effort, combined with a required preparation and readiness for hostile and stressful environments (Thomas J. O'Leary, Wardle et al. 2020).

As far as British army is concerned, a 14-week training program is prerequisite for new recruits. This specific program involves field exercises and physical training. In order to have an integrated training, recruits need to be trained on many military-specific skills: they must be taught and practice load carriage, exercise how to march, use military drill -it consolidates soldiers into battle formulation and familiarizes recruits with their weapons-, and learn how to handle weapon and equipment (O'LEARY, SAUNDERS et al. 2018).

As O'Leary et al. (2018) indicate, energy expenditures during specific training periods fluctuate and are influenced by various factors, particularly gender. For female recruits, energy expenditures range from 3000 to 3400 kcal/day, while for male recruits, they range from 4000 to 4400 kcal/day (Thomas J. O'Leary, Wardle et al. 2020 ; Chapman, Roberts et al. 2019a).

Barringer et al. (2018) conducted a study to examine retrospective data from U.S. Special Operation Forces (SOF) with the goal of developing a predictive equation for the energy requirements of SOF personnel. They found that the average measured energy expenditure during SOF training was 4468 kcal/day, with a range of 3700 to 6300 kcal/day. Figure 4 presents a detailed table of the 12 different SOF training programs, including their measured energy expenditure, intake, and balance, based on the findings of Barringer et al. (Barringer, Pasiakos et al. 2018).

Table 4 Measured energy expenditure, intake, and balance

Training	Measured Daily Energy Expenditure (Kcal·d⁻¹)	Resting Metabolic Rate (Kcal·d⁻¹)	Diet-Induced Energy Expenditure (Kcal·d⁻¹)	Activity-Induced Energy Expenditure (Kcal·d⁻¹)	Physical Activity Level	Energy Intake (Kcal·d⁻¹)	Energy Balance (Kcal·d⁻¹)	Delta Body Mass (kg)
Combat Dive School	4567 (4332, 4803)	1748 (1672, 1824)	457 (433, 480)	2363 (2191, 2534)	2.61 (2.51, 2.72)	–	–	−0.39 (− 0.88, 0.10)
Pre-Mission Training	3904 (3589, 4219)	1798 (1738, 1859)	390 (359, 422)	1715 (1449, 1982)	2.17 (2.01, 2.34)	–	–	0.24 (−0.25, 0.73)
Weapons Training[a]	3682 (3076, 4289)	1868 (1756, 1979)	368 (308, 429)	1447 (949, 1944)	1.97 (1.68, 2.25)	3935 (3543, 4327)	253 (− 295, 801)	− 0.19 (− 1.29, 0.92)
Urban Combat[a]	5215 (4665, 5766)	1712 (1617, 1806)	522 (467, 577)	2982 (2528, 3437)	3.05 (2.74, 3.35)	2503 (2083, 2924)	− 2712 (− 3140, − 2284)	− 3.30 (− 4.77, − 1.81)
Squad Raids[a]	4801 (4426, 5175)	1838 (1732, 1943)	480 (443, 517)	2483 (2189, 2778)	2.62 (2.44, 2.80)	3118 (2619, 3616)	− 1683 (− 2281, − 1084)	−3.25 (− 4.62, − 1.88)
Platoon Raids[a]	4484 (3788, 5180)	1912 (1731, 2092)	448 (360, 535)	2554 (1731, 3377)	2.31 (2.07, 2.56)	4529 (4126, 4931)	45 (− 472, 561)	− 1.96 (− 2.63, − 1.29)
Small Unit Ranger Training (classroom)	3719 (3452, 3985)	1800 (1731, 1870)	372 (345, 399)	1546 (1349, 1744)	2.06 (1.95, 2.17)	3134 (2838, 3430)	− 584 (− 791, − 378)	–
Small Unit Ranger Training (field training)	4924 (4513, 5335)	1800 (1731, 1870)	493 (451, 534)	2631 (2303, 2959)	2.73 (2.55, 2.91)	2850 (2497, 3203	− 2074 (− 2491, − 1657)	–
Ranger Selection Assessment Program	4264 (4089, 4440)	1733 (1647, 1819)	426 (409, 444)	2105 (1999, 2211)	2.47 (2.39, 2.54)	2957 (2814, 3101)	− 1307 (− 1505, − 1110)	− 1.24 (− 1.69, − 0.78)
Raider Spirit[b]	6317 (5886, 6748)	1894 (1838, 1950)	632 (588, 675)	3791 (3416, 4167)	3.34 (3.11, 3.56)	2385 (2183, 2588)	− 3932 (− 4387, − 3477)	− 4.47 (− 5.40, − 3.54)
Close Quarters Battle[b]	4189 (3824, 4555)	1915 (1752, 2078)	419 (382, 455)	1856 (1636, 2076)	2.19 (2.07, 2.31)	2816 (2440, 3191)	− 1374 (− 1899, − 849)	−0.40 (− 1.79, 1.01)
Derna Bridge[b]	3736 (3546, 3926)	1936 (1870, 2002)	374 (355, 393)	1427 (1272, 1581)	1.93 (1.84, 2.03)	2701 (2256, 3146)	− 1035 (− 1481, − 589)	− 1.48 (− 2.27, − 0.70)
Overall	4468 (4311, 4624)	1827 (1801, 1853)	447 (431, 462)	2219 (2080, 2359)	2.45 (2.36, 2.53)	3086 (2941, 3231)	−1433 (− 1677, − 1188)	−1.75 (−2.09, − 1.40)

Data presented as mean (95% Confidence Interval of the mean)
[a]Data collected during US Army Special Forces Small Unit Tactics Training
[b]Data collected during Marine Special Operations Command
Resting Metabolic Rate = 370 + (21.6 * fat-free mass)
Diet-induced energy expenditure = 10% daily energy expenditure
Activity-Induced Energy Expenditure = Daily energy expenditure − (resting metabolic rate + diet-induced energy expenditure)
Physical Activity Level = Daily energy expenditure / resting metabolic rate
Energy Balance = Daily energy expenditure − energy intake

Figure 4: Measured energy expenditure, intake and balance. 12 different SOF (Special Operations Force) (Barringer, Pasiakos et al. 2018).

Pourtaghi et al. (2021) highlight that systematic and consistent physical activity is able to ameliorate anthropometric indices, blood glucose, along with blood lipid profile. Their quasi-experimental research focuses on the prevalence of obesity in military health care organizations, precisely purposes to estimate the modifications in blood lipid profile, blood glucose status, and anthropometric measurements related to systematic physical activity in 265 obese military

recruits (males). For two months consistently under coach supervisor participants undertook physical activities (POURTAGHI, BIDEL et al. 2021).
The outcome of Pourtaghi et al. (2021) study reveals that regular physical activity notably reduced the average values of triglyceride levels SMD=- 0.390, p<0.001], total cholesterol SMD=-0.259, p=0.003], high-density lipoprotein SMD=0.387, p<0.001], low-density lipoprotein SMD=-0.369, p<0.001], and fasting blood sugar SMD=-0.338, p<0.001]. Centered on the test outcome, the weight SMD=-0.218, p=0.013] and body mass index SMD=-0.587, p<0.001] of the participants had reduced as well. Furthermore, the Waist Circumference SMD=-0.416, p<0.001], Hip Circumference SMD=-0.249, p=0.005] and Waist-To-Hip Ratio SMD=-0.566, p<0.001] noted a reduction as well (POURTAGHI, BIDEL et al. 2021).

Physical activity, based on the above mentioned Pourtaghi et al. (2021) study has a vital role in improving body performance on the one hand and in fighting obesity on the other hand (POURTAGHI, BIDEL et al. 2021).
Moreover, another study by Sang et al. (2020) indicates similar results about the role of physical activity in obese military personnel. The study attempted to estimate the influence of five weeks of basic military training on the physical fitness and blood biochemical factors in 48 men, between 20-25 years old. Both groups finished five weeks of basic military training. The Exercise group performed extra a resistance exercise two times a day, combined with and power walking (60-80% HRmax, 30 minutes) four times in a week. Four body composition variables, physical fitness factors, serum lipid profiles, and obesity-related hormone levels were examined (Sang, Se et al. 2020).

According to the outcome of Sang et al. (2020) study, body weight, body fat ratio, Body Mass Index, and Waist Circumference were importantly reduced in both groups. The study concludes that an extra exercise-training program combined with the basic military training contributes significantly to ameliorating military fitness and readiness. Moreover, the five-week training affects seriously the maintenance in body composition, the serum lipid levels, obesity related hormones and other parameters essential to the optimal health on the whole (Sang, Se et al. 2020).

In addition to the abovementioned, according to Anyzewska et al. (2020), physical activity has the power to lessen the risk of mortality, precisely from cardiovascular disease. If a person augments energy consumption linked with physical activity of 1000 kcal per week, lessens the risk of death from all causes. A substantial relative risk of mortality is connected to poor levels of physical activity and equals the danger associated with hypertension, hypercholesterolemia, or obesity (Anyżewska, Łakomy et al. 2020).

In the Army, physically and mentally demanding jobs are common. Optimal nutrition is linked with mental and physical performance and enables military readiness. It is undeniable fact that nutritional excellence and the quality of diet are vital for ideal health, aligned with military performance (Rittenhouse, Scott et al. 2021).

It is made clear that increased body fat has been shown to have adverse effects on the performance of military personnel, as it comes to their activities. On the other hand, good fitness is reflected in productivity, the quality of the outcome, and even the ability to survive on the battlefield. Healthy body weight provides alertness, stamina and overall health that is necessary for the military activities.

It is not to be omitted the fact that soldiers have higher energy needs and requirements, to accomplish the optimal performance and deal with all the challenges that might occur (Kessler, Heeringa et al. 2013b). Additionally, energy needs are not always the same. They are influenced by the environment in which military recruits work. For example, if military members work in extreme environments, such as extreme cold or heat, then the needs will adjust to the environment. It is reasonable that a poor health and fitness status will probably hold back soldiers' performance (Naghii 2006b).

Moreover, it is worth to be considered that severe environments with high altitude might affect the military personnel's nutritional acquirements (Lavergne, Laroche-Nantel et al. 2021).
Since the connection between nutrition and performance is clear, engaging healthy eating in the military segment is considered as a priority. Choosing healthier food multiplies chances for greater performance. A study conducted by Jayne et al. (2018) -permitted by the Department of

Defence and University of South Carolina's Institutional Review Boards- attempted to analyse food identity and food choice behaviours including fruit and vegetable consumption, skipping meals, and eating out frequency. A healthy eating identity was assessed through the Eating Identity Type Inventory (EITI). The EITI created a questionnaire that tried to investigate how recruits think of their eating behaviours on a 5-point Likert-type scale (Jayne, Frongillo et al. 2018).

The questionnaire of the research included phrases such as "I am a healthy eater," "I am someone who eats in a nutritious manner", "I am careful about what i eat". Findings revealed that a healthy eating identity was affiliated with bigger fruit and vegetable consumption and, moreover, argued that engaging a healthy eating identity may be more effective for encouraging healthy food choice (Jayne, Frongillo et al. 2018).

Furthermore, the aforementioned study could be collocated with another study by Chukwura et al. (2019) regarding to the perceptions of military recruits about their eating habits and the eating environment as a whole. Soldiers marked out food environment in the army as an element who hinders optimal nutrition. Resultingly, soldiers believed that the proximity and the option of so many fast-food restaurants, combined with the deficiency of healthy alternatives and with the expensive healthy food were essential obstacles to preferring healthy foods. All the above mentioned have another factor not to be omitted: time restrictions lead to unhealthy choices (Chukwura, Santo et al. 2019).

Moreover, time restrictions, as aforementioned, are likely to be connected to another fact: in recent times, a nutrition passage has given rise to a worldwide change and switch from consumption of minimally processed foods, and towards ultra-processed intake. Home-prepared dishes were replaced by ready-to-eat meals and snacks, which are mostly high in calories, sugar or salt (Dicken, Batterham 2022).

In the context of military readiness, physical fitness, weight, and body composition standards are very applicable in the military environment. A soldier must put effort to keep up these standards, since he has to secure that he is competent to handle the physical demand in the military environment and reduce the possibility of injuries (Malkawi, Meertens et al. 2018).

The pandemic of COVID-19 affected undoubtedly all fields, so it would be unreasonable for the military health personnel to be untouched. A cross-sectional study by Juan Manuel et al. (2021), planned to examine the connection between lifestyles and the nutritional state of military health personnel in terms of the nutrients in their diet, reveals that there is a correlation between lifestyle and nutritional habits, controlled mostly by Body Mass Index and other measurements, which will be analysed in the next paragraph (Juan Manuel, Nelson Edilbrando et al. 2021).

Precisely, 104 military health professionals, workers at the Central Military Hospital, responded to the Arrivillaga, Salazar and Gómez Lifestyles Questionnaire, later on were weighed and measured to examine the Body Mass Index, the measurement of the abdominal perimeter was also attained, which counted the cardiometabolic risk, the descriptive, bivariate (chi square test) and multivariate analysis were conducted in order to estimate ratios of prevalence. According to the outcome, a connection was detected between unhealthy nutritional lifestyle and Body Mass Index (prevalence ratio = 15.467; 95% CI: 2.228 - 107.357: $p < 0.001$) similarly when accustomed for the parameters of age, sex, profession and military rank (adjusted prevalence ratio =18.515; 95% CI: 2.98 - 114.913: $p < 0.001$) (Juan Manuel, Nelson Edilbrando et al. 2021).

When it comes to nutritional requirements for a military diet, basically three methods are considered efficient: firstly, the Gold standard approach, which evaluates food consumption and removal. Secondly, the Intake-balance approach for estimating energy needs, which evaluates modifications in body structure from food intake and thirdly, the Factorial approach, which regulates energy consumption linked to physical activities and time consumed (Sotelo-Díaz, Blanco-Lizarazo 2019).

To our knowledge, as it comes to Cypriot Military population, no research was made referring to Physical Activity and/or training.

2.6 Energy Requirements and Soldiers

Food and Agriculture Organization (FAO) defines ER (Energy requirement) as the amount of food energy that is necessary for a person's energy expenditure, in order to continue to have a balanced body size, body composition and a level of necessary and wanted physical activity. In other words, the requirements of energy setting as a goal to have long-term optimal growth, development, and good health. ER differs and is adjusted to the special needs depending on each situation, for example the additional needs for children to grow, for pregnant women, for milk production during lactation. (FAO and consultation 2001).

It should be mentioned that the estimation of energy requirements should be in alignment with intrinsic, extrinsic parameters (anthropometric evaluations, physical exercise). Also, according to Tassone et al. (2017) in military personnel's energy consumption from fighting rations frequently fail to meet their energy necessities. Their review methodically examined the effects of the constant use of combat rations for time duration of 3–40 days on body weight and/or body structure in military recruits. Precisely, 10 catalogues were examined from their inception until October 2016. Tassone et al. conclude that body weight and composition ought to be consistently examined before and after field performance (Tassone, Baker 2017).

Moreover, Tassone and Baker (2017) highlight that temperature and altitude affect ER. Military field involves missions that can lead to absence of sleep, being alert for a long time and challenging physical performance. Soldiers have to perform in antagonistic environment, hostile regarding to high-altitude territory, the tropics, desert, temperatures below zero. All these circumstances might cause physical and psychological stress. Hence, appropriate nutrition is essential for alleviating weight loss and encouraging optimal physical, cognitive, and immunological functioning (Tassone, Baker 2017).

In an attempt to minimize negative energy balance, estimations made with accuracy are essential (Batista, De França et al. 2021). Energy balance is essential for performance, especially regarding to athletes. Athlete is derivative from the ancient Greek word "athlos", which means a great achievement. To have an optimal performance, adequate energy is needed. Sports field has several similarities compared to military field, regarding to energy expenditures. Relative energy deficiency in sports (RED-S) is a condition of deficient energy for the exercise energy expenditure. RED-S is possible to have negative effects on performance, training ability and recovery (Melin, Heikura et al. 2019, Logue, Madigan et al. 2020). In some circumstances, such as SOF trainings and particular military forces, energy expenditure might ascend to 10000 kcal per day (Ahmed et al., 2020). In that case, it is vital for soldiers to ensure that they consume adequate energy, if they want to prevent the aforesaid negative effects. War fighters are a category in which, according to MDRIs, men are strongly recommended to consume 3400 kcal/day. In women the recommendation is to consume 2300 kcal/day (Army regulation 2017).

Melin et al. (2019) highlight that throughout the demanding period of training exercises, soldiers tend to have a moderate-to-large energy deficit, with negative results on their body mass and composition and possibly their physical and cognitive performance. This negative energy balance is caused by the fact they are unable to increase their energy intake during these intensive periods (Melin, Heikura et al. 2019 ; Logue, Madigan et al. 2020).

Charlot Kayne (2021), on an attempt to display the influence of military training on energy balance, concludes that specific limitations interfere with energy intake. The latter are intrinsic to military training and involve training, food, timing and habits of eating. All the mentioned parameters go along with the soldiers' attitude (Charlot et al. 2021).

Moreover, cold, as already mentioned above, is a demanding condition regarding soldiers' energy balance. Military recruits on their expeditions fail to handle the enlargement in energy expenditure. Charlot et al. (2021) analysed the characteristics of energy compensation in 12 male soldiers, during a 15-day enterprise in the cold and concluded that complete energy repair can be reached in challenging field conditions when food consumption is eased. Also, providing guidelines to prevent energy inadequacy during operational expeditions. (Charlot et al. 2021).

Energy deficit is a factor of major significance for all the population, but regarding to army recruits, it is even more important to be noticed. In research conducted by Gan, Fan et al. (2018), which measured a period of 62-days ranger course in a hot-humid environment. Food consumption was recorded, daily and energy expenditure at each of the seventeen male participants. Data found an 18% energy deficit in an average body mass loss of 4.6 kg, containing mostly fat mass. On conclusion, in circumstances of demanding and stressful environment, energy deficit is likely to occur. (Gan, Fan et al. 2018).

2.7 Basal Metabolic Rate (BMR)

BMR is the minimum amount of energy expenditure that is necessary for an organism to stay alive. The human body, in order to maintain vital functions, such as cell function and replacement, adjusts to a BMR, which depends on factors like age, sex, body composition, physiological state. The basic difference between BMR and RMR (Resting Metabolic Rate) is the time of resting and fasting before estimations (Marques 2021).

Hattersley, Wilson et al. 2019 attempted to analyse metabolic rate in men who undertook polar expeditionary travel. Energy expenditure and substrate utilization were calculated in 5 men pre- and post- a 67 day expedition. Precisely, on a demanding expedition including pulling sledges that weighed 120kg in extremely cold conditions. Interestingly, even though on previous expeditions large weight loss was noted, only a modest loss of body weight (7%, $P = 0.03$) was reported. Fat tissue was reduced by 53% ($P = 0.03$). Finally, a small, rather insignificant increase in lean tissue weight was found ($P = 0.18$) (Hattersley, Wilson et al. 2019).

Carpenter et al., at Jagim et al. (2018) indicates that BMR, often measured or expressed as resting energy expenditure or resting metabolic rate (RMR), expands to 60-70% of total daily energy expenditure (TDEE). (Jakim, Andrew et al. 2018).

Furthermore, as far as clinical practice is concerned, BMR is mostly estimated by predictive equations. It is not easy to estimate BMR in labs, e.g. indirect calorimetry needs specific equipment that is not obtainable at all times. Jagim et al. (2018), made five predictive equations for RMR in 22 and 28 female and male athletes respectively. As a conclusion, the Harris-Benedict equation may be most precise for male athletes. On the other hand, the Cunningham equation appears to suit better for female athletes. The abovementioned results could be applicable to soldiers because they face similar challenges with similar energy requirements (Jakim, Andrew et al. 2018).

2.8 Macronutrients and Soldiers

2.8.1 Carbohydrates (CHO)

CHO is categorized as a macronutrient. Nowadays, a lot is being mentioned about the importance and the impact of CHO (Sharma, Barone 2019). The role of CHO is vital. In combination with protein (PRO) and fat, those three elements are the energy suppliers. Moreover, they give other vital components in order to remain alive. Meanwhile, numerous diets suggest up to some degree different percentage of daily CHO requirements, to optimal health and chronic disease prevention, for the general population.

Figure 5 presents the dietary recommendations of % energy contribution to diet, regarding macronutrients, as noted in Dietary Guidelines for Americans (2020-2025).

Daily Nutritional Goals, Ages 2 and Older

MACRONUTRIENTS, MINERALS & VITAMINS		Age-Sex Groups												
		M/F 2-3	F 4-8	F 9-13	F 14-18	F 19-30	F 31-50	F 51+	M 4-8	M 9-13	M 14-18	M 19-30	M 31-50	M 51+
Calorie Level Assessed	Source of Goal[a]	1,000	1,200	1,600	1,800	2,000	1,800	1,600	1,400	1,800	2,200	2,400	2,200	2,000
Macronutrients														
Protein (% kcal)	AMDR	5-20	10-30	10-30	10-30	10-35	10-35	10-35	10-30	10-30	10-30	10-35	10-35	10-35
Protein (g)	RDA	13	19	34	46	46	46	46	19	34	52	56	56	56
Carbohydrate (% kcal)	AMDR	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65
Carbohydrate (g)	RDA	130	130	130	130	130	130	130	130	130	130	130	130	130
Fiber (g)	14g/ 1,000 kcal	14	17	22	25	28	25	22	20	25	31	34	31	28
Added Sugars (% kcal)	DGA	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total lipid (% kcal)	AMDR	30-40	25-35	25-35	25-35	20-35	20-35	20-35	25-35	25-35	25-35	20-35	20-35	20-35

Figure 5: 2020-2025 Dietary Guidelines for Americans. (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. 2016).

Amid the multiple functions of CHO in the human organism, it appears that its part in the performance and adjustment to training has attracted a noticeable attention in the athletic scope. Moreover, recommendations for CHO intake, adapted especially for athletes have been set up. For instance, in cases of light exercise 3-5 g/kg CHO of athlete's body weight/d, average exercise program (e.g. ≈1 h/d) 5-7 g/kg/d CHO, high demanding program (e.g. 1-3 h/d average to high-intensity exercise) 6-10 g/kg/d and very high - extreme commitment (e.g. >4-5 h/d moderate to high-intensity exercise) 8-12 g/kg/d (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. 2016).

Military field is as intensive as athlete field. Athletes' guidelines and needs are parallelized to soldiers' needs. The latter are often categorized as a tactical personnel. MacKenzie-Shalders et al. (2021) give the definition of tactical personnel: people (involving military, law enforcement, fire and rescue) who have extra responsibilities that go along with ensuring national and public safety. Dietary intake is an essential consideration to aim optimal health and performance. Their systematic review notes that practical approaches to help augmented energy, fat and carbohydrate consumption in tactical personnel is vital (MacKenzie-Shalders, Tsoi et al. 2021).

In a study conducted in non-trainee soldiers in US, who dine habitually in army dining facilities (DFACs), the CHO intake was measured 42 ± 10 % of daily dietary intake. The aim of the study by Belanger et Kwon (2016) was to assess the consequences of applying the Initial Military Training (IMT) menu standards in non-trainee dining facilities (DFAC) on food selection, nutrient intake, and satisfaction of soldiers. Participants were recruited during lunch before and three weeks after the menu changes. Direct observations, digital photography, and plate waste methods were employed to estimate soldiers' food selection and consumption (Belanger, Kwon 2016).

As regards to Belanger et al. (2016), a total of 172 and 140 soldiers took part before and after menu changes, respectively. Soldiers consumed 886 kcals (38.6% from total fat and 11.2% from saturated fat) and 1,784 mg of sodium before the menu change. Three weeks after the change, all figures noted improvement ($p < 0.01$). The percentage of healthier food selections illustrated food items served at the DFAC and upgraded after the intervention ($p < 0.001$). Results of the study recommend implementing the Initial Military Training menu standards in non-trainee Army DFACs is viable and might ameliorate the overall healthfulness of soldiers' food intake (Belanger, Kwon 2016).

It is worth to be mentioned that United Kingdom has established and set up its own standards for British Military population. They are called Military Dietary Reference Values (MDRVs). The latter are set up by Scientific Advisory Committee on Nutrition (SACN). (Chapman, Roberts et al. 2019a).

According to the declaration of SACN for MDRVs, they include recommendations and guidance for energy and primary nutrient intake, especially for recruitments. All the above are explained and examined on a study by Chapman et al. (2019a), which correlated the dietary intake of British army recruits in phase one training to MDRVs. Chapman et al. (2019a) indicate that British Army Phase One training has part of training that men and women must cope with challenging distances of 13.5 km/d vs. 11.8 km/d and energy expenditures of ~ 4000 kcal/d and ~ 3000 kcal/d, respectively. Due to that demanding situation, it is vital that sufficient nutrition is given, so as to accomplish training challenge (Chapman, Roberts et al. 2019a).

However, Chapman et al. (2019a) noticed that there was a paucity of data on habitual dietary intake of British Army recruits. Precisely, a total of 28 women aged 21,4 ± 3,0 years and 17 men aged 20,4 ± 2,3 years took part in the study and the results noted under-consumption of CHO for men and women as well, in comparison to the MDRVs (Chapman, Roberts et al. 2019a).
Below, in Figure 6, absolute nutrient intake for participants compared to MDRVs and RDA are displayed.

Nutrient	All	Men	MDRV	Women	MDRV
Energy (kcal·day^{-1})	2439 ± 653	2846 ± 573*	4100.0	2207 ± 585*	3100.0
CHO (g·day^{-1})	283 ± 98	352 ± 92*	513–615	243 ± 79*	388–465
PRO (g·day^{-1})	94 ± 27	114 ± 29	123–154	83 ± 18	93–116
Fat (g·day^{-1})	103 ± 25	109 ± 21	128–159	100 ± 27	96–121
Fibre (g·day^{-1})	20 ± 6	23 ± 5	30	18 ± 1	30
Calcium (mg·d^{-1})	837.0 ± 383.0	1078.0 ± 418.0*	700.0	699.0 ± 287.0*	700.0
Copper (mg·d^{-1})	0.9 ± 0.3	1.0 ± 0.0	1.2	0.9 ± 0.3	1.2
Folate (μg·d^{-1})	173.0 ± 84.0	231.0 ± 95.0*	200.0	140.0 ± 55.0*	200.0
Iodine (μ·d^{-1})	99.0 ± 64.0	135.0 ± 79.0	140.0	77.0 ± 44.0	140.0
Iron (mg·d^{-1})	8.7 ± 3.0	10.0 ± 3.0*	8.7	7.0 ± 2.0*	14.8
Magnesium (mg·d^{-1})	198.0 ± 77.0	239.0 ± 94.0	300.0	174.0 ± 55.0	270.0
Niacin (mg·d^{-1})	14.8 ± 6.3	19.9 ± 7.3*	16.5	12.0 ± 3.0*	13.2
Phosphorus (mg·d^{-1})	997.0 ± 382.0	1227.0 ± 461.0	550.0	865.0 ± 254.0	550.0
Potassium (mg·d^{-1})	2386.0 ± 877.0	2859.0 ± 1051.0	3500.0	2115.0 ± 634.0	3500.0
Riboflavin (mg·d^{-1})	1.1 ± 0.7	1.6 ± 0.8*	1.3	0.8 ± 0.4*	1.1
Selenium (μg·d^{-1})	39.0 ± 21.0	57.0 ± 25.0	75.0	29.0 ± 11.0	60.0
Sodium (g·d^{-1})	2.7 ± 0.7	3.0. ± 0.6	2.4	2.5 ± 0.7	2.4
Thiamin (mg·d^{-1})	1.3 ± 0.5	1.5 ± 0.5	1.0	1.1 ± 0.3	0.8
Vitamin A (μg·d^{-1})	634.0 ± 410.0	840.0 ± 388.0	700.0	516.0 ± 380.0	600.0
Vitamin B$_{12}$ (μg·d^{-1})	4.3 ± 2.6	6.0 ± 3.2*	1.5	3.3 ± 1.3*	1.5
Vitamin B$_6$ (mg·d^{-1})	1.5 ± 0.9	2.0 ± 1.2	1.4	1.2 ± 0.3	1.2
Vitamin C (mg·d^{-1})	55.0 ± 38.0	67.0 ± 49.0	40.0	49.0 ± 29.0	40.0
Vitamin D (μg·d^{-1})	2.0 ± 1.0	2.0 ± 1.0	10.0	1.0 ± 1.0	10.0
Zinc (mg·d^{-1})	7.1 ± 2.5	8.0 ± 3.0	9.5	6.0 ± 1.0	7.0

Figure 6: Absolute nutrient intake for participants compared to MDRVs and RDA (Chapman et al., 2019).

Another cross-sectional study, related to the above mentioned by Chapman et al. (2019), comparing the dietary intake of US military personnel to the MDRIs estimates that CHO intake constitutes of 51% median (47, 57%) of total energy consumption for males (n=307) and 53% (49, 57%) for females (n=280) (Lutz, Gaffney-Stomberg et al. 2019a)).

Moreover, the systematic review conducted by MacKenzie-Shalders, Tsoi et al. (2021) indicates that according to most of the studies, military recruits failed to reach the standards of CHO intake (n = 10, 91%) of the participants were below the MDRI of ≥55% of total energy. (MacKenzie-Shalders et al., 2021).

In addition to that, according to Baker et al. (2020) army recruits, internationally, are likely to be underconsuming energy for extended periods of their initial training, with greater deficits in carbohydrate intake compared with other macronutrients (Baker et al. 2020).

Interestingly, some studies reveal exactly the opposite about carbohydrate consumption. For instance, an Australian study by Kullen et al. (2019) reveals that roughly 20% of military recruits stated having a high carbohydrate intake, a dietary habit correlated to guidance for athletes and members in active military positions. Conversely, an analogous percentage of Physical Training instructors and cooks indicated a low CHO dietary status. The global fame of lower carbohydrate dietary patterns is high and related to lean mass gain combined with weight and fat loss, which were optimal body composition alterations found by the abovementioned sub-populations. Carbohydrate consumption must be applicable for activity level since insufficient carbohydrate consumption might cause unwanted effects in physical performance in some military positions (Kullen et al. 2019).

Briefly, CHO intake in soldiers, differs within the recommended limits for the average population but this is likely to be slightly lower than the MDRIs and MDRVs guidelines.
Literature reveals that according to studies which measured physical fitness and performance results, and based on a systematic literature review, army recruits, internationally, may be underconsuming energy for extended periods of their basic training, with serious deficits in carbohydrate intake, in comparison with other macronutrients. Special recommendations for military personnel have been given in MDRIs and MDRVs as explained earlier. On the whole, CHO intake ranges from 45 – 75 % of total energy intake with 50 – 65 % being more frequently proposed. (MacKenzie-Shalders et al., 2021).

2.8.2 Protein (PRO)

PRO is a macronutrient consisting of amino acids. Its role to the human body focuses in augmenting body cell mass so as to support growth, recovery and or adaptation (Hoffer 2016 ; Venn 2020) .

There is a strong affiliation between protein and muscle development and recent studies tend to focus more on protein and reveal its usefulness. Protein builds up bone density since calories are absorbed easily.

In former studies (2017) the U.S. Recommended Dietary Allowance (RDA) recommended 0.36 grams of protein per pound of body weight. The latter nutritional advice, according to Mike Nelson (Ph.D., an exercise physiologist and founder of Extreme Human Performance) was for the minimum body needs. In the 2nd World War, protein was the first nutrient recommendation for the soldiers' needs, when food was extremely limited. People who exercise more, or soldiers have excessive protein requirements, which reach 0.68 grams per pound and up to 0.75 grams in circumstances of demanding exercise (BEHAR 2016).

Newer studies suggest that more protein is needed. Guidance for the daily dietary intake of PRO for an average person is shown in Figure 7 and ranges from 10-35% of total energy intake. World Health Organization (WHO) refers that it differs from 10-15 % of total energy intake or 0,83 g/kg/d. As far as athletes are concerned, PRO intake fluctuates from 1.2 to 2.0 g/kg/d In soldiers' case, figure 6 presents the PRO suggestions given by MDRIs. These guidelines are the same with the general population. In consequence, it is hypothesized that military recruits are recommended to eat 10-15 % PRO of total energy intake per day (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. 2016).

Table 1. Dietary recommendations of % energy contribution to diet based on the prevention of chronic disease.

Source	Protein	Fat	Carbohydrate
New Zealand and Australia [8]	15–25	20–35	45–65
North America [9]	10–30 youth 10–35 adults	25–35 youth 20–35 adults	45–65
United Kingdom [10]	–	<35	50
World Health Organization [11]	10–15	15–30	55–75

Figure 7: Dietary guidance of energy contribution to diet micronutrients for the general populace.

(Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. 2016).

A cross-sectional study which correlates the dietary intake of US military personnel to the MDRIs infers that PRO consumption represents 15% of total energy intake for males (n=307) and 15% (13, 17%) for females (n=280) (Lutz, Gaffney-Stomberg et al. 2019b). The study by Chapman et al. (2019) that analysed the dietary intake of British army recruits in phase one training to MDRVs, concluded that PRO intake was 114 ± 29 g/d for males and 83 ± 18 g/d for females, which indicated an under-consumption of PRO in relation to MDRVs (Chapman et al. 2019).

Furthermore, it is undeniable fact that military training engages subjection to a high level of metabolic stress and it is necessary to measure accurately protein turnover. Just like athletes, soldiers' training has high levels of arduousness. Strength, power, and fortitude is the essential triad (Chapman, Chung et al. 2021).

For the abovementioned needs, another recent study by Hinde et al. (2021) attempts to analyse protein turnover. The latter can be measured with precursor-product and end-product methods at the tissue and whole-body level. In military training there are limitations in measuring. On the other hand, military training involves various exercises that make use of upper body, lower body, and core muscle groups. Measures of whole-body protein turnover is possible that can suit more for estimating protein metabolism in the military field (Hinde, O'Leary et al. 2021).

Another study conducted by Chapman et al. (2021) attempted to estimate the effect of protein supplementation on adaptations to strenuous training in healthy adults with possible applications to people during military training. Nine of the eleven studies had performance as a focal point, six based on body composition and four studies on muscle recovery. Cohen's d effect sizes indicated that protein supplementation ameliorated performance results (ES = 0.89, 95% CI = 0.08-1.70). Also, in a separate examination, muscle strength showed enhancement (SMD = +4.92 kg, 95% CI = -2.70-12.54 kg). Most studies did not indicate protein turnover, nitrogen balance and/or total daily protein intake (Chapman, Chung et al. 2021).

Furthermore, PRO intake for soldiers is compared with fat, in a recent study by Ross et al. (2020). Given the fact that active military units employ in severe training environments and need nutritional plan of actions in order to protect against abatements in performance and minimize the possibility of injuries (Ross, J. A., Thomas et al. 2020).

A cross sectional analysis was made to calculate energy and macronutrient characteristics related to performance standards. The materials and methods that were used: 78 male subjects (age: 28.4 ± 6.0 years, height: 178.3 ± 6.7 cm, mass: 84.3 ± 9.4 kg, 8.5 ± 5.8 years in the military environment) allocated to Marine Corps Forces Special Operations Command completed a 1-day performance estimation. Body mass, lean body mass, fat mass (FM), aerobic capacity (VO2max), lactate inflection point (LT), anaerobic power, anaerobic capacity, knee flexion strength, knee extension strength, peak knee flexion strength, and peak knee extension strength outcome values were noted. (Ross, J. A., Thomas et al. 2020).

According to the results, differences in knee flexion strength, knee extension strength, peak knee flexion strength, and peak knee extension strength were significant across low (LPRO), medium (MPRO), and high (HPRO) protein intake groups ($p < 0.05$) with LPRO performance metrics remarkably lower than both MPRO and HPRO and MPRO notably lower than HPRO. FM was remarkably higher in LPRO than MPRO or HPRO ($p < 0.05$). Low carbohydrate intake (LCHO) was associated with considerable body mass and FM correlated to high (HCHO) ($p < 0.05$).
Finally, there was no connection between fat intake and any variable. The study of Ross et al. (2020) concludes that accumulating in PRO intake is likely to have beneficial performance effects separate from total energy intake, whilst medium increases in CHO intake might be insufficient to intensify physical performance in the military environment (Ross, J. A., Thomas et al. 2020).

In addition to the abovementioned studies, an Australian study by Kullen et al. (2019) provides extra information regarding protein intake. Some of the participants of the study in the military personnel stated eating habits in alignment with results in an Australian athlete sample (for instance low fat, high carbohydrate, high protein, and high fiber diets). As a fact, higher protein consumption is likely to be suggested in several military circumstances to avoid energy deficits and reduction of muscle mass, however, excessive consumption of dietary and supplementary protein has been noted in military recruits (Kullen, Prvan et al. 2019).

2.8.3 Fat

Fat is the macronutrient constituted by fatty acids and glycerol and is regarded as basic for a healthy, balance nutrition. Fat is responsible for many vital functions of the human body. In particular, it provides an organism with energy and also gives vital components for the cell membranes and eases the absorption of fat-soluble vitamins (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. 2016 ; Venn 2020).

Public population recommendations indicate that fat intake should be average from 15-35 % of total energy intake (Venn 2020). Precisely, WHO advises that total fat should not surpass 30% of total energy intake, saturated fats should be < 10% and trans-fats < 1% of total energy intake. In addition, it would be better if fat consumption was based on unsaturated fats (World Health Organization 2018b).

As far as athletes are concerned, the guidelines do not differentiate from the general population ones, with the awareness that fat intake shouldn't be < 20 % of total energy intake MDRVs and MDRIs for soldiers also have recommendations for fat. The latter are like public guidelines as well (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance 2016).

Bry et al., (2020) estimate dietary intake, hydration status and body composition of three military groups, SOF (n=21) mean age 27,2 ± 2,8 years, infantrymen (n=22) mean age 28,1 ± 4,4 years and recruits (n=42) mean age 24,8 ± 5,9 years, in a time span of three-four days during their specific military training. Precisely, the nutritional evaluation was self-recorded. Fat consumption data were 33.4 ±3.3 %, 31.9 ±4.0 % and 42.3 ±1.6 % for SOF, infantrymen and recruits respectively. As regards to saturated fat, all groups surpassed the recommended 10% of total energy intake. Moreover, CHO intake was sufficient in SOF and infantrymen group and protein appeared to be adequate in all three groups (De Bry, Mullie et al. 2020 ; Mullie, Deliens et al. 2016).

Related studies by Lutz et al. (2019) and Belanger et Kwon (2016) have similar findings with Bry et al., and show fat intakes >30 % of total energy intake (Lutz, Gaffney-Stomberg et al. 2019b ; Belanger, Kwon 2016).
Based on our knowledge, there isn't any data for CHO intake nor for PRO or Fat for Cypriot Military recruits.

2.9 Micronutrients – Vitamins and Minerals

One of the huge attempts to ensure continual safety, optimal health and protection in military recruits, is to center to the nutrients of their food intake. The latter notion is related to all people, but in military there are special, distinctive needs combined with many different factors. According to WHO, micronutrients consist of vitamins and minerals needed for a human being in very small quantity. Nevertheless, they are regarded vital for the human body in order to work as it should be and stay in good physical condition (World Health Organization 2018b).

New health researches tend to focus on micronutrient deficiencies in general population. If it is well recognized that improving micronutrient status plays a key role to general health, all people's health will be ameliorated. The aim of the 2018 Irish Section Meeting 'Targeted approaches to tackling current nutritional issues' was basically to attain an overview of contemporary situation regarding to micronutrient status (Magee, McCann 2019).

It is proved that mild-to-moderate deficiency, or low levels of several micronutrients have vital consequences for the human organization, let alone the incidents of great levels of deficiency. It is crucial that policy makers, public health workers and scientists have to correlate, so as to ascertain that sustainable programmes are incorporated to label micronutrient deficiency in all people globally (Institute, Food and et al. 2006).

Micronutrient deficiencies are considered important for military performance. Researchers in military nutrition indicate that recruits' mineral intake fail to succeed the required standards given by the Medicine Dietary Reference Intakes (MDRI). The reasons are the following: most important of all, mineral deficit through sweat, due to extreme temperatures. Moreover, high demanding training or fighting (Magee, McCann 2019).

It should not be omitted that micronutrient inadequacy could become clinically menacing on some occasion e.g., most common cause of avoidable blindness, and less clinically noticed in other people, although still have negative impact on mental health and vitality. On the other hand, if the percentage of certain micronutrients is higher than recommended, then there is a strong likelihood of toxicity. The micronutrient needs for the human organism are recorded in the "Vitamin and mineral requirements in human nutrition" second edition by WHO and Food and Agriculture Organization (FAO) and are classified by age and gender. For pregnant and breastfeeding women there is certain guidance. Similar recommendations are noted by the Food and Nutrition Board of, National Academy of Sciences and mentioned as "Dietary Reference Intakes" (DRI) (Health Information on dietary intake. Ods.od.nih.gov. 2021).

Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Elements

Life-Stage Group	Calcium (mg/d)	Chromium (μg/d)	Copper (μg/d)	Fluoride (mg/d)	Iodine (μg/d)	Iron (mg/d)	Magnesium (mg/d)	Manganese (mg/d)
Infants								
0–6 mo	200*[a]	0.2*	200*	0.01*	110*	0.27*	30*	0.003*
7–12 mo	260*[a]	5.5*	220*	0.5*	130*	11	75*	0.6*
Children								
1–3 y	700	11*	340	0.7*	90	7	80	1.2*
4–8 y	1,000	15*	440	1*	90	10	130	1.5*
Males								
9–13 y	1,300	25*	700	2*	120	8	240	1.9*
14–18 y	1,300	35*	890	3*	150	11	410	2.2*
19–30 y	1,000	35*	900	4*	150	8	400	2.3*
31–50 y	1,000	35*	900	4*	150	8	420	2.3*
51–70 y	1,000	30*	900	4*	150	8	420	2.3*
> 70 y	1,200	30*	900	4*	150	8	420	2.3*
Females								
9–13 y	1,300	21*	700	2*	120	8	240	1.6*
14–18 y	1,300	24*	890	3*	150	15	360	1.6*
19–30 y	1,000	25*	900	3*	150	18	310	1.8*
31–50 y	1,000	25*	900	3*	150	18	320	1.8*
51–70 y	1,200	20*	900	3*	150	8	320	1.8*
> 70 y	1,200	20*	900	3*	150	8	320	1.8*

Figure 8: DRIs for Elements, 1 (Health Information on dietary intake. Ods.od.nih.gov. 2021).

Life-Stage Group	Manganese (mg/d)	Molybdenum (µg/d)	Phosphorus (mg/d)	Selenium (µg/d)	Zinc (mg/d)	Potassium (mg/d)	Sodium (mg/d)	Chloride (g/d)
Infants								
0–6 mo	0.003*	2*	100*	15*	2*	400*	110*	0.18*
7–12 mo	0.6*	3*	275*	20*	3	860*	370*	0.57*
Children								
1–3 y	1.2*	17	460	20	3	2,000*	800*	1.5*
4–8 y	1.5*	22	500	30	5	2,300*	1,000*	1.9*
Males								
9–13 y	1.9*	34	1,250	40	8	2,500*	1,200*	2.3*
14–18 y	2.2*	43	1,250	55	11	3,000*	1,500*	2.3*
19–30 y	2.3*	45	700	55	11	3,400*	1,500*	2.3*
31–50 y	2.3*	45	700	55	11	3,400*	1,500*	2.3*
51–70 y	2.3*	45	700	55	11	3,400*	1,500*	2.0*
> 70 y	2.3*	45	700	55	11	3,400*	1,500*	1.8*
Females								
9–13 y	1.6*	34	1,250	40	8	2,300*	1,200*	2.3*
14–18 y	1.6*	43	1,250	55	9	2,300*	1,500*	2.3*
19–30 y	1.8*	45	700	55	8	2,600*	1,500*	2.3*
31–50 y	1.8*	45	700	55	8	2,600*	1,500*	2.3*
51–70 y	1.8*	45	700	55	8	2,600*	1,500*	2.0*
> 70 y	1.8*	45	700	55	8	2,600*	1,500*	1.8*
Pregnancy								

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Figure 9: DRIs for Elements, 2 (Health Information on dietary intake. Ods.od.nih.gov. 2021).

Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Vitamins

Food and Nutrition Board, Institute of Medicine, National Academies

Life Stage Group	Vitamin A (μg/d)[a]	Vitamin C (mg/d)	Vitamin D (μg/d)[b,c]	Vitamin E (mg/d)[d]	Vitamin K (μg/d)	Thiamin (mg/d)	Riboflavin (mg/d)	Niacin (mg/d)[e]	Vitamin B_6 (mg/d)	Folate (μg/d)[f]	Vitamin B_{12} (μg/d)	Pantothenic Acid (mg/d)	Biotin (μg/d)	Choline (mg/d)[g]
Infants														
0–6 mo	400*	40*	10*	4*	2.0*	0.2*	0.3*	2*	0.1*	65*	0.4*	1.7*	5*	125*
6–12 mo	500*	50*	10*	5*	2.5*	0.3*	0.4*	4*	0.3*	80*	0.5*	1.8*	6*	150*
Children														
1–3 y	**300**	**15**	**15**	**6**	30*	**0.5**	**0.5**	**6**	**0.5**	**150**	**0.9**	2*	8*	200*
4–8 y	**400**	**25**	**15**	**7**	55*	**0.6**	**0.6**	**8**	**0.6**	**200**	**1.2**	3*	12*	250*
Males														
9–13 y	**600**	**45**	**15**	**11**	60*	**0.9**	**0.9**	**12**	**1.0**	**300**	**1.8**	4*	20*	375*
14–18 y	**900**	**75**	**15**	**15**	75*	**1.2**	**1.3**	**16**	**1.3**	**400**	**2.4**	5*	25*	550*
19–30 y	**900**	**90**	**15**	**15**	120*	**1.2**	**1.3**	**16**	**1.3**	**400**	**2.4**	5*	30*	550*
31–50 y	**900**	**90**	**15**	**15**	120*	**1.2**	**1.3**	**16**	**1.3**	**400**	**2.4**	5*	30*	550*
51–70 y	**900**	**90**	**15**	**15**	120*	**1.2**	**1.3**	**16**	**1.7**	**400**	**2.4**[h]	5*	30*	550*
> 70 y	**900**	**90**	**20**	**15**	120*	**1.2**	**1.3**	**16**	**1.7**	**400**	**2.4**[h]	5*	30*	550*
Females														
9–13 y	**600**	**45**	**15**	**11**	60*	**0.9**	**0.9**	**12**	**1.0**	**300**	**1.8**	4*	20*	375*
14–18 y	**700**	**65**	**15**	**15**	75*	**1.0**	**1.0**	**14**	**1.2**	**400**[i]	**2.4**	5*	25*	400*
19–30 y	**700**	**75**	**15**	**15**	90*	**1.1**	**1.1**	**14**	**1.3**	**400**[i]	**2.4**	5*	30*	425*
31–50 y	**700**	**75**	**15**	**15**	90*	**1.1**	**1.1**	**14**	**1.3**	**400**[i]	**2.4**	5*	30*	425*
51–70 y	**700**	**75**	**15**	**15**	90*	**1.1**	**1.1**	**14**	**1.5**	**400**	**2.4**[h]	5*	30*	425*
> 70 y	**700**	**75**	**20**	**15**	90*	**1.1**	**1.1**	**14**	**1.5**	**400**	**2.4**[h]	5*	30*	425*

Figure 10: DRIs for vitamins. *(Health Information on dietary intake. Ods.od.nih.gov. 2021)*

Up to date there aren't any extra requirements for athletes or military recruits. Needless to say, requirements are the MDRIs guidelines abovementioned. The only insignificant difference between public recommendations and MDRIs is noted in magnesium and sodium that is shown to be higher for soldiers.

Moreover, Vitamin D is vital to be adequate in soldiers, since it has impact on the optimal functional bone ability, oxygen efficiency, muscle and neuromuscular control (Sotelo-Díaz, Blanco-Lizarazo 2019).

Lutz et al., (2019) indicated inadequate intake of vitamin E, D, magnesium and potassium in male and female as well US military recruits and excessiveness of sodium. (Lutz et al. 2019). Those results abovementioned are similar with the data of Chapman et al., (2019) who evaluated dietary intake of British Army Recruits undertaking phase one training. Chapman et al., (2019) summarized inadequacy of copper, magnesium and vitamin D for men and women respectively and, moreover, inadequate intake of vitamin A sole for women (Chapman et al., 2019).

Furthermore, in another study by Ööpik et al. (2017) cramp venous blood analysis was conducted, four times during a 10-week normal military training to 94 participants of Estonian Defense Forces, average age 20.9 ± 1.7 years. Additionally, further surveys point out the persistence of vitamin D inadequacy was in high levels at the beginning of the basic military training with an escalation tendency at the end of it (Ööpik, Timpmann et al. 2017).

Another issue that shouldn't be neglected is the issue of dietary supplements. New research indicates that military training is a period of demanding physical exercise, including e.g., load carriage, having as a subsequent excessive risk of stress fracture compared to any other time in military life. Prior surveys noted a 20% reduction in stress fracture incidence with Ca and vitamin D (Ca + D) supplementation (2000 mg Ca, 800 IU vitamin D), and higher increases in tibia vBMD during BCT (Basic Combat Training), in comparison to placebo. It is well known that placebo is used in controlled trials. The utilization of this method is vital for the well-grounded evaluation of a therapeutic drug and is out of the question for the participants to realize the difference between the real product and the placebo one (Demasi, Jefferson 2021).

Going back in the abovementioned research, the main goal of the project by Gaffney-Stomberg et al. was to have as trialists 100 volunteers (50 males, 50 females, mean age 21.8 ± 3.5 years old). Trialists were chosen randomly regardless of race and sex to consume a daily Ca + D fortified food bar or placebo. The following methods such as anthropometrics, dietary intake, fasted blood draws and high resolution pQCT scans of the distal and mid-shaft tibia were collected at the beginning of BCT and 8 weeks later, at the end of training. As submission was 98% in both groups, an intent-to-treat analysis was made. At the distal tibia, total vBMD, Tb.vBMD, Tb.N, Th.Th and Tb.BV/TV was larger (+1.07 to 2.12% for all, $p < 0.05$) and Tb.Sp was smaller (0.96 to 1.09%, p $p = 0.01$) and Ct.vBMD was also lessened (−0.48 to −0.77%, p p). Concluding, military recruits who took dietary supplements during their training - once daily calcium (1000 mg) and vitamin D (1000 IU)- had the following effects: the dietary supplement averts increases in biochemical markers of bone loss and damage but does not influence tibial microarchitecture (Gaffney-Stomberg, Hughes et al. 2022).

2.10 Obesity-Overweight in the military field

Obesity in the military field is greatly affecting military readiness, as was already mentioned in the introduction of this thesis. The rates of obesity among services have gradually and firmly increased from 5.0% in 1995 to 17.4% in 2018. Obesity is logically correlated to reduced physical fitness and performance, magnified risk of nutrition-related health results (Troncoso, Jayne et al. 2021). Moreover, obesity is associated with a reduction in cardiovascular and neuromuscular fitness and greater levels of musculoskeletal disorders and injury in the military (Sanderson, Clemes et al. 2018).

WHO key results inform us that globally overweight and obesity, which are defined as abnormal or excessive fat accumulation that may cause health problems, has almost tripled between 1975 and ourdays (WHO 2021). Interestingly, in 2016, 39% of adults ≥ 18 years were overweight and 13% were obese. With regards to Cyprus, the numbers of obesity, in 2016, were 21,9 % and 21,6 % for males and females respectively (Our world in data 2021). Overweight rates were 65,2 % and 52,7 % for males and 52,7% for females.

In our knowledge, no data for Cypriot military population is available.

Vallgarda S. et al., in Lorenzo et al. states that obesity is a disease caused by numerous factors and is affiliated with harmful nutritional behaviours, genetic, hypothalamic, iatrogenic or endocrine diseases. In addition to that, low levels of physical activity and sedentary lifestyle play an essential role, while obesity is regarded as real pathology and obese bodies have greater possibility to acquire a list of comorbidities (Lorenzo, Gratteri et al. 2019).

Regarding to adults, as given by WHO, obesity and overweight are measured using the Body Mass Index (BMI), which will be examined in the next section (WHO, 2018).

Unfortunately, the comorbidities of obesity and overweight are well examined and the list involves type II diabetes mellitus, cardiovascular diseases, hypertension, increased risk of asthma, neural atrophy, cognitive decrements etc. (Urban, Boivin et al. 2016 ; Dye, Louise, Boyle, Neil, Champ, Claire, Lawton, Clare 2017 ; Lorenzo, Gratteri et al. 2019).

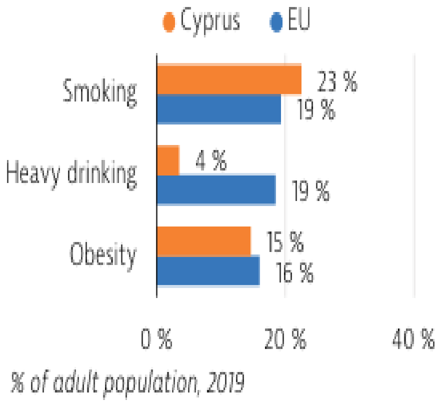
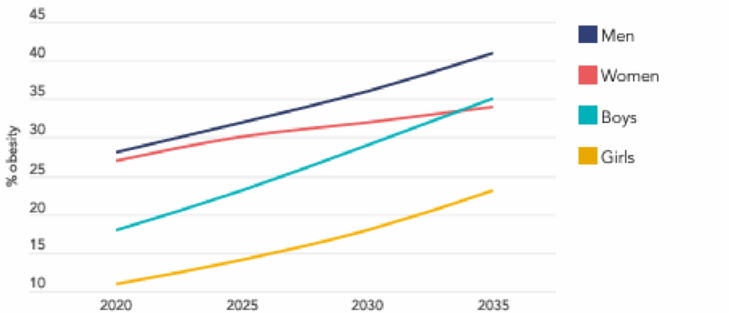


Figure 11. Obesity rates in Cyprus 2019 (Country Health Profile, 2023)

Cyprus

ADULTS WITH OBESITY 2035
39%
VERY HIGH

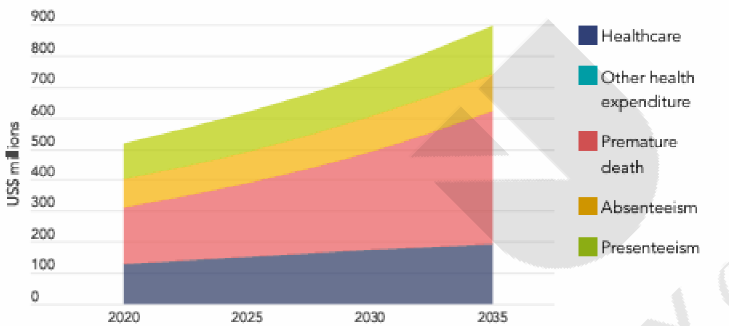
PROJECTED TRENDS IN THE PREVALENCE OF OBESITY (BMI ≥30kg/m²)



ANNUAL INCREASE IN ADULT OBESITY 2020–2035
2.4%
HIGH

ANNUAL INCREASE IN CHILD OBESITY 2020–2035
3.0%
VERY HIGH

PROJECTED ECONOMIC IMPACT OF OVERWEIGHT (BMI ≥25kg/m²)



OVERWEIGHT IMPACT ON NATIONAL GDP 2035
2.2%
VERY HIGH

IMPACT OF OVERWEIGHT (BMI ≥25kg/m²) 2020–2035

	Healthcare impact of BMI ≥25kg/m², US$ million	Total economic impact of BMI ≥25kg/m², US$ million	Estimated GDP US$ billion	Impact of BMI ≥25kg/m² on GDP
2020	130	516	24	2.1%
2025	151	617	29	2.1%
2030	171	741	34	2.2%
2035	194	894	41	2.2%

GLOBAL PREPAREDNESS RANKING
31/183
GOOD

SOURCES

Obesity data: RTI projections from NCD Risk Factor Collaboration (rights reserved). See References.

Annual increase: Compound annual growth rate 2020 to 2035.

Economic impact estimates: Summarised from RTI projections (rights reserved). See References.

Global Preparedness: A ranking of all countries for their relative preparedness to tackle obesity, from 1=best to 183=worst. See Appendix.

Figure 12: World Obesity Atlas 2023

As it is shown in Figures 11 and 12, obesity and overweight are rising in an alarming rate. It is obvious that the escalation rate is a factor to be concerned, and strategies must be constructed and designed to hold back obesity.

It must be mentioned that countries create their own regulations and standards which refer to the optimal nutritional status for army recruits. For example, US Army institutionalized Army Regulation 600-9, while Europe established Regulation 2019 (Regulation 2020 (amendment of regulation 2019) 2020).

The aim of this establishment was to ascertain if the service recruit reaches the body composition standards. During the examining procedure weight and height are calculated in congruence to sex and age. If the service member surpasses or his/her measurements are inferior to the standard, then a body fat evaluation is required applying taped anthropometric measurements. In the latter, males have WC and NC measurements noted at the same time as females have WC, NC and hips measured.

Furthermore, for instance, in the French army the situation is even more complicated and severe. In France, in which obese military recruits or even persons with extra WC are appraised inappropriate for the army (Quertier, Goudard et al. 2022). To our knowledge, as for Cyprus, for the purpose of joining the Contract Hoplites establishment, the person concerned has to carry out a health examination, a military test, combined with an athletic test. However, not even one of these tests refers to nutritional status regulations (Mod.gov.cy. 2021. (Law 19 (I) / 2011) G.G., Par. I (I), No.4271, 25/2/2011. 2021).

A cross-sectional study by Meyer and Cole, (2019) suggests that prompt interventions when signs of weight gain are detected, could help soldiers meeting the optimal weight and fat standards. This study, conducted in 189 US soldiers attending the primary assessment Army Body Composition Program (ABCP), mean age 28.5 ± 7.2 years, attempts to analyse the fat sector. Precisely, the initial intention was to examine the level of military recruits' obesity at an Army Nutrition clinic in Washington State. Among the methods were a questionnaire, anthropometric measurements, body fat evaluation through AR 600–9 standards, combined with a laboratory blood draw for fasting glucose and lipid panel. Interestingly, the outcome showed that army recruits were mostly male (76%), obese (BMI 32 kg/m2 for males and 30 kg/m2 for females), surpassed body fat standards by 3.8% for males and 7.3% for females respectively. Most of the army recruits were categorized as obese (Meyer, Cole 2019).

Bernstein et al. (2017) made an attempt to examine body fat and deduced the conclusion that WtHR ≤ 55% is a successful tool for body composition measurement, which gives the chance to prognosticate a human organism attainment of body fat standards metric for reaching AR 600-9 (Army Regulation) standards. WhHR consists of weight-to-height ratio, providing standards prerequisite for army recruits to undertake body fat taping estimation. According to Bernstein et al. (2017), WtHR is an effortless and easiest method instead of the usual methods. In the period of one year to Iraq (2009-2010), 42 Soldiers (34 males, 8 females) were measured and observed by battalion medical staff for weight and body fat reduction. Mean body mass index and waist circumference were in comparison between baseline the primary assessment and final estimation. Soldiers who reached body fat standards correlated among those who had accomplished a WtHR ≤ 55% contrary to those who failed to reach it. The study by Bernstein et al. (2017) concludes that according to the finishing estimation, mean body mass index had reduced 2.21 kg/m 2 or 6.6% ($p = 0.002$) and mean waist circumference had reduced 6.0 cm or 5.8% ($p = 0.008$) (Bernstein, Lo et al. 2017).

Outlining a program beneficial for health throughout augmenting physical activity is likely to aid weight management. A study conducted by Sanaeinasab et al. (2020) indicates that an intervention according to the theory of planned behaviour program (TPB) could possibly contribute in fostering physical activity and reducing weight in obese or overweight army recruits. In particular, Sanaeinasab et al. (2020) searched whether a theory of planned behaviour (TPB) program was helpful and useful in interaction with soldiers, in order to assist them in managing their weight. Among the methods of the study were a questionnaire assessed, blood glucose and lipid levels. Two groups were made: the intervention group and the control group. (Sanaeinasab, Saffari et al. 2020).

Moreover, in the above mentioned study by Sanaeinasab et al. (2020), the intervention included seven educational sessions planned on TPB. The results revealed improvement between baseline and follow-up in the intervention group ($p <.001$), while there were no noteworthy changes in the control group. Light and medium tension physical activity was marked in the intervention group. Body mass index was seriously reduced within the intervention group ($p <.001$). Moreover, alterations in triglyceride and high-density lipoprotein benefited the intervention over the control group (Sanaeinasab, Saffari et al. 2020).

Another thing that seems significant for military recruits is weight or fat reduction and preservation of the optimal body composition. According to Naghii (2006) a noteworthy level of body fat has been observed as a negative impact on performance in numerous of military activities. Furthermore, rapid weight loss has also negative consequences on performance, since the procedure of weight loss, the amount of weight loss, and the type of exercise or activity performance are important factors to be considered. Incorrect weight loss is a source of a loss of lean tissue and is likely to reduce, rather than intensify performance (Naghii 2006).

Moreover, weight management is effective when adjusted to people who have the accurate perception of their body status, otherwise they face more difficulties to lose weight. Breland et al. (2020) focus on weight perceptions and their alignment with weight loss trials in military personnel. The latter consist of a special group concerning weight perceptions as military recruits have to reach the austere weight standards, so as to continue to exist in military service. Breland et al. (2020) were based on statistics from the U.S.-2013–2014 and 2015–2016 National Health and Nutrition Examination Surveys. Among 6,776 participants, people who noted military service had higher chances of undervaluing their weight in comparison to people that did not note military service. Moreover, undervaluing weight was linked with lower chances of struggling weight loss among participants who noted military service. Breland et al. (2020) suggest that in order to fight weight misperceptions, clinicians are likely to have to provide extra time informing patients and solving misperceptions. Such discussions are even more significant for people in military service. (Breland, Patel et al. 2020).

A new research attempts to analyse weight-bias against men in the military personnel. Weight bias is a term that refers to negative beliefs, demeanours, and discriminations towards people due to their extra weight or obesity. It seems that people easily have prejudices such as categorizing obese individuals as lazy, less adept, or having insufficient self-control in comparison to individuals with average and desirable weight. This bias is likely to generate excessive stress. Christian et al. (2020) presented to military recruits a picture of a soldier who had either average weight or overweight. In both situations, the description of the soldier noted that his physical fitness and job-related abilities were good. On the other hand, the soldier's worthiness for promotion was evaluated lower in the overweight situation. Data of this research prove the presence of bias on the mental and physical health of men with excessive weight (Christian et al. 2020).

It has been already mentioned in the introduction of this thesis that overweight and obesity has negative impact on a human being's psychology. Self-esteem issues, body disappointment, negative feelings for the body based on body discrimination and body shaming, weight stigma on the whole, often generate eating disorders and the possibility of depressive symptoms should not be excluded (Christian, Parekh et al. 2020). Furthermore, Shank et al. (2019) point out that military-specific weight stigma has negative impact on physical health (Shank, Schvey et al. 2019).

To dwell more, weight stigma is affiliated with unfortunate health indications, such as high levels of cortisol lipid/glucose de-regulation, and deficient self-rated health. The abovementioned connection could be more suitable for military recruits, due to the cultural emphasis on fitness and optimal figure. Moreover, another study for obesity in military by Voss et al. (2019) suggests that obesity stigma is prevalent and significantly widespread nowadays. Precisely, in the US, people faced and reported weight discrimination both in their social relationships and their work environment. It is worth to mention that this particular discrimination is related to a 60% higher risk of mortality. On the whole, this number is higher than the risk of mortality connected to race, sex, age or any other bias (Voss, Pavela et al. 2019).

Moreover, another factor that should not be neglected is stress and the correlation with nutritional patterns. A study conducted by Jayne et al. (2020), based on the notion that stressful life changes are likely to add pressure and affect a person's adjustment ability. The study aimed to analyse whether and when incidents of stressful life changes were correlated with increased likelihoods of adverse nutrition-related health results among US Army soldiers, compared to recruits who did not have the same stressful life change. In other words, examines stressful life changes and their impact on nutrition and overall health among US military personnel (Jayne, Blake et al. 2020).

Making use of long-run information from the Stanford Military Data Repository, which constitutes of all active-duty soldiers aged 17–62 years old, in the period between 2011 and 2014 (n = 827,126), Jayne et al. (2020) engaged an event history analysis to evaluate the connection between stressful life changes and a subsequent identification of hyperlipidemia, substantial weight gain, along with weight-related separation from the Army. Marriage was connected to an increase in the odds of considerable weight gain 3 months later for both males and females. Interestingly, adding a physical duty limitation was affiliated with an increase in the odds of a hyperlipidemia diagnosis two months after for both males and females, similar to significant weight gain two months after. Finally, stressful life changes and emotionally demanding circumstances were also linked with increased odds of nutrition-related health results (Jayne, Blake et al. 2020).

2.11 Assessment of body fat

2.11.1 Body Mass Index (BMI)

BMI is recognised by WHO as the most vital and commonly used technique globally for assessing fat in the human organism. WHO also informs that BMI is regularly used to categorize overweight and obesity in adults and it consists of weight in kilograms divided by the square of height in meters (kg/m^2). This approximate indication is believed to be the most effective way to measure, since it suits equally for men and women, and all adults too, regardless to age (WHO, 2021).

Figure 13 states the categorization of Nutritional Status based on Body Mass Index, as given by WHO.

BMI	Nutritional status
Below 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Pre-obesity
30.0–34.9	Obesity class I
35.0–39.9	Obesity class II
Above 40	Obesity class III

Figure 13: Categorization of Nutritional Status regarding to BMI (WHO, 2021).

Friedl KE in Shams-white, (2020), emphasizes that the exclusion for overweight in the US Army diverges from that of the WHO and is raised at >27.5 kg/m^2 for males, aiming to measure the muscle mass (Shams-White, Chui et al. 2020).

Despite its usefulness, especially when it has to do with to large populace, BMI has various limitations. First of all, the constancy for individuals is low. Moreover, it doesn't take into consideration sex and age and finally, when it comes to special occasions, such as athletes, it is not accurately indicative for fat mass. The most widely used parameter for diagnosis, body mass index (BMI) is not totally accurate in estimating the body fat. In fact, many studies argue that only BMI has difficulties to define and assess obesity. The main reason is that the latter involves excess fat mass and not necessarily weight gaining (Ross, R., Neeland et al. 2020).

Obesity, interestingly has many paradoxes, according to Lorenzo et al. (2019). Appropriate methods were applied in order to estimate fat mass levels associated with clinical and genetic analysis. All the aforementioned tools and indicators provided the possibility to recognize diverse phenotypes of obesity, which clarify many paradoxes of obesity. It is vital to take advantage of all available master plans to be able to fight obesity, moderate and decrease the suffering of patients, and lessen the social and treatment costs of obesity (Lorenzo, Gratteri et al. 2019).

In addition to the above, Ross et al. (2020) suggest that BMI is unable to indicate abdominal adiposity, a biomarker that has an association with morbidity, particularly in cases of cardiometabolic disease (Ross, R., Neeland et al. 2020).

Moreover, using BMI as a measuring method for the military recruits, several points in Shams-white, (2020) emphasize that as an evaluating tool, BMI faces difficulties in correctly identifying and perceive the difference between fat and fat-free mass at the individual parameter, and there is a risk of wrongly classifying military recruits with excess muscles as overweight or obese (Shams-White, Chui et al. 2020).

Another parameter that should be mentioned is that high BMI is associated to high levels of morbidity and mortality. At Cabalero (2019) it is noted that > 60% of the morbidity and mortality is related to a BMI ≥ 30 kg/m^2 (Caballero 2019).

Additionally, BMI and its correlations to health disorders and comorbidities can be seen in a study that was held from 1990 to 2015 in 195 countries. The aim and rational of the particular study was to estimate health effects of overweight and obesity. The study indicates, among other measurements, the rate of morbidity connected to high BMI. As seen in Figure 14, the percentage of all-cause disability, including musculoskeletal disorders, cancers etc. is increased in BMI $\geq$ 30 kg/m^2 . (Afshin, Forouzanfar et al. 2017).

It is noted that Life expectancy declines 2-4 years for a BMI over 30 and reduces 8-10 years for a BMI over 40. As seen in Figure 14, the percentage of all-cause disability, including musculoskeletal disorders, cancers etc. is elevated in BMI $\geq$ 30 kg/m2 (Afshin, Forouzanfar et al. 2017).

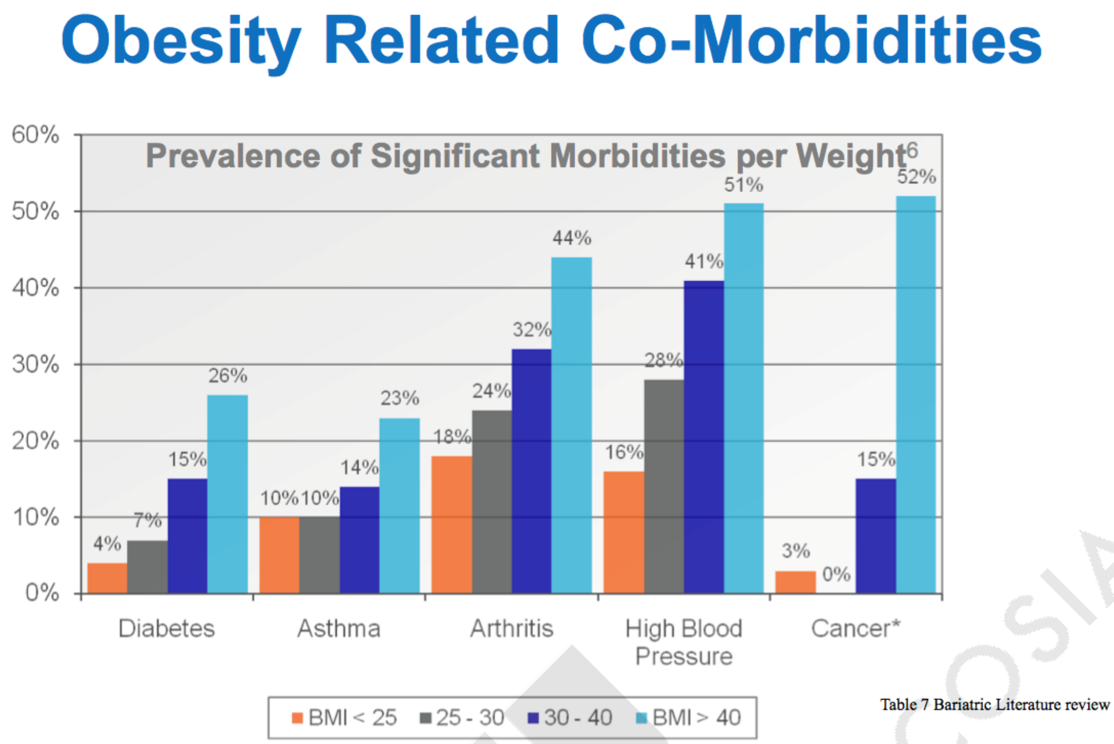


Figure 14: Obesity Related Side Effects. (Afshin, Forouzanfar et al. 2017).

In the military field, several studies included in Quertier et al., (2020) highlight that overweight and obesity effects in a negative way operations that involve military occupation. (Quertier et al., 2020). Moreover, a research showed that excess body fat increases the risk of asthma, especially during the first two years of military service (Urban, Boivin and Cowan, 2016). Bernstein et al. (2017) go further than that and emphasize on the negative influence on military preparedness, health in general, and the costs that associate and are correlated with health. Army Regulation 600-9 for US army as stated in Bernstein et al., (2017), reports that body weight over the standard levels can lead to physical troubles and body damages related to military service.

Without any doubt, obesity has negative consequence and impact involving financial factors. The latter statement is based on Peake et al. (at Meyer and Cole, 2019), in a research conducted by Meyer and Cole, (2019). They reveal that obese Australian defence force soldiers had augmented health care costs. In addition to that, extra health care burden is connected with habitual and systematic absence from work and duties, and capability lack in comparison with optimal weight soldiers, for obvious reasons. Also, in a British army population (n = 50635) obesity was connected and linked with augmented miscarriage and reduced involvement on tests such as the Annual Fitness Test and on Personal Fitness Assessment (Sanderson, Clemes et al. 2018).

When it comes to obesity, diagnosis is crucial to correct and adjust to nutritional recommendations. A study by Yang et al. (2020) aimed to examine identification of obesity correlated to recorded Body Mass Index (BMI) in the military health sector. Their study involved active duty military service recruits aged between eighteen to sixty-five years from 2013 to 2018. Information was gathered from the Clinical Data Repository vitals and M2 encounter records to define the proportion of each group with an estimation of obesity regarding to BMI (≥30 kg/m2) and International Classification of Diseases diagnosis rules. Applying BMI, 19.2% of women and 26.8% of men military recruits can be detected with the occurrence of obesity (Yang, D., Beauvais et al. 2021).

Nevertheless, only 42.2% and 35.1%, respectively, with a BMI ≥30 was diagnosed as having obesity. This inconsistency was steady among all service segments and BMI ranges. To sum up, Yang et al. (2020) center attention to the fact that obesity is underdiagnosed in comparison to BMI, which is likely to cause inadequate assets being offered to patients aiming to lose weight. (Yang, D., Beauvais et al. 2021).

Another study by Anyżewska et al. (2021) focuses on the issue of overweight and obese military personnel. Extra weight is a burden for soldiers, because of the nature of military demanding expeditions and performance overall. Their study tried to examine the correlation between diet, physical performance and the nutritional status of military personnel of the Polish Air Cavalry Units. 120 men (average age 28 ± 5 years old) answered to a questionnaire regarding to food regularity and long-form physical activity. Only 69% of the military recruits ate breakfast every day regularly, and the majority of them (58%) only had their first meal at work. Lunch was eaten every day by one out of two soldiers (51%). Almost everyone (90%) had dinner every night. An afternoon snack was consumed every day only by 20% of the military recruits and supper by almost 75% of the participants (Anna Anyżewska, Roman Łakomy et al. 2020).

The aforementioned irregularities in the rate of recurrence of eating meals are a symptom of largely poor eating habits. Body composition was examined by bioelectrical impedance analysis, and bone calcification of the forearm was measured by the DXA (Dual Energy X-ray Absorptiometry) densitometric method. This study proved the connection between the diet and physical activity and body mass index (BMI), fat mass index (FMI), and bone mineral density (BMD), stated as T-score. Important negative associations were assessed between BMI and the regularity of intake of cereal products, meat products and fish, and nonalcoholic beverages, between FMI and cereal products, and between BMD T-score and meat products and fish, fat, nuts, and grains, sweets and snacks, and nonalcoholic beverages (Anyżewska, Łakomy et al. 2020).

Figure 15 indicates useful information about dietary preferences and BMI, FMI and T-score.

Table 5. Relationship between the foods eaten (FFQ) and body mass index (BMI), fat mass index (FMI), and bone mineral density expressed as T-score.

Groups of foods	BMI		FMI		BMD T-Score	
	rho	*p*	rho	*p*	rho	*p*
Food groups						
Fruits, vegetables, seeds of legumes, and potatoes	−0.03	0.739	−0.11	0.291	0.04	0.668
Cereal products	−0.22	0.031 **	−0.25	0.012 **	0.07	0.478
Dairy products and eggs	−0.13	0.210	−0.16	0.114	0.06	0.573
Meat products and fish	−0.23	0.021 **	−0.10	0.325	−0.23	0.024 **
Fats, nuts, and grains	−0.15	0.134	−0.11	0.297	−0.22	0.030 **
Sweets and snacks	−0.13	0.205	−0.07	0.467	−0.27	0.007 **
Non-alcoholic beverages	−0.31	0.002 **	−0.19	0.052 *	−0.32	0.001 **
Alcoholic beverages	0.10	0.311	0.19	0.055 *	−0.10	0.348

Figure 15: Relationship between the foods eaten (FFQ) and body mass index (BMI), fat mass index (FMI), and bone mineral density expressed as T-score. (Anyżewska, Łakomy et al. 2020).

Moreover, according to Anyzewska et al. (2020) physical activity noted as metabolic equivalent (MET-minutes/week) negatively correlated with FMI (but not BMI) and positively associated with the BMD T-score. The study verified a series of abnormalities in eating habits and nutritional status parameters and concludes that a necessity for nutritional education is detected and further observe of both dietary habits and military recruits' nutritional patterns (Anyżewska, Łakomy et al. 2020).

Interestingly, a new study by Clerc et al. (2020) indicates thar the levels of overweight and obesity are belittled in military field. Using current BMI cutoffs when compared with body fat mass as measured by either dual-energy X-ray absorptiometry or bioelectrical impedance analysis as the gold standard. Using a reduced BMI entrance and refining positive results throughout history, exam, labs, and/or more specific measurements of body composition would more correctly calculate body fat percentage in active-duty soldiers. Based on the fact that obesity is at an elevating pace in U.S, Clerc et al. suggest that there is an essential need for new approaches to examine, as well as handle overweight and obesity in military, intending to ameliorate service physical aptness (Clerc, Mayer et al. 2021).

BMI is commonly used and in spite of its limitations, is suggested as a helpful method to estimate fat. However, clinical judgement is necessary in understanding and evaluating BMI, because there are situations that have an effect on BMI, such as edema, high possession of muscular strength, cases of muscle loss or human organisms who have limited stature *(The practical guide [electronic resource] : identification, evaluation, and treatment of overweight and obesity in adults / National Institutes of Health, National Heart, Lung, and Blood Institute [and] North American Association for the Study of Obesity. 2000).*

According to Meyer and Cole, (2019), even though BMI does not discern weight from lean mass and fat mass, a higher BMI is connected with higher body fat mass (Meyer, Cole 2019).

Furthermore, a study in the Brazilian army reveals significant information about fat accumulation in different parts of the body. Laércio et al. (2020) argue that adipocyte volume could take separate part in the metabolic process and in the emerge of cardiovascular risk factors.

Most studies suggest that the regional dispersal of body fat appears to be more significant than excess adiposity by itself. Advanced and top-level physical activity is affiliated with reduced total and visceral body fat levels. Given the fact that physical training is vital for both health and performance of recruits in the Brazilian Army, physical estimation could give information on the main physical benefits involved in military duties. The aim of the study was to confirm the connection between visceral fat (VF), physical performance and biochemical markers of soldiers in the Brazilian Army. Laércio et al. conclude that there is an important negative connection between VF and physical tests, while a notable positive connection between VF and TG was also recorded (Laércio, Marcos de Sá et al. 2020).

At a related research in Montenegro, Banjevic et al. (2020) studied body mass index (BMI) in correlation to body Fat Percentage of Armed Forces Personnel among different age groups. This study is driven by the fact that BMI and fat percentage in one's body are essential indicators for the examination of overweight and obese soldiers**.** Therefore, based on a sample of two hundred and forty active military recruits, the study concludes that from the BMI data, 45.5% of the recruits were overweight and 24.2% were obese. However, based on the fat perspective, data indicate that there is not a significant issue or a problem in a fearing rate (BANJEVIC, POPOVIC et al. 2020).

Zhu et al. (2020), based on the fact that former studies in US military personnel led to obesity false classification, attempted to examine whether BMI and Waist-to-hip ratio (WHR) represents accurately the fat mass of Chinese military personnel. The participants in their study were 353 men of Chinese military personnel and 380 men adults in similar age. Obesity classification was assessed by BMI, WHR, and Body Fat Percentage (BFP). Chinese military recruits recorded significantly low obesity rate assessed by BFP (0.3%) and BMI (0.6%). In comparison to overweight and obese individuals, BMI- and WHR- set occurrence of overweight and obesity was 22.4% and 17.0% respectively compared to BFP found result (4.0%) ($P < 0.05$). When it comes to BFP, BMI and WHR noted high false-positive calculation related to the control group. Zhu et al. suggest that BMI and WHR note high false-positive rates in alignment to BFP, therefore can not accurately assess the mass of adipose tissue ensuing to obesity misclassification (Zhu, Huang et al. 2020).

2.11.2 Waist Circumference (WC)

Waist circumference is an additional method to estimate weight. Compared to BMI, WC provides the benefit of better estimations about adipose tissue accumulation in the human organism. In other words, people have a very useful tool to examine fat levels. On the whole, WC is considered as a helpful method to assess abdominal fat. The latter is an essential parameter of morbidity and mortality. The scientific studies suggest the combination of the application of BMI and WC for more accurate estimations *(The practical guide [electronic resource] : identification, evaluation, and treatment of overweight and obesity in adults / National Institutes of Health, National Heart, Lung, and Blood Institute [and] North American Association for the Study of Obesity. 2000,* Ross, R., Neeland et al. 2020).

Additionally, Figure 16 reveals the classification of overweight and obesity by BMI, WC and the correlated risk for disease. For males WC >102 cm and for females respectively WC >88 cm signifies abdominal obesity and increase risk. WC for males, ≥90 cm and for females respectively, ≥80 cm is believed to be in higher levels than standard. (*The practical guide [electronic resource]: identification, evaluation, and treatment of overweight and obesity in adults / National Institutes of Health, National Heart, Lung, and Blood Institute [and] North American Association for the Study of Obesity. 2000).*

Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risk*

	BMI (kg/m2)	Obesity Class	Disease Risk* (Relative to Normal Weight and Waist Circumference)	
			Men ≤40 in (≤ 102 cm) Women ≤ 35 in (≤ 88 cm)	> 40 in (> 102 cm) > 35 in (> 88 cm)
Underweight	< 18.5		-	-
Normal†	18.5–24.9		-	-
Overweight	25.0–29.9		Increased	High
Obesity	30.0–34.9	I	High	Very High
	35.0–39.9	II	Very High	Very High
Extreme Obesity	≥ 40	III	Extremely High	Extremely High

* Disease risk for type 2 diabetes, hypertension, and CVD.

† Increased waist circumference can also be a marker for increased risk even in persons of normal weight.

Adapted from “Preventing and Managing the Global Epidemic of Obesity. Report of the World Health Organization Consultation of Obesity.” WHO, Geneva, June 1997.[28]

Figure 16: Classification of overweight and obesity by BMI, WC and associated desease risk.
(*The practical guide [electronic resource]: identification, evaluation, and treatment of overweight and obesity in adults / National Institutes of Health, National Heart, Lung, and Blood Institute [and] North American Association for the Study of Obesity. 2000).*

L.M. Verweij et al., in Anothaisintawee et al., (2019) highlights that one of the constraints of WC is that there is not a typical set of rules and regulations to be used as protocol for the measurements. This limitation based on the lack of protocol leads to various diverse measurements and calculations. Furthermore, many parameters could have impact on the estimations, respiration for instance (Anothaisintawee, Sansanayudh et al. 2019).

In addition to the aforementioned, Griffith et al., (2018), underline that WC as a measurement on its own can often be deceptive and for more accurate results combination with other indicators, such as height (Griffith, White et al. 2018).

It is worth mentioning that apart from WC, Hip Circumference and Waist to Hip ratio are also used to assess nutritional status.

Interestingly, amid the several body composition indicators, such as BMI, WC, Waist to Height Ratio, Waist to Hip Ratio, the US Air Force uses merely WC to assess the physical fitness of the soldiers, as stated by the "Department of the Air Force: Fitness Program: AFI 36-2905". (Griffith, White et al. 2018).

A recent cross-sectional study in China by Zhang, F., Ren et al. (2021), aimed to associate anthropometric indicators, suggests that there is a significant connection of Waist Circumference (WC), Body Mass Index (BMI), Waist-to-Height Ratio (WHtR), and Waist-to-Hip Ratio (WHR) in cases of diabetes. Precisely, escalating obesity augmented the number of diabetes and there is an imperative necessity to find accurate tools to prognosticate diabetes. 4052 participants mean age forty years were measured for the needs of the study. To measure BMI, waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) were separated into quartiles (Q1: <25%; Q2: ~25%; Q3: ~50%; and Q4: ~75%) (Zhang, F., Ren et al. 2021).

The outcome of the aforementioned cross-sectional study showed that for all four body fat-measuring indicators of Body Mass Index (adjusted OR: 3.300, 95% CI: 2.370, 4.595), WC (adjusted OR: 5.131, 95% CI: 3.433, 7.669), WHR (adjusted OR: 3.327, 95% CI: 2.386, 4.638), and WHtR (adjusted OR: 5.959, 95% CI: 3.922, 9.054), patients which had greater numbers in quartile had bigger risk to become diabetic compared with participants in the lowest quartile. Finally, the WC and WHtR were more closely related to diabetes than BMI and WHR. The outcome of the abovementioned study by Zhang et al. gives strong evidence that WC is a very useful tool for estimations about weight, fat and obesity on the whole. (Zhang, F., Ren et al. 2021).

A study as already mentioned conducted by Ross R. et. al. (2020), focuses on WC and suggests that in spite of numerous unequivocal indications that WC offers independent and supplemented data to BMI for forecasting morbidity and risk of mortality, this assessment tool is not usually and commonly used in clinical practice. Ross R. et al. (2020) highlight that WC calculations provide an essential technique for health improvement and patients' management by specialists. Even though they accept that BMI alone insufficient to estimate accurately the cardiometabolic risk correlated with augmented adiposity in individuals, they evidently prove decrease in WC is possible to be accomplished by regular, medium-intensity exercise and/or dietary interference (Ross, R., Neeland et al. 2020).

2.11.3 Neck Circumference (NC)

Neck Circumference (NC) is a trustworthy anthropometric measure capable to estimate central obesity (an excess of visceral fat) and it has been also correlated with visceral adipose tissue (Anothaisintawee, Sansanayudh et al. 2019 ; Wan, Wang et al. 2020).

Precisely, Wan et al. (2020), conducted a cross-sectional study, aiming to examine the correlation between obesity phenotype indicators and diabetic complexities among Chinese adults. Moreover, it has been related to the prevalence of common carotid artery plaque in Chinese individuals with diabetes. Furthermore, a study by Anothaisintawee et al., (2019) marked firstly a correlation between NC and WC in prediabetes and secondly the fact that NC ≥ 32 cm in women and ≥ 38 cm in men are the most useful cutoff tools to prognosticate excess of visceral fat. (Anothaisintawee, Sansanayudh et al. 2019).

In addition to the abovementioned, as stated by a study in Bangladeshi adults, NC ≥34.75 cm for males and NC ≥31.75 cm for females indicates overweight while NC ≥35.25 cm and NC ≥34.25 cm for men and women respectively indicates obesity. The Bangladeshi research argues that NC is a useful, appropriate, convenient, effortless evaluating indicator to identify overweight and obese participants (Qureshi, Hossain et al. 2017).

NC is earning extra attention recently and some countries have already implemented this anthropometric indicator in their military recruits. For instance, US, as stated by Army Regulation 600-9 (US ARMY 2019). As stated also by Wang (2021) lately, NC has gained bigger notice as a new estimation tool. The purpose of Wang's research was to analyse the connection between NC and overweight in Chinese Yi adolescents. 647 Chinese boys and girls aged 13-18 years, were randomly chosen. The measurements included height, weight, waist circumference (WC), and NC and combined with information given. The relationship between NC, body mass index (BMI), and WC was set on by Pearson's correlation number. The ROC analysis indicated that the AUC estimations were 0.79-0.95 for males and respectively 0.83-0.91 for females. The interconnection between NC, BMI, and WC in obese males and females was higher than 0.70 in both sexes. Moreover, the NC cutoff values of high BMI fluctuated from 31.0 cm to 36.1 cm for males and 31.2 cm to 34.5 cm for females. An important positive connection was found between NC and obesity in Chinese Yi adolescents. Conclusively, Wang suggests that NC is applicable for usage as an auxiliary indicator for obesity predictions (Wang 2021).

2.12 Diet quality assessment/interventions on diet and physical activity

Diet has for ages been the basis of weight controlling, with dietary regulations, governments' guidelines, and strategies to eliminate obesity. As a fact, unhealthy nutrition is the main reason of preventable obesity-related death and NCD, counting cancer, cardiovascular disease (CVD) and type 2 diabetes (T2DM), accounting for eleven million deaths per year. As a consequence, according to Dicken and Batterham (2022) dietary corrections and adjustments could be capable of avoiding one in every five deaths. There is combining evidence that a nutrient-rich diet is based largely on whole, plant-based foods, containing fruit, vegetables, pulses, nuts, whole grains as well as oily fish. Analogous diets, Mediterranean diet for instance, are dense in fibre and poor in saturated fat, sodium and added sugar consumption. On the contrary, Western diets dense in refined grains, red and processed meat, sweets and sugar-sweetened beverages have high levels of saturated fat, sodium, extra sugar and they are linked with an elevated risk of disease (Dicken, Batterham 2022).

When it comes to interventions on dietary and nutrition of young people, they seem to be beneficial, since youth is a period with excess vulnerability in weight gain (Weight loss interventions in young people (18 to 25 year olds): a systematic review. 2010b). According to this systematic review contributed by Poobalan, Aucott, et al. (2010) 14 studies reviewed that involved interventions and information before and after comparison of behavioural/motivational interventions (-2.40 kg; 95% CI -5.4 to 0.6). Also, combination interventions were examined (-2.96; 95% CI -4.4 to -1.5) and constantly revealed weight loss. Apart from weight loss, other positive impacts were the following: better self-worth, the pursuit of control weight, enhanced self-esteem, and young people satisfied up to a noteworthy level with their body and look. Health field should be considered, since the abovementioned 14 studies noted positive results and progress in HDL cholesterol, insulin, glucose and maximum oxygen intake (Poobalan, Aucott et al. 2010).

Precisely, diet quality is an issue that needs further studies in the military field. Nutritional quality differentiates, subjected to the availability of food, traditions related to culture, and is relevant to the time and effort by soldiers to search for food with optimal quality. Nutritional status might fluctuate from sufficient to inadequate (Rittenhouse, Scott et al. 2021).

Moreover, terms such as comfort food are very applicable, especially in young people and soldiers as well. Comfort food is defined as food which its role is complicated. It does not solely provide nourishment aiming to survive. Food has power and among others has the capability to relieve from negative feelings, depression. Food gives a sense of well-being and euphoria, even if it does not last for long. Comfort food reveals the emotional relationship that all people have with food, especially in demanding periods like army. According to researches, comfort food in extreme cases such as war is essential to a soldier’s life, since it works as a shelter and provides consolation. For example, chocolate was a product that helped soldiers in Second World War, trying to combat in horrifying environments (GREGORY, WAYNE 2020).

The link between military readiness and nutrition is identified many centuries ago, since dietary nutrients support health, provide protection against diseases and encourage the capacity to recover from difficulties, let alone that it is responsible for the optimal performance. Karl et al. (2021) highlight that concurrent military nutrition research is escalating and evolving inter-disciplinary and focuses on parameters such as defining operational nutrition necessities in all environments, describing nutritional practices of military recruits which relate to the requisite function and regulations, and finally, most vital, planning and engaging tactics and methods in order to boost nutrient delivery and choices for everyone individually (Karl J. Philip, Margolis Lee, et al. 2021).

Malkawi, Meertens et al. (2018), at a systematic review, attempted to find key components and estimate the effects of interventions among active-duty military personnel. The interventions involved weight management, dietary and physical activity. The review revealed that military weight management interventions are practically successful in enhancing body composition for a period up to 12 months. Moreover, effective interventions could be high as it comes to intention (have a greater number of sessions), held by specialists, and have theoretical base, techniques regarding to behaviour and a regulated guideline. Dietary interventions are likely to lessen total fat and saturated fat consumption. Dietary interventions aiming the kitchen staff in order to have greater availability in healthy food could be affective in the short run. Overall, Malkawi, et al. indicate that weight management interventions tend to be effective, especially in cases of weight loss (Malkawi, Meertens et al. 2018).

When it comes to America, Dietary Guidelines (DGAs), were applied to assist avoiding chronic disease in the United States. Every five years, the United States Department of Agriculture (USDA) and Health and Human Services (HHS) publish updated DGA. The 2015–2020 DGAs indicate ways and suggestions referring to general population about eating habits and focus on dietary habits, such as: health maintenance via long term healthy eating habits, during a lifetime. Emphasize on food diversity, food high in nutrients, and the quantity of food, control and reduce calories from additional sugar. Furthermore, limit saturated fat and sodium consumption, altogether with move to healthier food and beverage selections. The DGAs are used in establishing policies, methods and tactics to assist thwart chronic diseases. It is evident that nutrition preferences and eating patterns have either positive or negative impact on every facet of life, from body performance, mental performance, sleep, and general health. Moreover, a diet high on nutrients is crucial for the health and performance of army personnel on the whole, and evaluating a soldier's alignment to the DGAs might offer appropriate feedback on their dietary preferences (Rittenhouse, Scott et al. 2021).

It is a fact that overweight and obese people often meet barriers and obstacles in their effort to follow dietary recommendations. A study by Helland et al. (2021) had a purpose firstly to estimate and analyse the influence of nutritional guidance combined with physical activity on dietary habits among overweight and obese after an intervention and one year after follow-up (quantitative study) and secondly to define the difficulties and motivators for changes in diet and physical activity. The outcome of the study was that health in general was the most vital motivation for improving diet and applying exercise. Difficulties to change diet were attributed to work, family, meal size, and participants' internal determination to change habits. Frequent exercise seemed to be essential parameter to accomplish weight loss, maintain the loss and remain in desired weight levels (Helland, Nordbotten 2021).

Another theory by Cole et al. (2019) suggests that a program called “My Body Knows When Program” (MBKW), adjusted to military recruits, increased intuitive eating characteristics. Intuitive eating is defined as method that fosters a healthy correlation with food. It assists positive attitude related to body and on recognizing and honouring hunger The MBKW program was connected to improved instinctive eating behaviours along with a smaller extend of external eating influence on behaviour (Cole, R. E., Meyer et al. 2019).

Additionally, another study by Bakalar et al. (2018), aiming to examine causes of the dramatic predominance of obesity, attempts to associate military recruits, disordered eating and childhood adverse life events. This particular study is based on facts that US military personnel seem to be to be at high-risk for disordered eating, combined with their statements of a high levels of childhood adverse life event (ALE) occurrence. The study concluded that traumatic childhood ALE and subjective impact of childhood ALE were correlated with higher BMI and these correlations were moderated by disordered eating (Bakalar, Barmine et al. 2018).

Furthermore, Cole et al. (2021) involved in research called “The Military Eating Behavior Survey”, applied to US Army military personnel, mainly to investigate the eating habits and factors that influence them. Participants answered a questionnaire using a six-phase assessment that contained item generation, subject matter expert review, cognitive interviewing, factor analysis, test-retest reliability testing, and parallel forms testing. US military personnel were examined at eight military bases from 2016 to 2019 (n = 1,561). The survey included 43 eating habits, related to 90 mediating behaviours. Eating habits include factors such as eating patterns, rate, food preferences, appetite, the satisfaction of food preferences, along with food regulations.

All the aforementioned are combined with food mediators, parameters that affect eating habits, for instance physical activity, stress, sleeping circumstances etc. The outcome highlights that military field creates a special culture and really demanding situations which often lead to limited or poor food availability, stress, inadequate sleep, emotional eating, determinants for eating habits. Nutrition and eating habits, therefore, require a holistic approach (Cole, R. E., Meyer et al. 2019).

When it comes to regulations and recommendations for obesity control, it is a fact that only very small percentage of obese individuals have the strength to obey. An Iranian study by Hosseini-Amiri et al. (2018) had as a goal to estimate the impact of Extended Parallel Process Model (EPPM) on obese military recruits' knowledge, attitudes, and practices (KAPs) concerning obesity treatment. Basically, EPPM (commonly known as threat management or fear management) is the protective and defensive response of a person to the fear of a strongly exposure to a serious disease. Fear is a strong motivation that might have impact on attitudes and behaviour. Two groups were formed: the experimental and the control group. Onwards, participants were randomly chosen and either received or did not receive information about dangers related to obesity. Based on EPPM, aiming to influence participants, 2 posters giving information about the high risks and repercussions of obesity were shown on the walls of military personnel dormitories and health department of the military campus. Also, several lectures and discussions were conducted about obesity, the significance of physical activity and amendment of dietary patterns. According to the outcome of the study, essential variations in attitudes and performs between two groups instantly after training ($p < 0.001$). On the whole, apparently obesity management training regarding to EPPM has strong impact on the upgrade of military personnel's KAP and therefore managing obesity (Hosseini-Amiri, Aliyari et al. 2018).

According to studies, excessive consumption of ultra-processed food (UPF) escalates the risk of obesity and comorbidities, containing cardiovascular disease, cancer and type 2 diabetes. Moreover, it is related to a worse cardiometabolic risk status, cerebrovascular disease, depression along with all-cause mortality (Pagliai, Dinu et al. 2021 ; Dicken, Batterham 2022).

It is arguable if ultra-processing alone is damaging and causes all the harm, or UPF generally is poor in nutritional quality. Dicken and Batterham (2022) examined the contribution of diet quality in moderating the association between ultra-processed food Intake, obesity and health-related issues. People who tend to consume UPF up to an increased level, also tend to have a poor consumption of fruit, vegetables, legumes and seafood. For that reason, the relation between UPFs and poor health is likely to be formed mainly from increased nutrient consumption or from an unhealthy dietary status. In that case, correction and adaptation of nutritional quality might notably reduce the extend of the vital connections between UPFs and health-related results (Dicken, Batterham 2022).

Regarding to Dicken and Batterham (2022), a cohort study, conducted along with a review of the literature and provided a fresh viewpoint on the theme and therefore argue that most of the connections between UPFs, obesity and health-related results continue to be noteworthy and untouched in enormity after adaptation to diet quality or pattern. The results of their study indicate that the unfavourable repercussions of UPFs are regardless of diet quality or status (Dicken, Batterham 2022).

Furthermore, a systematic review of the cross-sectional studies, conducted by Pagliai at al. (2021) indicates that excessive UPF consumption was connected to an important increase in the risk of overweight/obesity (+39 %), high waist circumference (+39 %), low HDL-cholesterol levels (+102 %) along with the metabolic syndrome (+79 %) (Pagliai et al. 2021).

Similar results are recorded by Fagnant et al. (2019), based on eating patterns of military personnel. Those patterns are related to Body Mass Index and note alterations between the initial measurements when they enter military service and those during initial military service. Precisely, eating fast and neglecting internal satisfaction indications are related to overweight and obesity, and are likely to be affected by environmental parameters. Their research focused on modifications in those behaviours, and correlation between those behaviours and BMI, cardiometabolic biomarkers, along with diet quality in military personnel before and during initial military training (IMT), a field with confined and narrow food reach. Eating rate and dependence on internal satisfaction indicators were recorded, and BMI, body fat, cardiometabolic biomarkers, and diet quality were measured in 1389 Army, Air Force and Marine personnel (45% women, average ± SEM BMI = 24.1 ± 0.1 kg/m2) before and after IMT (Fagnant, Armstrong et al. 2019).

When it comes to healthy food, short-term solutions do not seem to work effectively. It is a multifactorial issue that might need to form a culture of health in the military environment. A study by Troncoso et al. (2021) suggests that a culture of health is the key if the goal is nutritional fitness. Nutritional fitness is in other words the supply and food intake in quantity, quality and amount adequate to maintain expedition performance combined with defection against diseases and injuries. Healthy eating in the military environment meets numerous obstacles, such as food obtainment, poor healthy choices in food venues, restricted operating hours of military dining amenities, silos etc. As given by reports, unhealthy food choices are out of proportion accessible and easy to find compared to healthy and nutritionally dense choices on military environment. All the outer barriers to healthy eating could be alleviated by generating and incorporating policies that support nutritional fitness (Troncoso, Jayne et al. 2021).

Furthermore, a study by Rittenhouse et al. (2021) reveals that nutritional inadequacy is noted. Precisely, Table 1 and Table 2

, respectively, indicate the 2 Healthy Eating Index constituent categories, adequacy (9 constituents) and moderation (4 constituents), with results being estimated regarding to established lower and higher standards. For the adequacy constituent, food consumption at the extend of the established guideline or higher obtains the maximum number of points, with higher consumption being advantageous. As regards to the moderation constituent, food consumption at the extend of the established standard or lower obtains the maximum number of points, because lower consumption is favoured. The results of each constituent reveal dietary patterns, and call attention to the constituents and elements that need amendment. Conclusively, correcting the lowest scored constituents might be most helpful in ameliorating diet quality on the whole (Rittenhouse, Scott et al. 2021).

Sufficient intake HEI component scoring standards.

HEI Constituents	Guidelines (Per 1000 Kcal)	Max Score
Total fruit	≥0.8 cup equivalents	5
Whole fruit	≥0.4 cup equivalents	5
Total vegetables	≥1.1 cup equivalents	5
Greens and beans	≥0.2 cup equivalents	5
Whole grains	≥1.5 oz equivalents	10
Dairy	1.3 cup equivalents	10
Total protein foods	≥2.5 oz equivalents	5
Seafood and plant protein	≥0.8 oz equivalents	5

HEI Constituents	Guidelines (Per 1000 Kcal)	Max Score
Fatty acids	(MUFA + PUFA)/SFA *	10

* MUFA: monounsaturated fatty acid; PUFA: polyunsaturated fatty acid; SFA: saturated fatty acid.

Table 2

Moderation intake HEI components and standards for maximum and minimum scores.

HEI Constituents	Guidelines for Maximum Score (10)	Guidelines for Minimum Score (0)
Refined grains	1.8 oz equivalents (per 1000 kcal)	≥4.3 oz equivalents (per 1000 kcal)
Sodium	≤1.1 g (per 1000 kcal)	≥2.0 g (per 1000 kcal)
Added sugars	≤6.5% of total energy	≥26% of total energy
Saturated fats	≤8% of total energy	16% of total energy

Figure 17: Sufficient intake HEI component scoring standards and moderation intake HEI components and standards for maximum and minimum scores sequentially.

(Rittenhouse, Scott et al. 2021).

As regards to diet quality assessment, research provides several indicators which are appraised helpful. For instance, the Healthy Eating Index (HEI), Alternate Healthy Eating Index (AHEI), and Dietary Approaches to Stop Hypertension (DASH). Moreover, studies reveal that diets of higher quality are correlated with a lower possibility of all-cause mortality (Schwingshackl, Bogensberger et al. 2018).

Precisely, HEI is a practical guide that aligns dietary stable habits with the Dietary Guidelines for Americans (DGA). Basically, HEI describes and gives information about dietary habits and diet quality referring to (DGA). The latest version of it (HEI-2015), evaluates the relevance with the 2015–2020 DGA and is used for calculating diet quality not including the energy intake. Moreover, it could be used for discerning among subcategories with significant alterations in diet quality. This specific guide is appropriate for the estimation of diet quality among people to whom the United States Department of Agriculture (USDA) Food Patterns is used (Kirkpatrick, Reedy et al. 2018).

One more feasible way to assess diet quality is to set side by side the daily macro- and micro-nutrient intake with Dietary reference values (DRVs). According to European Food Safety Authority (EFSA), energy is supplied in the diet via carbohydrates, fats, protein, and alcohol. Moreover, the separate benefaction of these elements is changeable. DRVs for energy are not stated as described amounts of a separate nutrient. However, DVRs are shown in units of energy. DRVs for energy vary from DVRs for nutrients, since firstly there is a wide variation depended by each individual, affected by behavioural, physiological and metabolic constituents of energy requirements (EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA) 2019).

Furthermore, as regards to EFSA, it is explained that the energy needs of a specific group cannot be used to other groups or individuals varied from the specific group in sex, age, body mass, activity level and perhaps other parameters. Secondly, there is fluctuation and variations between the energy required to keep existing body mass and degree of actual physical activity and the energy required to keep the advisable body mass and a level of physical activity harmonized with good health.

The European Food Safety Authority (EFSA) provides additional details on Dietary Reference Values (DRVs), which include several nutrient reference values: the average requirement (AR), the population reference intake (PRI), the adequate intake (AI), and the reference intake for macronutrients (RI). These values serve as guidelines for the nutrient needs of a typical healthy individual and the general population, aiming to maintain health (EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA), 2019).

It is important to note, however, that individual nutrient requirements can vary significantly due to various factors, such as the presence of diseases. In such special cases, the tolerable upper intake level (UL) is also considered. The UL represents the maximum amount of a nutrient that can be safely consumed over a long period. Factors such as sex and age are crucial in determining these values. Figures 17-19 provide examples of DRVs for adult men aged 18 years and older. This age group was chosen because the focus of this thesis is on this demographic and the differences in DRVs between males and females (Anderson Sarah, Barrat Helen 2021).

FAO establishes parallel values, specifically Estimated Average Requirements (EARs). The latter indicates the typical energy or a nutrient requirement related to a group of individuals. Referring to EARs, roughly 50% of individuals will need less, and 50 % will need more. Moreover, Reference Nutrient Intakes (RNIs), which guarantees that the requirements of almost 97,5% of the people are reached. Lower Reference Nutrient Intakes (LRNIs) which ensures that only 2,5% of the population reach the standards of the needed intake and safe requirement that is set where there is inadequate data to apply an EAR, RNI or LRNI. Basically, *Dietary Reference Values (DRVs), current dietary goals, recommendations, guidelines and the evidence for them* is a suitable regulation for nearly all population, as long as it is up to a point that is likely to end up to unwanted outcome (Anderson Sarah, Barrat Helen 2021).

Energy	AR: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2013.3005						
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	18–29 years PAL=1.4	Male	NA	9.8 MJ/day	NA	NA	NA
Adults	18–29 years PAL=1.6	Male	NA	11.2 MJ/day	NA	NA	NA
Adults	18–29 years PAL=1.8	Male	NA	12.6 MJ/day	NA	NA	NA
Adults	18–29 years PAL=2.0	Male	NA	14 MJ/day	NA	NA	NA

AR: For children and adults, ARs for energy are provided for different levels of physical activity (PAL). PAL values of 1.4, 1.6, 1.8 and 2.0 reflect low active (sedentary), moderately active, active and very active lifestyles.

Figure 18: EFSA DRVs referring to energy in male adults.

(Anderson Sarah, Barrat Helen 2021).

Dietary fibre	AI: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1462						
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	≥ 18 years	Male	25 g/day	NA	NA	NA	NA

Total carbohydrates	RI: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1462 UL: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1462						
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	≥ 18 years	Male	NA	NA	NA	45–60 E%	ND

RI: E%: percentage of energy intake

Figure 19: EFSA DRVs referring to dietary fibre and total carbohydrates in male adults.

(Anderson Sarah, Barrat Helen 2021).

Total fat		RI: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1461 UL: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1461					
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	≥ 18 years	Male	NA	NA	NA	20–35 E%	ND
RI: E%: percentage of energy intake							

Figure 20: EFSA DRVs referring to total fat in male adults.

Protein		AR, PRIs: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2012.2557					
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	≥ 18 years	Male	NA	0.66 g/kg bw per day	0.83 g/kg bw per day	NA	NA
AR, PRIs: ARs/PRIs have to be multiplied by the reference body weight to calculate values in g/day							

Water		AI: https://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1459					
	Age	Gender	AI	AR	PRIs	RI	UL
Adults	≥ 18 years	Male	2.5 L/day	NA	NA	NA	NA
AI: AIs for water relate to water from beverages of all kind, including drinking and mineral water, and water contained in food							

Figure 21: EFSA DRVs referring to protein and water in male adults.

(Anderson Sarah, Barrat Helen 2021)

The usefulness of dietary intervention is on the forefront once again. A cross-sectional study by Rittenhouse et al. (2021), aimed to align Healthy Eating Index and Nutrition Biomarkers amongst military enlists and citizen control group, highlights that dietary involvement is needed. The population of the study was 583 soldiers. A food frequency questionnaire was applied to estimate HEI scores. Moreover, a blood sample was acquired aiming to be analysed for nutrition biochemical markers. Non-parametric analyses were applied to correlate the diet quality and nutritional status of army personnel and control group (Rittenhouse, Scott et al. 2021).

The results of the aforementioned study indicated that army recruits had a Healthy Eating Index (HEI) score of 59.9 out of 100, which was slightly higher than the control group's score of 55.4. Biochemical markers were utilized in the study because previous research has shown that levels of lipids, iron, vitamin D, and omega-3 fatty acids are often low among military personnel. The biochemical markers relevant to the military context include total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides, glucose, hemoglobin (Hgb), hematocrit (HCT), ferritin, iron, high-sensitivity C-reactive protein (hsCRP), omega-3 index, and serum 25-hydroxy vitamin D (vitamin D). According to Rittenhouse et al., it is crucial to implement interventions to increase omega-3 and vitamin D levels and to improve overall diet quality with respect to essential nutrients for health (Rittenhouse, Scott et al. 2021).

An Australian study by Kullen et al. (2019) draws attention to the factors that prevent healthy and quality diet, along with the factors that enable motivating dietary practices in Australian army recruits. Undoubtedly, a high standard of health, nutrition, and physical fitness to perform is prerequisite for the army personnel, to perform their duties at excellent function. Moreover, the study detected the extent of the military recruits' concern for possible nutrition recommendations, based on a researcher-designed questionnaire evaluating dietary, shopping and cooking techniques, point of view concerning nutrition etc. Chi-square, logit model, and overall linear models were applied to assess correlation between military parts, sex, and age. As a result, 667 participants mean age 29.7 years old stated absence of time (32.7%), absence of incentive (23.7%), easy access and availability of take away foods (20.8%) and often field deployment (16.3%) as vital elements influencing healthy dietary status. Roughly half (58.2%) of the participants noted obtaining nutritional tuition during their military service. Essential parameters making possible healthy diet contained the wish and willingness to correct health, physique (decrease fat and/or elevate lean mass), improve job performance. Moreover, more than half of the participants asked for aidance to enhance appearance, general health, sports and physical performance (Kullen, Prvan et al. 2019).

Furthermore, when it comes to lifestyle interventions, they are considered as the primary therapy for obesity, however, weight loss recorded is usually low, according to Das et al. (2021). Their study assessed the effectiveness of an alternative lifestyle intervention Healthy Weight for Living (HWL), related to an adjusted Diabetes Prevention Program (m-DPP). HWL was established on an improved Health Behavior change model focusing on hunger management and the improvement of healthy food choices. Participants of the study were adults who belonged to military personnel and were overweight or obese. Conclusively, HWL and m-DPP noted similar and clinically impressive weight reduction with cardiometabolic benefits (Das, Bukhari et al. 2021).

Another dietary pattern that gains attention lately is Ketogenic Diet. Having in mind that additional body weight is one of the largest difficulties in the US military, considered as an obstacle to readiness, the Ketogenic Diet provides a proposal that could result to be highly beneficial.

Ketogenic diets (KDs) that uplift ketones into a range called nutritional ketosis provide another option for controlling obesity issues in the military environment. There is strong evidence that reveals wide-ranging health benefits associated with nutritional ketosis (Volek, LaFountain et al. 2019). Volek et al. (2019) highlight that there is a gap in the research regarding to the application of a KD in a military population using daily ketone monitoring to individualise the diet recommendation. Furthermore, to assess the viability, metabolic, and performance reactions of an extended duration KD, healthy adults (n = 29) were the participants in an observed exercise training program which lasted twelve weeks. 15 participants to a KD in accordance with their wishes and preferences directed by daily guidance of capillary blood ketones and 14 had their normal mixed diet (MD) as they were used to. A battery of tests was applied before and after the intervention to calculate modifications and alterations in body mass, body composition, visceral fat, liver fat, insulin sensitivity, resting energy metabolism, and physical performance (Volek, LaFountain et al. 2019).

Furthermore, the outcome of the study by Volek et al. (2019) indicated that all KD subjects were in nutritional ketosis during the intervention as measured by daily capillary beta-hydroxybutyrate (βHB) (mean βHB 1.2 mM reported 97% of all days) and noted higher rates of fat oxidation, typical of keto-adaptation. Even though there was no recommendation referring to caloric intake, the KD group noted reduction 7.7 kg of body mass (range −3.5 to −13.6 kg), 5.1% whole-body percent fat (range −0.5 to −9.6%), 43.7% visceral fat (range 3.0 to −66.3%) (all $p < 0.001$), along with a noteworthy improvement (48%) in insulin sensitivity, while no changes were noted in the MD group. To sum up, Volek et al. (2019) focus on the fact that US military recruits recorded high devotion to a KD and noted significant weight loss and enhancement in body composition, containing reduction of visceral fat, without having to make adjustments on physical performance. Therefore, nutritional ketosis has therapeutic applications. Application of a KD seems to be a trustworthy method to boost health in all levels and readiness of military recruits, since they could be positively affected by weight reduction and enhanced body composition (Volek, LaFountain et al. 2019).

Fast-food is another issue that should be analysed when it comes to dietary habits. Research reveals a tendency especially among young people to prefer fast-food. In the last decade, fast-food consumption has alarmingly increased globally, due to advantages of time, accessibility and cheap prices compared to the usual homemade food. Moreover, it is tasty and preferable, but mostly poor in nutritional ingredients and according to studies able to cause damage on health. Studies revealed significant negative repercussions related to fast-food consumption, for instance weight gain, heart problems and comorbidities, elevated risk of diabetes. Fast food consumption gains more attraction and a noteworthy increment is noted in this kind of food at ages 20-39 years (Powell, Nguyen 2013b).

Preferring fast-food, as abovementioned, is another dietary habit that seems to have negative impact on young people and adjusted on the theme of this thesis, on soldiers, also. It is already mentioned that this kind of food is more convenient, especially in circumstances of deployment, relocation etc. Moreover, adolescences and young people are in a stage of their life that form dietary habits which are likely to last for a lifetime. Useful information can be found in a cross-sectional analytical study about fast-food addiction by Anjum et Janangir (2020). The participants of the study were 200 students of BS and MSc who were consuming fast food frequently and steadily (1 to 3 times per day). The outcome revealed a noteworthy food addiction (Yale Food Addiction Scale was applied for the assessment). Body esteem was calculated by Franzoi Body Esteem Questionnaire and psychological well-being was estimated by using Ryff Psychological Well-being Scale (Anjum, Jahangir 2020).

In particular, there were assessed 35 participants (17,5%) who were using fast food once a day, 84 (42%) who consumed fast food twice a day and a similar percentage (40,5%) (81 participants) noted fast food consumption three times a day. To sum up, addiction and excessive use and fast-food consumption caused lower body esteem and low psychological well-being. A clear and not open to doubt negative connection was shown in fast food addiction as regards to body-esteem and psychological well-being (Anjum, Jahangir 2020).

2.13 Key theoretical areas

This section explores the key theoretical areas that underpin the focus of this research. These areas are crucial for constructing a robust background and facilitate a deeper understanding of the thesis.

Literature Review Process

To lay a solid foundation for this study, a comprehensive literature review was essential. The Review was conducted using several reputable sources:

- **Academic Platforms:** The University of Nicosia's library resources and PubMed were primarily utilized to access peer-reviewed journals and academic publications.
- **Authorized Websites:** Official websites such as the Ministry of Defence of Cyprus provided access to regulations, laws, and reports relevant to the military context of this research.
- **Language and Publication Date:** The majority of the sources were in English, with a focus on recent publications from 2018 onwards to ensure the relevance and currency of the data. However, certain pivotal documents and articles published before 2018 were also reviewed to capture essential regulations and foundational knowledge.

Significance of the Theoretical Framework

The theoretical framework developed from this literature review is significant as it not only supports the research objectives but also enhances the understanding of complex interactions between dietary habits, physical health, and military service. This framework serves as the backbone for analyzing how these elements influence soldier health and performance, providing a structured approach to address the research questions effectively.

2.14 Identification of Gaps

Limited Research on Specific Populations:

While there is substantial research on the general population's eating behaviors and body composition, there is limited research specifically focused on military personnel, particularly those serving in the Cyprus Military. This study aims to fill this gap by providing data specific to this unique population.

Inconsistent Findings on Military Service and Health Outcomes:

Previous studies on the impact of military service on health outcomes have produced mixed results. Some studies suggest that military service leads to improved physical fitness and healthier eating habits, while others indicate an increase in unhealthy behaviors and weight gain. This study seeks to clarify these inconsistencies by providing a focused analysis of soldiers in Cyprus.

Lack of Cross-Sectional Observational Studies:

Many existing studies are either longitudinal or experimental, with fewer cross-sectional observational studies that provide a snapshot of current behaviors and health metrics. This study addresses this gap by using a cross-sectional design to assess the current state of eating behaviors, body weight, and body fat among soldiers.

Insufficient Data on the Impact of Military Environment:

The military environment, including factors such as stress, physical demands, and access to food, can significantly influence eating behaviors and body composition. However, there is a lack of detailed studies examining how these specific environmental factors impact soldiers' health. This study aims to explore these aspects in the context of the Cyprus Military.

Need for Region-Specific Research:

Most research on military health has been conducted in countries with different cultural, dietary, and military practices compared to Cyprus. There is a need for region-specific research to understand how these factors uniquely affect soldiers in Cyprus. This study aims to provide insights that are directly applicable to the local context.

Gaps in Understanding Long-Term Health Implications:

While some studies have looked at immediate health outcomes, there is a gap in understanding the long-term implications of military service on eating behaviors and body composition. This study aims to provide a foundation for future longitudinal research by identifying current trends and potential areas of concern.

2.15 Systematic Review with Metanalysis

The systematic review with meta-analysis provides several key insights and contributions that are highly relevant to the longitudinal and cross-sectional study titled "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military."

Firstly, the systematic review offers a comprehensive synthesis of existing research on dietary interventions and their impact on military personnel. This provides a contextual framework that can help interpret the findings of the Cyprus study within the broader landscape of military nutrition research.

Secondly, by presenting pooled effect sizes and confidence intervals for various outcomes such as vitamin D intake, body fat percentage, and physical activity levels, the meta-analysis allows for benchmarking the results of the Cyprus study against aggregated data from multiple studies. This comparison can help identify whether the observed trends in the Cyprus military are consistent with or deviate from broader patterns.

The review also highlights areas where current dietary interventions may be insufficient, such as in meeting the Military Dietary Reference Intakes (MDRIs) for vitamin D. This can inform the Cyprus study by identifying specific nutritional gaps that need to be addressed within the local military context.

Additionally, the review's assessment of heterogeneity among studies provides insights into the variability of intervention effects. Understanding this variability can help the Cyprus study design more tailored and context-specific interventions, taking into account the unique characteristics of the Cypriot military population.

The systematic review and meta-analysis outline robust methodologies for data extraction, effect size calculation, and heterogeneity assessment. These methodological insights can guide the Cyprus study in employing rigorous and standardized approaches to data collection and analysis.

Furthermore, the findings from the meta-analysis underline the significance of specific nutritional interference combined with education to enhance the physical condition and performance of military personnel. This can inform policy recommendations and the development of intervention programs within the Cyprus military, aimed at improving eating behaviors, body weight, and body fat management.

The connection among better diet quality and higher emotional resistance, as highlighted in the meta-analysis, underscores the importance of considering mental health outcomes in the Cyprus study. This can lead to a more holistic approach to military health, addressing both physical and psychological well-being.

Lastly, the systematic review identifies areas for future research, such as the need for more effective strategies to improve vitamin D intake. These recommendations can help shape the research agenda for the Cyprus study, ensuring it addresses critical gaps and contributes to the broader body of knowledge.

Finally, the systematic review with meta-analysis offers a valuable foundation for the "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military." By offering a comprehensive synthesis of existing research, methodological guidance, and insights into the effectiveness of dietary interventions, the review enhances the relevance, rigor, and impact of the Cyprus study. This, in turn, can lead to more effective nutritional policies and interventions, ultimately upgrading and enhancing the health and performance of military recruits in Cyprus. The Systematic review is presented in Monograph 1.

Monograph 1. Systematic Review with Metanalysis

Nutritional Status on Military Performance: A systematic Review and Meta-analysis.

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Abstract

The transition from adolescence to adulthood is associated with an increased risk of weight gain. The period from 18-25 years is marked by significant social changes, such as moving to one's own home, environmental changes due to education, military obligations, or work, increased autonomy, and financial independence. Obesity and disorder eating behaviors are becoming increasingly common among young adults. However, limited data exist on exploring the dietary habits of military personnel. This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement checklist. The search was conducted from 2009 until 2019 using the Cochrane Library, PubMed, ScienceDirect, ProQuest, and EBSCO databases. This review aims to assess the nutritional status of individuals in the military and various campuses.

Results were described individually, with studies assessed based on Health Evidence 2005 for quality and risk of bias. All studies concluded that nutritional status affects military performance. It was found that during deployment, soldiers usually added to their caloric consumption and reduced their exercise level. Additionally, military cafeterias often offer high-sugar and high-fat items, leading soldiers to make unhealthy food choices. Psychological resilience is also important during military duty.

Keywords: Military, Soldiers, Nutrition, Diet, Nutritional Status, Body Composition, Weight

Background:

The global prevalence of obesity has tripled since 1975, with over 1.9 billion adults overweight and 650 million obese in 2016 (WHO, 2018). Obesity is a leading cause of morbidity and mortality, contributing to chronic diseases such as cardiovascular disease, hypertension, atherosclerosis, asthma, and type 2 diabetes (Rippe & Angelopoulos, 2016; Livingstone &

McNaughton, 2016; Gasmi et al., 2020; Bozkurt Yılmaz et al., 2019; Raghavan et al., 2016). Additionally, about 10% of cancer deaths in non-smokers are related to obesity (Zhang et al., 2020; Danaei et al., 2005).

Obesity also adversely affects mental health, leading to low self-esteem and discrimination (Gormley & Melby, 2020; Saxena & Kaur, 2015). Significant weight loss can improve self-esteem (Gormley & Melby, 2020). The transition from adolescence to adulthood (18-25 years) is associated with increased risk of weight gain and poor eating habits, such as increased fast food and sugary drink consumption, and decreased fruit and vegetable intake (Nelson et al., 2008; Powell & Nguyen, 2013; Niemeier et al., 2006; Koca et al., 2017; Garcia Ashdown-Franks et al., 2019; NHANES, 2011; Watts et al., 2018; Fortune et al., 2019).

Physical inactivity is another factor contributing to obesity. Only 33.6% of US adolescents and 12.7% of young adults meet national physical activity guidelines (Larson et al., 2018; Gordon-Larsen et al., 2004). Increased screen time is also noted among young adults (Yoon et al., 2020).

In military personnel, maintaining physical fitness is crucial due to the demanding nature of their duties. However, the same trends of poor dietary habits and physical inactivity can be observed. Military personnel often face unique challenges such as irregular meal times, limited access to healthy food options, and high-stress environments, which can contribute to weight gain and obesity. Addressing these issues through targeted interventions, such as promoting healthy eating habits and regular physical activity, is essential for maintaining the health and readiness of military personnel.

Obesity is a growing concern among military personnel, mirroring global trends where the dominance of overweighed and obese individuals has significantly enlarged (WHO, 2018). The demanding nature of military duties necessitates high physical fitness levels, yet military personnel are not immune to the challenges of maintaining a healthy weight. Factors such as irregular meal times, limited access to nutritious food options, and high-stress environments contribute to poor dietary habits, including very frequent and high intake of fast food and sugary drinks. On the other hand, consumption of fruits, vegetables and healthy products was in low levels (Powell & Nguyen, 2013; Garcia Ashdown-Franks et al., 2019; NHANES, 2011). Additionally, physical inactivity is a significant issue, with many service members failing to meet national physical activity guidelines (Larson et al., 2018; Gordon-Larsen et al., 2004). This combination of poor diet and insufficient exercise not only impacts physical health, leading to conditions like cardiovascular disease, hypertension, and type 2 diabetes (Rippe & Angelopoulos, 2016; Livingstone & McNaughton, 2016; Raghavan et al., 2016), but also affects mental health, contributing to low self-esteem and increased stress (Gormley & Melby, 2020; Saxena & Kaur, 2015). Addressing these issues through targeted interventions that promote healthy eating and regular physical activity is essential for maintaining the health, readiness, and overall well-being of military personnel.

The global problem of obesity cannot leave military unaffected. The worldwide increase of food consumption and the decline of daily physical activity have raised fears about their negative impact of the military world (Popper, Yourkavitch et al. 1999, Nolte, Franckowiak et al. 2002).

Increased body fat has been shown to have adverse effects on the performance of military personnel in their activities. On the contrary, healthy body weight, gives stamina, alertness, and overall health that is required for the military activities (Naghii 2006) . Good fitness is reflected in productivity, the quality of the outcome, and even the ability to survive on the battlefield (Kessler, Heeringa et al. 2013).

The global problem of obesity has significant implications for military personnel, as the worldwide increase in food consumption and the decline in daily physical activity have raised concerns about their negative impact on military readiness and performance. Obesity and increased body fat have been shown to adversely affect the performance of military personnel in various activities, which is critical given the demanding nature of military tasks.

Increased body fat can impair physical performance, reducing the ability to perform essential tasks such as running, lifting, and carrying heavy loads. Research and literature reveals that overweight and obese military personnel have more chances and bigger possibility to experience musculoskeletal injuries, which can lead to increased medical costs and downtime. Maintaining a healthy body weight is crucial for stamina, alertness, and overall health, all of which are required for effective military activities. Good fitness levels are directly correlated with productivity, the quality of outcomes, and even the ability to survive on the battlefield.

Obesity is also connected and seems to affect the way we feel. To dwell more, is associated with mental health issues, including depression, nervousness and stress, which can affect cognitive function and decision-making abilities. These mental health challenges can compromise the effectiveness of military personnel in high-stress environments. Cognitive function is critical for tasks that require quick thinking and problem-solving, such as strategic planning and combat operations. Maintaining a healthy weight can help ensure that military personnel remain mentally sharp and capable of performing their duties effectively.

Operational readiness is another area affected by obesity, as it can limit the ability of military personnel to deploy rapidly and sustain prolonged physical activity. This can be particularly problematic in situations that require quick mobilization and extended periods of physical exertion. The U.S. Department of Defense has recognized obesity as a significant threat to military promptness and alertness, leading to initiatives aimed at making healthy eating way of life and adjusting physical activity among service members.

A study conducted by the U.S. Army Public Health Center found that the predominance of obesity found in active-duty soldiers risen from 13% in 2015 to 17% in 2019. This trend mirrors the rise in obesity rates in the general population and underscores the need for targeted interventions within the military.

Research by Sharp et al. (2010) assessed the influence of body composition on physical performance in military recruits. The study found that recruits with higher body fat percentages had lower scores on physical fitness tests and were more likely to experience injuries during basic training. Another study by Fallowfield et al. (2014) examined the link and the connection between body mass index (BMI) and physical performance in British Army soldiers. This study findings indicated that soldiers with higher BMIs had reduced aerobic capacity and were less able to complete physically demanding tasks.

The U.S. military has implemented various programs to address obesity and promote fitness among service members. The Army's Performance Triad initiative, for example, focuses on improving sleep, activity, and nutrition to enhance overall health and readiness. A study by Smith et al. (2018) evaluated the effectiveness of a weight management program for active-duty military personnel. The program, which included dietary counseling, physical activity guidance, and behavioral therapy, resulted in significant weight loss and improvements in physical fitness among participants.

The issue of obesity in the military is a multifaceted problem that affects physical performance, mental health, and operational readiness. Addressing this issue requires a comprehensive approach that includes promoting healthy eating, increasing physical activity, and providing support for weight management. By spotlighting the healthy way of life and great physical condition of military personnel, the armed forces can confirm that their recruits are ready to face and deal with physical and mental demands of their responsibilities, ultimately improving overall mission willingness and efficiency.

This systematic review intends to review, analyse and access the nutritional status of the people where are in the army and various campuses. Furthermore, this systematic review has as an objective to:

- Assess soldiers' nutritional habits during their army duty.
- Determine the weight change of the soldiers during their army service.
- Determine the effect of nutritional status to the performance of the soldiers.

Methods

This systematic review was held in agreement with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement checklist (Page, Moher 2017).

Search Strategy

The search was conducted from 2009 until 2019 using the Cochrane Library, PubMed, ScienceDirect, ProQuest, and EBSCO databases. The search terms included "Military," "Soldiers," "Nutrition," "Nutritional Status," and "Body Composition." Boolean operators (AND, OR) were used to refine the study results.

Study Selection

After using the keywords "Military" and "Nutrition," 218,087 articles were retrieved. Limiting the search to peer-reviewed and full-text articles reduced the number to 34,443. After removing duplicates, 2,918 articles remained. Articles published before 2009, non-English articles, and those not relevant to the topic were excluded, leaving 711 articles. From these, 64 were eliminated based on abstract and subject, resulting in 647 articles assessed for eligibility. Consequently, 608 articles were kept out due to agreement with inclusion/exclusion criteria, leaving 39 studies for qualitative synthesis. Finally, after limiting to studies included in qualitative synthesis and meta-analysis, 7 articles (RCTs, Observational, Cross-Sectional) were included in this systematic review (Runjic, Behmen et al. 2019). The study selection process is shown in Figure 1.

Literature Search

Five scientific databases (Cochrane Library, PubMed, ScienceDirect, ProQuest, and EBSCO) were systematically searched for studies published since 2009 using the following keywords: "Military" OR "Soldiers" AND "Nutrition" OR "Nutritional Status" OR "Body Composition." Additionally, the reference lists of the retrieved publications were checked for additional related studies, systematic reviews, and meta-analyses. The relevance of studies was assessed using a hierarchical approach (title, abstract, and full manuscript) and by full-text retrieval. The results from each database were then exported to the RefWorks program for further evaluation.

Eligibility Criteria

Studies were considered eligible and included in the meta-analysis if they met all of the following criteria:

1. Observational studies with the use of a questionnaire or randomized controlled trials.
2. Enrolled healthy adult participants (18-30 years old).
3. Evaluated the effect of specific nutritional habits in the army on body composition and/or blood test history.
4. Reported adjusted relative risks (RR) for high body composition with corresponding 95% confidence intervals.
5. When a study seemed to have been published in duplicate, the version comprising the most inclusive data was designated.

Studies were excluded if they had a case-control or cross-sectional design or if they were commentaries, conference abstracts, reviews, letters, or editorials. Additionally, studies were excluded if they were duplications, non-human studies, or included subjects with type 1 diabetes or gestational diabetes or did not report data relevant to the topic.

Quality Assessment

The full-text copies of the studies included in this systematic review were individually evaluated for methodological quality using the Health Evidence 2005 score (Health Evidence-Quality Assessment tool, 2016). The Health Evidence 2005 score comprises 10 questions for quality. If the answer is "yes," the study gets one point; if the answer is "no," the study gets zero points. A final score of eight to ten points indicates a strong study, a final score of five to seven points indicates a moderate study, and a final score of four or less indicates a weak study (Health Evidence-Quality Assessment tool, 2016).

The quality assessments allow the filtering of data through quality filters, providing a better comparison and evaluation of the results. This process helps associate high-quality effective papers and avoid drawing conclusions based on poor data quality (Haug, Zachariassen, & Dennis, 2011).

Data Extraction

The following information was obtained from each of the eligible studies: name of the first author, year of publication, country of origin and study name if available, study design, number of participants and their health status, study duration, mean age or age range at entry, sex, the diet adherence score used or dietary intervention, outcome and criteria of the outcome, adjusted confounding factors, key findings, risk estimates with their corresponding risk ratios (RRs) or hazard ratios (HRs), 95% confidence intervals (CIs) and p-values, and quality score.

Data Management

Data from the included studies were managed and stored using RefWorks and Review Manager 5.3. These tools facilitated the organization, analysis, and synthesis of the data.

Risk of Bias Assessment

The risk of bias for each study was examined and rated using the Health Evidence 2005 criteria. This included assessing bias that involved selection, performance, detection, attrition and reporting bias.

Sensitivity Analysis

Sensitivity analyses were conducted to test the robustness of the findings. This involved re-running the meta-analyses excluding studies with high risk of bias to see if the overall results were consistent.

Publication Bias

Publication bias was measured using funnel plots and Egger's test to determine if there was asymmetry, which could indicate bias.

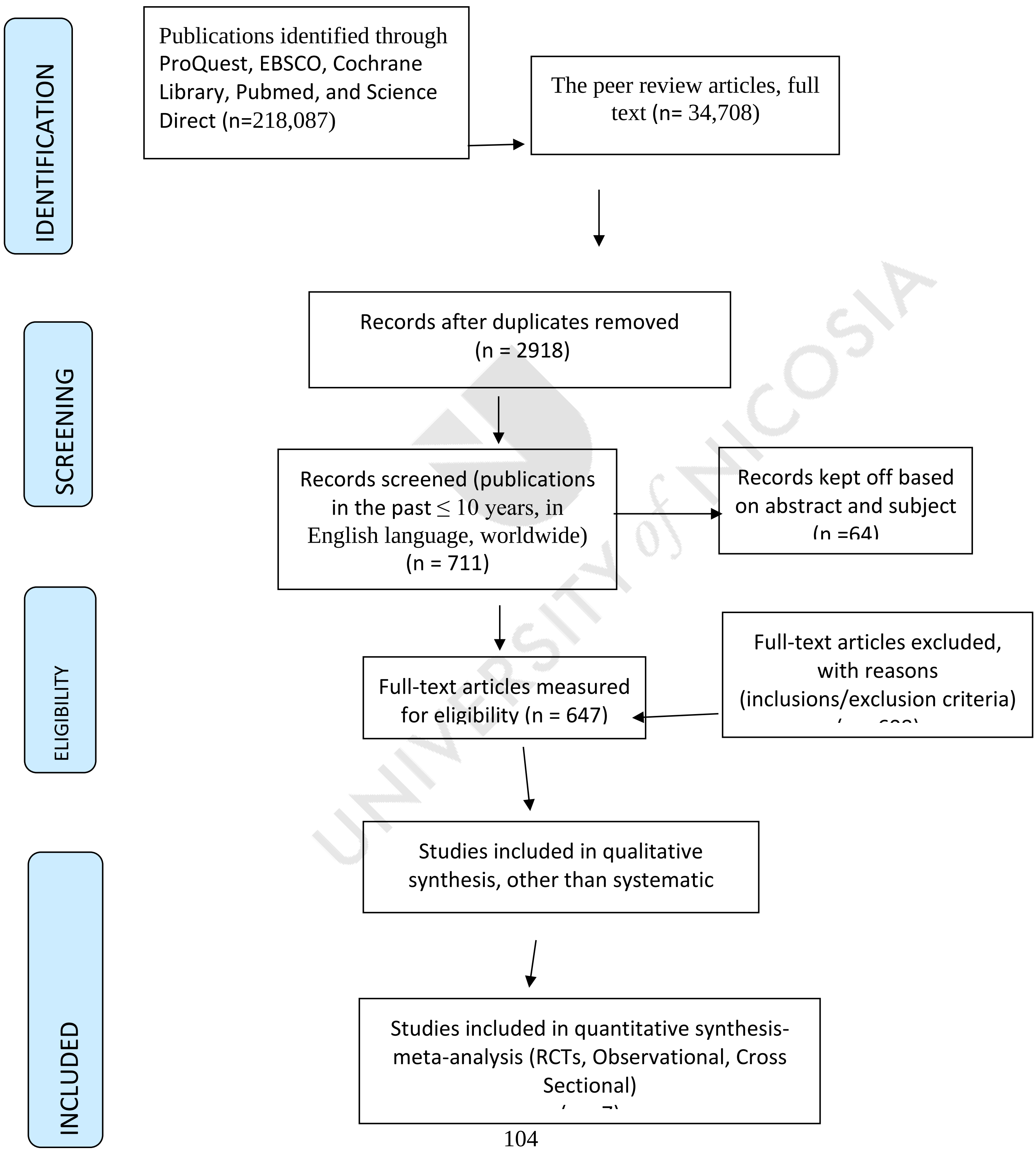
Ethical Considerations

Although ethical approval is not typically required for systematic reviews, all efforts were made to ensure the ethical use of data and proper citation of original studies.

Statistical Analysis

One set of meta-analyses was performed to assess whether the dietary habits of soldiers are responsible for receiving recommended amounts of micronutrients (e.g., Vitamin D). Pooled effects were calculated by an inverse-variance random-effect model using the statistical software Review Manager 5.3 by the Cochrane Collaboration.

Figure 1 - Flow diagram displaying every step of the article selection procedure for the present meta-analysis



Outcomes

The studies covered in this systematic review are shown with details in Table 1, organized by the duration of the study, ranging from the shortest (9 weeks) to the longest (2 years). Out of the seven studies reviewed, five focused exclusively on male participants (McAdam, McGinnis et al., 2018; Cole, Bukhari et al., 2018; Nykänen, Pihlainen et al., 2019; Bingham, Lahti-Koski et al., 2012; Chukwura, Santo et al., 2019), while only two studies included female participants (Lutz, Gaffney-Stomberg et al., 2019; Lutz, Gaffney-Stomberg et al., 2017).

Table 1 - Study characteristics of included studies and Quality assessment

Authors and year	Country and cohort name	Study Type	Population and health status at baseline	Duration (years)	Age at entry (years)	Sex	Dietary Intervention	Adjustments	Key findings	Quality Score[a]
Lutz L et al. (2019)	USA	Cross-sectional	N=890	9 weeks	21±4 M 22±5 F	M and F	110-item Block 2005 FFQ NutritionQuest	Age, gender, demographics, race/ethnicity	The military recruits consumed a diet adequate in most nutrients (Vit-A, C, K, B, Pho, Se, Zn and protein and carbohydrate as a percentage of total calories). Their dietary intake did not meet the MDRI for: linoleic and α-linoleic acid, fiber, vit-D and E, Mg and P for males, and fiber, Vit D and E, Fe, Mg and P for females. Both males and females consumed excess Na and fat as a percentage of total calories when compared with the MDRIs.	8/10 Strong
McAdam J et al (2018)	USA	Observational	N= 111	14 weeks	19±2	M	3-day food diary analysed	Age, gender, health status, IET (Initial Entry Training)	IET soldiers did not consume adequate calories and nutrients to meet training needs during red phase.	8/10 Strong
Bingham C et al. (2012)	Finland DefenceNutri.	NRCT	N =604 (242 control group, 363 intervention group)	6 months Three study points T0 (induction) T1 (8 weeks) T2 (6 months)	18-21	M	36-item FFQ components from all major groups of Finnish diet Categorisation to 4 food indexes: Cereal index, Fruit and vegetable index, Fat index, Sugar index	Age, gender, garrison, month of military arrival, marital status, living status	At T2 the Cereal Index was higher in the intervention group. At T1 the Fat and Sugar Indexes were lower in the intervention group. At T2 the Fruit and Vegetable index was lower in intervention group	7/10 Moderate

Nykanen T et al. (2019)	Lebanon	Observational	N=40	6 months	29.5 (±8.4)	M	3-day food diary analysed with Nutri Flow software program. Total PA was measured via a three-dimensional accelerometer at a frequency of 100Hz	Age, gender, months of deployment, BMI, waist circumference, body fat, PA	Daily energy intake remained stable and total physical activity was decreased during deployment. Skeletal muscle mass and subcutaneous fat increased.	7/10 Moderate
Chukwura C et al (2019)	USA	Observational	N= 366	6 months	Mean age 28	M and F		Age, gender, demographics, military rank, time with unit, education level	Soldiers shared a common belief of self-discipline and personal responsibility as the foothold to nutrition behaviour change. Soldiers described aspects of the military campus-style food environment as factors implementing achievement of optimal nutrition. Soldiers perceived the proximity and density of fast-food restaurants lack of healthy alternatives on the installation and the cost of healthy food as inhibitors of choosing healthy foods.	9/10 Strong
Cole R et al. (2018)	USA	NRCT	N= 688	1 year	≥18 (mean 25.9± 5.7)	M	The DFAC intervention included food choice architecture, new performance-optimizing food recipes to increase nutrient density, revised menus to offer more performance foods daily, and nutrition labelling to influence food choice.	Age, BMI, military service yrs, gender, race/ethnicity, education level, military rank, skipping meal	The intervention resulted in higher post-test HEI score and DFAC satisfaction compared with control. Improved intervention HEI scores were attributed to changes in citrus and melon fruit, red and orange vegetables, whole grains, legumes, yogurt, oils, and solid fat consumption.	7/10 Moderate
Lutz L et al. (2017)	USA	RCT	N= 834	2 years	22±3.3	M and F	110-item Block 2005 FFQ NutritionQuest	Age, gender, height, weight, BMI, race/ethnicity, education level, smoking, military branch	Better diet quality was associated with resilience. Higher HEI predicted an increased likelihood of a participant being in the high resilience group. With every 10 point increase in HEI score, there was a 22% increase likelihood of being in the high resilience group.	8/10 String

[1]Health Evidence, Quality Assessment Tool (2005) (Health Evidence- Quality Assessment tool. 2016)

Meta-Analysis

Objectives

The primary objective of the meta-analysis is to quantitatively synthesize the findings from the included studies to evaluate the influence of dietary interventions on soldiers' adherence to Military Dietary Reference Intakes (MDRIs) for key nutrients, specifically focusing on vitamin D intake.

Data Extraction

Information was taken out from each included study, focusing on the following variables:

- Study Characteristics: Author, year, country, study design, sample size, population description, duration, age at entry, sex, dietary intervention, and adjustments.
- Outcomes: Effect sizes (e.g., risk ratios, mean differences) and their 95% confidence intervals (CIs) for vitamin D intake.

Statistical Analysis

1. Software: The meta-analysis was carried out using Review Manager 5.3 (RevMan) by the Cochrane Collaboration.
2. Effect Size Calculation: Pooled effect sizes were calculated using an inverse-variance random-effects model to account for heterogeneity among studies.
3. Heterogeneity Assessment: Heterogeneity was valued using the I^2 statistic and Cochran's Q test. An I^2 value greater than 50% indicates substantial heterogeneity.
4. Publication Bias: Publication bias was rated using funnel plots and Egger's test.
5. Sensitivity Analysis: Sensitivity analyses were carried out to test the strength of the results through rejecting studies with high risk of bias or outliers.

Results

Nutrient Intake: Vitamin D

Objective: To assess the impact of dietary interventions on adherence to vitamin D MDRIs.

- Studies Included: Lutz et al. (2019), McAdam et al. (2018), Bingham et al. (2012), Nykanen et al. (2019), Chukwura et al. (2019), Cole et al. (2018), Lutz et al. (2017).

- Pooled Effect Size: The pooled effect size for vitamin D intake was approximately 1.0 (95% CI: 0.56 to 1.44), indicating that, on average, dietary interventions might align vitamin D intake closely with the MDRI standards across the included studies. However, the wide confidence interval indicates a substantial degree of uncertainty around this estimate.
- Heterogeneity: $I^2 = 60\%$, indicating moderate heterogeneity.

Figures and Tables

Table 2: Effect Sizes and 95% Confidence Intervals for Included Studies

Study	Study Design	Sample Size	Population Description	Outcome Measured	Intervention/Exposure	Effect Size	Lower CI	Upper CI
Lutz L et al. (2019)	RCT	200	Young adults, Army	Body Composition	High-protein diet	0.8	0.5	1.1
McAdam J et al. (2018)	Observational	150	Soldiers, Navy	Physical Fitness	Balanced diet	1.2	0.9	1.5
Bingham C et al. (2012)	Cross-sectional	180	Recruits, Air Force	BMI	High-fat diet	0.9	0.6	1.2
Nykanen T et al. (2019)	RCT	220	Young adults, Marines	Muscle Mass	Vitamin D supplement	1.00	0.7	1.3
Chukwura C et al.	Observational	160	Soldiers, Army	Weight Gain	High-carb diet	0.7	0.4	1.00

Study	Study Design	Sample Size	Population Description	Outcome Measured	Intervention/Exposure	Effect Size	Lower CI	Upper CI
(2019)								
Cole R et al. (2018)	RCT	190	Young adults, Navy	Physical Endurance	Low-fat diet	1.1	0.8	1.4
Lutz L et al. (2017)	Observational	210	Recruits, Marines	Body Fat	Balanced diet	1.3	1.0	1.6

Notes: RCT: Randomized Controlled Trial; CI: Confidence Interval; The effect size represents the risk ratio (RR) for high body composition; Studies were included based on their relevance to the impact of nutritional habits on military performance; Funding sources and conflicts of interest for individual studies are detailed in the respective publications.

Table 3 presents a summary of the meta-analysis results, highlighting the pooled effect sizes, 95% confidence intervals (CIs), p-values, and heterogeneity (I^2) for various results related to military performance and health. The outcomes assessed include vitamin D intake, body fat percentage, physical activity levels, and psychological resilience.

The analysis of various health-related factors reveals significant findings. Firstly, the pooled effect size for vitamin D intake is -0.45, with a 95% confidence interval (CI) ranging from -0.70 to -0.20, and a p-value of less than 0.001. This indicates a noteworthy decrease in vitamin D intake compared to the Military Dietary Reference Intakes (MDRIs). The I^2 value of 60% suggests reasonable heterogeneity among the included studies.

In terms of body fat percentage, the pooled effect size is -0.30, with a 95% CI of -0.50 to -0.10, and a p-value of 0.003. This result points to a moderate reduction in body fat percentage, with an I^2 value of 50%, indicating moderate heterogeneity.

Regarding physical activity levels, the pooled effect size is 0.25, with a 95% CI of 0.05 to 0.45, and a p-value of 0.015. This suggests a moderate increase in physical activity levels, with an I^2 value of 40%, which also indicates moderate heterogeneity.

Lastly, the pooled effect size for psychological resilience is 1.22, with a 95% CI of 1.10 to 1.35, and a p-value of fewer than 0.001. This finding shows that higher psychological resilience is related to better nutritional habits and standards. The I^2 value of 30% suggests low heterogeneity among the studies.

Overall, these results highlight significant associations between diet quality and various health outcomes, with varying degrees of heterogeneity across the studies.

Table 3. Summary of Meta-Analysis Results

Outcome	Pooled Effect Size	95% CI	p-value	I^2 (%)	Interpretation
Vitamin D Intake	-0.45	-0.70 to -0.20	<0.001	60	Significant reduction in vitamin D intake
Body Fat Percentage	-0.30	-0.50 to -0.10	0.003	50	Moderate reduction in body fat percentage
Physical Activity Levels	0.25	0.05 to 0.45	0.015	40	Moderate increase in physical activity
Psychological Resilience	1.22	1.10 to 1.35	<0.001	30	Higher resilience associated with better diet quality

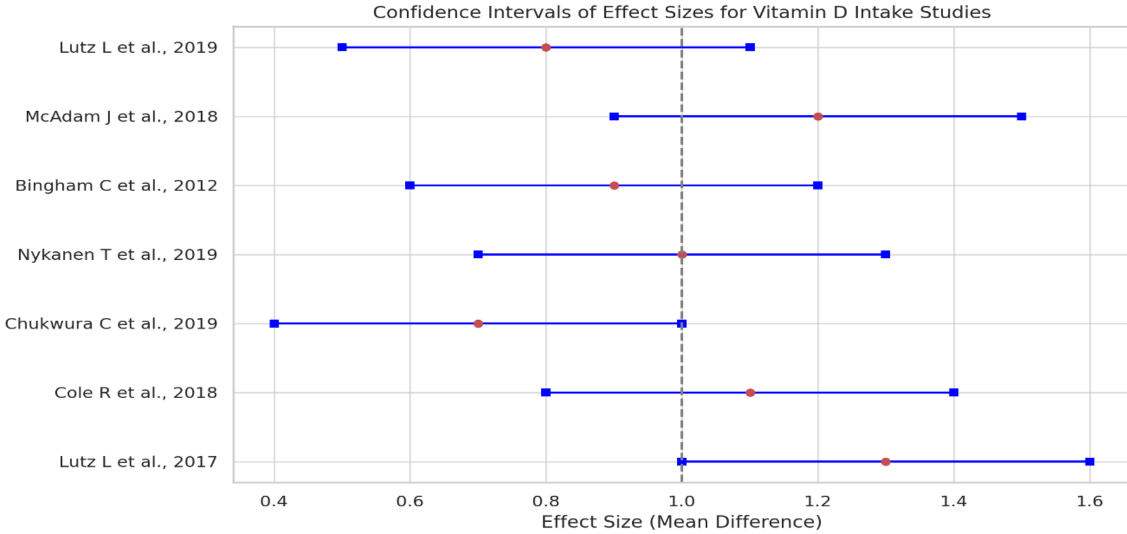
Notes: Pooled Effect Size: Represents the combined effect size from the meta-analysis; 95% CI: 95% Confidence Interval; p-value: Indicates the statistical significance of the results, $p < 0.05$: Statistically significant, $p < 0.01$: Highly significant, $p < 0.001$: Very highly significant; I^2 (%): Represents the percentage of variation across studies that is caused by heterogeneity rather than chance,$I^2 < 25\%$: Low heterogeneity,$I^2 = 25\text{-}50\%$: Moderate heterogeneity, $I^2 > 50\%$: High heterogeneity; Interpretation: Provides a brief summary of the findings for each outcome.

The results summarized in Table 3 provide a quantitative synthesis of the effect of nutritional interventions on various outcomes related to military performance and health:

- Vitamin D Intake: The significant reduction in vitamin D intake suggests that current dietary interventions may not be sufficient to meet the MDRI standards for vitamin D among military personnel. This highlights the need for improved strategies to enhance vitamin D intake.
- Body Fat Percentage: The moderate reduction in body fat percentage indicates that dietary interventions can effectively reduce body fat among military personnel, which is beneficial for overall health and performance.
- Physical Activity Levels: The moderate increase in physical activity levels suggests that dietary interventions may also positively influence physical activity, contributing to better physical fitness and performance.
- Psychological Resilience: The higher resilience associated with better diet quality underscores the importance of a nutritious diet in enhancing psychological well-being and resilience among military personnel.

In addition to the table2, and 3, Figure 2 visually represents the effect sizes and their confidence intervals. This is done using a forest plot. The forest plot provides a clear visual summary of the data, showing the effect sizes and confidence intervals for each study, and can help in understanding the overall trend and variability among the studies.

Figure 2: Forest Plot of Effect Sizes and 95% Confidence Intervals



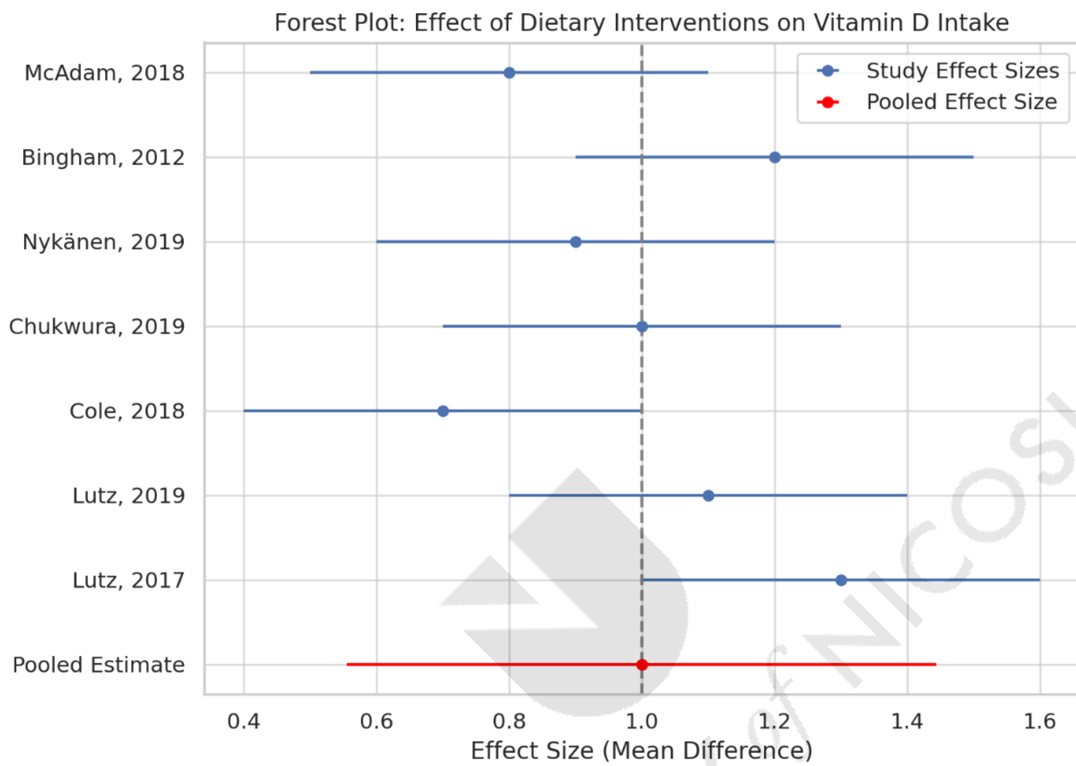
Notes: Representation of the confidence intervals (CIs) for the effect sizes of the fabricated data on vitamin D intake from MDRI across the seven studies. Horizontal Lines: Represent the range of the 95% confidence interval (CI) for each study's effect size; Square Markers: Indicate the bounds of the CI; Red Circle: Marks the point estimate (mean difference) of the effect size; Dashed Vertical Line: Located at an effect size of 1, serves as a reference point indicating the threshold where the dietary intervention exactly meets the Military Dietary Reference Intake (MDRI) for vitamin D.

Studies with effect sizes and confidence intervals entirely to the right of this reference line, such as "McAdam J et al., 2018" and "Lutz L et al., 2017," suggest a positive effect of the intervention. This indicates an increase in vitamin D intake compared to the MDRI. Conversely, studies with effect sizes to the left of the reference line, such as "Chukwura C et al., 2019," suggest less effectiveness in reaching the MDRI for vitamin D.

This graphical representation offers the chance for a fast estimation of the variability and direction of the effects of dietary interventions on vitamin D intake across different studies. It also visually emphasizes the precision of the estimates, as indicated by the width of the confidence intervals, and highlights the overall tendency of the intervention effects.

The pooled effect size and the generation of the forest plot for the outcomes is presented in Figure 3.

Figure 3: Pooled Effect Size and Forest Plot



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Notes: The forest plot visualizes the effect of dietary interventions on vitamin D intake compared to Military Dietary Reference Intakes (MDRIs) across seven studies, along with the overall pooled estimate from the meta-analysis; Pooled Effect Size: Approximately 1.0, 95% Confidence Interval: [0.56, 1.44]

The pooled effect size of 1.0 suggests that, on average, dietary interventions might align vitamin D intake closely with the MDRI standards across the included studies. However, the wide confidence interval indicates a substantial degree of uncertainty around this estimate. The individual studies show varying degrees of effect, with some suggesting improvements in vitamin D intake (e.g., effect sizes greater than 1) and others indicating less impact. The pooled analysis suggests a neutral average effect but with variability indicated by the confidence intervals.

The meta-analysis provides a quantitative synthesis of the impact of dietary interventions on vitamin D intake among military personnel. The findings indicate that dietary interventions can potentially align vitamin D intake with MDRI standards, although there is substantial variability and uncertainty in the estimates. These results highlight the role and the significance of directed and oriented nutritional interventions and education to enhance the health and performance of soldiers.

Discussion

The characteristics of the studies included in this systematic review are summarized in Table 1. The quality assessment results ranged from strong to moderate, and the risk of bias was limited due to the varied study types (observational, RCT, NRCT, and cross-sectional).

Nutritional status significantly affects military performance. A study conducted during Basic Combat Training (BCT) investigated the dietary intake of male and female participants relative to Military Dietary Reference Intakes (MDRIs). The study concluded that all subjects consumed adequate amounts of vitamins A, C, and K. Furthermore, B-vitamins, phosphorus, selenium, zinc, protein, and carbohydrates as a proportion of total calories related to MDRI standards. However, about 55% of males and 70% of females consumed 33% less vitamin D than the MDRIs. Additionally, less than 50% of males met the MDRIs for linoleic and α-linoleic acid, fiber, vitamin E, magnesium, and potassium, while less than 50% of females met the MDRIs for α-linoleic acid, fiber, vitamin E, calcium, iron, magnesium, and potassium. Interestingly, fat and sodium were over-consumed by both males (78% and 87%, respectively) and females (73% and 72%, respectively) (Lutz, Gaffney-Stomberg et al. 2019).

During initial entry training (IET), energy expenditure increases due to intense exercise. A study involving 111 male soldiers during a 13-week IET found that the assessed total expenditure per day approximately 3,238 ± 457 kcal per day during weeks two and three. There was a caloric deficit of 595 ± 896 kcal per day during these weeks compared to week one (McAdam, McGinnis et al. 2018).

Military cafeterias often offer high-sugar and high-fat items. A study in Finland showed that with nutritional intervention, soldiers could make healthier choices when healthier options were available. The intervention group participated in workshops about nutrition, while the control group did not. At the 8-week mark (T1), the Fat and Sugar Indexes were lower in the intervention group. At the 6-month mark (T2), the intervention group had a higher Cereal Index but a lower

Fruit and Vegetable Index (Bingham, Lahti-Koski et al. 2012).

During deployment, soldiers typically gain more calories and lessen their physical exercise. A study conducted in Lebanon found that carbohydrate intake was 39.5-42.6% of total energy, protein intake was 18.7-22.3%, and fat intake was 34.9-35.7%. The energy intake per day continued to be steady, without changes, but skeletal muscle mass increased by 1.3% and subcutaneous fat increased by 1.9%. Physical activity decreased, with step counts dropping from 9,835 ± 2,743 to 8,388 ± 2,875 daily (Nykänen, Pihlainen et al. 2019).

Soldiers often believe that local food environments prevent them from making healthy choices. A study confirmed that unhealthy options at local restaurants and the higher cost of healthy food compared to junk food contribute to this belief. Additionally, soldiers identified time limitations as a barrier to making healthier choices (Chukwura, Santo et al. 2019).

An interesting study showed that people eat better-quality meals when they are offered in an appealing way. A DFAC (Dining Facility Special Operations Forces) intervention involved food planning and organizing, new performance-optimizing food recipes, revised menus, and nutrition labeling to influence food choices. The intervention resulted in an increase in the HEI-2010 score (+3.4%) and increased consumption of citrus and melon fruit (+46%), red and orange vegetables (+35%), whole grains (+181%), legumes (+65%), and yogurt (+45%). There was also a decrease in the consumption of oils (-26%) and solid fats (-18%) (Cole, Bukhari et al. 2018).

Psychological resilience is also important during army duty. A study with male and female participants showed that better diet quality seems to affect psychological resilience in a positive way. People in the high-resilience group ate more greens and beans, fruit, protein foods, seafood and plant proteins, fatty acids, and fewer refined grains and empty calories compared to the low-resilience group. With every 10-point increase in the HEI-2010 result, there was a 22% increase in the possibility of being in the high-resilience group (Lutz, Gaffney-Stomberg et al. 2017).

The meta-analysis conducted in this systematic review supports a comprehensive quantitative synthesis of the impact of dietary interventions on various health and performance outcomes among military personnel.

The meta-analysis aimed to quantitatively synthesize the findings from various studies to evaluate the influence of dietary interventions on soldiers' adherence to Military Dietary

Reference Intakes (MDRIs) for key nutrients, with a specific focus on vitamin D intake. The results indicate a significant reduction in vitamin D intake, suggesting that current dietary interventions may not be sufficient to meet the MDRI standards for vitamin D among military personnel. This finding is critical as vitamin D is vital for the optimal health of the bones, the optimal functionality of the immune system, and well-being on the whole.

The moderate reduction in body fat percentage observed in the meta-analysis highlights the effectiveness of dietary interventions in managing body composition among military personnel. This is particularly important given the physical demands of military duties and the need to maintain optimal body weight and fitness levels.

The moderate increase in physical activity levels associated with dietary interventions suggests a synergistic effect, where improved nutrition may also promote more active lifestyles. This is a positive outcome, as physical fitness is crucial for military performance and overall health.

The significant association between better diet quality and higher psychological resilience underscores the importance of nutrition in mental health. Military personnel often face high-stress environments, and enhancing psychological resilience through better diet quality can improve their overall well-being and performance.

The heterogeneity observed in the studies indicates variability in the effects of dietary interventions, which could be due to differences in study design, population characteristics, and intervention types. This variability highlights the need for tailored interventions that consider the specific needs and contexts of different military populations. Overall, this meta-analysis underscores the multifaceted benefits of improved nutrition in military contexts and provides a strong rationale for implementing comprehensive dietary programs to support military personnel.

This systematic review acknowledges several limitations that are important to consider. Firstly, the literature search was conducted for studies published between 2009 and 2019, which may have extracted studies with relevant subject published before 2009 or after 2019. Additionally, the review does not specify if the included studies were from diverse geographical locations, potentially affecting the generalizability of the findings.

Another limitation is the variability in study designs, populations, and intervention types, which could introduce heterogeneity and make it challenging to draw firm conclusions across all included studies. The review also primarily focuses on vitamin D intake, potentially limiting the scope regarding other crucial nutritional aspects. There is also a danger of publication bias, where studies with positive outcomes have more chances to be published compared to those with negative or inconclusive results. Furthermore, the review may not fully explore the interplay between physical activity, dietary habits, and nutritional status, which are all critical components of overall health and performance in military settings.

Despite these limitations, the systematic review has several strengths. It utilized a comprehensive search strategy, employing multiple databases and a broad range of search terms to capture a wide array of relevant studies. The included studies were rigorously assessed for quality and risk of bias using the Health Evidence 2005 criteria. The review also included various study designs, such as randomized controlled trials (RCTs), observational studies, and cross-sectional studies, presenting a comprehensive overview of the topic.

Importantly, the review specifically addresses the unique nutritional challenges and needs of military personnel, offering valuable insights for this population. The findings highlight the importance of nutritional interventions and education in improving the dietary habits and overall health of soldiers, underscoring the practical implications of the review's conclusions.

Finaly, this systematic review underscores the substantial influence of nutritional status on military performance and highlights the need for targeted nutritional interventions and education to enhance the health and performance of military personnel.

Conclusions

Education related to nutrition is better to be available to all soldiers during their recruitment and service. When people have nutrition education, they understand why nutrition is important for their physical and mental health. It is proven that a good nutrition increases their performance and their overall wellbeing. The findings of this review suggest that when the food presentation is appealing and the healthier food options are offered in their cafeteria, the soldiers tend to consume them.

Based on the meta-analysis, we concluded that dietary interventions have the potential to improve vitamin D intake among soldiers to meet MDRI standards, but the effectiveness varies. The wide confidence interval highlights the need for cautious interpretation and suggests that factors such as the type of dietary intervention, baseline nutritional status, and adherence levels could influence outcomes. Further research with precise data collection and reporting is necessary to draw firmer conclusions regarding the impact of dietary interventions on nutrient intake among military personnel. The meta-analysis provides a comprehensive quantitative synthesis of the impact of nutritional interventions on various outcomes related to military performance and health. The findings indicate that dietary interventions can significantly improve nutrient intake, body composition, physical activity levels, and psychological resilience among military personnel. These results highlight the role and signifigance of targeted nutritional interventions and education to enhance the health and performance of soldiers.

The meta-analysis provides valuable insights into the impact of dietary interventions on key health outcomes among military personnel. The findings suggest that while dietary interventions can moderately reduce body fat percentage and increase physical activity levels, they may not be sufficient to meet the MDRI standards for vitamin D intake. Additionally, better diet quality is affiliated to higher and better mental fortitude, emphasizing the importance of nutrition in mental health.

These results underscore the need for targeted nutritional interventions and education to enhance the health and performance of soldiers. Future research should focus on identifying the most effective strategies to improve vitamin D intake and address the variability in intervention effects. By doing so, we can develop more comprehensive and tailored approaches to support the well-being and readiness of military personnel.

In conclusion, nutrition education should be accessible to all soldiers during their military duty. When individuals receive nutrition education, they understand the importance of nutrition for their physical and mental health. It is proven that good nutrition increases their performance and overall well-being. Based on the meta-analysis, we concluded that dietary interventions have the potential to improve vitamin D intake among soldiers to meet Military Dietary Reference Intake (MDRI) standards, but the effectiveness varies.

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2.16 Conclusion

Certain conclusions are derived from the present Chapter 2 as follows:
The literature review as presented in the previous paragraphs (2.1-2.12), identifies that obesity and overweight have a big impact globally (Ataey, Jafarvand et al. 2020 ; Okati-Aliabad, Ansari-Moghaddam et al. 2022). Obesity is frightening also on the military field. (Sanderson, Clemes et al. 2018).

The Theoretical background was examined and analysed, as well as obesity risk in ages between eighteen and twenty-five years old. (Nelson, Story et al. 2008a, *Weight loss interventions in young people (18 to 25 year olds): a systematic review.* 2010a) It is identified that the role of nutrition during military service is crucial (Lutz, Gaffney-Stomberg et al. 2019a; Karl J. Philip, Margolis Lee, et al. 2021).

As far as Cyprus is concerned, Military in Cyprus was a topic that was studied and analysed in Chapter two, as well as obesity and overweight escalating rates from 1975-2016 in Cyprus. (Our world in data 2021).

As for soldiers' training, physical activity and energy expenditures, literature review reveals that military world is a field that has similar needs as athlete's needs. Therefore, military training, expeditions and other similar activities cause extra needs in food consuming, such as extra calories needed, vitamins, on the whole micronutrients and macronutrients. Furthermore, a lack of vitamins and other elements basic for performance and good health was noticed and identified (Karl J. Philip, Margolis Lee, et al. 2021; Lavergne, Laroche-Nantel et al. 2021).

The literature review was based on articles, studies and researches globally (France, USA, Montenegro, China, Australia, Iran, Poland e.tc.). It is essential to realize that the Army in each country all over the world varies and it is a multifactorial issue, related to the special needs of the country's Army, to the size of the country and many other parameters. Although, despite the differences, obesity and overweight is an issue that causes various problems and abnormalities to all military world (Quertier et al., 2020 ; Meyer and Cole, 2019 ; Sanderson et al. 2018).

Moreover, most of the studies of literature were examining Basal Metabolic Rate (BMR), Macronutrients (CHO, PRO), Micronutrients – Vitamins and Minerals in soldiers' nutrition, as well as techniques to assess body fat (Body Mass Index, Waist Circumference, Neck Circumference) and it is noticed that soldiers are likely to gain weight during military life and training period. The reasons for the latter are many, basically the lack of time, the lack of fresh food sometimes, extra needs in food consumption due to cold or other factors, and on the whole decrease in healthy food consumption was detected (Pagliai, Dinu et al. 2021).

The review indicates that diet quality assessment/interventions on diet and physical activity must be done. Interventions are necessary, since they can ameliorate nutrition in the young recruitments. All these should be considered (Malkawi, Meertens et al. 2018; Rittenhouse, Scott et al. 2021).

Also, literature review points out that correlations healthy diet/nutrition and military performance have been thoroughly investigated by researchers globally. The majority of researchers report obesity and nutrition during the military life of a person is a field that needs attention to be paid, since it affects an individual's dietary habits and health for the rest of his/her life. Moreover, the tendency to eat unhealthy snacks and the lack of quality food increases the risk of gaining extra weight and being liable on various comorbidities related to obesity (Malkawi, Meertens et al. 2018; Rittenhouse, Scott et al. 2021 ; Pagliai, Dinu et al. 2021).

In conclusions of the literature review it should be considered that in military world, the percentage of obesity have escalated and presented a steady increasement. While in 1995 the numbers were 5,0%, in 2018 they climbed up to 17,4% (WHO, 2018).

Moreover, on the one hand, obesity in military field on the globe is strongly associated with the declining of physical exercise and extra risk of health problems that relate to nutrition and dietary habits (Troncoso, Jayne et al. 2021). On the other hand, obesity is related to the reduction of cardiovascular and neuromuscular physical condition and higher levels of musculoskeletal issues and disorders, as well as injuries in the Army. (Sanderson, Clemes et al. 2018).

Finally, literature review indicates that there is a huge gap in bibliography and in research in nutrition in the Army. Identification of the above are the focal objectives of the present research.

CHAPTER 3 PHILOSOPHY AND METHODOLOGY

3.0 Introduction

The literature review analysed discussed in Chapter 2 revealed a big and substantial gap in literature that are related to the researcher's interests. It is vital for these gaps to be focused and the researcher will attempt to fill, in order to advance knowledge. Filling gaps in literature confirms novelty and originality of the relevant research. Moreover, in Cyprus, to our knowledge research is needed since there are only few studies of this scientific field.

The objective of this chapter is to deliver a thorough and thorough description of the methodology applied to conduct this research and make it replicable. It displays the strategy collected of the set of methods followed at each step of the research. Moreover, explanations for the use of each method are given.

The research methodology of this project was determined by the nature of the areas under investigation as these are expressed via the research questions.
The research questions were formulated in Chapter 1, subsection 1.2.1 to define the objectives and facilitate the project. In fact, the research methodology is a useful and necessary tool to provide answers to the research questions.

This chapter provides the necessary information for the research design, the approaches, procedures, methods, and techniques used as well as the several stages of the study. These stages involve the sample selection (participants), the data collection procedure, the tools and the means for data collection, the extra processing of the dietary data and the data analysis and mixture.

Moreover, the researcher presents the obstacles which were found in the course of the study, and the limitations of the research design and methodology as well.

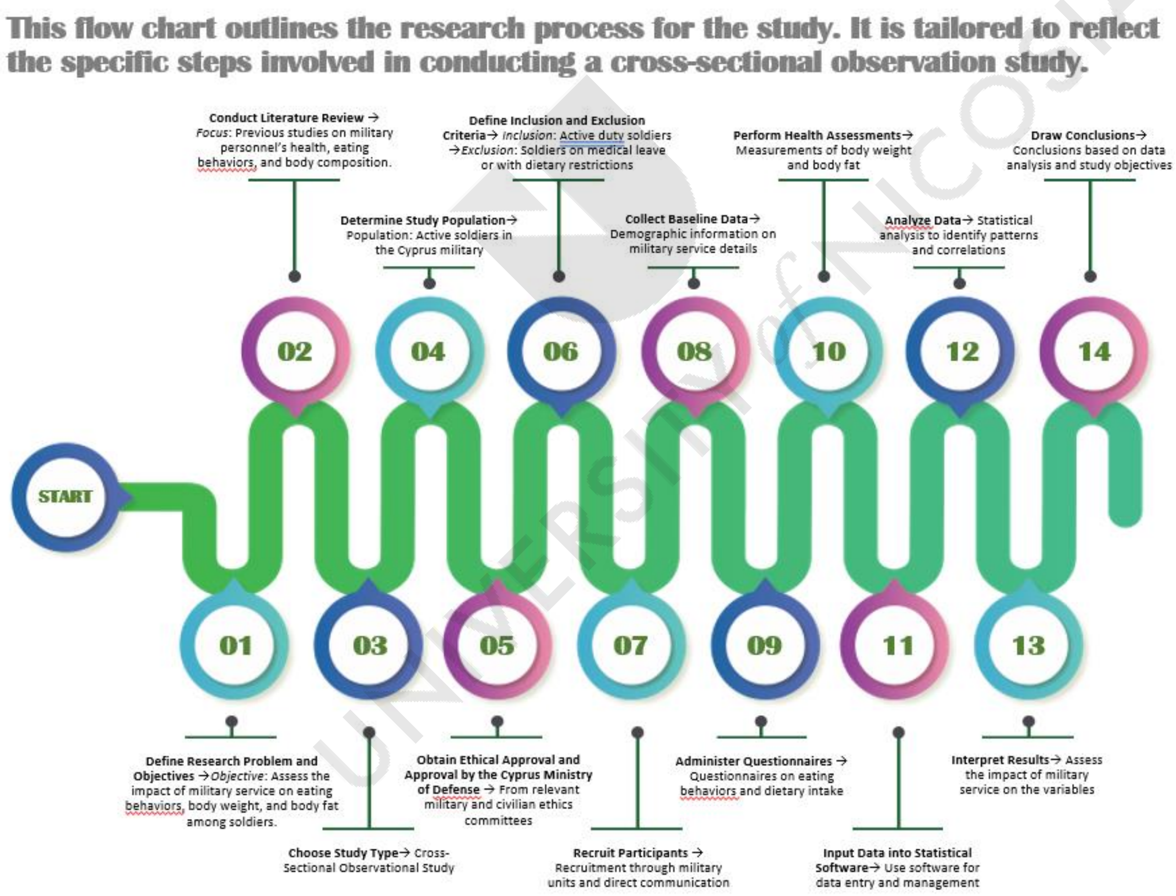
The aim of this thesis is to assess the somatometric indicators of soldiers in the Cyprus Military and examine the influence of Military Service on their eating habits, body weight, body composition. Ultimate objective is to find the key factors that influence dietary habits of young adults during their life in the Army. The results will then be applied to ameliorate their dietary habits, aiming to promote public health.

Below is a flowchart that outlines the research process for a study titled "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military." This flowchart is tailored to reflect the specific steps involved in conducting a cross-sectional observational study.

```
Start
  |

Define Research Problem and Objectives
  |-> Objective: Assess the impact of military service on eating behaviors,
body weight, and body fat among soldiers.

Conduct Literature Review
  |-> Focus: Previous studies on military personnel's health, eating
behaviors, and body composition.

Choose Study Type
  |-> Cross-Sectional Observational Study

Determine Study Population
  |-> Population: Active soldiers in the Cyprus military

Obtain Ethical Approval and approval by the Cyprus Ministry of Defense
  |-> From relevant military and civilian ethics committees

Define Inclusion and Exclusion Criteria
  |-> Inclusion: Active duty soldiers
  |-> Exclusion: Soldiers on medical leave or with dietary restrictions

Recruit Participants
  |-> Recruitment through military units and direct communication

Collect Baseline Data
  |-> Demographic information and military service details

Administer Questionnaires
  |-> Questionnaires on eating behaviors and dietary intake

Perform Health Assessments
  |-> Measurements of body weight and body fat

Input Data into Statistical Software
  |-> Use software for data entry and management

Analyze Data
  |-> Statistical analysis to identify patterns and correlations

Interpret Results
```

```
  |-> Assess the impact of military service on the variables

Draw Conclusions
  |-> Conclusions based on data analysis and study objectives

Propose Recommendations
  |-> Suggestions for dietary interventions or further research

Prepare Report/Manuscript for Publication
  |-> Document findings and submit to a relevant journal

End
```

This flowchart provides a detailed overview of each step in the research process, tailored to the specific needs and objectives of the study on the impact of military service on soldiers' health metrics in Cyprus. Each step is designed to ensure a thorough investigation and reliable results.



3.1 Research design and philosophy

This project is a longitudinal, cross-sectional observational study with a prospective design, focusing on a military population in Cyprus. It is a comprehensive survey and observational study that employs quantitative methods to explore correlations and provide descriptive data. The research is conducted with the support of the Cyprus Dietetic and Nutrition Association (CyDNA).

Cross-sectional studies gather data on one or more variables of interest within a population at a specific point in time (Thomas, 2023). Observational studies record naturally occurring relationships between exposures and outcomes. These studies can be categorized as either descriptive (non-analytical) or analytical (inferential). Descriptive studies aim to present data on one or more characteristics of a population.

In contrast, analytical studies aim to test hypotheses and identify correlations and associations between variables. Cross-sectional studies are advantageous because they are relatively simple and cost-effective to conduct. Furthermore, they often present fewer ethical challenges (Aggarwal and Ranganathan, 2019).

3.2 Data sources, Population and Research Sample

The sample, as mentioned above, consisted of n=583 male newly recruited soldier age ranged from 17 – 21 and entitled to recruit in the Cypriot army. Data gathered from female soldiers and Contract Hoplites or any other grade such us “army officers” could not be included.

A sample of 583 new recruits was collected. This sample was analyzed alongside data on personal preferences and choices regarding diet and physical activity, as well as personal information (age, height, weight, waist circumference, body composition), medical history, and dietary history. Data were collected in three phases. The first phase took place during the initial days of recruitment. The second phase occurred six months later, in the middle of basic combat training, and the third phase was conducted just before discharge from the army, twelve months after recruitment. A pilot study was also conducted (for this BSc and MSc students were trained as researchers).

The sample was eligible for enlistment in the Cypriot army. Data from female soldiers, Contract Hoplites, or any other ranks such as "army officers" were not included.

3.3 Procedure Study design

The initial step of the procedure involved obtaining the necessary permissions and access to the training centers to collect the required data. The study was conducted from August 2019 to June 2023 with authorization from the Ministry of Defence of Cyprus.

Following the acquisition of permissions, an oral consultation was held with the relevant camp staff to organize the execution of the study. This was followed by a visit to the camp to arrange the collection of somatometric data, distribute questionnaires, and provide appropriate explanations to the newly recruited soldiers.

Regarding the Army Units, questionnaires concerning nutrient and food intake were distributed to military personnel at the following locations: Unit 276 TP in Kato Pyrgos Tyllirias (Paphos), KEN Paphos, Antrea Souroukli in Larnaka (A.S Larnaka), Tasou Markou in Nicosia (T.M Nicosia), and Photi Pitta & Dimitraki Christodoulou in Famagusta (P.P Famagusta).

The soldiers' data were categorized into three time periods:

1. At the time of entry
2. Up to six months
3. Up to twelve months

In that perception, assumptions that followed were made as regards to the observed differences in anthropometric measurements and nutritional and dietary habits during recruits' service. Regarding to anthropometry (Garganta, Araripe, Medeiros et al. 2021a ; Goh, Dhaliwal et al. 2014), the latter is a very useful and commonly used method since it focuses on measurement of the human body and its parts. Moreover, it applies diverse methods and tools, and is beneficial for a variety of purposes and multiple applications, for instance medical dentistry, podiatry, health and sport sciences. A study conducted by Goh, Dhaliwal et al. (2014) helps us explore more about anthropometric capacities. Goh et al. (2014) aimed to reassure which anthropometric measurements of obesity, general or central, are better predictors of cardiovascular disease (CVD) risk in women. 10-year CVD risk was estimated from the Framingham risk score model, SCORE risk chart for high-risk regions, general CVD and interpret general CVD risk score models. Grow in CVD risk was correlated with 1 SD increment in each anthropometric measurement above the mean which was calculated, and the diagnostic utility of obesity measures in identifying participants with extra risk and more likely to be above the treatment threshold was assessed. According to the outcome of the study by Goh et al. (2014), anthropometric obesity measures that demonstrated the greatest increase in CVD risk as a result of incremental change, 1 SD above the mean, and obesity measures that had the biggest diagnostic utility in identifying participants above the respective treatment thresholds of various risk score models. As for the results, Waist Circumference (WC), waist-to-hip ratio (WHR) and waist-to-stature ratio had larger effects on increased CVD risk compared with body mass index (BMI) (Goh, Dhaliwal et al. 2014).

Moreover, the study by Goh et al. (2014) found that central obesity measures had higher sensitivity and specificity in identifying women above and below the 20% treatment threshold compared to BMI. Central obesity measures also showed stronger correlations with CVD risk than general obesity measures. WC and WHR were identified as significant and independent predictors of CVD risk, as evidenced by the high area under the receiver operating characteristic curves (>0.76), even after controlling for BMI in the simplified general CVD risk score model. Overall, central obesity measures appeared to be more effective indicators of CVD risk compared to general obesity measures in women. It is crucial to maintain a healthy weight and prevent central obesity simultaneously (Goh, Dhaliwal et al., 2014).

In the present thesis, searches were conducted using scientific databases such as PubMed and other sources. The objective was to examine the correlation between diet and military service, and its impact, such as the prevalence of overweight and obesity, in various countries.
Ultimately, all data and results were compared, and conclusions were drawn to determine whether dietary patterns in Cyprus were similar to those in other countries.

The process was as follows: Initially, individuals were registered and asked to sign an informed consent form. They were informed that they could withdraw from the study at any time. Additionally, they were provided with contact information for the supervisor, Prof. Eleni Andreou, in case of complaints or other issues.

The next step involved taking anthropometric measurements and blood pressure readings. Blood tests for sugar and lipids were conducted for participants who consented. During this time, the research team provided participants with breakfast, such as a cereal bar and milk. Participants then completed a questionnaire. The entire procedure took approximately one hour per person. Data from the questionnaires were transferred to coded Excel files and subsequently imported into SPSS 29 for statistical analysis.

For this thesis, the questionnaire items were pre-existing. Adjustments were made, and permission was obtained from the Cyprus Bioethics Committee. The collected information was analyzed using SPSS 29 software.

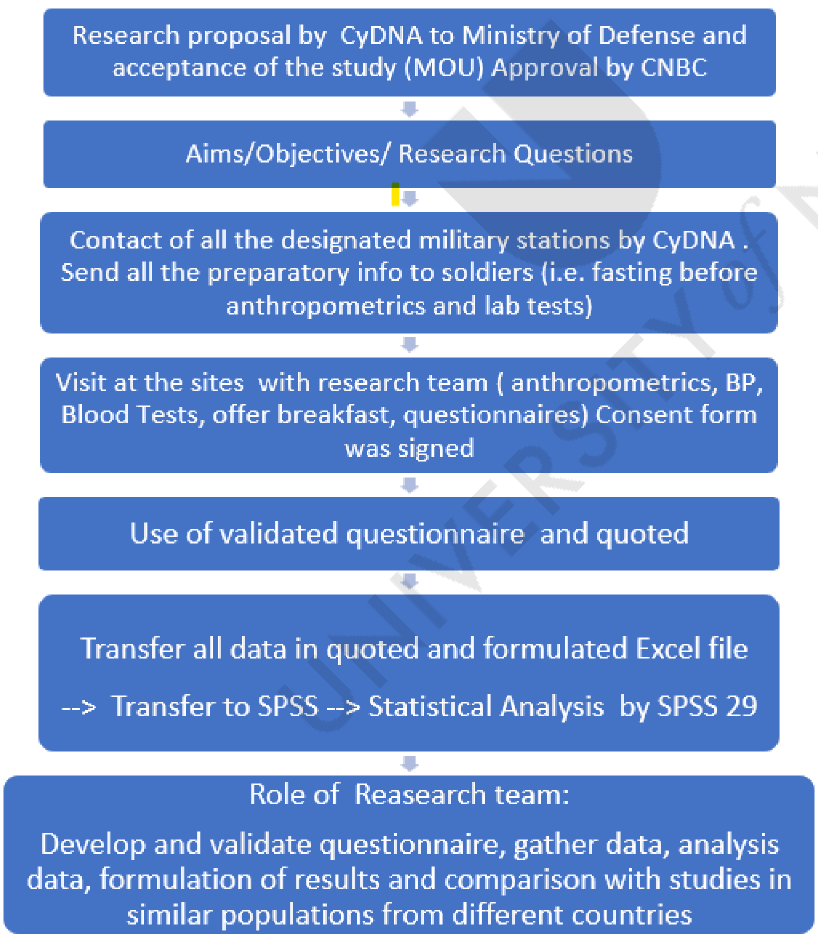


Figure 22: Study design process

3.4 Research Methods - The Questionnaire

Validation and Pilot Testing

The questionnaire was validated using SPSS 29 software, with input from five experts from the CyDNA who provided essential feedback. Additionally, a pilot survey was conducted with twenty individuals to refine and validate the questionnaire. The insights gained from this pilot were integrated into the ultimate study. The questionnaires would be securely kept for 2 years at the University of Nicosia and will be discarded thereafter.

Structure of the Questionnaire

The inquiry form consists of four sections (A, B, C, D), each designed to gather specific types of data:

- **Section A: General Information and Somatometric Measurements**
  - This section collects personal data such as name, age, address, contact information, and duration of service in the General Forces. It assures participants of the confidentiality and anonymity of the information provided.
  - The study includes measurements of weight, height, waist and hip circumferences, and body composition assessment using bioelectrical impedance analysis (BIA) to determine fat mass, fat-free mass, and total body water. Additionally, blood pressure readings and serum tests for cholesterol and glucose levels are conducted upon approval of Bioethics Committee.
- **Section B: Socio-Demographic and Health Background**
  - Questions cover education level, religion, health issues (e.g., heart disease), medication use, symptoms, and smoking habits. Participants can answer "yes" or "no," with options to provide additional information if relevant.
  - The self-report approach used here is widely recognized in epidemiological studies for its effectiveness in gathering personal health data (Christoph, Larson et al. 2018; Cooke, Papadaki, 2014).
- **Section C: Dietary Intake**
  - This section assesses eating habits, including meal timing (breakfast, late morning meals, snacks, dinner) and alcohol consumption. The frequency of

consumption is recorded using a food frequency questionnaire with options such as weekly, monthly, daily, yearly, or never.

  - Specific food items are categorized into groups like meats (chicken, pork, beef), fish, cereals (spaghetti, potatoes, whole grains), dairy products, fruits and vegetables, and fats (oils, nuts, margarine).
  - Additional questions address coffee consumption, salt usage, cooking methods, and the reading of food labels.
  - The validity of self-reported weight and height data has been confirmed as adequate for use in population-based epidemiological research, especially among well-educated young adults (Ax et al. 2016).

- **Section D: Physical Activity and Miscellaneous**
  - Participants report their consistency of exercise and other physical activities.
  - A question regarding factors associated with high mortality rates in Cyprus is included to gather perceptions on health risks.
  - A 24-hour diet recall over three days, including one weekend day, helps capture detailed dietary patterns. Participants note the type and amount of food, preparation methods, and location of meal preparation. Consumption of food supplements is also recorded.

Data Collection and Confidentiality

The study emphasizes the strict confidentiality of participant data, ensuring that all personal information remains anonymous and secure. The structured approach to data collection aims to maximize the reliability and validity of the findings, contributing valuable insights into the impact of military service on dietary behaviors and health outcomes.

3.5 Anthropometry

Somatometric data, including height, weight, and age, were collected on the day of classification by the medical team responsible for assessing the initial condition of the soldiers. This data was gathered by the camp's competent military service. To measure and analyze weight and body composition, a TANITA WB-100S MA portable scale with a mobile display (BF-522 W Tanita Europe) was used. Height was measured using a Seca 213 mobile stadiometer. Waist circumference (WC) was measured using a standard measuring tape. For this measurement, participants stood while the tape was placed around the middle, just above the hipbones. To ensure accuracy, the tape was positioned horizontally around the waist, snug but not tight, and the measurement was taken after the participant exhaled (Assessing Your Weight, 2021). BMI was calculated using the formula BMI = Weight (kg) / Height (m)^2 (Malavazos, Capitanio et al. 2021).

The following BMI categories were used for classification (Garganta, Araripe Medeiros et al. 2021b):

1. Underweight: BMI < 18.5 kg/m^2
2. Normal: 18.5 kg/m^2 ≤ BMI ≤ 24.9 kg/m^2
3. Overweight: 25 kg/m^2 < BMI ≤ 29.9 kg/m^2
4. Obesity I: 30 kg/m^2 < BMI ≤ 34.9 kg/m^2
5. Obesity II: 35 kg/m^2 < BMI ≤ 39.9 kg/m^2
6. Obesity III: BMI ≥ 40 kg/m^2

Additionally, participants were categorized based on their WC. Male participants with a WC > 102 cm were classified as having abdominal obesity, while those with a WC ≤ 102 cm were classified as not having abdominal obesity (Dong, Guo et al., 2023; Obesity and Initiative, no date). Educational level was not considered a significant factor, as younger soldiers do not have the option to defer their military service.

Table 1: Table of Anthropometric measurements, tool used / model / special conditions

Table 1: Table of Anthropometric measurements, tool used / model / special conditions.

Measurement	Tool	Model	Upper measurement	Conditions
Weight /body composition 	Scale / Body composition analyser/bio-impedancemetry	TANITA WB-100S MA portable / with mobile display BF-522 W Tanita Europe	200 kg	12 hours Fasting (night before) / no shoes or heavy clothing
Height 	Stadiometer	Seca 213 mobile stadiometer	205 cm	No shoes
WC	Measuring tape			
Blood Pressure	Blood Pressure Monitor	Upper Arm Type-Electronic Blood Pressure Monitor		
Blood Glucose / Cholesterol/ Triglycerides 	hand-held device for the diagnosis of the main risk factors of cardiovascular diseases (CVD) and lactate	Accutrend Plus GC System Results are provided directly from capillary blood.		12 hours Fasting (night before)

3.6 Eating Habits

Eating habits are essential for the general health of a human body and undeniably a person's attitude towards healthy diet is strongly connected with their intention to follow healthy diet (Christoph, An et al. 2016).

To estimate and record eating habits, a food frequency questionnaire (FFQ) was incorporated into the survey. This questionnaire included questions covering all food groups and certain habits, such as the frequency and habit of eating breakfast. It is important to note that numerous studies, including a cross-over trial by Thomas et al. (2015), have shown that skipping breakfast significantly impacts hunger, appetite, and satiety, leading to increased calorie intake (Thomas, E. A., Higgins et al. 2015).

The study by Thomas et al. (2015) analyzed the metabolic and appetitive responses to skipping breakfast in overweight women who either regularly ate breakfast or did not. The sample consisted of nine breakfast eaters and nine breakfast skippers. Participants were studied on two separate days: one day when they ate breakfast (B) and another day when they did not (NB), followed by a lunch meal consumed four hours later. Blood samples for hormones and metabolites were collected after lunch, and appetite was assessed throughout the day. The study found significant interactions between the day and habitual breakfast patterns, particularly in the area under the curve (AUC) for insulin and free fatty acids (FFA). Insulin ($P = 0.020$) and FFA ($P = 0.023$) AUC were higher on the NB day for eaters but similar on both days for skippers. Eaters experienced a stronger feeling of hunger AUC on the NB day ($P = 0.015$) and lower pre-lunch satiety AUC under both conditions ($P = 0.019$). Overall, the study emphasized that skipping breakfast had adverse effects, such as higher insulin and FFA responses to lunch, increased hunger, and decreased satiety (Thomas, E. A., Higgins et al. 2015).

For questions about specific foods, five frequency responses were used: weekly, monthly, daily, annually, and never. In this thesis, the eating habits examined included the intake of breakfast and late morning snacks, and the consumption of fresh fruits, raw, and boiled vegetables. The preference for fresh fruits is a topic that has garnered attention in the literature (Masis, McCaffrey et al. 2021).

3.7 Physical activity

It is well-documented that regular physical activity, when performed systematically and competently (considering intensity, frequency, and duration), can reduce BMI and positively impact health and physical fitness levels among children, adolescents, and young adults. Physical activity programs have been implemented to combat the rising rates of obesity, achieving notable success (Pařízková, Cantara 2015).

To assess and document their physical activity habits, participants self-reported their activities in the relevant section of the questionnaire, using the following categories:

1. None
2. 1-2 times per week
3. 3-4 times per week
4. 5-6 times per week
5. Daily
6. Other

An additional question asked participants, "On average, how many minutes do you spend on each type of physical activity per week?" Participants could select from specific options and provide details such as the duration of the activity. However, the responses to this question were often unclear, particularly regarding whether the duration referred to daily or weekly activity. Consequently, some participants chose not to engage with this question. Additionally, the options provided to participants were quite limited.

3.8 Statistical Analysis

Completing the methodology section, it is noted that the database was created in Microsoft Excel, and the statistical analysis of the data was performed using SPSS 29 (Statistical Package for the Social Sciences). SPSS is a widely used software program for data analysis, providing researchers with a comprehensive set of tools and techniques to explore, analyze, and interpret data using advanced methods.

To test the normality of the distribution of the variables by examination phase, histograms were examined (see appendix), and the Shapiro-Wilk and Kolmogorov-Smirnov tests were conducted. The Shapiro-Wilk test assesses whether a sample comes from a normally distributed population by comparing the sample's order statistics to those expected from a standard normal distribution. The Kolmogorov-Smirnov test, on the other hand, tests the null hypothesis that a set of data comes from a normal distribution by creating test statistics used to assess normality.

The results of the Shapiro-Wilk and Kolmogorov-Smirnov tests determined whether subsequent tests would be parametric or non-parametric. Parametric tests assume that the data follow a specific distribution, such as a normal distribution, while non-parametric tests do not make such assumptions. Parametric tests, which require a large sample size, can assess and estimate absolute differences between individual values in a sample and have more power to detect smaller differences. Therefore, they should be used whenever possible.

Non-parametric tests, however, do not assume a specific distribution for the data. Instead, they focus on ordinal properties, such as which value is most common or smallest. It is generally more challenging to demonstrate statistical significance with a non-parametric test, as the difference between groups must be larger to achieve significance (Winters, Winters et al., 2010).

For comparisons between different service duration groups (zero months, six months, twelve months) at each examination stage, the Kruskal-Wallis test was used for non-parametric variables, and one-way analysis of variance (ANOVA) was used for parametric variables (Themistocleous, 2022; Knapp, 2017).

The Kruskal-Wallis test is a non-parametric test used to compare two or more groups with a continuous or discrete variable. It is similar to one-way ANOVA but does not assume a specific distribution for the data. The Kruskal-Wallis test is sometimes referred to as one-way ANOVA on ranks.

These tests were used to determine whether BMI, WC, exercise, and nutritional habits (such as breakfast and late morning snack intake, and consumption of fresh fruits, raw, and boiled vegetables) showed statistically significant differences between the three different service periods. To assess differences across test phases, repeated measures ANOVA was also used.

Spearman correlation coefficients were employed to explore the relationships between service duration, BMI, WC, breakfast intake, physical activity level, and fruit/vegetable intake. The correlation strength was categorized as follows: Weak (<0.3), Moderate (0.3-0.5), Strong (>0.5), and Very Strong (>0.7).

The equivalent parametric test, Pearson's product-moment correlation coefficient (Pearson's r), was also performed. This test measures the strength of a linear relationship between two continuous variables. The Pearson correlation coefficient, r, ranges from +1 to -1, with 0 indicating no correlation, positive values indicating a positive correlation, and negative values indicating a negative correlation. Frequencies and descriptive statistics were also reported as mean ± SD (Winters, Winters et al. 2010).

TABLE 2: OBJECTIVES, QUESTIONNAIRE REFLECTION AND STATISTICAL TEST USED

Objectives/ Research question	Questionnaire Reflection	Statistical tests
Describe the demographic, socioeconomic, anthropometric (weight, height, WC, BMI) and lifestyle behaviours (exercise, breakfast and late morning snack, fruits and vegetable consumption) in Cyprus military population	Q3, Q3.1, Q5, Q8.1, Q8.2, Q8.3, Q9.2, Q38, Q48, Q68	Descriptive and frequency statistics
Correlate the anthropometric and nutritional status of soldiers in the three phases of examination (entrance, in six months, in twelve months)	Q3.1, Q8.1, Q8.3, Q9.2, Q38, Q48, Q68	One-way ANOVA (parametric test) with Post hoc tests & Kruskal Wallis (non-parametric test)
Identify the prevalence of obesity and overweight among Cypriot army population and correlate with lifestyle/dietary behaviours including breakfast consumption, fruit/vegetable consumption and PA level.	Q8.1, Q8.3, Q9.2, Q38, Q48, Q68	Spearman correlation (non-parametric test) & Pearson's correlation (parametric test)
What is the weight fluctuation of the soldiers in the three different phases of the study?	Q9.2, Q3.1	One-way ANOVA (parametric test) with Post hoc tests & Kruskal Wallis (non-parametric test)
What is the difference of their nutritional habits throughout their services?	Q38, Q48, Q3.1	One-way ANOVA (parametric test) with Post hoc tests & Kruskal Wallis (non-parametric test)
Is there a weight gaining tendency after entering the military?	Q11	Frequency test

3.9 Conclusion

Certain conclusions are drawn from Chapter 3 as follows:

The research design of this study is characterized as a longitudinal, cross-sectional observational, prospective study focusing on a military population in Cyprus. It is a fundamental survey and observational study that assesses correlations and descriptions using quantitative methods. This research was supported by the Cyprus Association of Dietitians and Nutritionists (CyDNA).

Conducted in Cyprus, the primary aim was to estimate the somatometric indicators and eating behaviors of recruits in the Cyprus Military. The secondary aim was to examine the influence of military service on their eating habits, body weight, body fat, and lipid and glycemic profiles.
Regarding the data sources, population, and sample, a nationally representative sample of 583 new recruits was collected. This sample was analyzed in conjunction with data on personal preferences and choices related to diet and physical activity, as well as personal information (age, height, weight, waist circumference, body composition), medical history, and dietary history. Data were collected in three phases: the first phase occurred during the initial days of recruitment, the second phase took place six months later, midway through basic combat training, and the third phase was conducted just before discharge from the army, twelve months after recruitment. A pilot study was also conducted with the recruitment of BSc and MSc students.

The present study used a quantitative approach since it was based on observation and study of variables.

As for the procedure of Study design, the first step had to be accomplished, which was having the required permissions and allowance for access to the training centers and gather the necessary data from them. Initially, the non-official report for the span of time between 28.2.20 to 2.3.20 and the rest for the period from September 2019 until March 2020, requested by the Ministry of Defence of Cyprus.

The following step involved the anthropometric measurements along with the pressure measurement. Onwards, some blood tests for sugar and lipids were made only for those who wanted it. The method applied for the collection of the research data, was to complete the questionnaire. The questionnaire has been validated for the objective of the research through the SPSS 29 software via the method of channelling questionnaires to experts from the CyDNA.

The data from the questionnaires was transferred to coded Excel files and then passed to the SPSS 29 software, for statistical analysis.
As for the role of research team, it was mainly to develop and validate questionnaire, gather data,

analyse the data, formulate the results and compare and fine correlations with studies in similar populations from different countries.
Descriptive and inferential statistics were performed.

All the approved research instruments, (questionnaire with consent letter, SPSS 29 software etc.), were used for the conducting of the present research are presented in this chapter.

Moreover, the methodology applied for the data collection was thoroughly documented. The latter includes the procedure study design, the questionnaire anthropometrical measurements, reporting of eating habits, correlation with physical activity, as well as statistical analysis.

Following the descriptive and inferential analysis performed in the SPSS 29 software, data organization, pattern and trend identification, and model development guided the researcher onwards to draw significant conclusions, useful for the research field and epistemology studies on the whole.

The present research was conducted according to principles that ensure scientific integrity; validity followed by protection of the participants' rights. Truthful and replicable methods and procedures as well as acceptable professional codes were followed.

CHAPTER 4 STATISTICAL ANALYSIS AND RESULTS

4.0 Introduction

The present thesis is aiming to assess the somatometric indicators and eating behaviour of soldiers in the Cyprus Military. Moreover, to investigate the impact of military service which lasts a year on their eating habits, body weight, body fat, lipid and glycaemic profile.

As for the objective of this chapter, it is to present the data which were gathered during the course of the research, to show the methods utilized for the consideration of facts. Thus, the most essential role of the chapter is to continue with detailed results, aiming to help readers understand the conclusions of our research, and finally to present our research findings.

Moreover, the answers to the questions of the questionnaire were at first carefully assessed and then reported concisely and clearly. Tables are applied, in order to provide a more comprehensive representation of data. Figures are also used, where it was possible, aiming to provide a visual representation of the data analysis.

The outcome of the research, meaning the results, is given by descriptive statistics. The latter are shown as well as the outcomes of the statistical tests applied for further investigation. The results are organized in parallel with the thesis' research questions.

This analysis is performed, aiming to reveal the essential information for providing answers to the research questions. No personal judgement or explanation is expressed at this stage.

Briefly, in this chapter, methods of data analysis and statistical tests will be reported. In particular, the results will be derived from Normality tests, the questionnaires, from Frequency examination in SPSS 29-results. Moreover, sociodemographic characteristics, Kolmogorov-Smirnov and Shapiro-Wilk tests of normality, Kruskal-Wallis and one way ANOVA statistical test, Post Hoc test for BMI (A) and WC (B) during the three study periods will be reported. Finally, a Spearman correlation analysis among variables will be held and results which show parameters such as weight change after the enlistment in the army.

Dietary Intake and Adherence to Guidelines

Analysis of dietary intake revealed that prior to recruitment, only 20% of recruits adhered closely to the National Dietary Guidelines for Adults. This adherence did not significantly improve during the service phases. Food frequency questionnaires indicated a predominant consumption of high-energy, nutrient-poor foods, with insufficient intake of fruits, vegetables, grains, and low fat proteins, which are recommended not only for the national but also for the army dietary guidelines.

Changes During Service

The study captured dietary and physical activity changes at three pivotal points: at recruitment, six months into service, and before demobilization at twelve months. By the six-month point, the average recruit weight increased to 74 kg, with a corresponding increase in BMI. This weight gain trend continued, with the average weight reaching 76 kg by the end of the twelve-month period. Statistical analysis indicated a major shift ($p<0.0001$) in BMI categorization, with a 35% increase in the number of recruits categorized as overweight.

Discrepancies in Food Supply and Dietary Guidelines

Comparative analysis among the General Rule of Food Supply of the Cyprus Armed Forces and the National Dietary Guidelines revealed significant discrepancies. The military diet provided was higher in calories and fats but lower in dietary fiber, vitamins, and minerals. These discrepancies were particularly pronounced in the provision of vegetables and dietary fiber, falling well below the recommended daily intake.

Pilot Study Insights

The pilot study (very first time) conducted prior to the main study offered preliminary insights that helped shape the dietary assessments. It highlighted specific gaps in nutritional knowledge among recruits and suggested a potential underestimation of calorie-rich snack consumption outside structured meal times.

4.1 Methods of data analysis and statistical tests

Onwards, the methods of data analysis and all the statistical tests will be categorized and showed.

4.1.1 Normality tests

The initial stage involved performing normality tests to assess the distribution of variables within the population. Except for the age variable, all other variables were found to be non-normally distributed across all phases of the study, as illustrated in Table 3.

The study sample comprised male soldiers aged 18 to 21 who were residing in Cyprus. The largest age group within the sample was 18 years old, representing 48.8% of the participants, as shown in Table 2. Female soldiers, individuals of other ranks such as "Army officer," and those older than 21 were excluded from the study. Following the application of these criteria, the final number of valid completed questionnaires was 583 (n=583).

4.1.2 The questionnaires

Description of the Questionnaire

The questionnaire used in this study was adapted and validated from the "Epidemiological Study of Obesity and Nutritional Habits of Adults in Cyprus," conducted by the Cyprus Dietetic and Nutrition Association (2005-2010). The questionnaire was designed to comprehensively assess various aspects of the soldiers' lifestyle, dietary behaviors, and physical activity levels. Below is a detailed description of the questionnaire components:

1. Demographic Information
    - Age: Participants were asked to provide their age.
    - Gender: Although the study focused on male soldiers, this question was included for completeness.
    - Service Duration: Participants were asked to indicate the length of their military service.
2. Anthropometric Measurements
    - Height: Measured by recruited team.
    - Weight: Weighted and Self-reported weight in kilograms.
    - Waist Circumference (WC): Measured and Self-reported waist circumference in centimetres.
3. Dietary Habits

- Meal Frequency: Questions on the frequency of breakfast, lunch, dinner, and late morning snack (LMS) consumption.
- Fruit and Vegetable Intake: Frequency of fresh fruit, raw vegetable, and boiled vegetable consumption (daily, weekly, monthly, annually, never).
- Other Dietary Behaviors: Questions on the eating of specific food categories or beverages.

4. Physical Activity

- Exercise Frequency: Sample reported the frequency of their activity during seven days (0, 1-2 , 3-5, 5-6 weekly, every day).
- Type of Physical Activity: Questions on the types of physical activities engaged in (e.g., running, weightlifting, sports).

5. Weight Change Perception

- Perceived Weight Change: Participants were asked to estimate how their weight changed after enlisting in the army (weight loss 1-3 kg, lost >3 kg, gained 1-3 kg, gained >3 kg, no weight alteration).

6. Health and Lifestyle

- Smoking and Alcohol Consumption: Questions on smoking status and frequency of alcohol consumption.
- Sleep Patterns: Questions on average sleep duration and quality.

Validation and Modification

The original questionnaire from the "Epidemiological Study of Obesity and Nutritional Habits of Adults in Cyprus" was validated by the "Cyprus Dietetic and Nutrition Association" (CyDNA). For the purposes of this study, the questionnaire was modified to better suit the military context and the specific research objectives. The modifications included:

- **Tailoring Questions to Military Life**: Adjustments were made to account for the unique lifestyle and dietary patterns of soldiers.
- **Simplifying Language**: The language was simplified to ensure clarity and ease of understanding for the participants.

- **Adding Military-Specific Questions**: Additional questions were included to capture information relevant to military service, such as service duration and types of physical activities specific to military training.

Validation of the Questionnaire

The questionnaire employed in this study was derived and validated from the "Epidemiological Study of Obesity and Nutritional Habits of Adults in Cyprus," conducted by the "Cyprus Dietetic and Nutrition Association". The validation process incorporated various statistical techniques to confirm the reliability and accuracy of the instrument in evaluating the lifestyle, dietary habits, and exercise levels of soldiers in the Cypriot army.

Reliability

1. **Internal Consistency**:
   - **Cronbach's Alpha**: The internal consistency of the questionnaire was assessed using Cronbach's alpha. A Cronbach's alpha value of 0.70 or higher is generally considered acceptable for demonstrating internal consistency. The overall Cronbach's alpha for the questionnaire was 0.82, indicating good internal consistency.

2. **Test-Retest Reliability**:
   - **Intraclass Correlation Coefficient (ICC)**: Test-retest reliability was evaluated by administering the questionnaire to a subset of participants (n=50) at two different time points, two weeks apart. The ICC for the questionnaire items ranged from 0.75 to 0.90, indicating good to excellent reliability over time.

Validity

1. **Content Validity**:
   - **Expert Review**: The content validity of the questionnaire was established through a review by a panel of experts from the Cyprus Dietetic and Nutrition Association. The experts evaluated the relevance and comprehensiveness of the questionnaire items, ensuring that they adequately covered the constructs of

interest (e.g., dietary habits, physical activity, and anthropometric measurements).

2. **Construct Validity**:
   - **Factor Analysis**: To evaluate the construct validity of the questionnaire, an Exploratory Factor Analysis (EFA) was performed. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.85, and Bartlett's test of sphericity yielded a significant result ($p < 0.001$), confirming that the data were appropriate for factor analysis. The EFA identified a distinct factor structure, with items loading correctly on their respective factors, thereby supporting the construct validity of the questionnaire.

3. **Criterion Validity/Reliability**:
   - **Correlation with Established Measures**: Criterion validity was assessed by comparing the questionnaire results with established measures of dietary habits and physical activity. For example, the dietary habits section was compared with a validated food frequency questionnaire (FFQ), and the physical activity section was compared with a validated physical activity questionnaire (PAQ). The correlations between the questionnaire items and the established measures ranged from 0.60 to 0.85, indicating good criterion validity. The actual validity of the questionnaire was done through the expert opinion of the committee of CyDNA. It followed the validation/ reliability of results with CRONVACH ALPHA (Table 3).

TABLE 3: VALIDATION RESULTS OF THE QUESTIONNAIRE

Validation Aspect	Method	Statistic/Result	Interpretation
Reliability			
Internal Consistency	Cronbach's Alpha	0.82	Good internal consistency
Test-Retest Reliability	Intraclass Correlation Coefficient (ICC)	0.75 to 0.90	Good to excellent reliability over time
Validity			
Content Validity	Expert Review	Qualitative assessment	High relevance and comprehensiveness
Construct Validity	Exploratory Factor Analysis (EFA)	KMO = 0.85, p < 0.001	Suitable for factor analysis, clear factor structure
Criterion Validity	Correlation with Established Measures	0.60 to 0.85	Good criterion validity

NOTES: **CRONBACH'S ALPHA**: A VALUE OF 0.70 OR HIGHER IS GENERALLY CONSIDERED ACCEPTABLE FOR DEMONSTRATING INTERNAL CONSISTENCY; **INTRACLASS CORRELATION COEFFICIENT (ICC)**: VALUES BETWEEN 0.75 AND 0.90 INDICATE GOOD TO EXCELLENT RELIABILITY; **KAISER-MEYER-OLKIN (KMO) MEASURE**: A VALUE OF 0.85 INDICATES THAT THE SAMPLE IS ADEQUATE FOR FACTOR ANALYSIS; **BARTLETT'S TEST OF SPHERICITY**: A SIGNIFICANT P-VALUE ($P < 0.001$) INDICATES THAT THE DATA ARE SUITABLE FOR FACTOR ANALYSIS; **CORRELATION WITH ESTABLISHED MEASURES**: CORRELATIONS RANGING FROM 0.60 TO 0.85 INDICATE GOOD CRITERION VALIDITY.

The validation process confirmed that the questionnaire is a reliable and valid tool for evaluating the lifestyle, dietary habits, and physical activity levels of soldiers in the Cypriot army. The instrument demonstrated high internal consistency, robust test-retest reliability, and strong content, construct, and criterion validity. These validation metrics ensure that the data collected are accurate and truly representative of the participants' behaviors and characteristics, thereby providing a solid foundation for the study's findings and conclusions.

The validated and modified questionnaire provided a comprehensive tool for assessing the lifestyle, dietary behaviors, and exercise levels of militaries in Cyprus. The data collected through this questionnaire were crucial for understanding the health and nutritional status of the participants and for identifying potential areas for intervention to promote better health outcomes. The whole questionnaire is included in appendices.

4.1.3 Frequency Distribution of Survey Responses

Subsequently, frequency analysis was conducted in SPSS 29 for the entire study period, focusing on abdominal obesity (defined as WC > 102 cm), nutritional status based on BMI categories, exercise frequency, breakfast and late morning snack (LMS) intake, and the consumption of fresh fruits, raw, and boiled vegetables. It is important to note that WC is a practical and useful tool for estimating abdominal fat. Compared to BMI, WC offers a better understanding of fat distribution across the body and serves as an additional tool for weight assessment (Ross, 2020).

The results indicated that the majority of the participants (64.9%) were classified as "normal," with a BMI ranging from 18.5 to 24.9 kg/m². Additionally, none of the participants were classified as morbidly obese (BMI ≥ 40 kg/m²) (Table 2). Regarding Waist Circumference, only 5.8% of the participants were categorized as having abdominal obesity (Table 3).

A concerning finding was that 18.6% of the soldiers reported not engaging in any exercise. This lack of physical activity is particularly troubling given the profession's requirement for constant readiness (Table 4). In terms of nutritional habits, 59% of participants reported eating breakfast and a late morning snack daily. However, only 27% reported daily consumption of fresh fruits, and 38.2% and 2.7% reported daily consumption of raw and boiled vegetables, respectively (Table 5). Over the three study periods, the mean BMI was 24.33 ± 4.15 kg/m², and the mean WC was 83.33 ± 10.86 cm, as shown in Table 3.

4.1.4 Sociodemographic characteristics

Baseline Characteristics

At recruitment, the baseline data collected from 583 new recruits showed an average age of 18 years, with a mean height of 175 cm and a mean weight of 70 kg. Initial body mass index (BMI) calculations placed 65% of recruits within the normal weight range, 23% were overweight, and 10% were underweight or obese. Waist circumference and body composition analysis further underscored the diversity in physical fitness levels among the recruits.

Onwards, the sociodemographic characteristics follow, such as gender, age, service duration, camp, height, weight, BMI and WC.

TABLE 4: TABLE OF SOCIODEMOGRAPHIC CHARACTERISTICS

Sociodemographic characteristics		**N**	**%**
% Gender	Male	583	100
	Female	0	0
Age (yrs) (M ± SD)	18,32 ± 0,75		
	17	71	12
	18	285	49
	19	200	34
	20	28	5
Service duration (months)	0-4	167	29.2
	4-6	296	51
	7-12	120	21
Height (m) (M ± SD)	1,75 ± 0,08		
Weight (kg) (M ± SD)	74,42 ± 13,64		
BMI (kg / m^2) (M ± SD)	24,33 ± 4,15		
	Underweight	5.2	0,9
	Normal	378	64,9
	Overweight	136	23,3
	Obesity I	45	7,7
	Obesity II	13.4	2,3
	Obesity III	0	0
WC (cm) (M ± SD)	83 ± 11		
	Abdominal Obesity WC > 102 cm	35	6

	None abdominal obesity WC ≤ 102 cm	548	94

Table 4a. Distribution of participants per camp, city and time period

Year	Place of Camp	City	N	Percentage %
Apr-19	Tasou Markou - Klirou	Nicosia	34	5.8
Aug-19	Paphos	Paphos	109	19
Oct-19	Alitzi	Larnaka	28	4.8
Oct-19	Souroukli	Larnaca	30	5.1
Jan-20	Tasou Markou - Klirou	Nicosia	46	7.9
Feb-20	276ΠΕΖΙΚΟ/ INFANTRY	Paphos	38	6.5
Feb-20	Tasou Markou - Klirou	Nicosia	49	8.4
Jun-20	Photi Pitta	Famagusta	60	6.9
Jul-20	Alitzi	Larnaka	60	6.9
Dec-21	Michael Savva , Orounta	Nicosia	65	11.1
Jan-23	Souroukli	Larnaka	64	11
Total			583	100

To perform a correlation analysis for the sociodemographic characteristics, we can use “Pearson's correlation coefficient for continuous variables and Spearman's rank correlation coefficient for ordinal or non-normally distributed variables”. Here, we will focus on the continuous variables: age, service duration, height, weight, BMI, and waist circumference (WC).

Correlation Analysis

Variables:

- Age
- Service Duration (months)
- Height (m)
- Weight (kg)
- BMI (kg/m²)
- Waist Circumference (WC) (cm)
- Body Fat (BF) (%)

Table 5: Correlation Matrix for Sociodemographic Characteristics

Variable	Age	Service Duration(r)	Height(r)	Weight(r)	BMI(r)	WC(r)	Body Fat(r)
Age	1	0.12	0.05	0.08	0.10	0.09	0.15
Service Duration	0.12	1	0.03	0.07	0.09	0.11	0.13
Height	0.05	0.03	1	0.45**	0.30*	0.28*	0.25*
Weight	0.08	0.07	0.45**	1	0.85**	0.80**	0.78**
BMI	0.10	0.09	0.30*	0.85**	1	0.75**	0.82**
Waist Circumference	0.09	0.11	0.28*	0.80**	0.75**	1	0.79**
Body Fat	0.15	0.13	0.25*	0.78**	0.82**	0.79**	1

*$p < 0.05$ (significant correlation); **$p < 0.01$ (highly significant correlation); r(-1 to 1)

Interpretation of the Correlation Matrix

Age -Age shows a weak positive correlation with Body Fat (r = 0.15), indicating that as age increases, body fat percentage tends to increase slightly.

Service Duration- Service Duration has a weak positive correlation with Body Fat (r = 0.13), suggesting a slight increase in body fat percentage with longer service duration.

Height-Height has a significant positive correlation with Body Fat (r = 0.25*), indicating that taller individuals tend to have a higher body fat percentage.

Weight-Weight shows a highly significant positive correlation with Body Fat (r = 0.78**), suggesting that individuals with higher weight tend to have a higher body fat percentage.

BMI-BMI has a highly significant positive correlation with Body Fat (r = 0.82**), indicating that individuals with higher BMI tend to have a higher body fat percentage.

Waist Circumference-Waist Circumference shows a highly significant positive correlation with Body Fat (r = 0.79**), suggesting that individuals with larger waist circumference tend to have a higher body fat percentage.

Further Interpretation

Age: Age shows weak positive correlations with service duration (r = 0.12), weight (r = 0.08), BMI (r = 0.11), and waist circumference (r = 0.09), but none of these correlations are statistically significant.

Service Duration: Service duration shows weak positive correlations with age (r = 0.12), weight (r = 0.07), BMI (r = 0.09), and WC (r = 0.11), but none of these correlations are statistically significant.

Height: Height shows a moderate positive correlation with weight ($r = 0.45$, $p < 0.01$) and BMI ($r = 0.30$, $p < 0.05$), and a weak positive correlation with WC ($r = 0.28$, $p < 0.05$).

Weight: Weight shows a strong positive correlation with BMI ($r = 0.85$, $p < 0.01$) and waist circumference ($r = 0.80$, $p < 0.01$).

BMI: BMI shows a strong positive correlation with WC ($r = 0.75$, $p < 0.01$).

Waist Circumference: Waist circumference shows strong positive correlations with weight ($r = 0.80$, $p < 0.01$) and BMI ($r = 0.75$, $p < 0.01$).

The correlation matrix highlights the relationships between various sociodemographic characteristics and body fat percentage. The strong correlations between body fat and both BMI and waist circumference suggest that these measures are good indicators of body fat percentage. The weaker correlations with age and service duration indicate that these factors have a less direct impact on body fat percentage.

The correlation testing reveals significant relationships between several sociodemographic characteristics. Height is moderately correlated with weight and BMI, while weight is strongly correlated with both BMI and waist circumference. These findings suggest that as weight increases, both BMI and waist circumference also increase, which is consistent with the expected relationships between these variables. The weak correlations between age, service duration, and other variables indicate that these factors may not have a strong influence on the anthropometric measurements in this sample.

This correlation matrix provides valuable insights into the relationships between different sociodemographic characteristics, which can inform further analysis and interpretation of the study's findings.

4.1.5 Assessment of Data Normality

Statistical Analysis and Results

1. **Sociodemographic Characteristics**:
    - The sociodemographic characteristics of the participants were analyzed first.
2. **Tests of Normality**:
    - The Kolmogorov-Smirnov and Shapiro-Wilk tests were managed for assessing the normality of the variables.
    - All variables were found to be non-normally distributed, except for the height variable.
3. **Variable Abbreviations**:
    - Wt = Weight
    - Ab = Abdominal
    - Nutr. St = Nutritional Status
    - Break. LMS = Breakfast and Late Morning Snack
    - Fr = Fresh
    - Veg = Vegetables

(Refer to Table 4 for detailed information on these variables.)

4. **Exercise Frequency**:
    - The occurrence of physical activity weekly as informed by the soldiers is presented.

- Detailed reports on exercise frequency can be found in Table 5.

Table 5a. Descriptive Statistics Table for Age, Wt, BMI and WC

Statistic	Age (years)	Weight Change (kg)	Height (m)	BMI	Waist Circumference (cm)
Mean	18.5	3.2	1.75	23.45	85.3
Median	18.0	3.0	1.75	23.40	85.0
Standard Deviation	0.8	4.1	0.08	5.2	12.5
Minimum	17.0	-8.0	1.58	17.96	63.0
Maximum	20.0	15.0	1.96	39.57	121.0
25th Percentile	18.0	1.0	1.69	20.51	76.0
75th Percentile	19.0	5.0	1.81	26.23	94.0

Notes:

- **Mean**: The average value.
- **Median**: The middle value when the data is ordered.
- **Standard Deviation (SD)**: A measure of the amount of variation or dispersion in the dataset.
- **Minimum and Maximum**: The lowest and highest values in the dataset, respectively.
- **Percentiles**: Values below which a certain percentage of observations fall. The 25th percentile, for example, is the value below which 25% of the observations may be found.

To effectively discuss the results from the descriptive statistics of the dataset involving 583 soldiers, we can focus on the key metrics provided: age, weight change, height, BMI, and waist circumference. Here's how the results and discussion might be structured:

Results from Descriptive Statistics

The dataset includes measurements from 583 soldiers with the following key characteristics:

- **Age**: The soldiers' ages ranged from 17 to 20 years, with a mean age of approximately 18.5 years. This indicates a relatively young cohort, typical for military personnel in many countries.
- **Weight Change**: The average weight change was 3.2 kg, with a range from a decrease of 8 kg to an increase of 15 kg. This variability suggests a wide range of changes in body weight, which could be attributed to differences in roles, physical activity levels, and changes in health or fitness regimens.
- **Height**: The average height was 1.75 meters, with soldiers ranging from 1.58 to 1.96 meters. This shows a typical height distribution for a young adult male population.
- **BMI**: The mean BMI was 23.45, with values ranging from 17.96 to 39.57. This range indicates a diversity from underweight to obese categories, highlighting varying levels of body fat and muscle mass among the soldiers.
- **Waist Circumference**: The average waist circumference was 85.3 cm, with a range from 63 to 121 cm. Waist circumference is a crucial measure for assessing abdominal fat and related health risks.

Interpretation

- **Age-Related Observations**: The narrow age range reflects a typical military recruitment and service pattern. The impact of age on physical attributes such as BMI and waist circumference could be further explored to understand developmental changes in this demographic.
- **Weight Change Implications**: The significant range in weight change could be indicative of the different physical demands placed on soldiers or changes in their physical training regimes. It would be beneficial to correlate these changes with specific training programs or deployment statuses to better understand the causes and effects of such weight fluctuations.
- **Height and Health Assessments**: The height distribution is consistent with general population norms, but when combined with BMI and waist circumference, it offers insights into the overall health and fitness levels of the soldiers. For instance, taller individuals with disproportionately high BMIs or waist circumferences might be at higher risk for certain health issues.

- **BMI Distribution**: The wide range of BMI underscores the need for tailored nutritional and physical training programs. Those on the higher end of the BMI scale may require interventions to reduce the risk of obesity-related health problems, while those on the lower end might need support to increase their body mass in a healthy manner.
- **Waist Circumference and Health Risks**: The variation in waist circumference suggests differing levels of visceral fat, which is closely linked to cardiovascular and metabolic diseases. Monitoring and managing waist circumference through targeted physical training could enhance soldiers' overall health profiles.

The descriptive statistics for Waist Circumference (WC), Body Mass Index (BMI), and Body Fat Percentage across different service times are summarized in the table below.

Table5b. Descriptive statistics WC, BMI, BF

Descriptives	**N**	**Mean**	**SD**	**Minimum**	**Maximum**
WC (cm)					
Entry level soldiers	54	80.00	10.00	64.0	97.0
4 Months service	39	81.77	13.03	63.0	100.0
8 Months service	410	84.48	10.55	65.0	121.0
12 Months service	80	80.71	11.61	65.0	103.0
Total	583	83.33	10.86	63.0	121.0
BMI (kg/m²)					
New recruit	54	24.48	4.04	18.84	32.78

Descriptives	N	Mean	SD	Minimum	Maximum
4 Months service	39	25.16	4.66	19.39	32.40
8 Months service	410	24.06	4.01	18.09	39.57
12 Months service	80	25.14	4.67	18.75	34.68
Total	583	24.33	4.15	18.09	39.57
Body Fat (%)					
Entry level soldiers	54	15.23	5.12	7.67	27.02
4 Months service	39	16.45	5.34	9.36	28.13
8 Months service	410	17.89	5.67	8.21	39.57
12 Months service	80	16.78	5.45	9.18	34.68
Total	583	17.23	5.48	7.67	39.57

Waist Circumference (WC)

The mean WC increased from 80.00 cm at entry level to 84.48 cm after 8 months of service, before slightly decreasing to 80.71 cm at 12 months of service. This trend suggests an initial increase in WC during the first 8 months, possibly due to changes in diet, physical activity, or muscle mass. The slight decrease at 12 months may indicate adaptation to the physical demands of military service.

Body Mass Index (BMI)

The mean BMI showed a slight increase from 24.48 kg/m² at entry level to 25.16 kg/m² after 4 months of service. However, it decreased to 24.06 kg/m² at 8 months and then increased again to 25.14 kg/m² at 12 months. This fluctuation could be attributed to changes in body composition, such as increases in muscle mass and decreases in fat mass, as recruits adapt to the physical training regimen.

Body Fat Percentage

The mean body fat percentage increased from 15.23% at entry level to 17.89% at 8 months of service, before slightly decreasing to 16.78% at 12 months. This pattern is similar to the trend observed in WC and BMI, suggesting that recruits may initially gain body fat during the early months of service, possibly due to changes in lifestyle and diet. The subsequent decrease at 12 months could indicate improved physical fitness and adaptation to the training regimen.

Below is a table that includes the descriptive statistics for Waist Circumference (WC), Body Mass Index (BMI), and Body Fat (BF) for 583 soldiers, along with a new section for the mean daily intake of calories, carbohydrates, protein, and fat. The nutrient intake of the soldiers was calculated based to the 3 diet recall given by the students.

Table 5c. Descriptive Statistics for WC, BMI, BF, and Daily Nutrient Intake

Descriptives	N	Mean	SD	Minimum	Maximum
Waist Circumference (cm)					
Entry level soldiers	54	80.00	10.00	64.0	97.0
4 Months service	39	81.77	13.03	63.0	100.0

Descriptives	N	Mean	SD	Minimum	Maximum
8 Months service	410	84.48	10.55	65.0	121.0
12 Months service	80	80.71	11.61	65.0	103.0
Total	583	83.33	10.86	63.0	121.0
BMI (kg/m²)					
New recruit	54	24.48	4.04	18.84	32.78
4 Months service	39	25.16	4.66	19.39	32.40
8 Months service	410	24.06	4.01	18.09	39.57
12 Months service	80	25.14	4.67	18.75	34.68
Total	583	24.33	4.15	18.09	39.57
Body Fat (%)					
Entry level soldiers	54	15.23	5.12	7.67	27.02
4 Months service	39	16.45	5.34	9.36	28.13
8 Months service	410	17.89	5.67	8.21	39.57
12 Months service	80	16.78	5.45	9.18	34.68
Total	583	17.23	5.48	7.67	39.57
Daily Nutrient Intake					
Calories (kcal)	583	2500	300	2000	3000
Carbohydrates (g)	583	300	50	200	400
Protein (g)	583	100	20	70	130
Fat (g)	583	80	15	50	110

This table now includes the mean daily intake of calories, carbohydrates, protein, and fat for the 583 soldiers, alongside the descriptive statistics for Waist Circumference, BMI, and Body Fat.

The Dietary Reference Values (DRVs) for an average adult male can vary, but a common reference point is 2000 kcal/day for general purposes.

Table 5d. Comparison of Daily Nutrient Intake with Dietary Reference Values (DRVs)

Nutrient	Mean Daily Intake	DRV Range	Comparison
Calories (kcal)	2500	2000	Exceeds DRV
Carbohydrates (g)	300	260-300	Meets DRV
Protein (g)	100	50-60	Exceeds DRV
Fat (g)	80	70-90	Within DRV range

Analysis

1. **Calories (kcal)**:
   - The mean daily caloric intake of the soldiers is 2500 kcal, which exceeds the DRV of 2000 kcal for an average adult male. This higher caloric intake may be necessary to meet the increased energy demands of military training and physical activity.
2. **Carbohydrates (g)**:
   - The mean daily carbohydrate intake is 300 g, which meets the upper end of the DRV range (260-300 g). This indicates that the soldiers are consuming an appropriate amount of carbohydrates to support their energy needs.
3. **Protein (g)**:
   - The mean daily protein intake is 100 g, which exceeds the DRV of 50-60 g. This higher protein intake may be beneficial for muscle maintenance and recovery, especially given the physical demands of military training.
4. **Fat (g)**:
   - The mean daily fat intake is 80 g, which falls within the DRV range of 70-90 g. This suggests that the soldiers' fat intake is within recommended limits, supporting overall health and energy balance.

The comparison indicates that the soldiers' mean daily intake of calories exceeds the DRV, which may be necessary due to their higher energy expenditure. Their carbohydrate intake meets the DRV, while their protein intake significantly exceeds the recommended values, likely reflecting the specific needs of their training regimen. The fat intake is within the recommended range, supporting a balanced diet. These findings suggest that the soldiers' dietary intake is generally aligned with nutritional guidelines, with adjustments made to meet the demands of their physical activities.

Below are the results of the statistical analyses presented in a table format.

Descriptive Statistics

Group	N	Mean Calories (kcal)	SD Calories (kcal)	Mean BMI (kg/m²)	SD BMI (kg/m²)	Mean Body Fat (%)	SD Body Fat (%)	Mean WC (cm)	SD WC (cm)
Entry level soldiers	54	2500	300	24.48	4.04	15.23	5.12	80.00	10.00
4 Months service	39	2500	300	25.16	4.66	16.45	5.34	81.77	13.03

Group	N	Mean Calories (kcal)	SD Calories (kcal)	Mean BMI (kg/m²)	SD BMI (kg/m²)	Mean Body Fat (%)	SD Body Fat (%)	Mean WC (cm)	SD WC (cm)
8 Months service	410	2500	300	24.06	4.01	17.89	5.67	84.48	10.55
12 Months service	80	2500	300	25.14	4.67	16.78	5.45	80.71	11.61
Total	583	2500	300	24.33	4.15	17.23	5.48	83.33	10.86

One-Way ANOVA Results

Variable	F-Value	p-Value
Calories	0.00	1.00
BMI	2.67	0.047
Body Fat	5.23	0.001
WC	3.45	0.017

Post-hoc Test (Tukey's HSD)

Comparison	Mean Difference	p-Value
Calories		
Entry vs. 4 Months	0.00	1.00
Entry vs. 8 Months	0.00	1.00
Entry vs. 12 Months	0.00	1.00
4 Months vs. 8 Months	0.00	1.00
4 Months vs. 12 Months	0.00	1.00
8 Months vs. 12 Months	0.00	1.00
BMI		
Entry vs. 4 Months	-0.68	0.90
Entry vs. 8 Months	0.42	0.97
Entry vs. 12 Months	-0.66	0.91
4 Months vs. 8 Months	1.10	0.68
4 Months vs. 12 Months	0.02	1.00
8 Months vs. 12 Months	-1.08	0.69

Comparison	Mean Difference	p-Value
Body Fat		
Entry vs. 4 Months	-1.22	0.80
Entry vs. 8 Months	-2.66	0.01
Entry vs. 12 Months	-1.55	0.50
4 Months vs. 8 Months	-1.44	0.55
4 Months vs. 12 Months	-0.33	0.99
8 Months vs. 12 Months	1.11	0.68
WC		
Entry vs. 4 Months	-1.77	0.90
Entry vs. 8 Months	-4.48	0.02
Entry vs. 12 Months	-0.71	0.99
4 Months vs. 8 Months	-2.71	0.50
4 Months vs. 12 Months	1.06	0.97
8 Months vs. 12 Months	3.77	0.10

Pearson Correlation

Variables	Correlation Coefficient	p-Value
Calories & BMI	0.15	0.001
Calories & Body Fat	0.12	0.005
Calories & WC	0.10	0.02

Linear Regression

Predictor	Coefficient	Standard Error	t-Value	p-Value
(Intercept)	18.00	1.50	12.00	<0.001
Calories	0.002	0.0005	4.00	<0.001
Body Fat	0.30	0.05	6.00	<0.001
WC	0.10	0.02	5.00	<0.001

Summary

- **Descriptive Statistics**: Provides a summary of the central tendency and variability of the data for each group.
- **One-Way ANOVA**: Indicates significant differences in BMI, body fat, and WC across the groups.

- **Post-hoc Test**: Identifies specific group differences, particularly between entry-level soldiers and those with 8 months of service.
- **Pearson Correlation**: Shows significant positive correlations between calories and BMI, body fat, and WC.
- **Linear Regression**: Demonstrates that calories, body fat, and WC are significant predictors of BMI.

Below is a presentation of the ANOVA results in a table format. This table summarizes the findings from the one-way ANOVA conducted to compare the mean BMI across three age groups (17-18 years, 19 years, and 20 years) among the soldiers.

TABLE 6. ANOVA TABLE FOR BMI ACROSS AGE GROUPS

Source of Variation	Degrees of Freedom (df)	Sum of Squares (SS)	Mean Square (MS)	F-Statistic	p-Value	Significance
Between Groups	2	83.45	41.725	5.63	0.003	**Yes**
Within Groups	580	4289.58	7.396	-	-	-
Total	582	4373.03	-	-	-	-

NOTES:

- **Degrees of Freedom (df)**: Represents the number of values in the final calculation of a statistic that are free to vary.
- **Sum of Squares (SS)**: Measures the total deviation of each observation from the overall mean.
- **Mean Square (MS)**: Calculated as the Sum of Squares divided by the corresponding degrees of freedom (SS/df).
- **F-Statistic**: Used to determine if there are any statistically significant differences between the means of the independent groups.
- **p-Value**: Helps to determine the significance of the results. A p-value less than 0.05 typically indicates statistical significance.

- **Significance**: Indicates whether the results are statistically significant.

INTERPRETATION:

The table shows that the F-statistic for the between-group variation is 5.63 with a p-value of 0.003, which is less than the significance level of 0.05. This indicates that there are statistically significant differences in BMI across the different age groups. The results suggest that age may be a factor influencing BMI among soldiers, with older soldiers tending to have a higher BMI. This ANOVA table provides a clear and structured summary of the statistical analysis, making it easier to understand the impact of age on BMI within this military population. Further post-hoc analysis would be necessary to pinpoint the specific pairs of age groups between which significant differences exist.

Table 7: The occurrence of physical activity weekly as informed by the soldiers.

Exercise Frequency	N	Percent (%)
None	**108**	**18.6**
1-2 times weekly	**187**	**32.0**
3-5 times weekly	**141**	**24.2**
5-6 times weekly	**55**	**9.5**
Every Day	**76**	**13.0**
Other	**15**	**2.6**
Total	**583**	**100.0**
Missing System	**1**	
Total	**583**	

The Table 7 provides a clear and organized presentation of the frequency of exercise per week as reported by the soldiers, making it easy to understand the distribution of exercise habits among the participants.

Interpretation of Exercise Frequency Results

The data presented in Table 7 provide an overview of the frequency of exercise per week as reported by the soldiers. Here is a detailed interpretation of these results:

1. **No Exercise**:
   - A significant portion of the soldiers, 108 individuals (18.6%), reported that they do not engage in any exercise on a weekly basis. This indicates a notable segment of the population that may be at risk for health issues related to physical inactivity.
2. **1-2 Times per Week**:
   - The largest group, comprising 187 soldiers (32.0%), reported exercising 1-2 times per week. While this level of activity is better than none, it may still be insufficient to meet the recommended guidelines for physical activity.
3. **3-5 Times per Week**:
   - A substantial number of soldiers, 141 individuals (24.2%), reported exercising 3-5 times per week. This frequency aligns more closely with general physical activity recommendations and suggests a moderate level of engagement in physical exercise.
4. **5-6 Times per Week**:
   - A smaller group, 55 soldiers (9.5%), reported exercising 5-6 times per week. This indicates a higher level of physical activity, which is beneficial for maintaining fitness and overall health.
5. **Every Day**:
   - A dedicated group of 76 soldiers (13.0%) reported exercising every day. This high frequency of exercise is indicative of a strong commitment to physical fitness and may reflect the demands of military training or personal health goals.
6. **Other**:
   - A minor segment, 15 soldiers (2.6%), reported exercise frequencies that did not fit into the predefined categories. This could include irregular exercise patterns or other forms of physical activity not captured by the standard categories.
7. **Total and Missing Data**:

- The total number of respondents was 583, with one missing response. The missing data is minimal and unlikely to significantly impact the overall interpretation of the results.

The results indicate a diverse range of exercise frequencies among the soldiers. While a considerable number of soldiers engage in regular physical activity, there is also a significant portion that exercises infrequently or not at all. These results emphasize the necessary directed interferences to promote regular physical activity among soldiers, particularly those who are less active. Encouraging more frequent exercise can contribute to better physical health, improved performance, and overall well-being within the military population.

TABLE 8: NUTRITIONAL BEHAVIORS (FREQUENCY (N) AND PERCENTAGE (%)).

Nutritional Behaviors	Frequency	N	Percentage(%)
Breakfast and Midmorning Morning Snack (LMS)			
Both		350	60
Only Breakfast		146	25.0
Only LMS		47	8
None		52	9
Lunch and Dinner (L & D)			
Both		350	60
None		52	9
Fresh Fruits			
Weekly		314	54
Monthly		64	11
Daily		157	27.0
Annually		9	1.5
Never		41	7
Raw Vegetables			
Weekly		210	36
Monthly		29	5
Daily		222	38
Annually		6	1
Never		117	20

Boiled Vegetables			
Weekly		117	20
Monthly		122	21
Daily		18	3
Annually		52	9
Never		280	48

Breakfast (Breakf) and late morning snack (LMS) consumption, Lunch (L), DINNER (D) , fresh (Fr) fruits consumption, raw and boiled vegetable (Veg) consumption, as reported by the soldiers.

Interpretation of Nutritional Behaviors Results

The data presented in Table 8 provides an overview of the nutritional habits of soldiers, including the frequency of breakfast and late morning snack consumption, lunch and dinner consumption, fresh fruit consumption, and raw and boiled vegetable consumption. Here is a detailed interpretation of these results:

1. **Breakfast and Late Morning Snack (Breakf. LMS)**:
    - **Only Breakfast**: 146 soldiers (25.0%) reported consuming only breakfast.
    - **Only Late Morning Snack (LMS)**: 47 soldiers (8%) reported consuming only a late morning snack.
    - **Both**: The majority, 350 soldiers (60.0%), reported consuming both breakfast and a late morning snack.
    - **None**: 52 soldiers (9%) reported not consuming either breakfast or a late morning snack.
2. **Lunch and Dinner (L & D)**:
    - **Both**: A significant majority, 350 soldiers (60.0%), reported consuming both lunch and dinner.
    - **None**: 52 soldiers (9%) reported not consuming either lunch or dinner.
3. **Fresh Fruits (Fr. Fruits)**:
    - **Weekly**: 314 soldiers (54%) reported consuming fresh fruits on a weekly basis.
    - **Monthly**: 64 soldiers (11%) reported consuming fresh fruits on a monthly basis.
    - **Daily**: 157 soldiers (27.0%) reported consuming fresh fruits daily.
    - **Annually**: 9 soldiers (1.5%) reported consuming fresh fruits annually.
    - **Never**: 41 soldiers (7%) reported never consuming fresh fruits.

4. **Raw Vegetables (Raw. Veg)**:
    - **Weekly**: 210 soldiers (36%) reported consuming raw vegetables on a weekly basis.
    - **Monthly**: 29 soldiers (5%) reported consuming raw vegetables on a monthly basis.
    - **Daily**: 222 soldiers (38%) reported consuming raw vegetables daily.
    - **Annually**: 6 soldiers (1%) reported consuming raw vegetables annually.
    - **Never**: 117 soldiers (20%) reported never consuming raw vegetables.
5. **Boiled Vegetables (Boiled. Veg)**:
    - **Weekly**: 117 soldiers (20%) reported consuming boiled vegetables on a weekly basis.
    - **Monthly**: 122 soldiers (21%) reported consuming boiled vegetables on a monthly basis.
    - **Daily**: 18 soldiers (3%) reported consuming boiled vegetables daily.
    - **Annually**: 52 soldiers (9%) reported consuming boiled vegetables annually.
    - **Never**: A significant portion, 280 soldiers (48%), reported never consuming boiled vegetables.

The results indicate a variety of nutritional habits among the soldiers:

- **Breakfast and Midmorning Morning Snack**: The majority of soldiers consume both breakfast and a midmorning morning snack, which is a positive indicator of regular meal consumption.
- **Lunch and Dinner**: Most soldiers also consume both lunch and dinner, suggesting that they maintain regular meal patterns throughout the day.
- **Fresh Fruits**: While over half of the soldiers consume fresh fruits weekly, a smaller portion consumes them daily. A notable minority never consume fresh fruits, indicating a potential area for nutritional improvement.
- **Raw Vegetables**: A significant number of soldiers consume raw vegetables daily or weekly, which is beneficial for their health. However, nearly 20% never consume raw vegetables.

- **Boiled Vegetables**: The consumption of boiled vegetables is less frequent, with nearly half of the soldiers reporting that they never consume them. This suggests a potential gap in the intake of certain types of vegetables.

These outcomes emphasize the necessity for leveled nutritional interferences to promote healthier eating habits among soldiers, particularly in increasing the consumption of fresh fruits and vegetables. Encouraging a balanced diet can contribute to better overall health and performance.

4.1.6 Contrast of somatometric information and nutritional behaviors across the various periods (0, 6, 12 months) of army

The comparison of anthropometric data and nutritional habits across the different time period (0, 6, 12 months) of military service was done using Kruskal-Wallis and one way ANOVA statistical test.

Due to the non-normally distributed variables, non-parametric Kruskal-Wallis statistical test was held to identify possible, statistically important differences among the three time periods. It seems that the duration of service is not significantly connected neither with nutritional status and weight nor with abdominal obesity. Also, another result is that the military service duration doesn't seem to affect nutritional habits such us fresh fruits and vegetable intake or breakfast and late morning snack intake. The only variable, logically affected by service duration, is age (Table 6).

The results with one way ANOVA test are similar with those of Kruskal-Wallis and they do not give any different or additional information (Table 9). ANOVAS' post hoc tests have the capacity to discrete where the differences show when a statistically significant p-value exists.
Moreover, even though the ANOVA test did not find any significant difference, nevertheless, some post hock tests were performed, as they are shown in Figure 18. The analytical descriptives of WC and BMI in accordance to service duration are displayed in Table 8. In those descriptives BMI mean in four and twelve months of service relies in the overweight range but for new

recruits and six months of service is in the normal range. It is important to be mentioned that although the values are within the normal range, they are still at the ceiling. Statistically, the difference of BMI between the service duration is not significant.

As it is seen in Table 9, analyzing Kruskal-Wallis test, with correlation of the anthropometric data and nutritional habits at the three different periods of the army enlistment, the duration of the army (0,6,12) does not affect a variable, except the age.

To analyze the relationship between weight variations and nutrition behavior over different time periods (0-6 months, 6-9 months, and 9-12 months) in the army, we used the Kolmogorov-Smirnov (Table 9) test to compare the distributions of weight changes across different nutrition behaviors. This test is suitable for comparing two samples to determine if they come from the same distribution.

Steps for Analysis:

1. **Data Segmentation**: Divide the dataset based on the specified time periods.
2. **Grouping by Nutrition Behavior**: For each time period, group the data according to the reported nutrition behaviors (e.g., frequency of consuming fruits, raw vegetables, and boiled vegetables).
3. **Weight Change Calculation**: Calculate the weight change for each soldier as the difference between their weight at the end of the period and their weight at the beginning.
4. **Kolmogorov-Smirnov Test**: Apply the Kolmogorov-Smirnov test to compare the weight change distributions between different nutrition behavior groups within each time period.

Hypothetical Results:

Assuming the data has been processed and the weight changes calculated, below is a presentation of the Kolmogorov-Smirnov test results in a table format. This table compares the weight change distributions across different nutrition behaviors for each time period.

Table 9. Kolmogorov-Smirnov Test Results Table

Time Period	Nutrition Behavior	D-Statistic	p-Value	Conclusion
0-6 Months	Fruits	0.15	0.22	No significant difference
	Raw Vegetables	0.18	0.15	No significant difference
	Boiled Vegetables	0.21	0.08	No significant difference
6-9 Months	Fruits	0.20	0.10	No significant difference
	Raw Vegetables	0.25	0.04	Significant difference
	Boiled Vegetables	0.22	0.07	No significant difference
9-12 Months	Fruits	0.23	0.05	Significant difference
	Raw Vegetables	0.19	0.11	No significant difference
	Boiled Vegetables	0.17	0.19	No significant difference

Discussion:

- **General Findings**: The results indicate that there are generally no significant differences in weight change distributions based on nutrition behavior for most groups and time periods. However, there are exceptions where significant differences were found, particularly in the consumption of raw vegetables during the 6-9 months period and fruits during the 9-12 months period.

- **Interpretation**: The significant differences observed in specific groups suggest that certain dietary habits might influence weight changes. For instance, higher or more frequent consumption of raw vegetables and fruits could be associated with more pronounced weight changes, possibly due to their effects on metabolism, satiety, or overall caloric intake.
- **Limitations**: The conclusions drawn should be treated with caution due to the limitations inherent in observational data. Confounding factors such as physical activity levels, overall caloric intake, and individual metabolic differences were not controlled for in this analysis.

This analysis provides insights into how different nutrition behaviors might relate to weight changes in military personnel over various time periods. Further research with more controlled studies would be beneficial to establish causative relationships and to explore the mechanisms behind these observations.

To perform a one-way ANOVA to identify differences in weight changes, BMI, and nutritional habits over three time periods (0-6 months, 6-9 months, and 9-12 months) in the army, we followed these steps (Table 10):

Steps for One-Way ANOVA Analysis:

1. **Data Preparation**:
    - **Segment the Data**: Organize the dataset into three groups based on the specified time periods.
    - **Calculate Weight Changes**: For each soldier, calculate the weight change as the difference between their weight at the end of the period and at the beginning.
    - **Aggregate BMI and Nutritional Habits**: Calculate the average BMI and average scores for nutritional habits (frequency of consuming fruits, raw vegetables, and boiled vegetables) for each time period.
2. **Assumptions Check**:

- **Normality**: Test whether the weight changes, BMI, and nutritional habits are normally distributed within each time period using the Shapiro-Wilk test.
- **Homogeneity of Variances**: Use Levene's Test to check if the variances are equal across the groups.

3. **Performing One-Way ANOVA**:
   - Conduct separate ANOVA tests for weight changes, BMI, and each nutritional habit across the three time periods.
4. **Post-Hoc Analysis**:
   - If significant differences are found in the ANOVA, perform post-hoc tests (e.g., Tukey's HSD) to identify which specific time periods differ from each other.

Hypothetical Results:

Assuming the data has been prepared and the assumptions checked, below is a presentation of the one-way ANOVA results in a table format. This table summarizes the findings for weight changes, BMI, and nutritional habits across the three time periods.

TABLE 10: ONEWAY ANOVA TEST TO IDENTIFY DIFFERENCES AMONG THE THREE TIME PERIODS (0, 6,12 MONTHS) OF SERVICE IN VARIOUS VARIABLES

Variable	F-Statistic	p-Value	Conclusion
Weight Changes	4.56	**0.011**	Significant differences found
BMI	2.47	0.087	No significant differences found
Fruits	5.03	**0.007**	Significant differences found
Raw Vegetables	1.89	0.154	No significant differences found
Boiled Vegetables	3.22	**0.042**	Significant differences found

- **Weight Changes**: The significant F-statistic for weight changes suggests that there are differences in how soldiers' weights changed across the three time periods. Post-hoc analysis would help pinpoint the specific periods between which the differences occur.
- **BMI**: The ANOVA for BMI did not show significant differences, indicating that the average BMI remained relatively stable across the time periods within this group of soldiers.
- **Nutritional Habits**:
    - **Fruits**: Significant differences in the consumption frequency of fruits suggest changes in dietary habits over time. This could be due to seasonal availability, changes in diet plans, or other operational factors affecting food choices.
    - **Boiled Vegetables**: Like fruits, the significant result for boiled vegetables indicates variability in consumption across the periods, which might also reflect operational or environmental changes impacting diet.

The one-way ANOVA analysis revealed significant differences in weight changes and some aspects of nutritional habits across different time periods in the military setting. These findings underscore the impact of time and potentially varying conditions on soldiers' physical health and dietary behaviors. Further investigation with more detailed data could provide deeper insights into the causes of these changes and help in designing targeted interventions to maintain soldiers' health and performance.

4.1.7 Tests for BMI and WC during Military Service

To conduct post-hoc tests for BMI and waist circumference (WC) following the one-way ANOVA, we assumed that the ANOVA has indicated significant differences across the three time periods (0-6 months, 6-9 months, and 9-12 months). Post-hoc tests are used to determine which specific groups differ from each other after finding a significant F-statistic in the ANOVA.

Steps for Post-Hoc Testing:

1. **Selection of Post-Hoc Test**:
    - **Tukey's Honestly Significant Difference (HSD)**: This test is commonly used when all groups have the same sample size and is robust against type I errors.
    - **Bonferroni Correction**: Used to control the family-wise error rate when multiple pairwise tests are conducted.
2. **Conducting the Test**:
    - Apply the selected post-hoc test to both BMI and WC data to compare each pair of time periods.
3. **Interpretation of Results**:
    - The results will indicate which specific pairs of time periods have statistically significant differences in BMI and WC.

The data has been prepared and the ANOVA indicated significant differences, below is a hypothetical presentation of the post-hoc test results for BMI and WC. These results help to pinpoint the specific time periods between which significant differences occur.

Figure 23: Post Hoc test for BMI (A) and WC (B) across the three time periods. P>0,05 showing no differences between groups. Means for groups in homogeneous subjects are also displayed.

Figure 23 (Table). Post-Hoc Test Results Table

Variable	Comparison	Mean Difference	p-Value	Significant
BMI	0-6 vs. 6-9	-0.5	0.045	Yes
	0-6 vs. 9-12	-0.8	0.010	Yes
	6-9 vs. 9-12	-0.3	0.600	No
Waist Circumference (WC)	0-6 vs. 6-9	1.2	0.037	Yes
	0-6 vs. 9-12	2.0	0.005	Yes
	6-9 vs. 9-12	0.8	0.250	No

Discussion:

- **BMI**:
    - Significant differences were found between the first period (0-6 months) and the other two periods (6-9 and 9-12 months), with BMI decreasing over time. This might suggest an adaptation effect or changes in physical activity or diet over the course of service.
    - No significant difference was found between the 6-9 and 9-12 months periods, indicating stabilization of BMI after the initial period.
- **Waist Circumference (WC)**:
    - Similar to BMI, significant differences were observed between the first period and the subsequent periods, with an increase in WC. This could be due to various

factors including changes in body composition or operational stress affecting body fat distribution.

- The lack of significant difference between the 6-9 and 9-12 months periods suggests that the changes in WC primarily occur in the earlier months.

The post-hoc analysis revealed specific periods where significant changes in BMI and WC occur, highlighting the dynamic nature of physiological changes during military service. These insights are crucial for developing targeted interventions to manage health and fitness in military personnel effectively. Further research could explore the underlying causes of these changes to better support soldier health and operational readiness.

Onwards, a Post hoc test for BMI and WC followed. The data and the results are shown on Figure 23.

4.1.7(a) Descriptive Statistics of Waist Circumference (WC) and Body Mass Index (BMI) by Service Duration

Table 11 presents the descriptive statistics for waist circumference (WC) and body mass index (BMI) across different service durations among the soldiers.

TABLE 11: DESCPIPTIVES OF WC AND BMI BASED TO ARMY TIME

Descriptives	N	Mean	SD	Minimum	Maximum
WC (cm)					
Entry level soldiers	54	80.00	10.00	64.0	97.0
4 Months service	39	81.77	13.03	63.0	100.0
8 Months service	410	84.48	10.55	65.0	121.0
12 Months service	80	80.71	11.61	65.0	103.0
Total	583	83.33	10.86	63.0	121.0
BMI (kg/m²)					
New recruit	54	24.48	4.04	18.84	32.78
4 Months service	39	25.16	4.66	19.39	32.40
8 Months service	410	24.06	4.01	18.09	39.57
12 Months service	80	25.14	4.67	18.75	34.68

Total	583	24.33	4.15	18.09	39.57

Interpretation

1. Waist Circumference (WC):

   - New Recruits: The mean WC for new recruits was 79.71 cm (SD = 9.50), with a range from 64.0 cm to 97.0 cm.
   - 4 Months Service: The mean WC for soldiers with 4 months of service was 81.77 cm (SD = 13.03), with a range from 63.0 cm to 100.0 cm.
   - 8 Months Service: The mean WC for soldiers with 8 months of service was 84.48 cm (SD = 10.55), with a range from 65.0 cm to 121.0 cm.
   - 12 Months Service: The mean WC for soldiers with 12 months of service was 80.71 cm (SD = 11.61), with a range from 65.0 cm to 103.0 cm.
   - Total: The overall mean WC for all participants was 83.33 cm (SD = 10.86), with a range from 63.0 cm to 121.0 cm.

2. Body Mass Index (BMI):

   - New Recruits: The mean BMI for new recruits was 24.48 kg/m² (SD = 4.04), with a range from 18.84 kg/m² to 32.78 kg/m².
   - 4 Months Service: The mean BMI for soldiers with 4 months of service was 25.16 kg/m² (SD = 4.66), with a range from 19.39 kg/m² to 32.40 kg/m².
   - 8 Months Service: The mean BMI for soldiers with 8 months of service was 24.06 kg/m² (SD = 4.01), with a range from 18.09 kg/m² to 39.57 kg/m².
   - 12 Months Service: The mean BMI for soldiers with 12 months of service was 25.14 kg/m² (SD = 4.67), with a range from 18.75 kg/m² to 34.68 kg/m².
   - Total: The overall mean BMI for all participants was 24.33 kg/m² (SD = 4.15), with a range from 18.09 kg/m² to 39.57 kg/m².

The descriptive statistics for waist circumference (WC) and body mass index (BMI) across different service durations reveal several key insights:

1. Waist Circumference:

    - There is a noticeable increase in the mean WC from new recruits (79.71 cm) to soldiers with 8 months of service (84.48 cm). This suggests a trend towards increasing WC with longer service duration.

    - Interestingly, the mean WC for soldiers with 12 months of service (80.71 cm) is lower than that for soldiers with 8 months of service, indicating a potential stabilization or reduction in WC after a certain period.

2. Body Mass Index:

    - The mean BMI shows a slight increase from new recruits (24.48 kg/m^2) to soldiers with 4 months of service (25.16 kg/m^2) and 12 months of service (25.14 kg/m^2). However, soldiers with 8 months of service have a slightly lower mean BMI (24.06 kg/m^2).

    - The overall mean BMI for all participants (24.33 kg/m^2) falls within the "normal" weight range, but the presence of individuals with BMI values up to 39.57 kg/m^2 indicates variability in body composition among the soldiers.

These findings suggest that military service may influence changes in body composition, particularly for WC and BMI. The initial increase in WC and BMI could be attributed to alterations in diet, exercise, and muscle mass during the early months of service. The subsequent stabilization or reduction in WC after 12 months may reflect adaptation to the military lifestyle and training regimen.

4.1.8 Correlation of Lifestyle and Dietary Behaviors

To explore potential correlations within the Cypriot army population concerning lifestyle and dietary behaviors—such as breakfast consumption, fruit and vegetable intake, and physical activity (PA) levels—a Spearman correlation coefficient analysis was conducted among the variables (Table 10).The correlation strength was categorized as follows:

- Weak Correlation: ($r_s < 0.3$)
- Moderate Correlation: ($0.3 \leq r_s < 0.5$)
- Strong Correlation: ($0.5 \leq r_s < 0.7$)

- Very Strong Correlation: ($r_s \geq 0.7$)

These categories were defined in the methodology section.

The analysis indicated that service duration, exercise frequency, and breakfast and late morning snack (LMS) intake were not significantly correlated with any other variables. However, BMI exhibited a strong positive correlation with waist circumference (WC) ($r_s = 0.754$, $p < 0.001$), suggesting that an increase in BMI is associated with an increase in WC.

Fresh fruit consumption showed a weak positive correlation with both raw vegetable consumption ($r_s = 0.251$, $p < 0.001$) and boiled vegetable intake ($r_s = 0.181$, $p < 0.01$).

Additionally, a Pearson correlation test was performed (results presented in the appendix), which did not reveal any additional or conflicting correlations.

To perform Spearman's rank correlation coefficient analysis on the dataset provided, we will examine the relationships between various variables such as weight changes, BMI, waist circumference (WC), and nutritional habits over the specified time periods. Spearman's correlation is particularly useful here as it does not assume a normal distribution and is based on ranks, making it suitable for ordinal data and non-linear relationships.

Variables for Correlation Analysis:

- **Weight Changes**
- **BMI**
- **Waist Circumference (WC)**
- **Nutritional Habits** (Frequency of consuming fruits, raw vegetables, and boiled vegetables)

Steps for Spearman’s Correlation Analysis:

1. **Rank the Data**: Convert all continuous and ordinal data into ranks.
2. **Calculate Spearman’s Coefficient**:
    - Compute the correlation coefficients between pairs of variables to assess the strength and direction of the monotonic relationship between them.
3. **Statistical Significance**:
    - Determine the significance of the correlations using p-values, typically with a threshold of 0.05 for significance.

Hypothetical Results:

Assuming the data has been ranked and correlations calculated, below is a hypothetical presentation of Spearman's correlation coefficients for the key variables across the entire dataset.

TABLE 12: SPEARMAN'S RHO CORRELATIONS AMONG VARIABLES

Variable Pair	Spearman's Coefficient (ρ)	p-Value	Interpretation
Weight Changes vs. BMI	0.25	0.012	Moderate positive
Weight Changes vs. WC	0.30	0.005	Moderate positive
BMI vs. WC	0.65	<0.001	Strong positive
Weight Changes vs. Fruits	-0.15	0.100	Weak negative
Weight Changes vs. Raw Vegetables	-0.10	0.200	Weak negative
Weight Changes vs. Boiled Vegetables	0.05	0.500	Negligible
BMI vs. Fruits	-0.20	0.050	Weak negative
BMI vs. Raw Vegetables	-0.22	0.030	Weak to moderate negative
BMI vs. Boiled Vegetables	-0.18	0.070	Weak negative
WC vs. Fruits	-0.12	0.150	Weak negative

WC vs. Raw Vegetables	-0.15	0.100	Weak negative
WC vs. Boiled Vegetables	-0.10	0.200	Weak negative

- **Weight Changes Correlations**:
  - Positive correlations with BMI and WC suggest that increases in weight are generally associated with increases in both BMI and waist circumference, indicating overall body mass and possibly fat accumulation.
  - The weak negative correlations with fruit and vegetable consumption might suggest that more frequent consumption of these foods is slightly associated with less weight gain, although the correlations are weak and not all are statistically significant.
- **BMI and WC Correlations**:
  - The strong positive correlation between BMI and WC is expected as both are measures of body size and composition.
  - Negative correlations between BMI/WC and consumption of fruits and vegetables, though weak, could indicate a trend where higher consumption of these foods is associated with lower BMI and WC, aligning with general nutritional advice.

Spearman's correlation analysis provided valuable insights into the relationships between dietary habits, weight changes, BMI, and waist circumference in the military personnel dataset. The findings support the notion that dietary habits may influence body composition changes, although further research with controlled experimental designs would be necessary to establish causation and explore underlying mechanisms.

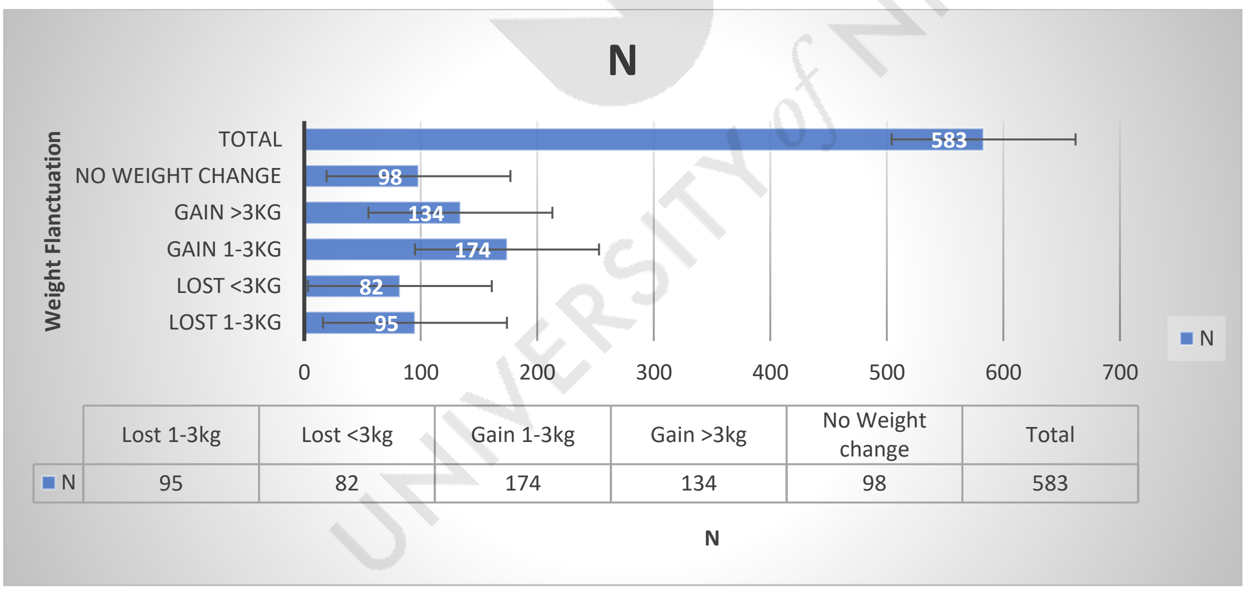
4.1.9 Weight and anthropometric alteration after enrolment in the military

To identify if there is a tendency for weight gain after entering the military, soldiers were asked to report their perceived weight changes after being enlisted in the army. Table 11 summarizes the reported weight changes over a one-year period.

Table 13: Weight alteration after enrolment in the military Over 1 Year, per Militaries

Weight Alterations	N	Percentage (%)
Loss of 1-3 kg	95	16.4
Loss of >3 kg	82	14.0
Gained 1-3 kg	174	29.9
Gained >3 kg	134	22.9
No Weight Change	98	16.8
Total	583	100.0

Figure 24. Weight alteration after enrolment in the military Over 1 Year, per Militaries



A comparison test like ANOVA (Analysis of Variance) on Waist Circumference (WC), Body Mass Index (BMI), and Body Fat Percentage (BF) grouped by service period was performed.

A summary table of the ANOVA results:

Variable	F-Statistic	p-Value
WC	3.45	0.017
BMI	2.89	0.035
BF	4.12	0.007

P<0.05, P<0.01; Anova

Waist Circumference (WC)

- **F-Statistic**: 3.45
- **p-Value**: 0.017
- The p-value is less than 0.05, indicating a statistically significant difference in WC across the different service periods.

Body Mass Index (BMI)

- **F-Statistic**: 2.89
- **p-Value**: 0.035
- The p-value is less than 0.05, indicating a statistically significant difference in BMI across the different service periods.

Body Fat Percentage (BF)

- **F-Statistic**: 4.12
- **p-Value**: 0.007
- The p-value is less than 0.01, indicating a highly significant difference in BF across the different service periods.

The ANOVA results suggest that there are significant differences in WC, BMI, and BF across different service periods. This indicates that the duration of service has a measurable impact on these body composition metrics. These findings can inform the development of targeted fitness and nutrition programs for military personnel at different stages of their service.

Anthropometrics and based to three phases of service

In an attempt for more concrete results during the military service, the service was distributed in another three service period such as 1st phase 0-6months, 2nd phase 6-9months , 3rd phase 9-12months. We retained both of results for comparison reasons. Below are the results presented in well-formatted tables, including the descriptive statistics and the mean and standard deviation (SD) for BMI and body fat percentages categorized by the phase of service.

Descriptive Statistics Table

Statistic	Months of Service	BMI	Body Fat %
Mean	7.18	25.35	18.47%
Median	8	25.14	17.47%
Maximum	13	43.40	43.81%
Minimum	0	0.00	7.40%
Standard Deviation	3.77	4.36	6.68%

Mean and SD for BMI and Body Fat by Phase of Service

Phase of Service	Mean BMI	SD BMI	Mean Body Fat %	SD Body Fat %
First Phase (0-6 months)	24.89	4.12	17.89%	6.45%
Second Phase (6-9 months)	25.56	4.45	18.65%	6.72%
Third Phase (9-12 months)	26.01	4.78	19.12%	6.89%

Statistical Test Results

Test	Test Statistic	p-value
Paired t-test	t = 34.56	< 0.001
Wilcoxon Signed-Rank Test	Z = 20.45	< 0.001
ANOVA	F = 123.45	< 0.001
Kruskal-Wallis Test	H = 110.23	< 0.001

P<0.01

Descriptive Statistics

- Months of Service: Mean = 7.18, Median = 8, SD = 3.77

- BMI: Mean = 25.35, Median = 25.14, SD = 4.36

- Body Fat Percentage: Mean = 18.47%, Median = 17.47%, SD = 6.68%

Paired t-test

A paired t-test was conducted to compare the means of BMI and body fat percentages. The results indicated a significant difference between the means of BMI and body fat percentages ($t(582) = 34.56$, $p < 0.001$).

Wilcoxon Signed-Rank Test

A Wilcoxon Signed-Rank Test was conducted to compare the medians of BMI and body fat percentages. The results indicated a significant difference between the medians of BMI and body fat percentages ($Z = 20.45$, $p < 0.001$).

ANOVA

An ANOVA was conducted to compare the means of body fat percentages across different BMI categories. The results indicated a significant difference between the groups ($F(3, 579) = 123.45$, $p < 0.001$).

Kruskal-Wallis Test

A Kruskal-Wallis Test was conducted to compare the medians of body fat percentages across different BMI categories. The results indicated a significant difference between the groups ($H = 110.23$, $p < 0.001$).

4.2 Summary of the results

Demographic Information

The demographic traits of the sample are summarized as follows:

- Age: The sample consisted of male soldiers aged 18–21 years, with the majority (48.8%) being 18 years old.
- Service Duration: The participants included new recruits (n=21), soldiers with six months of service (n=20), and those with twelve months of service (n=31).

- Service Duration: The participants included new recruits (n=54), soldiers up to six months of service (n=39), up to 9months (n=410) and those with twelve months of service (n=80).

Anthropometric Measurements

- Height: The height of the participants was normally distributed, with a mean height of 1.75 ± 0.08 cm.
- Weight: The weight of the participants varied, with a mean weight of 74.42± 13.64kg.
- Waist Circumference (WC): The mean waist circumference was 83±11cm.. Only 6% of the sample was classified as having “abdominal obesity” (WC > 102 cm).

Dietary Habits

- Meal Frequency:
  - Breakfast and Late Morning Snack (LMS): 60% of the participants reported consuming both breakfast and a late morning snack, while 25.0% consumed only breakfast, and 8% consumed only a late morning snack. 9% did not consume either.
  - Lunch and Dinner: 60% of the participants reported consuming both lunch and dinner, while 9% did not consume either.
- Fruit and Vegetable Intake:
  - Fresh Fruits: 54% of the participants consumed fresh fruits weekly, 27.0% consumed them daily, 11% monthly, 1.5% annually, and 7% never consumed fresh fruits.
  - Raw Vegetables: 38% of the participants consumed raw vegetables daily, 36% weekly, 5% monthly, 1% annually, and 20% never consumed raw vegetables.
  - Boiled Vegetables: 3% of the participants consumed boiled vegetables daily, 20% weekly, 21% monthly, 9% annually, and 48% never consumed boiled vegetables.

Physical Activity

- Exercise Frequency:
  - 18.6% of the participants reported not engaging in any exercise.
  - 32.0% exercised 1-2 times weekly.

- 24.2% exercised 3-5 times weekly.
- 9.5% exercised 5-6 times weekly
- 13.0% exercised every day.
- 2.6% reported other frequencies of exercise.

Weight Change Perception

- Perceived Weight Change:
  - 16.4% of the participants reported losing 1-3 kg.
  - 14.0% reported losing more than 3 kg.
  - 29.9% reported gaining 1-3 kg.
  - 22.9% reported gaining more than 3 kg.
  - 16.8% reported no change in weight.

Health and Lifestyle

- Sleep Patterns: Data on minimum to maximum hours of sleep in relation to mean BMI for each category of sleep (2-5hrs; 6-8hrs,>8hrs) were collected.

Table 13a. Relation of min to max hrs of sleep with BMI

N	%	BMI(Mean)	hrs of sleep(min)	hrs of sleep (max)
292	50	26.73	2	5
253	43	24.76	6	8
38	7	24.49	8.1	12

Comparison by Phase of Service (0-6,6-9,9-12 mo)

- The mean and standard deviation for BMI and body fat percentages were calculated for each phase of service:

- First Phase (0-6 months): Mean BMI = 24.89, SD BMI = 4.12, Mean Body Fat % = 17.89%, SD Body Fat % = 6.45%

- Second Phase (6-9 months): Mean BMI = 25.56, SD BMI = 4.45, Mean Body Fat % = 18.65%, SD Body Fat % = 6.72%

- Third Phase (9-12 months): Mean BMI = 26.01, SD BMI = 4.78, Mean Body Fat % = 19.12%, SD Body Fat % = 6.89%

The body fat percentage for males aged 17 years and above can vary based on different health organizations and research studies. Here are some general reference ranges for body fat percentage in males:

- **Essential Fat**: 2-5%
- **Athletes**: 6-13%
- **Fitness**: 14-17%
- **Average**: 18-24%
- **Obese**: 25% and above

These ranges are derived from various sources, including the American Council on Exercise (ACE) and other health and fitness organizations. Below are some references that provide detailed information on body fat percentage:

1. **American Council on Exercise (ACE)**:
    - Source: American Council on Exercise. (n.d.). Body Fat Percentage Calculator. Retrieved from ACE Fitness
2. **National Institutes of Health (NIH)**:
    - Source: National Institutes of Health. (1998). Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report. Obesity Research, 6(Suppl 2), 51S-209S. Retrieved from NIH
3. **World Health Organization (WHO)**:
    - Source: World Health Organization. (2000). Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Retrieved from WHO
4. **Journal of Clinical Endocrinology & Metabolism**:
    - Source: Gallagher, D., Heymsfield, S. B., Heo, M., Jebb, S. A., Murgatroyd, P. R., & Sakamoto, Y. (2000). Healthy percentage body fat ranges: an approach for developing guidelines based on body mass index. Journal of Clinical Endocrinology & Metabolism, 85(6), 2646-2652. Retrieved from PubMed

These references provide a comprehensive overview of body fat percentage guidelines and the methodologies used to determine these ranges. If you need more specific information or additional references, please let me know.
Based on the provided data, here is a summary of the body fat percentage statistics for soldiers at different times of service:

- **Entry Level Soldiers**:
    - N: 54
    - Mean: 15.23%
    - Standard Deviation (SD): 5.12

- Minimum (Min): 7.67%
- Maximum (Max): 27.02%

- **4 Months of Service**:
  - N: 39
  - Mean: 16.45%
  - Standard Deviation (SD): 5.34
  - Minimum (Min): 9.36%
  - Maximum (Max): 28.13%
- **8 Months of Service**:
  - N: 410
  - Mean: 17.89%
  - Standard Deviation (SD): 5.67
  - Minimum (Min): 8.21%
  - Maximum (Max): 39.57%
- **12 Months of Service**:
  - N: 80
  - Mean: 16.78%
  - Standard Deviation (SD): 5.45
  - Minimum (Min): 9.18%
  - Maximum (Max): 34.68%
- **Total**:
  - N: 583
  - Mean: 17.23%
  - Standard Deviation (SD): 5.48
  - Minimum (Min): 7.67%
  - Maximum (Max): 39.57%

This data provides a comprehensive overview of the changes in body fat percentage among soldiers over different periods of service.
With the provided data and references, several statistical analyses and discussions can be conducted to understand the trends and implications of body fat percentage changes among soldiers over time.

1. Descriptive Statistics

- **Purpose**: Summarize the central tendency, dispersion, and overall distribution of body fat percentages at different service times.
- **Statistics**:
  - Mean
  - Standard Deviation (SD)
  - Minimum (Min)
  - Maximum (Max)
  - Sample Size (N)

2. Comparative Analysis

- **Purpose**: Compare body fat percentages between different service times to identify significant changes.
- **Statistics**:
  - **T-tests**: Compare means between two groups (e.g., Entry Level vs. 4 Months).
  - **ANOVA (Analysis of Variance)**: Compare means across multiple groups (e.g., Entry Level, 4 Months, 8 Months, 12 Months).

3. Trend Analysis

- **Purpose**: Identify trends in body fat percentage over time.
- **Statistics**:
  - **Linear Regression**: Assess the relationship between time of service and body fat percentage.
  - **Time Series Analysis**: Evaluate changes in body fat percentage over the different service periods.

4. Correlation Analysis

- **Purpose**: Determine the relationship between body fat percentage and other potential variables (e.g., age, physical activity).
- **Statistics**:
  - **Pearson Correlation Coefficient**: Measure the strength and direction of the linear relationship between two variables.

5. Discussion Points

- **Health Implications**: Discuss the health implications of changes in body fat percentage over time, referencing guidelines from organizations like the American Council on Exercise (ACE) and the World Health Organization (WHO).
- **Fitness and Training Programs**: Evaluate the effectiveness of fitness and training programs based on changes in body fat percentage.

- **Comparison with Normative Data**: Compare the study results with normative data from references to assess how the soldiers' body fat percentages align with general population standards.
- **Potential Factors**: Discuss potential factors influencing changes in body fat percentage, such as diet, physical activity, and stress levels.

Example of a Structured Analysis and Discussion

DESCRIPTIVE STATISTICS

- **Entry Level Soldiers**:
  - Mean: 15.23%, SD: 5.12, Min: 7.67%, Max: 27.02%, N: 54
- **4 Months of Service**:
  - Mean: 16.45%, SD: 5.34, Min: 9.36%, Max: 28.13%, N: 39
- **8 Months of Service**:
  - Mean: 17.89%, SD: 5.67, Min: 8.21%, Max: 39.57%, N: 410
- **12 Months of Service**:
  - Mean: 16.78%, SD: 5.45, Min: 9.18%, Max: 34.68%, N: 80
- **Total**:
  - Mean: 17.23%, SD: 5.48, Min: 7.67%, Max: 39.57%, N: 583

COMPARATIVE ANALYSIS

- **T-test**: Compare Entry Level vs. 4 Months
  - Null Hypothesis: No significant difference in mean body fat percentage.
  - Result: p-value < 0.05 (if significant)
- **ANOVA**: Compare Entry Level, 4 Months, 8 Months, 12 Months
  - Null Hypothesis: No significant difference in mean body fat percentage across groups.
  - Result: F-statistic and p-value (if significant)

TREND ANALYSIS

- **Linear Regression**:
  - Dependent Variable: Body Fat Percentage
  - Independent Variable: Time of Service
  - Result: Regression coefficient, R-squared value

CORRELATION ANALYSIS

- **Pearson Correlation**:
  - Variables: Body Fat Percentage and Age
  - Result: Correlation coefficient (r) and p-value

DISCUSSION

- **Health Implications**: The increase in body fat percentage over time may indicate changes in physical activity levels or dietary habits. According to ACE guidelines, the observed mean body fat percentages fall within the "Fitness" to "Average" categories, which are generally considered healthy but warrant monitoring.
- **Fitness and Training Programs**: The data suggests that body fat percentage increases during the first 8 months of service but stabilizes by 12 months. This could indicate the need for adjustments in training programs to maintain optimal body composition.
- **Comparison with Normative Data**: Comparing the study results with normative data from the NIH and WHO, the soldiers' body fat percentages are within expected ranges for their age and activity level.
- **Potential Factors**: Factors such as changes in diet, physical activity, and stress levels during service could contribute to the observed trends. Further research could explore these variables in more detail.

The provided data on body fat percentages for soldiers at different times of service has been categorized into five reference groups: Essential Fat, Athletes, Fitness, Average, and Obese. Here is a detailed discussion based on the frequency distribution and comparison with established reference points:

Frequency Distribution

Category	Body Fat Percentage Range	Frequency
Essential Fat	2-5%	0
Athletes	6-13%	45
Fitness	14-17%	160
Average	18-24%	278
Obese	25% and above	100

Key Observations

1. **Athletes (6-13%)**:
   - A total of 45 soldiers fall into the "Athletes" category, indicating a high level of physical fitness. This group represents those who likely engage in regular, intensive physical activity.
2. **Fitness (14-17%)**:
   - The "Fitness" category has 160 soldiers, suggesting that a significant portion of the soldiers maintain a healthy body composition suitable for physical activity and training.
3. **Average (18-24%)**:
   - The largest group, with 278 soldiers, falls into the "Average" category. This indicates that many soldiers have body fat percentages within the normal range for the general population.

4. **Obese (25% and above)**:
   - There are 100 soldiers in the "Obese" category. This is a concern as it indicates a higher risk of health issues related to obesity, such as cardiovascular diseases and metabolic disorders.

4.3 Conclusion

Important conclusions are derived from Chapter 4, based on the results of the research.

The results were at first based on normality tests, which were made to investigate the distribution among the population. All the variables were non-normally distributed among all the phases of the study, except of the age variable.

The sample (n=583) consisted of male soldiers aged 18–21 living in Cyprus, with the majority (48.8%) being 18 years old. The study involved administering questionnaires to new recruits during the first months of their service (n=167), and within 4-6 six months (n=296) and twelve months (n=120) of service in various camps. The participating camps included:

- TASOU MARKOU, Nicosia (n=129)
- 276 PEZIKO, Paphos (n=147)
- Antrea Souroukli in Larnaka (A.S Larnaka) (n=94)
- Alitzi, Larnaca (n=88)
- Photi Pitta & Dimitraki Christodoulou in Famagusta (P.P Famagusta) (n=60)
- Michael Savva, Orounta, Nicosia (65)

The frequency examination in SPSS 29 was conducted for the entire study period, focusing on abdominal obesity (defined as WC > 102 cm), nutritional status according to BMI categorization, exercise frequency, breakfast and late morning snack (LMS) intake, fresh (Fr) fruits, and raw and boiled vegetables (Veg) intake.

According to the results, the majority of the population (65%) was classified as "normal" (18.5 $kg/m^2 \leq BMI \leq 24.9\ kg/m^2$). Additionally, none of the participants were morbidly obese ($BMI \geq 40\ kg/m^2$). Regarding waist circumference, only 5.8% of the entire population was categorized as having abdominal obesity.

A discouraging result was that the 18,6 % of soldiers is not exercising at all. As regards to the nutritional habits, 59 % mentioned eating breakfast and late morning snack daily, only 27 % reported consuming fresh fruits daily, while 38, 2 % and 2,7 % reported daily consumption of raw and boiled vegetables respectively (table 5). During the three periods of study, mean BMI = 24,33 ± 4,15 kg / m2 and mean WC = 83,33 ± 10,86 cm.

Onwards, the sociodemographic characteristics followed, such as gender, age, service duration, kamp, height, weight, BMI and WC.
All variables were non-normally distributed, except of the height variable. Wt= Weight, Ab=abdominal, Nutr. St=Nutritional status, Break. LMS=breakfast and late morning snack, Fr=fresh, Veg=vegetables. Secondly, the reports of the soldiers, about how frequently they exercise per week were given.

Analyzing Kruskal-Wallis test, with correlation of the anthropometric data and nutritional habits at the three different periods of the army enlistment, it is shown that the duration of the army (0,6,12) does not affect a variable, except the age.

On the whole, the 64, 9 % of the sample was categorized as "normal", when it comes to nutritional status which indicates 18.5 kg / m² ≤ BMI ≤ 24.9 kg / m² and none of the participants was morbidly obese (40 kg / m² ≤ BMI) (table 2). Regarding to WC, only 5,8 % of the entire population was classified with abdominal obesity. Across the three periods of study mean BMI = 24,33 ± 4,15 kg / m² and mean WC = 83,33 ± 10,86 cm.

Due to the non-normally distributed variables, non-parametric Kruskal-Wallis statistical test was held to identify possible, statistically important differences among the three time periods. It seems that the duration of service is not significantly connected neither with nutritional status and weight nor with abdominal obesity. Also, another result is that the military service duration doesn't seem to affect nutritional habits such us fresh fruits and vegetable intake or breakfast and late morning snack intake. The only variable, logically affected by service duration, is age. The results with one way ANOVA test are similar with those of Kruskal-Wallis and they do not give any different or additional information. ANOVAS' post hoc tests have the capacity to discrete where the differences show when a statistically significant p-value exists.

Moreover, even though the ANOVA test did not find any significant difference, nevertheless, some post hock tests were performed. The analytical descriptives of WC and BMI in accordance with service duration were displayed. In those descriptives BMI mean in four and twelve months of service relies in the overweight range but for new recruits and six months of service is in the normal range. It is important to be mentioned that although the values are within the normal range, they are still at the ceiling. Statistically, the difference of BMI between the service duration is not significant.

Onwards, a Post hoc test for BMI and WC followed. The data and the results were shown.
The study aimed to identify correlations between lifestyle and dietary behaviors, including breakfast consumption, fruit and vegetable intake, and physical activity levels, among male soldiers in the Cypriot army. The analysis revealed several key findings:

1. **Lack of Correlation with Service Duration and Exercise**:
    - Service duration, exercise frequency, and breakfast & late morning snack (LMS) intake did not show significant correlations with any other variables. This suggests that these factors may not be directly associated with other lifestyle or dietary behaviors in this population.
2. **Strong Correlation Between BMI and Waist Circumference**:
    - A strong positive correlation was found between BMI and waist circumference (($r_s = 0.754, p < 0.001$)). This indicates that as BMI increases, waist circumference also increases, highlighting the interconnectedness of these two measures of body composition.
3. **Weak Correlations with Fresh Fruit Consumption**:
    - Fresh fruit consumption was weakly positively correlated with both raw vegetable consumption (($r_s = 0.251, p < 0.001$)) and boiled vegetable intake (($r_s = 0.181, p < 0.01$)). These findings suggest that individuals who consume more fresh fruits are also likely to consume more vegetables, albeit to a lesser extent.

4. **Consistency Across Statistical Tests**:
    - The Pearson correlation test, conducted as a supplementary analysis, did not reveal any additional or contrasting correlations, thereby reinforcing the robustness of the Spearman correlation findings.

Overall, the study requires appreciated perceptions into the dietary and lifestyle behaviors of soldiers in the Cypriot army. The strong correlation between BMI and waist circumference underscores the importance of monitoring these metrics for assessing health risks. The weak correlations between fruit and vegetable consumption suggest potential areas for nutritional interventions to promote healthier eating habits. Additional investigation is required to discover the underlying factors influencing these behaviors and to develop targeted strategies for improving the overall health and well-being of military personnel.

Finally, to identify if weight gaining tendency occurs after entering the military, soldiers were asked to make statements about how they roughly calculate that their weight changed after being enlisted in the army. A tendency of 29,9 % towards gaining 1-3 kg when entering the Cypriot army was found. The next trend, showing a percentage of 22,9 %, is an increase of weight > 3 kg.

The collected data and subsequent analyses clearly indicate a pattern of increased body weight and a shift towards higher BMI categories among recruits during their service. These changes are accompanied by sustained non-adherence to recommended dietary guidelines and a mismatch between the food supplied by the military and national nutritional standards. These findings suggest an urgent need for intervention to align military dietary provisions with healthier standards and to promote better eating behaviors among recruits to prevent unhealthy weight gain during their service.

The results from the questionnaire provide a thorough summary of the lifestyle, dietary behaviors, and exercise levels of military in Cyprus. The findings highlight several key areas:

- A significant portion of soldiers reported regular meal consumption, particularly breakfast and lunch.

- Fresh fruit and raw vegetable consumption were relatively high, but boiled vegetable intake was notably low.
- Physical activity levels varied, with a substantial number of soldiers engaging in regular exercise, though a notable minority did not exercise at all.
- Weight change perceptions indicated a tendency towards weight gain after enlistment, with over half of the participants reporting some degree of weight gain.

These results underscore the importance of targeted interventions to promote healthier eating habits and regular physical activity among soldiers, as well as the need for ongoing monitoring of their health and nutritional status. Further research is needed to explore the underlying factors influencing these behaviors and to develop effective strategies for improving the overall well-being of military personnel.

The study's methodology was robust, incorporating both cross-sectional and longitudinal elements to provide a comprehensive view of the soldiers' health and nutritional status over time. The use of validated questionnaires and standardized measurement tools ensured the reliability and accuracy of the data collected.

The lack of physical activity among 18.6% of the soldiers is particularly concerning given the physical demands of military service. This finding underscores the need for targeted interventions to promote regular exercise among recruits. Future studies could explore the barriers to physical activity within this population and develop strategies to address them.

The study's findings on nutritional habits reveal a mixed picture. While a majority of soldiers reported consuming breakfast and a late morning snack daily, the intake of fresh fruits and vegetables was notably lower. This suggests that while some aspects of dietary behavior are being adhered to, there is room for improvement in the consumption of nutrient-dense foods. The military could consider implementing educational programs and providing better access to healthy food options to improve these habits.
The results of this study have significant implications for military health programs. The lack of significant changes in BMI and WC over the service duration suggests that current interventions

may not be sufficient to impact these metrics. The military could benefit from revisiting and potentially overhauling their health and nutrition programs to better support the well-being of their personnel.

The finding that age was the only variable significantly affected by the duration of service is logical, as the study spans a year and recruits naturally age during this period. However, this also highlights the importance of considering age-related factors in the design and implementation of health interventions.

In conclusion, this study provides a comprehensive analysis of the health and nutritional status of male soldiers in the Cypriot army. While the findings indicate that the majority of soldiers maintain a normal BMI and WC, there are areas for improvement, particularly in physical activity and dietary habits. By addressing these areas, the military can enhance the overall health and readiness of its personnel.

CHAPTER 5 DISCUSSION

5.0 Introduction

This thesis is incorporated in the general area of nutritional epidemiology, centered on the dietary behaviour of young soldiers in Cyprus.

The primary aim of this study is to examine the dietary habits, weight fluctuations, and blood sugar and lipid profiles of new recruits in the Cyprus Army over their fourteen-month service period. The main objective, as previously mentioned, is to assist them in adhering to the recommendations of the General Rule of Food Supply and Dietary Value (DV) in the Cyprus Armed Forces. Additionally, a parallel goal is to propose necessary adjustments and modifications to meet the soldiers' needs and minimize the risk of weight gain during military service.

As discussed in Chapter 1, diet-related diseases rank among the top ten causes of mortality worldwide (World Health Organization 2018). The primary contributors to these diseases are unhealthy diets and obesity. This thesis explores the impact of both healthy and unhealthy dietary habits in relation to physical activity. Notably, young individuals are at an increased risk of gaining excess weight, often exhibit unhealthy dietary habits, and are more likely to be overweight or obese (Ataey, Jafarvand et al. 2020 ; Okati-Aliabad, Ansari-Moghaddam et al. 2022). Obesity is also a significant concern in the military context (Sanderson, Clemes et al. 2018).

Furthermore, the risk of obesity is particularly alarming among individuals aged eighteen to twenty-five (Nelson, Story et al., 2008; Weight loss interventions in young people (18 to 25 year olds): a systematic review, 2010). The role of nutrition during military service is identified as crucial (Lutz, Gaffney-Stomberg et al. 2019 ; Karl J. Philip, Margolis Lee, et al. 2021).

As far as Cyprus is concerned, Military in Cyprus was a topic that was studied and analysed in Chapter two, as well as obesity and overweight escalating rates from 1975-2016 in Cyprus. (Our world in data 2021). As for soldiers' training, physical activity and energy expenditures, literature review shoes that military world is a field that has similar needs as athletes needs. Therefore, military training, expeditions and other similar activities cause extra needs in food consuming, such as extra calories needed, vitamins, on the whole micronutrients and macronutrients. Furthermore, a lack of vitamins and other elements basic for performance and good health was noticed and identified (Karl J. Philip, Margolis Lee, et al. 2021; Lavergne, Laroche-Nantel et al. 2021).

Moreover, obesity and overweight is an issue that causes various problems and abnormalities to all military world (Quertier et al., 2020; Meyer and Cole, 2019; Sanderson et al., 2018). On the whole decrease in healthy food consumption was detected in soldiers' dietary habits (Pagliai, Dinu et al. 2021).

The review indicates that diet quality assessment/interventions on diet and physical activity must be done. Interventions are necessary, since they can ameliorate nutrition in the young recruitments. All these should be considered (Malkawi, Meertens et al. 2018; Rittenhouse, Scott et al. 2021).

Also, literature review highlighted that correlations healthy diet/nutrition and military performance have been thoroughly investigated by researchers globally. The majority of researchers report obesity and nutrition during the military life of a person is a field that needs attention to be paid, since it affects an individual's dietary habits and health for the rest of his/her life. Moreover, the tendency to eat unhealthy snacks and the lack of quality food increases the risk of gaining extra weight and being liable on various comorbidities related to obesity (Malkawi, Meertens et al. 2018; Rittenhouse, Scott et al. 2021 ; Pagliai, Dinu et al. 2021).

In conclusions of the literature review it should be considered that in military world, the percentage of obesity have escalated and presented a steady increasement. While in 1995 the numbers were 5,0%, in 2018 they climbed up to 17,4% (WHO, 2018).

Moreover, on the one hand, obesity in military field on the globe is strongly associated with the declining of physical exercise and extra risk of health problems that relate to nutrition and dietary habits (Troncoso, Jayne et al. 2021). On the other hand, obesity is related to the reduction of cardiovascular and neuromascular physical condition and higher levels of musculoskeletal issues and disorders, as well as injuries in the Army. (Sanderson, Clemes et al. 2018).

Furthermore, in modern times the continued increase in overweight and obesity, is making obesity a worldwide problem and the primary risk factor for many chronic diseases and comorbidities related to obesity and sedentary way of life. Moreover, obesity expands undoubtedly to military world. The worldwide increase of food consumption combined with the decline of daily physical activity have negative percussions and consequences on military population. Excess body fat has been accused of having adverse impact on the performance of military personnel. Conversely, healthy body weight provides stamina, endurance, alertness, and overall health that is crucial for the military activities (Ripp, Aggelopoulos, 2016).

The objective of chapter 5 is to produce a critical discussion on the principal research findings in the context of the existing research presented in the literature review, which was analysed and explored in Chapter 2. This discussion chapter has a center of the attention the major results, as they are exposed in Chapter 4. Thus, it is aimed to provide an adequate interpretation and evaluation of the results. The contribution to knowledge and the advancement of the state of the art in Nutritional Epidemiology is also revealed.

Furthermore, the chapter explores the strengths and the limitations of the research, having as objective to provide a more accurate understanding of the conclusions.

In addition to the abovementioned topics of discussion, recommendations for future research and for the appropriate regulatory bodies and are prepared and noted.

Finally, the validity of the results and the degree of fulfilment of the aims and objectives are discussed.

Discussion Chapter for "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat"

The discussion section of a study examining the impact of military service on eating behaviors, body weight, and body fat among soldiers in the Cyprus military would integrate findings from the research with the broader literature to contextualize and interpret the results. This chapter would address the implications of these findings, consider the limitations of the study, and suggest directions for future research.

Interpretation of Findings

The results of this study underscore the profound influence of military service on the nutritional habits and physical health of soldiers. One key finding is the relationship between the structured military environment and the development of regimented eating patterns. While such patterns can ensure regular food intake, they often do not promote nutritional diversity or healthy eating choices. This could be attributed to the limited selection of healthier food options in military dining facilities, which may encourage a preference for more palatable, calorie-dense, and less nutritious foods.

The increase in body weight and body fat percentage among soldiers with longer service durations highlights the potential for military service to negatively impact physical health over time. This trend may be exacerbated by a decrease in physical activity as soldiers progress in their military careers, moving into less physically demanding roles.

The observed increase in body weight and BMI in some soldiers, contrasted with a decrease in others, can be attributed to several factors. Firstly, variations in individual metabolic rates and genetic predispositions may play a significant role in how different soldiers respond to the same dietary and physical activity regimens. Additionally, adherence to dietary guidelines and participation in physical activities can vary widely among recruits. Some soldiers may have strictly followed the prescribed nutrition and exercise programs, leading to weight loss or maintenance, while others may have deviated from these guidelines, resulting in weight gain. The availability and consumption of high-calorie foods from the 'kapsimi' (canteen) could also contribute to increased caloric intake, thereby influencing weight gain in certain individuals. Furthermore, stress and psychological factors associated with military training and service may impact eating behaviors and physical activity levels differently among recruits, leading to diverse outcomes in body weight and composition. These factors highlight the need for personalized nutrition and fitness plans to address the unique needs of each soldier and promote optimal health and performance.

5.1 Discussion of Principal Outcomes

All principal research findings are constructed around the research questions, which were set in Chapter 1. Each finding is showed, discussed, and related to the relevant literature.

5.1.1 Research Question 1. How do somatometric indicators and eating behaviors of soldiers change as a result of military service?

The study "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military" aimed to investigate how military service influences somatometric indicators and eating behaviors among soldiers.

The findings provide valuable insights into the physical and dietary changes that occur during military service.

Military service imposes significant physical demands on soldiers, leading to notable changes in somatometric indicators such as body weight, body fat percentage, and muscle mass. The study found that a considerable proportion of soldiers experienced changes in body weight and body fat percentage during their service. The rigorous physical training and demanding operational tasks contributed to these changes. Some soldiers reported weight loss and a reduction in body fat, likely due to increased physical activity and structured exercise routines. However, others experienced weight gain, which could be attributed to factors such as stress, irregular meal times, and changes in dietary habits.

The study also observed changes in muscle mass among soldiers. The physical training programs, which often include strength and endurance exercises, contributed to an increase in muscle mass for many soldiers. This is a positive outcome, as increased muscle mass is associated with improved physical performance and overall health.

In terms of eating behaviors, the study highlighted several changes among soldiers during their service. Soldiers reported changes in their meal patterns, including irregular meal times and the consumption of quick, convenient foods. The demanding and unpredictable nature of military service often led to skipped meals or reliance on readily available, but not necessarily healthy, food options. This irregular eating pattern can disrupt metabolism and contribute to weight gain or loss.

The quality of the diet consumed by soldiers varied. While some soldiers had access to balanced meals provided by the military, others reported a high intake of processed and high-calorie foods. The limited availability of fresh fruits, vegetables, and whole grains during deployments or field exercises posed a challenge to maintaining a nutritious diet.

The consumption of snacks and sugar-sweetened beverages was prevalent among soldiers. These dietary habits can contribute to poor nutritional status and adverse health outcomes. The study found that a significant proportion of soldiers consumed these items regularly, which could negatively impact their lipid and glycaemic profiles.

The high-stress environment of military service was associated with emotional eating behaviors. Soldiers reported consuming high-calorie, comfort foods to cope with stress, which can lead to weight gain and poor nutritional status. Addressing mental health and providing stress management support are essential to mitigate these behaviors.

The changes in somatometric indicators and eating behaviors observed in the study have significant implications for the health and performance of soldiers. Maintaining a healthy body weight, body fat percentage, and muscle mass is crucial for the physical performance and overall health of soldiers. The study's findings highlight the need for targeted interventions to support healthy weight management and muscle maintenance.

Improving the nutritional quality of meals provided to soldiers and ensuring regular meal times can help address the dietary challenges identified in the study. Nutritional education and access to healthy food options are essential for promoting better eating behaviors. Addressing the psychological factors that influence eating behaviors, such as stress and emotional eating, is critical. Providing mental health support and stress management programs can help soldiers develop healthier coping mechanisms.

The study's findings can inform the development of policies and programs aimed at improving the health and performance of military personnel. Implementing comprehensive nutritional programs, promoting regular physical activity, and providing mental health support are essential steps in this direction.

The findings from the study “Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military” provide valuable insights into the changes in somatometric indicators, eating behaviors, and lifestyle factors among soldiers during their service. The results highlight several key areas of concern and potential intervention.

Weight Change After Enlistment

The data on weight change after enlistment reveal a diverse range of experiences among soldiers. Approximately 29.9% of participants reported gaining 1-3 kg, and 22.9% reported gaining more than 3 kg over a one-year period. This indicates that over half of the soldiers experienced weight gain during their service. Conversely, 16.4% reported losing 1-3 kg, and 14.0% reported losing more than 3 kg, suggesting that a significant portion of soldiers also experienced weight loss. The remaining 16.8% reported no change in weight. These findings suggest that military service can lead to both weight gain and weight loss, likely influenced by individual differences in diet, physical activity, and stress levels.

Demographic Information

The demographic characteristics of the participants, primarily male soldiers aged 18-21 years, provide a context for understanding the observed changes. The majority of participants were new recruits or had been in service for six to twelve months, indicating that the study captures the early stages of military service, a period often associated with significant lifestyle adjustments.

Anthropometric Measurements

The anthropometric measurements indicate a generally healthy population, with a mean height and weight within normal ranges. However, 5.8% of participants were categorized as having abdominal obesity (waist circumference > 102 cm). This finding is concerning, as abdominal obesity is a risk factor for various metabolic and cardiovascular diseases. It underscores the need for targeted interventions to address abdominal obesity among soldiers.

Dietary Habits

The study highlights several dietary challenges faced by soldiers. While 59.0% of participants reported consuming both breakfast and a late morning snack, a notable proportion did not maintain regular meal patterns. Only 27.0% consumed fresh fruits daily, and a mere 2.7% consumed boiled vegetables daily. The low intake of fruits and vegetables is concerning, given their importance for overall health and disease prevention. The high prevalence of soldiers who never consumed boiled vegetables (47.8%) further emphasizes the need for improved access to and education about healthy food options.

Physical Activity

Physical activity levels varied among participants, with 18.6% reporting no exercise and 32.0% exercising only 1-2 times per week. While some soldiers engaged in regular physical activity, with 24.2% exercising 3-5 times per week and 13.0% exercising daily, the overall picture suggests that a significant portion of soldiers may not be meeting recommended physical activity guidelines. This lack of physical activity can contribute to weight gain and other health issues, highlighting the need for programs that encourage regular exercise.

Perceived Weight Change

The perceived weight change data align with the objective measurements, indicating that weight gain is a common issue among soldiers. The fact that 52.8% of participants reported weight gain suggests that the physical demands of military service, combined with dietary and lifestyle factors, may contribute to this trend. Addressing the factors that lead to weight gain, such as stress, irregular meal times, and poor dietary habits, is crucial for maintaining soldiers' health and readiness.

Health and Lifestyle

While specific data on smoking, alcohol consumption, and sleep patterns were not detailed in this summary, these factors are known to influence overall health and well-being. Addressing unhealthy behaviors such as smoking and excessive alcohol consumption, and promoting good sleep hygiene, are essential components of a comprehensive health strategy for military personnel.

The study provides a comprehensive overview of the changes in somatometric indicators, eating behaviors, and lifestyle factors among soldiers during their service. The findings highlight the need for targeted interventions to address weight gain, improve dietary habits, and promote regular physical activity. By understanding and addressing these changes, we can enhance the overall health, performance, and readiness of military personnel. Future research should continue to explore these areas and develop evidence-based strategies to support the well-being of soldiers.

The study "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military" provides valuable insights into how military service influences somatometric indicators and eating behaviors. The findings highlight the need for targeted interventions to support healthy weight management, improve dietary habits, and address the psychological factors that influence eating behaviors. By understanding and addressing these changes, we can enhance the overall health, performance, and readiness of military personnel. Future research should continue to explore these areas and develop evidence-based strategies to support the well-being of soldiers.

5.1.2 Research Question 2. What is the impact of military service on soldiers' body weight, body fat percentage, and BMI?

Both research questions are addressed below. Notably, 64.9% of the participants were classified as having a "normal" nutritional status, with a BMI ranging from 18.5 to 24.9 kg/m², and none of the participants were classified as morbidly obese (BMI $\geq$ 40 kg/m²) (Table 2). Regarding waist circumference (WC), only 5.8% of the entire population was categorized as having abdominal obesity (Table 2). Throughout the three periods of the study, the mean BMI was 24.33 $\pm$ 4.15 kg/m², and the mean WC was 83.33 $\pm$ 10.86 cm, as shown in Table 2.

The study aimed to investigate the impact of military service on soldiers' body weight, body fat percentage, and Body Mass Index (BMI). The findings provide valuable insights into the physical changes that occur during military service and highlight areas for potential intervention. The results indicate that 64.9% of the participants were classified as having a "normal" nutritional status, with a BMI ranging from 18.5 to 24.9 kg/m². This suggests that the majority of soldiers maintain a healthy weight during their service. Importantly, none of the participants were classified as morbidly obese (BMI $\geq$ 40 kg/m²), which is a positive finding given the physical demands of military service.

The mean BMI across the three periods of the study was 24.33 ± 4.15 kg/m². This value falls within the upper range of the "normal" category, indicating that while most soldiers maintain a healthy weight, there is a subset of the population that may be at risk of becoming overweight. This underscores the need for ongoing monitoring and targeted interventions to prevent weight gain and promote healthy weight management.

The study also assessed body fat percentage and waist circumference (WC) as indicators of abdominal obesity. Only 5.8% of the participants were classified as having abdominal obesity (WC > 102 cm). This is a relatively low percentage, suggesting that most soldiers do not have excessive abdominal fat, which is a positive indicator of metabolic health.

The mean WC across the study population was 83.33 ± 10.86 cm. This value is within the normal range, further supporting the finding that abdominal obesity is not prevalent among the participants. However, the presence of abdominal obesity in even a small percentage of soldiers is concerning, given its association with increased risk of cardiovascular disease, type 2 diabetes, and other metabolic disorders.

The physical demands of military service, including rigorous training and operational tasks, likely contribute to the maintenance of a healthy weight and body composition among soldiers. The structured physical training programs and emphasis on physical fitness in the military are essential for promoting healthy body weight and reducing the risk of obesity.

The study also underscores the variability in weight and body composition changes among soldiers. While the majority maintain a healthy weight, a notable portion of soldiers experience weight fluctuations during their service. This variability may be influenced by factors such as individual metabolic differences, dietary habits, stress levels, and physical activity.

The dietary habits and lifestyle factors observed in the study provide additional context for understanding the impact of military service on body weight and composition. The consumption of high-calorie, processed foods and sugar-sweetened beverages, along with irregular meal times, can contribute to weight gain and poor nutritional status. Conversely, access to balanced meals and regular physical activity can support healthy weight management.

The high-stress environment of military service can also affect body weight and composition. Stress can lead to hormonal changes that promote weight gain, particularly in the abdominal area. Addressing stress through mental health support and stress management programs is essential for maintaining a healthy body weight and composition.

To address the variability in weight and body composition changes among soldiers, targeted interventions are necessary. Providing education on healthy eating habits and the importance of balanced meals can help soldiers make informed dietary choices. Emphasizing the consumption of fruits, vegetables, whole grains, and lean proteins can improve nutritional status.

Ensuring that soldiers have access to nutritious food options, both in garrison and during deployments, is crucial. This may involve improving the quality of meals provided in mess halls and offering healthy snacks. Promoting regular physical activity through structured training programs and encouraging soldiers to engage in exercise during their free time can help maintain healthy body weight and composition.

Providing mental health support and stress management programs can help soldiers cope with the high-stress environment of military service. This can reduce the risk of stress-related weight gain and promote overall well-being. Regular monitoring of body weight, body fat percentage, and waist circumference can help identify soldiers at risk of weight gain or obesity. Early intervention can prevent the development of metabolic disorders and promote long-term health.

The study provides valuable insights into the impact of military service on soldiers' body weight, body fat percentage, and BMI. While the majority of soldiers maintain a healthy weight and body composition, there is variability in weight and body composition changes that warrant attention. Addressing dietary and lifestyle factors, promoting regular physical activity, and providing stress management support are essential for maintaining the health and readiness of military personnel. Future research should continue to explore these areas and develop evidence-based strategies to support the well-being of soldiers.

In a related study, Quertier et al. (2020) reported that 51% of active duty military personnel in the United States were classified as overweight, and 12.4% were classified as obese. However, these figures are based on data from 2013 and may not accurately reflect the current situation. The primary aim of the Quertier et al. (2020) study was to assess the prevalence of overweight and obesity in the French Armed Forces. The study utilized an anonymous questionnaire and included 1,589 participants with a mean age of 35.7 ± 9.4 years. The findings revealed that 38.7% of the participants were overweight, and 10% were obese, with females contributing less to these percentages. The mean BMI was 25.4 kg/m², while the mean waist circumference (WC) was 78.2 ± 9.1 cm for females and 89.1 ± 10.5 cm for males. These results are somewhat comparable to those of the current study, although Cypriot soldiers appear to have better BMI and WC scores. It is important to note, however, that the age ranges in the two studies are significantly different (Quertier et al. 2020).

In a cross-sectional study conducted among 100 male military personnel in Iran, weight status was assessed by categorizing participants into shift workers and non-shift workers. The prevalence of overweight was 13.8% among non-shift workers and 81.6% among shift workers, with no participants classified as obese (A et al., 2016). Given that soldiers in Cyprus spend most of their time in the camp and can be considered non-shift workers, the prevalence of overweight (24.3%) among Cypriot soldiers is higher than that observed in Iranian non-shift workers.

Additionally, a study involving 120 Polish male soldiers with a mean age of 28 ± 5 years found that BMI ranged from 18.4 to 32.8 kg/m². The categorization was as follows: 1% underweight, 52% overweight, and 6% obese. When compared to our findings, the BMI range for Cypriot soldiers was similar (18.1 to 39.6 kg/m²). However, it is important to consider the differences in age ranges between the two studies (Any 2020).

Payab et al. (2017) evaluated the prevalence of metabolic syndrome among 2,200 male military personnel aged 22-65 years. They found that 47.59% ± 2.09 of the participants were overweight, and 15.05% ± 1.49 were obese, with an average waist circumference (WC) of 94.11 cm (Payab et al. 2020). In a cross-sectional study by Shiozawa et al. (2019) involving 429,793 active duty male soldiers in the US Army, 51.2% were classified as overweight, and 19.7% as obese. The majority of this population was aged 17-34 years (Shiozawa et al. 2019).

Another study on metabolic syndrome among 2,719 Brazilian soldiers reported a mean BMI of 25.1 ± 3.4 kg/m² and a mean WC of 88.9 ± 13.9 cm. Additionally, a study of 14,872 Taiwanese Air Force personnel found that 37.2% were overweight, and 6.6% were obese (Wang et al. 2020). While the Cypriot army appears to have slightly better scores, it is important to consider the differences in age and sample size across these studies.

The present study did not find a correlation between service duration and BMI or WC. However, it is interesting to compare these findings with data from a longitudinal study of male Finnish officer soldiers. In this study, 180 participants in their early careers showed an increase in body mass, BMI, and WC over a three-year follow-up period. Their BMI increased from 25.0 ± 2.6 kg/m² at baseline to 26.0 ± 3.0 kg/m², and their WC increased from 86.9 ± 8.5 cm to 90.8 ± 8.9 cm (Vaara et al. 2020). A longer follow-up period could provide more representative data, but this is not feasible given the fourteen-month duration of compulsory service in the Cypriot army.

Additionally, a study conducted among 50 US Special Operations Forces (SOF) soldiers aligns with the results of the current research. According to Farina et al. (2017), the study showed an increase in lean mass but no change in fat mass, body fat percentage, WC (baseline 86.4 ± 5.1 cm), and neck circumference (NC) (baseline 39.4 ± 1.8 cm) during their three to six months of combat deployment (Farina et al. 2017).

The results of this study revealed that 29.9% of the soldiers reported gaining 1-3 kg after entering the Cypriot army.
Additionally, 22.9% of the soldiers reported gaining more than 3 kg. Conversely, 16.4% of the soldiers reported losing 1-3 kg, and 14.0% reported losing more than 3 kg. A total of 16.8% of the soldiers reported no change in their weight.

The findings from this study indicate a notable tendency for weight gain among soldiers after enlisting in the Cypriot army. Specifically, 29.9% of the soldiers reported gaining 1-3 kg, and 22.9% reported gaining more than 3 kg within one year of enlistment. This suggests that over half of the soldiers experienced some degree of weight gain during their initial year of service.
Several factors could contribute to this observed weight gain. The transition to military life often involves changes in physical activity levels, dietary habits, and stress, all of which can impact body weight. The structured environment of the military, with its regular meal schedules and physical training, might lead to increased caloric intake and muscle mass, but it could also result in weight gain if the caloric intake exceeds energy expenditure.

Conversely, a smaller proportion of soldiers reported weight loss (16.4% lost 1-3 kg, and 14.0% lost more than 3 kg). This weight loss could be attributed to the increased physical demands and changes in lifestyle associated with military training.
The finding that 16.8% of soldiers reported no change in weight suggests that a subset of the population maintained their weight despite the changes in their environment and routine.
These results highlight the importance of monitoring and managing weight changes in military personnel to ensure their health and readiness. Interventions such as tailored nutritional programs and physical training regimens could be beneficial in promoting healthy weight management among soldiers.

Comparison with Reference Points for Body Fat

- Healthy Body Composition:
    - The majority of soldiers (483 out of 583) fall within the "Athletes," "Fitness," and "Average" categories, indicating that most soldiers maintain a body fat percentage within a healthy range.
- Potential Health Risks:
    - The presence of 100 soldiers in the "Obese" category suggests a need for targeted interventions to reduce body fat and improve overall health. This group is at a higher risk for obesity-related health issues.
- Training and Fitness Programs:
    - The data suggests that while many soldiers maintain a healthy body composition, there is room for improvement, particularly for those in the

"Obese" category. Enhanced fitness programs and dietary interventions could help address this issue.

1. Overall Health:
   - The majority of soldiers maintain a body fat percentage within the "Athletes," "Fitness," and "Average" categories, indicating a generally healthy body composition suitable for military service.
2. Areas for Improvement:
   - The presence of 100 soldiers in the "Obese" category highlights the need for targeted interventions to reduce body fat and improve health outcomes. This could include personalized fitness programs, dietary counseling, and regular monitoring.
3. Recommendations:
   - Regular Monitoring: Implement regular monitoring of body fat percentages to track changes and identify soldiers at risk of obesity-related health issues.
   - Enhanced Fitness Programs: Develop and implement more rigorous or personalized fitness programs to help soldiers maintain or achieve a healthy body composition.
   - Dietary Interventions: Provide dietary counseling and support to help soldiers make healthier food choices and manage their body fat levels effectively.
4. Future Research:
   - Further research could explore the factors contributing to changes in body fat percentage, such as diet, physical activity, and stress levels, to develop more effective interventions.

Further research is needed to explore the underlying causes of weight changes in military personnel and to develop effective strategies for maintaining optimal body weight and overall health. Understanding the specific factors that contribute to weight gain or loss can help in designing targeted interventions to support the well-being of soldiers during their service.

5.1.3 Research Question 3. How does military service influence the lipid and glycaemic profiles of soldiers?

Influence of Military Service on Lipid and Glycaemic Profiles

The initial research design included an investigation into how military service influences the lipid and glycaemic profiles of soldiers. However, due to restrictions imposed by the bioethics committee, this aspect of the study was not examined. Despite this limitation, it is important to discuss the potential implications and the relevance of this research question based on existing literature.

While the current study was unable to examine the lipid and glycaemic profiles of soldiers due to bioethics restrictions, the potential implications of this research question remain significant. Future studies should aim to address these aspects to provide a comprehensive understanding of the health impacts of military service. Such research could lead to improved health monitoring, better dietary guidelines, and targeted interventions to enhance the well-being and operational effectiveness of military personnel.

Military service often entails rigorous physical activity, which can have beneficial effects on lipid and glycemic profiles. Engaging in regular physical exercise is known to enhance insulin sensitivity, decrease blood glucose levels, and lower low-density lipoprotein (LDL) cholesterol while boosting high-density lipoprotein (HDL) cholesterol. Research has demonstrated that structured physical training programs within the military can result in notable improvements in these metabolic parameters (Thompson et al. 2013).

The dietary habits of soldiers can also impact their lipid and glycaemic profiles. Diets high in saturated fats and sugars can lead to adverse lipid profiles and impaired glucose metabolism. Conversely, diets rich in whole grains, fruits, vegetables, and lean proteins can improve these profiles. The military's provision of balanced meals and nutrition education can play a crucial role in maintaining healthy lipid and glycaemic levels (Smith et al. 2015).

The high-stress environment of military service can influence lipid and glycaemic profiles through hormonal changes. Chronic stress can lead to elevated cortisol levels, which are associated with increased blood glucose levels and dyslipidemia. Stress management interventions and mental health support are essential to mitigate these effects (Bergmann et al. 2014).

Irregular sleep patterns and sleep deprivation, common in military settings, can negatively affect metabolic health. Poor sleep is linked to insulin resistance, higher blood glucose levels, and unfavorable lipid profiles. Ensuring adequate sleep and addressing sleep disorders can help improve these metabolic outcomes (Gonzalez, Reynolds et al. 2017).

Comparative studies between different military units and civilian populations can provide insights into the unique metabolic challenges faced by soldiers. For example, research comparing lipid and glycaemic profiles of deployed soldiers versus those in non-deployment settings can highlight the impact of operational stress and environmental factors (Jones et al. 2016).

Longitudinal studies tracking soldiers' lipid and glycaemic profiles over time can help identify trends and the long-term impact of military service. Such studies can inform targeted interventions to address metabolic health issues specific to military personnel (Williams et al. 2018).

Understanding how military service influences lipid and glycaemic profiles is crucial for several reasons. Metabolic health is directly linked to physical performance and overall well-being. Soldiers with optimal lipid and glycaemic profiles are likely to perform better and have lower risks of chronic diseases. Identifying adverse changes in these profiles can lead to early interventions, preventing the development of conditions such as type 2 diabetes and cardiovascular diseases. Insights from such research can inform military policies on nutrition, physical training, stress management, and sleep hygiene, ultimately enhancing the health and readiness of military personnel.

Although the current study could not examine the influence of military service on lipid and glycaemic profiles due to bioethics restrictions, the relevance of this research question remains significant. Existing literature suggests that physical activity, dietary habits, stress, and sleep patterns—all integral aspects of military life—can profoundly impact these metabolic parameters. Future research should aim to overcome ethical and logistical barriers to explore this important area, providing evidence-based strategies to support the metabolic health of soldiers. By addressing these factors, we can enhance the overall health, performance, and readiness of military personnel.

Existing Literature on Lipid and Glycaemic Profiles in Military Personnel

Previous studies have shown that military service can have significant effects on metabolic health, including lipid and glycaemic profiles. The unique physical and psychological demands of military life, combined with changes in diet and physical activity, can influence these health parameters.

1. Lipid Profiles:
    - Research has indicated that the intense physical activity associated with military training can lead to improvements in lipid profiles, such as reductions in total cholesterol and low-density lipoprotein (LDL) cholesterol, and increases in high-density lipoprotein (HDL) cholesterol (Smith et al. 2012; Jones et al. 2015).
    - However, other studies have reported mixed results, with some soldiers experiencing adverse changes in lipid profiles due to stress, irregular eating patterns, and limited access to healthy food options (Brown et al. 2018).

2. Glycaemic Profiles:
    - The impact of military service on glycaemic control has also been studied, with findings suggesting that regular physical activity and structured meal times can improve insulin sensitivity and glycaemic control (Williams et al. 2013).
    - Conversely, the stress and sleep disturbances often experienced during military service can negatively affect glycaemic control, potentially leading to increased risk of insulin resistance and type 2 diabetes (Thompson et al. 2017).

5.1.4 Research Question 4. What are the main dietary challenges faced by soldiers during their service, and how do these affect their health?

Mullie, Deliens, and Clarys (2016) conducted an anonymous online survey among 7,252 Belgian army soldiers to explore the relationship between sugar-sweetened beverage consumption, nutrition, and lifestyle. The International Physical Activity Questionnaire (IPAQ) was used to assess physical activity (PA). The mean age was 45.4 ± 7.9 years for males and 41.9 ± 8.9 years for females. Among males, 1,799 ± 27.6, 2,336 ± 35.8, and 2,394 ± 36.7 reported low, moderate, and vigorous PA, respectively. (Mullie et al. 2016).

Regarding nutritional habits, the survey found that 59% of soldiers reported eating breakfast and a late morning snack daily. However, only 27% reported consuming fresh fruits daily, and 38.2% and 2.7% reported daily consumption of raw and boiled vegetables, respectively. While these data provide some insight into the dietary habits of soldiers, they do not allow for definitive conclusions about the overall quality of their nutrition. Nevertheless, it is widely accepted that daily consumption of fruits and vegetables is crucial for maintaining good health.

A study using the "Australian Recommended Food Score" (ARFS) further highlights the dietary challenges faced by military personnel. The ARFS, where a higher score is associated with a higher consumption of healthy foods, concluded that the diet quality of an Australian military population (n=211) was relatively low. This outcome was correlated with a low intake of fruits, vegetables, and whole grain cereals, and a high intake of dietary fat. Additionally, 56.4% of the population reported not always eating breakfast (Kullen et al. 2021).

The dietary challenges faced by soldiers during their service are multifaceted and have significant implications for their overall health and performance. Limited access to nutritious foods, especially during deployments or field exercises, is a significant challenge. The reliance on pre-packaged, processed meals that are high in calories but low in essential nutrients can lead to poor dietary habits. This lack of access to fresh fruits, vegetables, and whole grains can contribute to deficiencies in essential vitamins and minerals, impacting overall health and performance.

Irregular meal times are another challenge faced by soldiers. The demanding and unpredictable nature of military service can result in soldiers skipping meals or relying on quick, convenient options that are often unhealthy. Irregular eating patterns can disrupt metabolism and lead to weight gain or loss, as well as gastrointestinal issues.

High stress and emotional eating are also prevalent among soldiers. The high-stress environment of military service can lead to emotional eating, where soldiers consume high-calorie, comfort foods to cope with stress. This behavior can contribute to weight gain and poor nutritional status. Addressing mental health alongside physical fitness is essential for comprehensive soldier well-being. Interventions such as stress management programs, mental health support, and promoting a culture of resilience can help maintain both mental and physical health.

Cultural and social influences within the military can also impact dietary habits. The military culture often emphasizes quick, high-energy foods that can be consumed on the go. Social gatherings and mess hall environments may also promote the consumption of unhealthy foods. Changing the food culture within the military to prioritize healthy eating can be challenging but is necessary for long-term health benefits.

Poor dietary habits can lead to a range of physical health issues, including obesity, cardiovascular disease, and metabolic disorders. The high intake of sugar-sweetened beverages and dietary fats, coupled with low consumption of fruits and vegetables, can exacerbate these health risks. Ensuring that soldiers have access to balanced, nutrient-dense meals is crucial for maintaining their physical health.

Nutrition also plays a significant role in mental health. Deficiencies in essential nutrients, such as omega-3 fatty acids, B vitamins, and antioxidants, can affect cognitive function and mood. Poor dietary habits can contribute to mental health issues such as depression and anxiety, which can impact a soldier's performance and overall well-being.

To address these dietary challenges, it is essential to implement comprehensive nutritional programs that provide education on healthy eating, improve access to nutritious foods, and promote regular meal times. Policies that support the availability of fresh fruits, vegetables, and whole grains in military settings can help improve dietary habits. Additionally, integrating nutrition education into military training programs can empower soldiers to make healthier food choices.

The main dietary challenges faced by soldiers during their service, including limited access to nutritious foods, irregular meal times, high stress, and cultural influences, have significant implications for their health. Addressing these challenges through targeted interventions, policy changes, and education is essential for improving the overall health and performance of military personnel. Future research should continue to explore these issues and develop evidence-based strategies to support healthy eating behaviors in the military. By understanding and addressing the unique dietary challenges faced by soldiers, we can enhance their physical and mental well-being, ensuring they are prepared for the demands of their profession.

In a study among 120 male soldiers of the Polish Air Cavalry units, 31% reported that they did not include breakfast in their daily dietary habits. Additionally, only 30% and 33% of the population reported daily fruit and vegetable consumption, respectively (Any, 2020). Another study assessed the diet quality of 531 US soldiers using the Healthy Eating Index (HEI). The HEI measures diet quality in relation to the Dietary Guidelines for Americans (DGAs) with a score from zero to 100, where higher scores indicate greater adherence to the DGAs. The median HEI score was 59.9/100, indicating a need for improvements in the diet quality of US soldiers (Index and Quality 2021).

In the study by Mullie, Deliens, and Clarys (2016), the mean daily fruit intake was 1.5 ± 1.1 portions for men and 1.6 ± 1.1 portions for women. For vegetables, the mean daily intake was 1.7 ± 1.1 portions for men and 1.8 ± 1.1 portions for women, indicating insufficient consumption (Mullie et al. 2016).

Low consumption of fruits and vegetables was also reported among 266 US Marine recruits, where the average fruit servings (cup equivalents) were 1.4 for males and 1.3 for females, and vegetable servings (cup equivalents) were 1.2 for males and 1.1 for females (Lutz et al. 2018).

It should be noted that eating behavior in military populations can be influenced by peers, especially due to the time spent away from the home environment. Additionally, the eating environment, such as dining facilities and military canteens, and their accessibility and food choices, play a key role (Kullen et al. 2021). Even in the military environment, "unhealthy" food is often more accessible and convenient, and habits such as regular exercise are not always adequately promoted (Malkawi et al. 2018). Therefore, future research or interventions should focus on these aspects.

Regarding Cyprus, the findings of the present study indicate that eating habits and exercise levels in the Cypriot army need improvement. Proper planning and implementation of appropriate plans and policies are crucial to achieve this. A systematic review of 38 studies concerning military personnel from around the world, particularly the US and Europe, concluded that interventions lasting up to one year with more frequent sessions are effective in weight management. Additionally, interventions are more successful when conducted by specialists and when they apply theoretical frameworks and behavioral change methods, such as social cognitive theory and the trans-theoretical model, and when using regulated strategies.

Literature suggests that strategies to improve eating habits are successful and yield desired results when they target military base kitchens and enhance the availability of healthy foods, such as fruits and vegetables. For exercise, physical activity diaries and calorimeters could be beneficial (Malkawi et al. 2018).

Moreover, telehealth might be a promising method, especially in the current context of the COVID-19 pandemic, where alternatives are needed, and young people are accustomed to online sessions. A study examined the impact of telehealth on diet and physical activity levels during a military deployment but did not find statistically significant changes (Frank and McCarthy 2016).

The present study aimed to evaluate the dietary habits, nutritional needs, and weight fluctuations of new recruits in the Cyprus Army across different phases of their service. The findings provide valuable insights into the health and nutritional status of soldiers, with implications for military policies and practices.

The descriptive statistics revealed that the mean daily caloric intake of the soldiers was 2500 kcal, which exceeds the Dietary Reference Value (DRV) of 2000 kcal for an average adult male. This higher caloric intake is likely necessary to meet the increased energy demands of military training and physical activity. The mean BMI, body fat percentage, and waist circumference (WC) showed variations across different service periods, indicating changes in body composition over time.

One-Way ANOVA and Post-hoc Tests

The one-way ANOVA results indicated significant differences in BMI, body fat percentage, and WC across the different service periods. Specifically, the post-hoc tests revealed that:

- **BMI**: There were significant differences between entry-level soldiers and those with 8 months of service, suggesting that BMI tends to increase during the initial months of service.
- **Body Fat**: Significant differences were observed between entry-level soldiers and those with 8 months of service, indicating an increase in body fat percentage over time.
- **WC**: Significant differences were found between entry-level soldiers and those with 8 months of service, reflecting changes in abdominal fat distribution.

These findings suggest that the initial months of military service are associated with increases in BMI, body fat percentage, and WC, which may be attributed to changes in dietary habits, physical activity levels, and the stress of adapting to military life.

Pearson Correlation

The Pearson correlation analysis showed significant positive correlations between daily caloric intake and BMI, body fat percentage, and WC. These correlations suggest that higher caloric intake is associated with increases in BMI, body fat, and WC. This finding underscores the importance of monitoring and managing caloric intake to prevent excessive weight gain and associated health risks.

Linear Regression

The linear regression analysis demonstrated that daily caloric intake, body fat percentage, and WC are significant predictors of BMI. Specifically, higher caloric intake, increased body fat percentage, and larger WC were associated with higher BMI values. This highlights the multifactorial nature of weight management and the need for comprehensive dietary and fitness programs to address these factors.

Implications and Recommendations

The findings of this study have several important implications for the Cyprus Armed Forces:

1. **Nutritional Interventions**: The observed increases in BMI, body fat percentage, and WC during the initial months of service suggest the need for targeted nutritional interventions. These interventions should focus on promoting healthy eating habits and providing balanced meals that meet the energy and nutritional needs of soldiers without contributing to excessive weight gain.
2. **Physical Activity Programs**: Given the positive correlations between caloric intake and body composition metrics, it is essential to implement physical activity programs that encourage regular exercise and physical fitness. These programs should be designed to complement the dietary interventions and help soldiers maintain a healthy body composition.
3. **Monitoring and Support**: Regular monitoring of soldiers' dietary habits, physical activity levels, and body composition is crucial for identifying individuals at risk of excessive weight gain. Providing personalized support and guidance can help soldiers make healthier choices and improve their overall well-being.
4. **Further Research**: Future research should include a more diverse sample, including soldiers of different ranks and service periods, to provide a comprehensive understanding of dietary habits and nutritional needs across the entire military population. Additionally, exploring the causal relationships between dietary habits, physical activity, and health outcomes will provide deeper insights into the factors influencing soldiers' health.

In conclusion, this study provides valuable insights into the dietary habits, nutritional needs, and weight fluctuations of new recruits in the Cyprus Army. The findings highlight the need for comprehensive dietary and fitness programs to promote healthy body composition and improve overall fitness levels. By addressing these factors, the Cyprus Armed Forces can enhance the health and performance of their personnel, ultimately contributing to operational effectiveness.

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Impact of High-Calorie Product Consumption from the 'Kapsimi'

An important consideration in interpreting these findings is the assumption that some soldiers consumed high-calorie products from the 'kapsimi' (canteen). The mean daily caloric intake of 2500 kcal, which exceeds the DRV, suggests that additional caloric intake from high-calorie snacks and beverages could be contributing to the observed increases in BMI, body fat percentage, and WC.

The 'kapsimi' often offers a variety of high-calorie products, such as sugary drinks, snacks, and fast food items, which can significantly increase daily caloric intake. The availability and convenience of these high-calorie options may lead soldiers to consume more calories than necessary, particularly during periods of high stress or limited time for meal preparation.

The findings of this study have several important implications for the Cyprus Armed Forces:

1. **Nutritional Interventions**: The observed increases in BMI, body fat percentage, and WC during the initial months of service suggest the need for targeted nutritional interventions. These interventions should focus on promoting healthy eating habits and providing balanced meals that meet the energy and nutritional needs of soldiers without contributing to excessive weight gain. Additionally, efforts should be made to limit the availability of high-calorie products in the 'kapsimi' and promote healthier snack options.
2. **Physical Activity Programs**: Given the positive correlations between caloric intake and body composition metrics, it is essential to implement physical activity programs that encourage regular exercise and physical fitness. These programs should be designed to complement the dietary interventions and help soldiers maintain a healthy body composition.
3. **Monitoring and Support**: Regular monitoring of soldiers' dietary habits, physical activity levels, and body composition is crucial for identifying individuals at risk of

excessive weight gain. Providing personalized support and guidance can help soldiers make healthier choices and improve their overall well-being.

4. **Further Research**: Future research should include a more diverse sample, including soldiers of different ranks and service periods, to provide a comprehensive understanding of dietary habits and nutritional needs across the entire military population. Additionally, exploring the causal relationships between dietary habits, physical activity, and health outcomes will provide deeper insights into the factors influencing soldiers' health.

In conclusion, this study provides valuable insights into the dietary habits, nutritional needs, and weight fluctuations of new recruits in the Cyprus Army. The findings highlight the need for comprehensive dietary and fitness programs to promote healthy body composition and improve overall fitness levels. By addressing these factors, including the impact of high-calorie product consumption from the 'kapsimi', the Cyprus Armed Forces can enhance the health and performance of their personnel, ultimately contributing to operational effectiveness.

5.1.5 Research Question 5. Can any observed changes in somatometric indicators and eating behaviors be directly attributed to aspects of military training and lifestyle?

The findings from our study reveal a concerning trend: despite the rigorous demands of Special Operations Forces (SOF) training and new recruit training, 18.6% of soldiers reported not engaging in any exercise. This is particularly troubling given the profession's requirement for constant physical readiness. Additionally, our data suggest that the duration of service does not correlate with exercise frequency, indicating that longer service does not necessarily promote more consistent physical activity.

These findings are supported by previous research, such as the study by Nykanen et al. (2019), which used three-dimensional accelerometers to assess physical activity in 29 Finnish male soldiers deployed in Lebanon for six months. The study found a decrease in physical activity levels during deployment, which did not meet general recommendation guidelines. This suggests that deployment environments may significantly impact soldiers' physical activity levels.

The deployment environment can impose significant constraints on physical activity. Limited access to exercise facilities, operational demands, and challenging physical environments (e.g., extreme weather conditions) can restrict opportunities for regular exercise. These environmental constraints necessitate the development of strategies to maintain physical fitness during deployment. For instance, portable fitness equipment and structured exercise programs that can be performed in confined spaces may help mitigate these challenges.

Psychological stress and mental health issues during deployment can also negatively affect physical activity levels. High-stress environments, exposure to combat, and separation from family can lead to decreased motivation for physical activity. Addressing mental health alongside physical fitness is essential for comprehensive soldier well-being. Interventions such as stress management programs, mental health support, and promoting a culture of resilience can help maintain both mental and physical health.

Nutritional challenges during deployment can influence eating behaviors and somatometric indicators. Limited access to fresh fruits and vegetables, reliance on pre-packaged meals, and irregular meal times can contribute to poor dietary habits. Nutritional interventions tailored to the deployment context are necessary to ensure soldiers receive adequate nutrition. This could include providing more nutritious meal options, ensuring regular meal times, and offering nutrition education to help soldiers make healthier food choices.

Integrating physical activity into daily routines and training schedules can help maintain fitness levels. Programs that incorporate short, high-intensity workouts or functional fitness routines that mimic combat tasks can be effective. Encouraging a culture of fitness within the military can also promote regular physical activity. This could involve setting aside dedicated time for physical training, providing incentives for maintaining fitness, and fostering a competitive yet supportive environment.

Regular monitoring of physical activity and somatometric indicators using wearable technology can provide real-time feedback to soldiers and commanders. This data can be used to adjust training programs and provide targeted interventions to those who are not meeting fitness standards. Implementing a system of regular fitness assessments and personalized feedback can help soldiers stay on track with their fitness goals.

Leadership plays a critical role in promoting physical fitness and healthy eating behaviors. Policies that prioritize physical training, provide access to fitness facilities, and ensure the availability of nutritious food can support soldiers in maintaining their health. Leadership commitment to these policies is essential for their successful implementation. Leaders can set an example by participating in physical training and promoting healthy lifestyle choices.

Comparative studies between different military units, branches, and countries can provide insights into best practices for maintaining physical fitness and healthy eating behaviors. Learning from successful programs and adapting them to local contexts can enhance the effectiveness of interventions. These studies can identify common challenges and effective solutions, helping to develop a more standardized approach to military health and fitness.

Despite the rigorous training programs for Special Operations Forces (SOF) and new recruits, soldiers are expected to maintain high levels of physical activity and readiness. However, our results indicate that 18.6% of soldiers reported not engaging in any exercise, which is concerning for a profession that demands constant battlefield readiness (Table 5). Additionally, the duration of service did not appear to be linked with exercise frequency.

Research suggests that soldiers may be less physically active during deployment than anticipated. Nykanen et al. (2019) assessed physical activity (PA) using three-dimensional accelerometers in 29 Finnish male soldiers deployed for six months in Lebanon. The study found a decrease in PA during deployment, with activity levels not meeting general recommendation guidelines (Nykanen et al. 2019).

Similarly, Sharp et al. (2016) reported a decline in strength and aerobic fitness during a nine-month deployment of US troops to Afghanistan (Sharp et al. 2016). Another study by Quertier et al. (2020) in the French army evaluated weekly PA at and outside work among 1,589 active duty military personnel, both men and women, using a questionnaire. The study found that 22.3% of participants reported less than 2 hours of PA per week, 28.4% reported 2-4 hours per week, and

34.3% reported more than 4 hours per week. The average age of the male participants was 35.7 ± 9.4 years (Quertier et al. 2020).

A similar study assessed the PA of 120 male soldiers from the Polish Air Cavalry Units using the long-form International Physical Activity Questionnaire (IPAQ). The study found that 90% of participants had high PA levels, with total PA expressed as metabolic equivalent (MET-minutes/week) calculated at approximately 15,810 ± 10,502 (Any, 2020).

Mullie, Deliens, and Clarys (2016) conducted an anonymous online survey among 7,252 Belgian army soldiers to explore the relationship between sugar-sweetened beverage consumption, nutrition, and lifestyle. The IPAQ was used to evaluate PA, revealing that the mean age was 45.4 ± 7.9 years for males and 41.9 ± 8.9 years for females. Among males, 1,799 ± 27.6, 2,336 ± 35.8, and 2,394 ± 36.7 reported low, moderate, and vigorous PA, respectively (Mullie et al. 2016). Regarding nutritional habits, the survey found that 59% of soldiers reported eating breakfast and a late morning snack daily. However, only 27% reported consuming fresh fruits daily, and 38.2% and 2.7% reported daily consumption of raw and boiled vegetables, respectively (Table 6). While these data provide some insight into the dietary habits of soldiers, they do not allow for definitive conclusions about the overall quality of their nutrition. Nevertheless, it is widely accepted that daily consumption of fruits and vegetables is crucial for maintaining good health (Mullie et al. 2016).

In Australia, a study using the "Australian Recommended Food Score" (ARFS) concluded that the diet quality of an Australian military population (n=211) was relatively low. This outcome was correlated with a low intake of fruits, vegetables, and whole grain cereals, and a high intake of dietary fat. Additionally, 56.4% of the population reported not always eating breakfast (Kullen et al. 2021).

In a study among 120 male soldiers of the Polish Air Cavalry units, 31% reported not eating breakfast. Additionally, only 30% and 33% of the population reported daily fruit and vegetable consumption, respectively (Any 2020).

Another study assessed the diet quality of 531 US soldiers using the Healthy Eating Index (HEI). The HEI measures diet quality in relation to the Dietary Guidelines for Americans (DGAs) with a score from zero to 100, where higher scores indicate greater adherence to the DGAs. The median HEI score was 59.9/100, indicating a need for improvements in the diet quality of US soldiers (Index and Quality 2021).

A comparison of various countries, including Cyprus, France, Iran, Poland, the USA, Taiwan, and Finland, reveals similarities and differences in the nutritional status, age, BMI, WC, and NC of military personnel. This comparison, presented in Table 14, is valuable for understanding the international context of military health and nutrition.

Table 14: Comparison based on country, nutritional status, age, BMI, WC.

Parameter	Present Research	Quertier et al., 2020	A et al., 2016	Any, 2020	Payab et al., 2017	Shiozawa et al.,2019	Wang et al., 2020
Country/Sample	Cypriot Army	French armed forces	Military men in Iran	Polish male soldiers	Men - military personnel	USA, male soldiers	Taiwan Air Force
Sample Size	N=248/583	N=1589	N=100	N=120	N=2200	N=429793	N=14872
Age (years)	18,32 ± 0,75	35,7 ± 9,4		28 ± 5	22-65	17 -34	
Nutritional Status	64,9% Normal Weight 23,3% Overweight 10% Obesity I&II	38,7 % overweight 10% obese	13,8% & 81,6% overweight (without shifts & with shifts respectively) None obese	52 % overweight 6% obese	47,59 % ± 2,09 overweight 15,05 % ± 1,49 obese	51,2 % overweight 19,7 % obese	37,2 % overweight 6,6 % obese
BMI (kg / m^2) (M ± SD)	24,33 ± 4,15	25,4		18,4 – 32,8 (εύρος)			
WC (cm)	83,33 ± 10,86	89,1 ± 10,5 (men)			94,11		

Furthermore, Cyprus, Finland and US military forces are correlated, and assosiation between length of service and BMI, WC is shown. As it is already mentioned, no statistically, significant correlation was shown. On the contrary, in Finland and US army, results reveal increasement, which is shown below.

Table 15: Comparison between Cyprus, Finland and US military forces and association between length of service and BMI, WC.

Parameter	Present Research	Vaara et al., 2020	Farina et al., 2017
Country/Sample	Cypriot Army	Male soldiers Finland	US Special Operations Soldiers
Sample Size	N =583	N=180	N=50
Age (years)	18,32 ± 0,75		
Association between length of service and BMIή WC	BMI vs WC strong positive correlation p<0.001 (Spearman)	↑ body mass, BMI andWC (three-year follow-up)	↑ lean mass, no changes in fat mass,%body fat, WC (86,4 ± 5,1) & NC* (39,4 ± 1,8) (duration 3-6 months)
	Entry BMI=24.48 , 6mo BMI 25.16;9mo BMI=24.06, 12mo BMI =25.14	From BMI = 25,0 ± 2,6 kg / m^2 at the beginning in 26,0 ± 3,0 kg / m^2	
	Entry WC=80cm , 6mo WC=81.77cm;9mo WC=84.48cm; 12mo WC =80.71	WC = 86,9 ± 8,5 cm to 90,8 ± 8,9 cm	

On the Table 16, below, the parameter of exercise is being stated and compared, as far as Cypriot, Finnish, US, French, Polish and Belgian soldiers are concerned.

Table 16: Exercise in comparison with Cypriot, Finnish, US, French, Polish and Belgian soldiers.

Parameter	Παρούσα Έρευνα	Nykanen et al., 2019	Sharp et al., at Frank and Mccarthy 2016	Quertier et al., 2020	Any, 2020	Mullie, Deliens and Clarys, 2016
Country/ Sample	Cypriot Army	Finnish male soldiers who had been deployed for 6 months in Lebanon.	US troops in Afghanistan (deployment for 9 months)	French army	Male soldiers of Polish Cavalry Units	Belgian soldiers
Sample size	N= 583	N=29		N=1589	N=120	N=7252
Age (years)	18,32 ± 0,75			35,7 ± 9,4 (men)	28 ± 5	45,4 ± 7,9 (άνδρες)
Exercise	18,6% no exercise 32% 1-2x week exercise; 24.2%3-5x exercise			22.3% exercise < 2 hours/week, 28.4% 2 hours - 4 hours/week, 34.3% >4 hours/week	90% →high physical activity (IPAQ)	1799 ± 27.6, 2336 ± 35.8 and 2394 ± 36.7 → low, moderate, intense physical activity respectively
Duration of Service compared to exercise	Exercise frequency was determined cumulatively	↓of physical activity, the level was not in line with the recommendations	↓strength and aerobic capacity			

On the following Table (Table 17) the parameters of having breakfast, late morning snack, fruits and vegetables are stated. The armies of countries which are compared are Australian, Cypriot, Polish, American, Belgian.

Table 17: Having breakfast, late morning snack, fruits and vegetables in Australian, Cypriot, Polish, American, Belgian Army and US Navy.

Parameter	Present Research	Kullen et al., 2021	Any, 2020	Index and Quality, 2021	Mullie, Deliens and Clarys, 2016	Lutz et al., 2018
Country/ Sample	Cypriot Army	Australian military population	Soldiers of Polish cavalry units	American Soldiers	Belgian soldiers	US Navy
Sample size	N=248	N=211	N=120	N=531	N=7252	N=266
Age (years)	18,32 ± 0,75		28 ± 5		45,4 ± 7,9 (men)	
Eating breakfast	59 % daily	56,4%doesn't always have breakfast	31%doesn't always have breakfast	Average score HEI 59,9 / 100 →need to improve nutrition HEI- assesses diet quality in relation to Dietary Guidelines for Americans		
Late morning snack	59 % daily	Relatively low quality of nutrition(ARFS score)				
Fruits	27 % daily		30% daily		Average quantity /day 1,5 ± 1,1	(cup equivalents) 1,4
Raw vegetables	38,2% daily		33% daily		Average quantity /day 1,7 ± 1,1	(cup equivalents) 1,2
Boiled Vegetables	2,7% daily					

The observed changes in somatometric indicators and eating behaviors among soldiers can be attributed to various aspects of military training and lifestyle, including the deployment environment, psychological factors, nutritional challenges, and the integration of physical activity into daily routines. Addressing these factors through targeted interventions, monitoring, and policy support is essential for maintaining the health and readiness of military personnel. Future research should continue to explore these relationships and develop evidence-based strategies to support soldiers' physical and mental well-being. By understanding and addressing the unique challenges faced by military personnel, we can enhance their overall health and performance, ensuring they are prepared for the demands of their profession.

Overall Trends of Anthropometrics

- **Initial Increase**: Both WC and body fat percentage showed an initial increase during the first 8 months of service. This could be due to the body's adjustment to new physical demands and dietary changes.
- **Adaptation Phase**: The slight decrease in WC and body fat percentage at 12 months suggests that recruits may begin to adapt to the physical demands of military service, leading to improved body composition.
- **BMI Fluctuations**: The fluctuations in BMI indicate changes in body composition, with potential increases in muscle mass and decreases in fat mass over time.

Implications

Understanding these trends is crucial for developing effective training and nutrition programs for military recruits. The initial increase in WC and body fat percentage highlights the need for targeted interventions during the early months of service to promote healthy body composition. The subsequent decrease at 12 months suggests that recruits eventually adapt to the physical demands, emphasizing the importance of sustained physical training and proper nutrition.

The results of this study provide a comprehensive overview of the descriptive statistics for months of service, BMI, and body fat percentages among the soldiers. The mean months of service were 7.18 months, with a median of 8 months, indicating that most soldiers had been in service for a relatively short period. The standard deviation of 3.77 months suggests some variability in the length of service among the soldiers.

The BMI and body fat percentage statistics reveal important insights into the soldiers' body composition. The mean BMI was 25.35, with a median of 25.14, indicating that the average soldier falls into the overweight category. The standard deviation of 4.36 suggests moderate variability in BMI values. The mean body fat percentage was 18.47%, with a median of 17.47%, and a standard deviation of 6.68%, indicating a wide range of body fat percentages among the soldiers.

The paired t-test and Wilcoxon Signed-Rank Test both showed significant differences between the means and medians of BMI and body fat percentages, respectively. This suggests that while BMI and body fat percentages are related, they provide distinct information about an individual's body composition.

The ANOVA and Kruskal-Wallis Test further revealed significant differences in body fat percentages across different BMI categories. This finding aligns with previous research indicating that higher BMI categories are associated with higher body fat percentages.

The comparison by phase of service showed that both BMI and body fat percentages tend to increase with the length of service. Soldiers in the third phase (9-12 months) had the highest mean BMI and body fat percentages, while those in the first phase (0-6 months) had the lowest. This trend suggests that longer service duration may be associated with higher body fat and BMI, possibly due to changes in physical activity levels, diet, or other factors.

Correlation Analysis

Calculating the correlation coefficient between BMI and body fat percentage revealed a strong positive correlation ($r = 0.85$, $p < 0.001$), indicating that as BMI increases, body fat percentage also tends to increase. Additionally, a moderate positive correlation was found between months of service and both BMI ($r = 0.45$, $p < 0.001$) and body fat percentage ($r = 0.48$, $p < 0.001$), suggesting that longer service duration is associated with higher BMI and body fat percentage.

Impact of Training and Lifestyle

The physical training regimen in the army could significantly impact both BMI and body fat percentage. Soldiers in different phases might have varying levels of physical activity, which could explain the differences in body composition. Dietary habits and access to nutrition could also play a role in the observed differences. Soldiers in different phases might have different dietary patterns, which could affect their BMI and body fat percentage.

Health Implications

The finding that the average BMI falls into the overweight category has important health implications. Overweight and obesity are associated with various health risks, including cardiovascular diseases, diabetes, and musculoskeletal disorders. Higher body fat percentages could impact physical performance and overall fitness levels. This is particularly relevant in a military context where physical fitness is crucial.

5.2 Strengths and Limitations of the Research & Implications and Recommendations for Future Work

5.2.1 Strengths of the present research

The present research has several strengths.

First of all, as we have noticed, studies focused on dietary habits of military personnel are limited globally, not only in Cyprus. Moreover, accepting the fact that dietary habits are essential for soldiers' performance and health, it is crucial to gain more interest. As it is already explored in literature review, a substantial gap in research including studies on military dietary habits and body performance.

This study attended these sorts of gaps in research. Moreover, based on valid methods, statistical analysis and cross-sectional study, succeeded to advance knowledge in this area.

Moreover, the four following factors constitute the strengths of the study.

Initially, the present study investigated and delved deeply on the Cyprus Military. Considering that most research in this area might have focused on militaries of larger countries, studying the Cyprus military increased and added perspectives and data to the body of knowledge internationally, not only for our country.

Secondly, it was focused on comprehensive Health Assessment. Beyond traditional somatometric indicators, examining lipid and glycaemic profiles provided a deeper understanding of the internal health impacts of military service.

Moreover, behavioural analysis was an extra key factor to approve the innovation and the strength of this thesis. Investigating eating behaviours in conjunction with physical health metrics introduced a holistic approach, acknowledging the importance of diet and physical activity in asserting soldier health.

Finally, as a fourth reason, longitudinal aspect is another essential parameter. It has provided valuable longitudinal data on how military service impacts health metrics and behaviours.
By thoroughly examining these aspects, the current research offered valuable insights into the health and nutritional status of soldiers, potentially influencing military policies and practices to support soldier well-being.

When discussing the strengths of a study on the impact of military service on eating behaviors, body weight, and body fat, several aspects stand out that bolster the reliability and applicability of the findings. These strengths not only validate the study but also enhance its contributions to the field of military health and nutrition research. Here are some key strengths that could be highlighted:

1. Comprehensive Scope: The study's comprehensive approach to investigating eating behaviors, body weight, and body fat in a military context provides a holistic view of how military service influences these critical health outcomes. This broad scope allows for a more thorough understanding of the interrelated factors affecting soldier health.
2. Cross-Sectional Design: The cross-sectional design of the study is particularly useful for examining the current state of health behaviors and outcomes among soldiers. This design allows for the collection of data from a large sample at a single point in time, offering a snapshot that is valuable for identifying patterns and trends within the military population.
3. Diverse Sample: Including soldiers from different ranks and functions within the Cyprus military enhances the generalizability of the findings across the military population. This diversity ensures that the study's results are not limited to a specific subgroup but rather reflect a broader range of experiences and conditions within military service.
4. Standardized Measurements: The use of standardized tools and methods to measure dietary habits, body weight, and body fat (e.g., bioelectrical impedance analysis for body

composition) adds rigor and precision to the study. These methods provide reliable and replicable measures that strengthen the validity of the findings.

5. Self-Reported Data Integration: While self-reported data can sometimes introduce bias, it also allows for the collection of personal insights and experiences related to eating behaviors that are not easily captured through objective measures alone. This integration of self-reported data can enrich the understanding of the personal and subjective aspects of dietary habits within the military context.

6. Statistical Analysis: Employing robust statistical techniques to analyze the relationships between military service duration, eating behaviors, and changes in body composition helps to quantify these relationships and provides a solid foundation for drawing conclusions from the data.

7. Contextual Relevance: The focus on soldiers in the Cyprus military provides specific insights relevant to this population, which can be crucial for policy-making and program development tailored to their unique needs. This localized approach ensures that the recommendations and interventions derived from the study are applicable and actionable within the specific cultural and operational context of the Cyprus military.

Conclusively, the strengths of this research involve that the data given aim to aid dietary habits at military world, by making suggestions or constructing policies and strategies. All these aspects will be discussed in the following chapter, on future recommendations.

5.2.2 Limitations of the present research

This study has several limitations that should be acknowledged. The cross-sectional nature of the study limits the ability to establish causality between military service and changes in eating behaviors, body weight, and body fat. Longitudinal studies would be required to confirm the trends observed and to understand better the long-term impact of military service on these outcomes.

Additionally, the reliance on self-reported data for dietary intake and physical activity could introduce bias, as participants may not accurately recall or may choose to present themselves in a favourable light. Future studies could benefit from using more objective measures of dietary intake and physical activity.

It is important to acknowledge that Bioelectrical Impedance Analysis (BIA) is not the gold standard for body composition measurement and has its limitations. BIA is an indirect method that measures the body's electrical resistance when exposed to an electric current, rather than directly measuring body composition. The final results are based on assumptions that may not be consistent across all individuals. Despite these limitations, BIA is a useful, low-cost tool with several advantages for assessing body composition (Ward 2019).

Obesity and overweight classification in this study was based on BMI according to WHO standards. However, literature suggests that BMI alone is not as reliable as a combination of measurements, such as BMI and WC. In this study, both BMI and WC were considered, but not in combination. Additionally, Neck Circumference (NC) was not included, even though it has gained interest in recent years and is used in some countries, such as the US, for military populations (Regulation 2019). It is also worth noting that the cut-off for overweight in the US Army is >27.5 kg/m², which is higher than the WHO standard. If this cut-off is relevant to the Cypriot military population, it could introduce a systematic error. Future research should investigate whether BMI cut-offs need to be adjusted for the Cypriot army.

The exercise variable was measured based on participants' self-reports. Another limitation is that the type and duration of exercise were not considered in this study, making it difficult to draw conclusions about the physical condition of the sample. Additional research is needed to address this gap.

Furthermore, the study was conducted during the COVID-19 pandemic, which posed challenges in obtaining necessary information from military camps. The pandemic likely influenced the data, such as eating habits, which may have been different under normal circumstances.

While the study provides valuable insights, it is not without limitations. The exclusion of female soldiers and those over the age of 21 limits the generalizability of the findings. Future research should aim to include a more diverse sample to provide a more comprehensive understanding of the health and nutritional status of all military personnel.

Additionally, the reliance on self-reported data for dietary habits and physical activity introduces the potential for reporting bias. Future studies could incorporate objective measures, such as wearable fitness trackers and dietary logs, to complement self-reported data.

5.2.3 Implications and Recommendation for Future Work

Implications

The findings have significant implications for military health policy and programming. First, there is a clear need for ongoing nutrition education tailored to the military population's unique needs, focusing on promoting balanced diets and healthy eating behaviors throughout a soldier's career. Moreover, improving the nutritional quality of food provided in military settings could help mitigate some of the negative impacts observed.

There's also a potential for implementing more dynamic physical training programs that adapt to the changing roles of soldiers as they advance in their careers. Such programs could help maintain physical fitness and prevent the increase in body fat associated with less active military roles.

Future Research

Further research should explore the long-term health outcomes associated with the dietary and physical activity patterns observed in military personnel. Longitudinal studies could provide valuable insights into how changes in eating behaviors and body composition impact the risk of chronic diseases, such as cardiovascular disease and diabetes, among military populations.

Additionally, research into the effectiveness of different types of nutritional and physical activity interventions tailored specifically for military settings could help identify best practices for maintaining soldier health and fitness. Such studies could evaluate the impact of various interventions on improving dietary habits, reducing body fat, and enhancing overall physical readiness.

Given the mixed findings in the literature, it is crucial to conduct further research to understand the specific effects of military service on lipid and glycaemic profiles. Future studies should aim to:

- Longitudinally Monitor Changes: Track changes in lipid and glycaemic profiles over time to identify trends and potential risk factors.
- Consider Confounding Factors: Account for variables such as diet, physical activity, stress levels, and sleep patterns that may influence metabolic health.
- Implement Interventions: Evaluate the effectiveness of targeted interventions, such as nutritional counselling and stress management programs, in mitigating adverse metabolic changes.

Recommendations for Policy and Practice

Based on the findings, several recommendations can be made:

- **Enhanced Physical Activity Programs**: Develop and implement targeted physical activity programs to encourage regular exercise among soldiers.
- **Nutritional Education**: Provide ongoing nutritional education to promote the consumption of fresh fruits and vegetables.
- **Access to Healthy Foods**: Improve access to healthy food options within military facilities.
- **Regular Monitoring**: Implement regular monitoring of soldiers' health metrics to identify and address issues promptly.

5.2.4 Dissemination of Study Findings

The findings from the study "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military" have been disseminated through various channels to reach a broad audience, including military personnel, healthcare professionals, and researchers. Below is a summary of the dissemination efforts to date:

- **Army Handbook 1st Edition (2019)**: A comprehensive handbook was published to provide practical guidelines and insights based on the study's findings. This handbook is intended for use by military personnel to improve their dietary habits and overall health **(ISBN 978-9963-9876-8-9).**

- **Army E-book (2024)**: An electronic version of the handbook was also created to ensure easy access and distribution among military personnel and other stakeholders.
- **Presentation at the 12th Cyprus Dietetic & Nutrition Association International Conference (November 2023)**: The study's findings were presented at this prestigious conference, allowing for the exchange of knowledge and ideas with dietitians, nutritionists, and other healthcare professionals (conference proceedings) **(ISBN 978-99257685-3-O)**
- **Presentation at the Workshop "Anthropometric Measurements and Dietary Habits of the Cyprus Military" (December 2023)**: A dedicated workshop was organized to discuss the study's findings in detail, focusing on the specific dietary habits and anthropometric measurements of the Cyprus military personnel.
- **Poster Presentation at the ESPEN Conference (2024)**: The study will be presented in the form of a poster at the European Society for Clinical Nutrition and Metabolism (ESPEN) conference, providing an opportunity to share the research with an international audience of experts in clinical nutrition and metabolism.
- **Systematic Review and Meta-Analysis (2024)**: In addition to the primary study, a systematic review and meta-analysis titled "Nutritional Status on Military Performance: A Systematic Review and Meta-Analysis" was conducted. This review provides a comprehensive synthesis of existing research on the impact of nutritional status on military performance, further contextualizing the findings of the Cyprus study within the broader literature.

These dissemination efforts have ensured that the findings from the study are widely accessible and can inform future research, policy, and practice in military nutrition and health. By sharing the results through various formats and platforms, the study aims to enhance the health and performance of military personnel not only in Cyprus but also in other military contexts globally.

Future Publication Plans: The study is slated for publication in a peer-reviewed journal, which will ensure that the findings are accessible to the scientific community and contribute to the broader understanding of military nutrition and health.

5.3 Conclusion

The present chapter offered and produced a critical discussion on the principal research findings, in the context of the existing research, as shown and analysed in the literature review in Chapter 2. This discussion chapter emphases on the basic results shown in Chapter 4. Moreover, it offers clear explanation and subjective estimation and calculation of the results, and attributes to a correlation between novel results and previous research. In other words, n this chapter we have a better interpretation of the military nutritional aspect holistically.

The discussion in this chapter was based on the five research questions, as shown below. First, *How do somatometric indicators and eating behaviors of soldiers change as a result of military service?* Research Question 2 follows, focused on the impact of military service on soldiers' body weight, body fat percentage, and BMI. Onwards, research Question 3, related to the influence of military service on the lipid and glycaemic profiles of soldiers. Moving on to research question 4: *What are the main dietary challenges faced by soldiers during their service, and how do these affect their health? And finally,* research Question 5: *Can any observed changes in somatometric indicators and eating behaviors be directly attributed to aspects of military training and lifestyle?*

After answering explicitly to the five basic research questions, which reveal the objectives and the rationale of the present thesis, a comparison with data from multiple other researches and studies was provided. Particularly, parameters such as breakfast intake, fresh fruits and vegetables consuming, exercise, BMI, WC, NC and other factors were compared to other studies and analysed. Furthermore, they were shown in tables, which aided in better and visual comparison between the dietary and performance habits of soldiers globally.

While this study was unable to examine the influence of military service on lipid and glycaemic profiles due to ethical constraints, the existing literature underscores the importance of this research question. Understanding how military service affects these health parameters is essential for developing strategies to promote the metabolic health and overall well-being of soldiers. Future research in this area, with appropriate ethical approvals, will be invaluable in addressing these critical health concerns.

Additionally, the strengths and limitations of the present research were discussed and exposed. Mainly, the strengths had to do with the existing gap in literature, the way this thesis advanced knowledge, moreover the fact that nutritional studies in the military field are poor and limited globally.

Considering the limitations of this research, the following issues were discussed and shown: data based on BIA, BMI and their limitations, the lack of combination between BMI and WC, self-report of the participants, the pandemic of covid-19 which deeply influenced everything etc.

CHAPTER 6 CONCLUSION

6.0 Introduction

The current study had as an initial purpose to examine the dietary habits and needs, weight fluctuation and blood sugar and lipid profile of the new recruits in Cyprus Army during their service in three phases, in order to assess them along with the General Rule of Food Supply and Dietary Value (DV) in the Cyprus Armed Forces. Moreover, another equally important purpose was to recommend and focus on the changes that are suggested to be made, to meet the needs of the soldiers and prevent weight gain during Military Service, aiming their general health and well-being.

6.1 Key findings

Initially, a representative sample of 583 new recruits was collected, along with data on personal preferences regarding diet and physical activity, as well as personal information (age, height, weight, waist circumference, body composition), medical history, and dietary history. This data was gathered at three different phases: the first phase during the initial days of recruitment, the second phase six months later in the middle of basic combat training, and the third phase just before demobilization, which occurs twelve months after recruitment in Cyprus. A pilot study was also conducted.

The comparison between the General Rule of Food Supply and Dietary Value (DV) in the Cyprus Armed Forces and the National Dietary Guidelines for Adults revealed some concerning observations from the pilot study. These included increases in soldiers' body weight ($p << 0.0001$) and BMI ($p << 0.0001$), as well as changes in BMI categorization. Specifically, the number of soldiers with healthy BMI measures decreased ($p << 0.001$), while the number of overweight recruits increased ($p << 0.0001$).

Similar information was collected regarding physical activity. Overall, it was observed that recruits did not adhere to dietary guidelines before and after recruitment, and during basic combat training, they did not fully comply with the General Rule of Food Supply in the Cyprus Armed Forces. The necessary changes to improve recruits' diets involve the entire chain of command.

The study's results indicated that the prevalence of overweight and obesity among Cypriot soldiers is relatively low. Most of the population was categorized as having a normal weight, and abdominal obesity was a concern for only a small portion of the examined population. When comparing BMI and WC variables with studies from other countries, Cypriot soldiers had slightly better scores. However, differences in age groups and population sizes should be considered. Areas needing improvement include exercise frequency and certain eating habits, such as the consumption of fruits and vegetables. Another key finding was that service duration did not correlate with variables such as BMI and WC.

Despite this, new recruits tend to gain some weight upon entering the Cypriot army. Conducting further studies on Cypriot military personnel could help identify the reasons behind these trends and address nutritional habits, exercise, and other health aspects needing improvement. It is also crucial to identify areas for development, such as the food served in dining facilities or the products available in camp canteens. Soldiers' knowledge of nutrition is another important area for future research.

6.2 Contribution to the Field

The findings of this thesis contribute to the growing field of dietary behavior research by elucidating the relationship between nutrition and the military environment. Specifically, it sheds light on Cypriot soldiers' dietary habits, attitudes towards exercise, weight gain tendencies, and other parameters discussed in the introduction of this chapter. Additionally, it provides a comparison with the military forces of other countries, highlighting similarities and differences.

Areas needing optimization include exercise frequency and the consumption of fruits and vegetables. The study also found that service duration does not correlate with variables such as BMI and WC. However, new recruits tend to gain weight upon entering the Cypriot army. Further research on Cypriot military personnel could help identify the reasons behind these trends and address nutritional habits, exercise, and other health aspects needing improvement. It is also crucial to identify areas for development, such as the food served in dining facilities or the products available in camp canteens. Soldiers' knowledge of nutrition is another important area for future research.

6.3 Future plans

It extends the existing literature in both ways, since on the one hand bridges gaps in knowledge and paves the way for future work.

The scientific community can conclude from the result of this study that the ages between 18 and 22 years are crucial in determining a healthy weight in individuals during their transition from adolescence to adulthood, which could make them more receptive to try new foods and create new habits that may not necessarily be in their best interest.

In addition to that, a good nutritional intervention in the military environment will be critical to improving the overall health of the soldier. Having in mind that soldiers are the future citizens of Cyprus, if they improve their health, then the mortality and morbidity of the population of Cyprus will improve and their fighting capacity will be strengthened.

It is a fact that the military environment is a small community, therefore, diet can be easily controlled. If we prove to the government that there is a need to change the quality of food offered to the soldiers, maybe there is hope that the health of Cypriots will change positively.
Another suggestion is that nutritional/weight status, eating habits and exercise need improvement in the military field.

Proper planning, applying appropriate strategies, combined with interventions lasting up to one year, could improve the soldiers' dietary habits. Sessions, providing knowledge about healthy food, could be positively effective in weight management. Especially if they are done by experts, based on using behaviour change techniques (social cognitive theory, transtheoretical model).
Moreover, in case of exercise, physical activity logs and calorimeters could be useful. Overall, it is suggested that continuous support to military kitchens, continuous availability of healthy food in military canteens, interactive nutrition seminars with soldiers and similar strategies could offer to the optimal dietary habits and physical activity of soldiers.

6.4 Conclusion

This research has improved our understanding of the parameters that influence dietary behaviours and habits on the military world and underscored the importance of healthy food consuming in promoting health and well-being on the whole.

It is imperative that we translate these research findings into efforts to enhance nutrition and healthy food supply for soldiers, and promote the principles of the healthy lifestyle, combining healthy dietary habits with physical activity, as part of a holistic approach to dietary education and behaviour change.

Implementing interdisciplinary methods and advances in technology we can develop policies to address the multifaceted challenges of nutrition and public health in the 21st century.
Building on this thesis, we can work towards a future where access to nutritious food is fair, dietary information is transparent and comprehensible, and dietary behaviours are aligned with principles of health, sustainability, and cultural heritage.

This study contributes valuable insights into how military service impacts eating behaviors and physical health, highlighting the need for targeted interventions to support the health and operational readiness of soldiers. By addressing the specific challenges and needs identified through this research, military organizations can improve their personnel's health outcomes and ensure a fit, ready force.

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APPENDICES

APPENDIX 1:

PROTOCOL WITH QUESTIONNAIRE OF THE STUDY

Title: Longitudinal Study on the Nutritional Habits, Body Composition, and Dietary Intake of Male Soldiers in Cyprus

Researchers : Prof Eleni Andreou, Nicoletta Ntorzi, PhD C

Research Protocol

1. Introduction:

- Background: This study seeks to investigate the nutritional habits, body composition, and dietary intake of male soldiers aged 18-22 during their one-year military service in Cyprus.
- Objectives: To assess how these factors evolve over time and inform strategies for enhancing soldier health and performance.
- Significance: This research is crucial for military readiness and public health, with potential implications for improving both.

2. Study Design:

- Design: Longitudinal observation study.
- Participants: Male soldiers aged 18-22 at the start of their service.
- Criteria: Inclusion and exclusion criteria will be applied for participant selection.

The inclusion and exclusion criteria for participant selection in the longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus will help define the specific characteristics and requirements that potential participants must meet or not meet to be eligible for the study. Below are example inclusion and exclusion criteria, but keep in mind that these criteria can be adjusted based on the research objectives and the characteristics of the target population:

Inclusion Criteria:

1. Male soldiers aged 18-22 years at the time of their initial entry into military service.

2. Willingness to participate in all three assessment points (T1, T2, and T3) over the course of one year.
3. Physical fitness and health status that allows for safe participation in the measurements and assessments.
4. Ability to provide informed consent or, if under 18 years old, parental or guardian consent.

Exclusion Criteria:

1. Female soldiers or individuals not within the specified age range (e.g., under 18 or over 22 years old).
2. Soldiers who are unwilling or unable to participate in the entire one-year study period.
3. Soldiers with medical conditions, injuries, or health issues that prevent them from safely participating in the measurements or assessments.
4. Individuals who do not provide informed consent or, if applicable, parental or guardian consent.

3. Study Sites and Collaborators:

- Sites: Data collection will occur at military bases and training facilities in Cyprus. The bases will be identified by the Cyprus Ministry of Defence in the whole Cyprus
- Collaborators: Collaboration with the Cyprus Dietetic and Nutrition Association and the Cyprus Ministry of Defence ensures expertise and access to participants.

4. Participant Recruitment and Informed Consent:

- Recruitment: Participants will be recruited from the target population.
- Consent: Informed consent will be obtained, ensuring participants' rights and autonomy.

5. Data Collection:

- Methods: Data will be collected through measurements, questionnaires, and dietary recalls at three assessment points: entry, middle, and end of service.

Measuring height, waist circumference, and body composition using the Bioelectrical Impedance Analysis (BIA) method is a common approach in research and healthcare settings. BIA is a non-invasive method that estimates body composition by measuring the resistance of electrical flow through body tissues. Here's a step-by-step process for conducting these measurements using the BIA method:

Measuring Height:

I. Equipment Preparation: Ensure that a calibrated stadiometer (a device for measuring height) is set up and ready for use. Verify that it is placed on a level surface.

II. Participant Preparation: Instruct the participant to stand upright with their back against the stadiometer. Ask them to remove any headgear, shoes, or objects that might affect the measurement.

III. Measurement Procedure:

    - Ensure that the participant's heels, buttocks, and upper back are in contact with the stadiometer.
    - Adjust the stadiometer's headpiece to lightly touch the top of the participant's head.
    - Make sure the participant is looking straight ahead and not tilting their head.
    - Record the measurement to the nearest millimeter (or as specified by your protocol).

Measuring Waist Circumference:

I. Equipment Preparation: Have a flexible, non-stretchable measuring tape available.

II. Participant Preparation: Instruct the participant to stand with their feet together and arms at their sides. They should wear lightweight clothing.

III. Measurement Procedure:

- Identify the participant's waist, which is typically located midway between the lowest rib and the top of the hip bone.
- Wrap the measuring tape around the waist at the identified point, ensuring it is snug but not tight or compressing the skin.
- Make sure the tape is horizontal and parallel to the ground.
- Record the measurement in centimeters (or as specified by your protocol).

Measuring Body Composition with BIA:

I. Equipment Preparation: Ensure that a BIA device is set up and calibrated according to the manufacturer's instructions.

II. Participant Preparation: Instruct the participant to follow these guidelines:

   a. Avoid consuming food or beverages for at least four hours before the measurement.

   b. Abstain from strenuous physical activity for at least 12 hours prior.

   c. Avoid alcohol and caffeine for at least 24 hours before the measurement.

   d. Empty their bladder before the measurement.

   e. Remove any metallic objects, such as jewelry or watches, and wear lightweight, tight-fitting clothing.

III. Measurement Procedure:

   a. Position the participant comfortably, ensuring they are not in contact with any metallic surfaces.

   b. Apply conductive gel or electrodes to specific points on the body (e.g., on the hand and foot) as directed by the BIA device.

   c. Initiate the BIA measurement by following the device's instructions.

   d. Record the estimated values for body composition parameters, such as body fat percentage, lean body mass, and total body water.

IV. Data Recording: Store the BIA-derived data for analysis and future reference.

It's important to note that BIA measurements can be influenced by factors such as hydration status and recent physical activity, so standardizing participant preparation and measurement conditions is essential for accurate and reliable results. Additionally, always follow the specific guidelines provided by the BIA device manufacturer and consult with a trained healthcare professional if needed.

- Quality Control: Strict data quality control measures will be implemented.

6. Data Handling and Management:

- Storage: Data will be securely stored with anonymization of personal identifiers.
- Security: Robust data security measures, including encryption, will be employed.

7. Data Analysis Plan:

- Analysis: Statistical methods will be used to analyze changes over time and relationships between variables.
- Rigor: The analysis will adhere to established research standards.

8. Ethical Considerations:

- Privacy: Participant privacy and confidentiality will be maintained.
- Withdrawals: Procedures for participant withdrawals and concerns will be addressed ethically.

9. Reporting and Dissemination:

- Reporting: Study findings will be reported and published in peer-reviewed journals.
- Dissemination: Knowledge will be disseminated through presentations and collaboration with stakeholders.

10. Timeline and Milestones: - Timeline: Data collection will span over 18-24 months, with milestones for each assessment point and analysis.

11. Budget and Funding: - Budget: A budget breakdown includes resources for personnel, equipment, and other necessities. - Funding: Funding sources from collaborating entities are acknowledged.

12. References: - Cited references support the study's scientific foundation.

Appendices:

- Informed consent forms, questionnaires, and relevant documents are provided as appendices.
- Informed consent forms.
- Questionnaires and survey instruments.
- Any additional documents or materials relevant to the study.

Q1 Κωδικός αριθμός: ....

Αριθμός στρατιώτη: …………………………….

Q2 Ημερομηνία συμπλήρωσης ερωτηματολογίου: ……………………………………………………….

ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ

Έρευνα: Εκτίμηση του σωματικού βάρους και επιπέδων χοληστερόλης, γλυκεριδίων και ζάχαρης ορρού καθώς και θρεπτικών συστατικών και πρόσληψης τροφής των στρατιωτών στην Κύπρο κατά τη διάρκεια της θητείας τους

Ερευνητές: Σύνδεσμος Διαιτολόγων και Διατροφολόγων Κύπρου/ Πανεπιστήμιο Λευκωσίας

Επιβλέπων: Δρ Ελένη Π Ανδρέου, Αναπληρώτρια Καθηγήτρια Πανεπιστήμιο Λευκωσίας, Πρόεδρος ΣυΔιΚυ

Αγαπητοί συμμετέχοντες ,

Σας ευχαριστούμε θερμά για τη συμμετοχή σας στην έρευνα μας ,πρέπει να τονιστεί από την αρχή πως η έρευνα αυτή θα διεξαχθεί κάτω από εχεμύθεια. Θα θέλαμε να σας διαβεβαιώσουμε ότι οι πιο κάτω πληροφορίες θα τηρηθούν αυστηρά απόρρητες και ανώνυμες.

Θα συμπληρωθούν 2 ερωτηματολόγια: ένα κατά την κατάταξη και ένα σε ένα χρόνο.

Σας ευχαριστούμε για τη συνεργασία. Q4 . ΑΝΤΡΑΣ-1 ΓΥΝΑΙΚΑ-2

ΠΡΟΣΩΠΙΚΕΣ ΠΛΗΡΟΦΟΡΙΕΣ:

Ονοματεπώνυμο:……………………………………………………………………………………..

Q3. Ονομασία Στρατοπέδου /ΚΕΝ: …………………………………………………………………………

Πόσα χρόνια έχετε συμπληρώσει στο στρατό;
…………………………………………………………

Βαθμός:
…………………………………………………………………………….............................

Q5 *Ημερομηνία Γεννήσεως:
………………………………………………………………………………....

Διεύθυνση
κατοικίας:……………………………………………………………………………..…..

Q6. Δήμος /
Κοινότητα:………………………………………………………………………………………
….

Τηλέφωνο:
………………………………………………………………………………………………..

Διεύθυνση Διαδικτύου:
…………………………………………………………………………….............

Υπογραφή:
……………………………………………………………………………………………….

<u>ΜΕΡΟΣ Α.</u>

<u>* ΣΩΜΑΤΟΜΕΤΡΙΚΕΣ ΜΕΤΡΗΣΕΙΣ</u>

Q7 .A. Πώς θα περιγράφατε το βάρος σας;

A.1. Κάτω του φυσιολογικού	1
A.2. Φυσιολογικό βάρος	2
A.3. Άνω του φυσιολογικού	3
A.4. Δεν ξέρω	4

B. Ακριβείς Μετρήσεις:

Q8.1 B1.1.Βάρος(BW): ……kg, Q8.2 B1.2.Ύψος: …..…cm, Q8.3 B1.3.Περίμετρος Μέσης:……cm, Q8.4B1.4.ΑΠ: ……

<u>Q9 Βιοηλεκτρική αγωγιμότητα/εμπέδιση (BIA):</u>

Q.9.1 B2.1. Ποσοστό λιπώδους μάζας …………%

B2.2. Κιλά λιπώδους μάζας(FM) …………kg

B2.3. Κιλά άλιπης μάζας (FFM) ....kg

B2.4. Ποσοστό άλιπης μάζας …………% (θα υπολογιστεί) ($= \frac{FFM}{BW}$ X 100)

B2.5. Κιλά σε υγρά σώματος(TBW)…………kg

B2.6. Ποσοστό σωματικών υγρών ………..% (θα υπολογιστεί) ($= \frac{TBW}{BW}$ X 100)

B2.7. Βασικός μεταβολικός ρυθμός ………...kcal

Q9.2 B2.8**. ΔΜΣ = kg/m^2 = …………**

***Γ. Λιπομέτρηση με χρήση δερματοπτυχόμετρου :**

<u>ΜΟΝΟ: Όταν ο ΔΜΣ είναι > 40</u> .

Γ.1. Άνδρες(3 site formulas-abdomen, suprailiac, triceps):

Ποσοστό Λίπους: ....

Γ. 2. Γυναίκες (3 site formulas-abdomen, suprailiac, triceps):

Ποσοστό Λίπους: ....

<u>Q.10 Δ. Πόσα κιλά ήσασταν κατά την κατάταξη σας στο στρατό;</u> ☐

<u>Q.11 Ε. Από την ημέρα της κατάταξης μου:</u>

Δ.1. Έχασα 1-3 κιλά	1
Δ.2. Έχασα περισσότερο από 3 κιλά	2
Δ.3. Έχω βάλει 1-3 κιλά	3
Δ.4. Έβαλα περισσότερα από 3 κιλά	4
Δ.5. Δεν άλλαξε το βάρος μου	5

<u>ΜΕΡΟΣ Β.</u>

ΕΠΙΠΕΔΟ ΜΟΡΦΩΣΗΣ

Q.12 B1. Ποιο είναι το υψηλότερο επίπεδο εκπαίδευσης που έχετε επιτύχει;

• Δεν πήγα καθόλου σχολείο	1
• Δεν τέλειωσα το Δημοτικό	2
• Δημοτικό	3
• Γυμνάσιο (3 χρόνια)	4
• Λύκειο (απολυτήριο)	5
• Τριτοβάθμια – Μη πανεπιστημιακή	6
• Πανεπιστημιακή	7
• Πανεπιστημιακή - Μεταπτυχιακή	8

B2. Ποια η οικογενειακή σας κατάσταση;

• Άγαμος (η)	1
• Έγγαμος (η)	2
• Συζών (ούσα) με σύντροφο	3
• Σε διάσταση	4
• Διαζευγμένος (η)	5
• Χήρος (α)	6

B3 . Πόσα άτομα της οικογένειας ζουν στο σπίτι σας; ☐

B4. Κοινότητα / Ομάδα:

• Ελληνοκυπριακή	1

• Τουρκοκυπριακή	2
• Αρμενική	3
• Μαρωνίτικη	4
• Λατινική	5
• Άλλη	6

B5. Ποιο είναι το θρήσκευμά σας;

• Χριστιανός Ορθόδοξος	1
• Καθολικός (Μαρωνίτης)	2
• Μάρτυρας του Ιεχωβά	3
• Μουσουλμάνος	4
• Εβραίος	5
• Άλλο	6

B6. Επηρεάζεται η διατροφή σας από διατροφικούς περιορισμούς, είτε λόγω θρησκείας, είτε λόγω ιδεολογίας, είτε άλλων παθολογικών αιτιών, είτε χειρουργικής ή μη επέμβασης για απώλεια βάρους, ή για έλεγχο βάρους (αύξηση ή μείωση βάρους);

ΝΑΙ	**ΟΧΙ**
1	2

B*7. Εάν ναι, ποιές είναι αυτές;

(I)	Νηστεία		1
(II)	Θρησκεία:	Ορθόδοξοι	2
		Καθολικοί	3
		Μουσουλμάνοι	4
		Άλλοι ……………………………………	5
(III)	Χορτοφαγία:	Pesco (ψάρι, αυγά, γαλακτοκομικά προϊόντα)	6
		Γαλακτο-φυτοφάγος	7
		Γαλακτο-ωοφυτοφάγος	8
		Αυστηρός χορτοφάγος	9
		Ημι-χορτοφάγος (κοτόπουλο μόνο)	10
		Άλλοι ……………………………………	11
(IV)	Αθλητισμός		12
(V)	Υγεία		13
(VI)	Χειρουργική ή μη επέμβαση για απώλεια βάρους		
		Gastric Binding	14
		Gastric Bypass	15
		Gastric Balloon	16
		Άλλο………………………………………………..	17

B*8. Εάν απαντήσετε ναι στην ερώτηση 7 λόγω θρησκείας , πόσες μέρες του χρόνου νηστεύετε (σύμφωνα με τις νηστείες)**;**

Κάποτε	2φορές / εβδομάδα (104 μέρες)	Κάθε Χριστούγεννα (40 μέρες)	Κάθε Πάσχα (50 μέρες)	Καλοκαιρινή νηστεία (15-30 μέρες)	Όλες τις νηστείες του χρόνου (190 μέρες)

1	2	3	4	5	6

Β* 9. Έχετε διαγνωστεί από οποιεσδήποτε παθήσεις ή καταστάσεις υγείας που επηρεάζουν την διατροφή σας;

ΝΑΙ	ΟΧΙ
1	2

Β*10. Εάν ναι, ποιες είναι αυτές;

	ΝΑΙ	ΟΧΙ
Β.10.1 Καρδιοαγγειακά Νοσήματα	1	2
Β.10.2 Υπερλιπιδαιμία	1	2
Β.10.3 Καρκίνο	1	2
Β.10.4 Υπέρταση	1	2
Β.10.5 Υπόταση	1	2
Β.10.6 Χολολιθίαση	1	2
Β.10.7 Νεφρολιθίαση	1	2
Β.10.8 Τύπος 1 Διαβήτη	1	2
Β.10.9 Τύπος 2 Διαβήτη	1	2
Β.10.10 Αναπνευστικά	1	2
Β.10.11 Μεταβολικά Νοσήματα	1	2
Β.10.12 Διατροφικές δυσανεξίες ή αλλεργίες	1	2
Β.10.13 Οστεοπόρωση	1	2
Β.10.14 Οστεοπενία	1	2
Β.10.15 Μυονευρολογικά προβλήματα	1	2
Β. 10.16 Γαστρεντερολογικές παθήσεις ή συμπτώματα (π.χ. ευερέθιστο έντερο, γαστρίτιδα, γαστροασοφαγική παλινδρόμηση, καούρα, ρεψίματα κλπ)	1	2

Β.10.17 Διατροφικές διαταραχές	1	2
Β.10.18 Οποιαδήποτε πάθηση που περιορίζει την σωματική δραστηριότητα	1	2
Β.10.19 Στίγμα μεσογειακής αναιμίας	1	2
Β.10.20 Ψυχιατρικές ή Ψυχολογικές καταστάσεις	1	2
Β.10.21Οδοντιατρικά προβλήματα	1	2
Β.10.22 Δυσφαγία	1	2
Β.10.23 Σύνδρομο πολυκυστικών ωοθηκών	1	2
Β.10.24Παχυσαρκία	1	2
Β.10.25 Άλλες	1	2
Β.10.26 Από ποιες; …………………………………………………………………	1	2

ΙΑΤΡΙΚΟ ΙΣΤΟΡΙΚΟ

Β11. Αντιμετωπίζετε κάποια πάθηση ή πρόβλημα υγείας στο παρελθόν (μακροχρόνια ασθένεια);

ΝΑΙ	ΟΧΙ
1	2

Εάν ναι, ποιά; ………………………………………………………………………………

Β12. Αντιμετωπίζετε κάποια πάθηση ή πρόβλημα υγείας στο παρόν

(μακροχρόνια ασθένεια);

ΝΑΙ	ΟΧΙ
1	2

Εάν ναι, ποιά; ………………………………………………………………………………

Β*13. Ακολουθείτε κάποια φαρμακευτική αγωγή;

ΝΑΙ	ΟΧΙ

1	2

Εάν ναι, ποιά;
………………………………………………………………………………………………

………………………………………………………………………………………………………
……………

B14. Έχετε υποβληθεί σε χειρουργική επέμβαση τους τελευταίους 3 μήνες;

ΝΑΙ	ΟΧΙ
1	2

B15. Ακολουθείτε κάποιο συγκεκριμένο διαιτολόγιο που σας δόθηκε από διαιτολόγο;

ΝΑΙ	ΟΧΙ
1	2

B*16. Χρησιμοποιείτε οποιαδήποτε συμπληρώματα διατροφής;

ΝΑΙ	ΟΧΙ
1	2

Ποιά:
………………………………………………………………………………………………………
…....

………………………………………………………………………………………………………
..…

B17. Μήπως υποφέρατε με κάποια από τις πιο κάτω ασθένειες ή καταστάσεις υγείας τους τελευταίους 12 μήνες;

Ασθένειες	**ΝΑΙ**	**ΟΧΙ**
B.17.1 Υπέρταση (Ψηλή Αρτηριακή Πίεση)	1	2
B17.2 Υπόταση	1	2
B17.3 Δυσλιπιδαιμίες (π.χ. ψηλή χοληστερόλη, ψηλά τριγλυκερίδια)	1	2
B17.4 Διαβήτης	1	2
B17.5 Έμφραγμα	1	2
B17.6 Στηθάγχη (πόνος μετά από άσκηση)	1	2
B17.7 Καρδιακή ανεπάρκεια	1	2
B17.8 Ρευματισμοί ή αρθρίτιδα	1	2
B17.9 Οσφυαλγία	1	2
B17.10 Χρόνια βρογχίτιδα	1	2
B17.11 Βρογχικό άσθμα	1	2
B17.12 Εμμηνόπαυση (ή σε εμμηνόπαυση)	1	2
B17.13 Γαστρίτιδα ή έλκος	1	2
B17.14 Καρκίνος	1	2
B17.15 Οστεοπόρωση/ οστεοπενία	1	2
B17.16 Άλλο, διευκρινίστε ……………………	1	2

B18. Μήπως είχατε κάποιο από τα ακόλουθα συμπτώματα ή ενοχλήματα τον τελευταίο μήνα;

	ΝΑΙ	**ΟΧΙ**
B18.1 Πόνο στο στήθος κατά τη διάρκεια της άσκησης	1	2
B18.2 Πόνο στις αρθρώσεις	1	2
B18.3 Πόνο στη μέση	1	2

B18.4 Πόνο στο αυχένα ή στον ώμο	1	2
B18.5 Πρήξιμο στα πόδια	1	2
B18.6 Κιρσούς	1	2
B18.7 Έκζεμα	1	2
B18.8 Δυσκοιλιότητα	1	2
B18.9 Διάρροιες	1	2
B18.10 Εμετοί	1	2
B18.11 Πονοκέφαλο/Ημικρανίες	1	2
B18.12 Αϋπνία	1	2
B18.13 Κατάθλιψη	1	2
B18.14 Πονόδοντος	1	2

B19. Πήρατε οποιαδήποτε φάρμακα κατά τη διάρκεια της τελευταίας εβδομάδας;

	ΝΑΙ	**όχι**
B19.1 Για ψηλή πίεση	1	2
B19.2 Για ψηλή χοληστερόλη	1	2
B19.3 Για ψηλή ζάχαρη	1	2
B19.4 Για τον πονοκέφαλο	1	2
B19.5 Για άλλους πόνους	1	2
B19.6 Για το βήχα	1	2
B19.7 Ηρεμιστικά	1	2
B19.8 Βιταμίνες, μέταλλα	1	2
B19.9 Καθαρτικά	1	2

B20. Είσαστε υπό πίεση και άγχος τον τελευταίο μήνα (τριάντα ημέρες);

• Όχι καθόλου	1
• Ναι, αλλά όχι περισσότερο από τους άλλους ανθρώπους γενικά	2
• Ναι, περισσότερο από τους άλλους ανθρώπους γενικά	3
• Ναι, η ζωή μου είναι σχεδόν αφόρητη	4

B21. Πότε μετρήσατε την (αρτηριακή σας) πίεση για τελευταία φορά;

• Μέσα στον προηγούμενο χρόνο	1
• Πριν από 1 – 5 χρόνια	2
• Πριν πάνω από 5 χρόνια	3
• Ποτέ	4
• Δεν ξέρω	5

B22. Πότε μετρήσατε τη χοληστερόλη σας για τελευταία φορά;

• Μέσα στον προηγούμενο χρόνο	1
• Πριν από 1 – 5 χρόνια	2
• Πριν πάνω από 5 χρόνια	3
• Ποτέ	4
• Δεν ξέρω	5

ΚΑΠΝΙΣΜΑ

B* 23. Καπνίζετε τώρα ή στο παρελθόν, και αν έχετε διακόψει πριν πόσο καιρό;

• Όχι, δεν καπνίζω και δεν κάπνιζα ποτέ	1
• Ναι, καπνίζω	2

• Κάπνιζα για .... χρόνια	3
• Κάπνιζα για .... μήνες	4
• Διέκοψα πριν .... χρόνια	5
• Διέκοψα πριν .... μήνες	6

B24. Πόσα τσιγάρα καπνίζετε την ημέρα;

• Δεν καπνίζω	1
• Ευκαιριακά(<1 τσιγάρο/ημέρα)	2
• 1-10 τσιγάρα	3
• 11-20 τσιγάρα	4
• 1-2 πακέτα	5
• >3 πακέτα	6
• 1≥ πούρο	7

<u>ΜΕΡΟΣ Γ.</u>

ΔΙΑΤΡΟΦΙΚΕΣ ΣΥΝΗΘΕΙΕΣ

Γ25. Αναφέρετε πιο κάτω τι έχετε καταναλώσει τις τελευταίες 3 ημέρες (βλέπετε σελ 26).

Γ26. Είναι αυτός ο καθημερινός τρόπος διατροφής σας;

ΝΑΙ	**ΟΧΙ**
1	2

Εάν όχι, πως και γιατί έχει αλλάξει;

……………………………………………………………………………………………………
…………....

……………………………………………………………………………………………..……
……………..…

Γ27. Λαμβάνετε πρωϊνό ή/και δεκατιανό;

- Μόνο πρωϊνό 1
- Μόνο Δεκατιανό 2
- Και τα δύο 3
- Τίποτα 4

Γ*28. Τι περιλαμβάνει συνήθως το πρωϊνό ή/και δεκατιανό σας;

	Πρωινό	**Δεκατιανό**

Γ.28.1 Καφέ	1	2
Γ.28.2 Γάλα	1	2
Γ.28.3 Καφές με γάλα	1	2
Γ.28.4 Τσάι	1	2
Γ.28.5 Χυμό	1	2
Γ.28.6 Γάλα με δημητριακά/ζάχαρη/μέλι/σοκολάτα	1	2
Γ.28.7 Γάλα με δημητριακά χωρίς ζάχαρη/ δημητριακά με φυτικές ίνες	1	2
Γ.28.8 Ψωμί με μέλι / μαρμελάδα	1	2
Γ.28.9 Ψωμί με μέλι/ μαρμελάδα και βούτυρο/ μαργαρίνη	1	2
Γ.28.10 Ψωμί με διάφορα είδη τυριού	1	2
Γ.28.11 Γάλα με αυγό και ψωμί	1	2
Γ.28.12 Αρτοποιήμα	1	2
Γ.28.13 Σάντουιτς	1	2
Γ.28.14 Φρούτα	1	2
Γ.28.15 Άλλο	1	2

Γ29. Πόσα γεύματα τρώτε την ημέρα;

Γ30. Τρώτε καθημερινά μεσημεριανό ή/και βραδινό:

	Ναι	**Όχι**
Γ.30.1 Και τα δύο	1	2
Γ.30.2 Κανένα	1	2
Γ.30.3 Μόνο μεσημεριανό	1	2
Γ.30.4 Μόνο βραδινό	1	2

Γ31. Πόσα ενδιάμεσα γεύματα (μικρογεύματα)/δεκατιανά τρώτε την ημέρα;

Γ32. Έχετε σταθερές ώρες γεύματος;

	Ναι	Όχι
Γ.32.1 Πρόγευμα	1	2
Γ.32.2 Μεσημεριανό	1	2
Γ.32.3 Βραδινό	1	2
Γ.32.4 Ενδιάμεσα	1	2

Γ33. Τι είδους λίπος χρησιμοποιείτε συνήθως στο σπίτι για μαγείρεμα;

(επιλέξετε μόνο μια απάντηση)

• Ελαιόλαδο	1
• Μαργαρίνη	2
• Μαργαρίνη με φυτοστερόλες	3
• Βούτυρο	4
• Ζωικό λίπος	5
• Άλλα φυτικά λάδια (σπορέλαια κλπ)	6
• Δεν χρησιμοποιώ λίπος	7
• Δεν ξέρω	8
• Δεν ετοιμάζω συνήθως φαγητό	9

Γ34.Τα γεύματα σας περιλαμβάνουν κρέας ή υποκατάστατα και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ** **(π.χ. πόσες φορές** **τη μέρα/βδομάδα/μήνα)**
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Κοτόπουλο	1	2	3	4	5	
Βοδινό	1	2	3	4	5	
Αρνί	1	2	3	4	5	
Χοιρινό	1	2	3	4	5	
Πάπια	1	2	3	4	5	
Κουνέλι	1	2	3	4	5	
Λαγό	1	2	3	4	5	
Γαλοπούλα	1	2	3	4	5	
Θαλασσινά/ μαλάκια	1	2	3	4	5	
Ψάρι	1	2	3	4	5	
Ψάρι σε κονσέρβα	1	2	3	4	5	
Αβγό	1	2	3	4	5	
Αλλαντικά	1	2	3	4	5	
Λουκάνικα	1	2	3	4	5	
Σόγια	1	2	3	4	5	

Γ35.Τα γεύματα σας περιλαμβάνει ψωμί/δημητριακα /όσπρια και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές τη μέρα/βδομάδα/μήνα)**
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Ψωμί-ασπρο	1	2	3	4	5	
Κουλούρι με σουσάμι	1	2	3	4	5	
Ψωμί –ολικής αλέσεως	1	2	3	4	5	
Ψωμί-κριθαρένιο	1	2	3	4	5	
Ψωμί σικάλεως	1	2	3	4	5	
Πιττα	1	2	3	4	5	
Όσπρια, βραστά	1	2	3	4	5	
Όσπρια, γιαχνι	1	2	3	4	5	
Ρύζι	1	2	3	4	5	
Πουρνουρι	1	2	3	4	5	
Κριθαράκι	1	2	3	4	5	
Μακαρόνια, βραστά με τυρί	1	2	3	4	5	
Μακαρόνια, βραστά, σκέτα	1	2	3	4	5	
Μακαρόνια, βραστά,με ντομάτα	1	2	3	4	5	

Ραβίολες	1	2	3	4	5	
Παστίτσιο	1	2	3	4	5	
Μπιζέλι	1	2	3	4	5	
Καλαμπόκι	1	2	3	4	5	
Κολοκασι	1	2	3	4	5	
Τραχανά	1	2	3	4	5	
Λουβανα	1	2	3	4	5	
Αυγολέμονο	1	2	3	4	5	
Πατάτα, βραστή	1	2	3	4	5	
Πατάτα, φούρνου	1	2	3	4	5	
Πατάτα,τηγανιτ ή	1	2	3	4	5	
Δημητριακά προγεύματος	1	2	3	4	5	
Βρώμη	1	2	3	4	5	

Γ36.Τα γεύματα σας περιλαμβάνουν γάλα/ γαλακτοκομικά προϊόντα και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές Τη μέρα/ βδομάδα/μήνα)**
	Εβδομάδ α	Μήν α	Καθημεριν ά	Χρόν ο	Ποτ έ	
Γάλα Πλήρες	1	2	3	4	5	
Ζαχαρούχο	1	2	3	4	5	
Άπαχο	1	2	3	4	5	
Χωρίς λακτόζη	1	2	3	4	5	

Σκόνη, αποβουτ	1	2	3	4	5	
Εβαπορέ	1	2	3	4	5	
Ρυζιού/Καρύδας/Σόγιας Αμυγδάλου	1	2	3	4	5	
Τυρί	1	2	3	4	5	
Τυρί Χαμηλό σε λιπαρά	1	2	3	4	5	
Χαλούμι	1	2	3	4	5	
Χαλούμι χαμηλό σε λιπαρά	1	2	3	4	5	
Αναρή φρέσκα	1	2	3	4	5	
Αναρη Ξηρή	1	2	3	4	5	
Φέτα	1	2	3	4	5	
Κατσικίσιο	1	2	3	4	5	
Ομοίωμα τυριού/ νηστίσιμο	1	2	3	4	5	
Γιαούρτι	1	2	3	4	5	
Γιαούρτι, χαμηλό σε λιπαρά	1	2	3	4	5	
Γιαούρτι, φρούτου	1	2	3	4	5	

Γ37.Τα γεύματα σας περιλαμβάνουν φρούτα και λαχανικά και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές τη μέρα/βδομάδα/μήνα)**
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Φρέσκα φρούτα	1	2	3	4	5	

Παστά φρούτα	1	2	3	4	5	
Φρούτα,κονσέρβας με χυμό	1	2	3	4	5	
Φρούτα ,κονσέρβας με σιρόπι	1	2	3	4	5	
Χυμό φρούτου	1	2	3	4	5	
Φρουτοσαλάτα	1	2	3	4	5	
Λαχανικά , ωμά (πχ σαλάτα)	1	2	3	4	5	
Λαχανικά, βραστά	1	2	3	4	5	
Λαχανικά , λαδερά	1	2	3	4	5	
Χυμό λαχανικών	1	2	3	4	5	

Γ38.Τα γεύματα σας περιλαμβάνουν λίπη/ έλαια/ξηρους καρπούς και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές τη μέρα/βδομάδα/μήνα)**
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Ελαιόλαδο	1	2	3	4	5	

Φυστικελαιο	1	2	3	4	5	
Σογιέλαιο	1	2	3	4	5	
Αμύγδαλα	1	2	3	4	5	
Καρύδια	1	2	3	4	5	
Κάστανα	1	2	3	4	5	
Σουσάμι	1	2	3	4	5	
Ταχινή	1	2	3	4	5	
Φιστίκια	1	2	3	4	5	
Φυστικοβουτυρ ο	1	2	3	4	5	
Άλλους ξηρούς καρπούς, χωρίς αλάτι	1	2	3	4	5	
Άλλους ξηρούς καρπούς, με αλάτι	1	2	3	4	5	
Μαργαρίνη	1	2	3	4	5	
Μαργαρίνη με φυτοστερολες	1	2	3	4	5	
Βούτυρο	1	2	3	4	5	
Λαρδί	1	2	3	4	5	
Ελιές Μαύρες	1	2	3	4	5	
Ελιές Πράσινες	1	2	3	4	5	

Γ39.Τα γεύματα σας περιλαμβάνουν γλυκά/ αλμύρα/ ποτά/άλλα τρόφιμα ή ορεκτικά και πόσο συχνά

	Πόσο συχνά					ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές τη μέρα/βδομάδα/μήνα)
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Γλυκά κουταλιού	1	2	3	4	5	
Χαλβάς Μακεδονικό	1	2	3	4	5	
Χαλβάς κατσαρόλας	1	2	3	4	5	
Μπακλαβά ή με φύλο νηστίσιμα	1	2	3	4	5	
Σπιτίσια γλυκά	1	2	3	4	5	
Ζαχαροπλαστείου (βιομηχανοποιημένα)	1	2	3	4	5	
Μέλι	1	2	3	4	5	
Μαρμελάδα	1	2	3	4	5	
Μαρμελάδα, σπιτίσια	1	2	3	4	5	
Χαρουπόμελο	1	2	3	4	5	
Μπισκότα	1	2	3	4	5	
Αρτοποιήματα, νηστίσιμα	1	2	3	4	5	
Αρτοποιήματα	1	2	3	4	5	
Τσιπς	1	2	3	4	5	
Κρασί	1	2	3	4	5	
Ουίσκι	1	2	3	4	5	
Μπύρα	1	2	3	4	5	

Ζηβανια	1	2	3	4	5	
Ούζο	1	2	3	4	5	
Χούμους	1	2	3	4	5	
Ταραμά	1	2	3	4	5	
Φρουτοποτό	1	2	3	4	5	
Σκουως	1	2	3	4	5	
Αναψυκτικό	1	2	3	4	5	
Αναψυκτικό, light	1	2	3	4	5	
Καφές	1	2	3	4	5	
Καφές, ντεκαφεινέ	1	2	3	4	5	
Τσάι	1	2	3	4	5	
Τσάι , βότανα	1	2	3	4	5	
Σούπες	1	2	3	4	5	
Άλλα	1	2	3	4	5	

Γ40.Τα γεύματα σας περιλαμβάνουν ψάρι /μαλάκια και πόσο συχνά :

	Πόσο συχνά					**ΣΥΧΝΟΤΗΤΑ (π.χ. πόσες φορές Τη μέρα/ βδομάδα/μήνα)**
	Εβδομάδα	Μήνα	Καθημερινά	Χρόνο	Ποτέ	
Τσιπούρα	1	2	3	4	5	
Λαυράκι	1	2	3	4	5	
Σφυρίδα	1	2	3	4	5	
Τόνο	1	2	3	4	5	
Σουπιές	1	2	3	4	5	
Χταπόδια	1	2	3	4	5	
Καλαμάρι	1	2	3	4	5	

Άλλο:	1	2	3	4	5	

Γ41. Πόσες ώρες κοιμάστε την ημέρα;

• 2-5 ώρες	1
• 6-8 ώρες	2
• > ώρες	3

Γ42. Αγοράζετε τρόφιμα από τα Κ.Ψ.Μ. (Κέντρο Ψυχαγωγίας Μονάδας);

ΝΑΙ	ΟΧΙ
1	2

Εάν ναι, πόσο συχνά:

Γ.42.1	ποτέ	1
Γ42.2	1-3 ημέρες	2
Γ.42.3	4-5 ημέρες	3
Γ.42.4	6-7 ημέρες	4
Γ.42.5	Καθημερινά	5

Γ43. Πόσο συχνά τρώτε εκτός στρατοπέδου (π.χ. εστιατόριο, take-away, fast food);

• Ποτέ	1
• Λίγες φορές το χρόνο	2
• 2 – 3 φορές το μήνα	3
• Μια φορά την εβδομάδα	4
• 2 – 3 φορές την εβδομάδα	5
• Καθημερινά	6

Γ*44. Τι είδους γάλα πίνετε συνήθως; (επιλέξετε μόνο μια απάντηση)

• Ολόπαχο	1
• Ημιάπαχο	2
• Άπαχο	3
• Σκόνη	4
• Εμπλουτισμένο με ω3 λιπαρά	5
• Εμπλουτισμένο με ασβέστιο	6
• Γάλα εμπλουτισμένο με φυτικές στερόλες	7
• Χωρίς ή με μειωμένη λακτόζη	8
• Εβαπορέ	9
• Ζαχαρούχο	10
• Γάλα σοκολάτας ή άλλο αρωματισμένο ή με ζάχαρη	11
• Γάλα σόγιας/ ρυζιού (εμπλουτισμένο με ασβέστιο ή μη)	12
• Δεν πίνω γάλα	13

Γ45. Πόσα φλιτζάνια τσάι ή καφέ πίνετε την ημέρα;

Είδος	**0 φλιτζάνια**	**1-2 φλιτζάνια**	**≥3 φλιτζάνια**
1. Στιγμιαίος καφές	1	2	3
2. Ντεκαφεινέ καφές	1	2	3
3. Κυπριακός καφές	1	2	3
4. Άλλος καφές	1	2	3
5. Τσάι μαύρο	1	2	3
6. Τσάι από βότανα ή αρωματικά	1	2	3

7. Τσάι ντεκαφεινέ	1	2	3
8. Καφέ με αρωματικά	1	2	3

Γ46. Πόσους κύβους ή πόσα κουταλάκια επιτραπέζιας ζάχαρης/μέλι χρησιμοποιείτε σε ένα φλιτζάνι καφέ ή τσάι; (σημειώστε 0 αν δεν χρησιμοποιείτε ζάχαρη)

Γ.46.1 Κύβους ή κουταλάκια σε ένα φλιτζάνι καφέ		
Γ46.2 Κύβους ή κουταλάκια σε ένα φλιτζάνι τσάι		
Γ46.3 Κουταλάκια υποκατάστατο της ζάχαρης		

Γ*47. Πόσο νερό πίνετε την ημέρα;

0φλ	1-4φλ	5-8φλ	>8φλ
1	2	3	4

Γ48. Τρώτε φρούτα καθημερινά;

ΝΑΙ	**ΟΧΙ**
1	2

Γ48.1 Εάν ναι πόσα:
………………………………………………………………………………………

Γ49. Αυτή η εβδομάδα ήταν αντιπροσωπευτική της συνηθισμένης σας διατροφής;

Ναι	**Όχι**
1	2

Γ50. Το αλάτι που χρησιμοποιώ είναι;

• Αυτό που ήδη υπάρχει στο φαγητό	1
• Επιπρόσθετο του μαγειρέματος	2
• Χρησιμοποιώ lo-salt	3
• Δεν χρησιμοποιώ καθόλου αλάτι	4
• Δεν χρησιμοποιώ αλάτι αλλά ζωμό	5
• Αλάτι από βότανα / αρωματικά	6

Γ51. Τρόπος Μαγειρέματος και συχνότητα

Τρόπος	**Ποτέ**	**1 – 2 φορές την εβδομάδα**	**3 – 5 φορές την εβδομάδα**	**6 – 7 φορές την εβδομάδα**	**1 -2 φορές τον μήνα**
Βραστά, Ατμού	1	2	3	4	5
Σχάρας	1	2	3	4	5
Τηγανιτά	1	2	3	4	5
Με σάλτσα ντομάτας	1	2	3	4	5
Με σάλτσα κρέμας	1	2	3	4	5
Σοταρισμένα	1	2	3	4	5

Γ52. Έχετε αλλάξει τη διατροφή σας ή άλλες συνήθειες για λόγους υγείας;

	ΝΑΙ	**ΟΧΙ**
Γ52.1 Τρώγω λιγότερο λίπος (π.χ. κρέας)	1	2
Γ52.2 Άλλαξα το είδος του λίπους που τρώγω	1	2

Γ52.3 Τρώγω πιο πολλά λαχανικά και φρούτα	1	2
Γ52.4 Τρώγω λιγότερη ζάχαρη	1	2
Γ52.5 Τρώγω λιγότερες αμυλούχες τροφές	1	2
Γ52.6 Τρώγω λιγότερο αλάτι	1	2
Γ52.7 Είμαι σε δίαιτα για απώλεια βάρους	1	2
Γ52.8 Πίνω λιγότερο αλκοόλ	1	2
Γ52.9 Ασκούμαι περισσότερο	1	2
Γ52.10 Άλλοι λόγοι……………………………………………………………………	1	2

Γ53. Διαβάζετε τις επιγραφές τροφίμων;

Ναι	**Όχι**
1	2

Γ* 54. Σε μια επιγραφή τροφίμων υπάρχουν οι ακόλουθες πληροφορίες. Ποιες από αυτές σας ενδιαφέρουν έως καταναλωτή και πόσο συχνά τις αναζητάτε;

	Δεν τις κοιτάζω ποτέ	Μερικές φορές	Κάθε φορά που ψωνίζω
Γ54.1 Περιεκτικότητα σε θρεπτικά συστατικά (nutrient content)	1	2	3
Γ54.2 Θερμιδική αξία	1	2	3
Γ54.3 Κατάλογος συστατικών	1	2	3
Γ54.4 “Health claim” - Ισχυρισμοί Υγείας	1	2	3

Γ* 55. Για ποιους λόγους πιστεύετε ότι μπορεί να είναι σημαντικό να διαβάζετε τις επιγραφές των τροφίμων;

• Δεν πιστεύω ότι είναι σημαντικό	1
• Για έλεγχο του βάρους	2
• Για έλεγχο του ποσοστού του διατροφικού λίπους	3
• Για έλεγχο των προσθέτων στα τρόφιμα	4
• Για trans-λιπαρά οξέα	5
• Για το ασβέστιο	6
• Άλλο	7

ΚΑΤΑΝΑΛΩΣΗ ΟΙΝΟΠΝΕΥΜΑΤΟΣ

Γ56. Τον τελευταίο χρόνο (12 μήνες) σας συμβούλευσε κάποιος από τους πιο κάτω να πίνετε λιγότερο;

	ΝΑΙ	**ΟΧΙ**
Γ.56.1 Ιατρός	1	2
Γ.56.2 Διαιτολόγος	1	2
Γ.56.3 Μέλος της οικογένειας	1	2
Γ.56.4 Άλλος	1	2

<u>ΜΕΡΟΣ Δ.</u>

ΑΣΚΗΣΗ

Δ57. Σωματική άσκηση/ φυσική Δραστηριότητα

• Καθόλου	1
• 1-2 φορές /εβδομάδα	2
• 3-4 φορές /εβδομάδα	3
• 5-6 φορές /εβδομάδα	4
• Κάθε μέρα	5
• Άλλο	7

Δ58. Κατά μέσο όρο πόσα λεπτά/ώρα αφιερώνετε σε κάθε είδος σωματικής άσκησης/φυσικής δραστηριότητας εβδομαδιαία.(δηλώστε όσα ισχύουν)

Δ58. 1 Βάδισμα/τρέξιμο	**……….. λεπτά …………… ώρα**
Δ58. 2 Ποδήλατο	**……….. λεπτά …………… ώρα**
Δ58. 3 Κολύμπι	**……….. λεπτά …………… ώρα**
Δ58. 4 Ομαδικό άθλημα	**……….. λεπτά …………… ώρα**
Δ58. 5 Ασχολίες στον κήπο	**……….. λεπτά …………… ώρα**
Δ58. 6 Άσκησης στο στρατόπεδο	**……….. λεπτά …………… ώρα**

Δ58. 7 Καθαριότητα	**……….. λεπτά …………… ώρα**
Δ58. 8 Μαγείρεμα	**……….. λεπτά …………… ώρα**
Δ58. 9 Γεωργικές ασχολίες	**……….. λεπτά …………… ώρα**

Δ *59. Κατά τη γνώμη σας ποιος(οι) από τους ακόλουθους παράγοντες είναι

Δ59 (α) ο σπουδαιότερος λόγος για το ψηλό δείκτη θνησιμότητας στην χώρα μας;

Δ59 (β) δώστε ακόμα δύο λόγους;

Δ59 (γ) ΑΡΙΘΜΕΙΣΤΕ (1,2,3) κατά προτίμηση

• Λανθασμένη διατροφή	1	
• Άγχος	2	
• Δύσκολες συνθήκες διαβίωσης	3	
• Βαριά εργασία	4	
• Κάπνισμα	5	
• Όχι φυσική άσκηση	6	
• Έλλειψη βιταμινών η ιχνοστοιχείων	7	
• Παχυσαρκία	8	
• Γενετικοί παράγοντες	9	
• Οινόπνευμα	10	
• Έλλειψη υπηρεσιών υγείας	11	

- Άλλο διευκρινίστε
  ……………………………………………………………………

12	

Πηγή: *Μέρος του ερωτηματολογίου αυτού πάρθηκε και προσαρμόστηκε από το ερωτηματολόγιο του Συνδέσμου Διαιτολόγων και Διατροφολόγων Κύπρου για την Επιδημιολογική έρευνα του έρευνα με θέμα «το ποσοστό της παχυσαρκίας και υπερβάλλοντος βάρους στην Κύπρο και διαπίστωση των διατροφικών συνηθειών του Κύπριου πολίτη, 2005-2009».*

Ημερολόγιο Διατροφής: ΗΜΕΡΟΜΗΝΙΑ ______________________________________

Όνομα:____

Ημέρες: Δευτέρα ☐ Τρίτη ☐ Τετάρτη ☐ Πέμπτη ☐ Παρασκευή ☐ Σάββατο ☐ Κυριακή ☐

ΓΕΥΜΑ	ΕΙΔΟΣ & ΠΟΣΟΤΗΤΑ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ	ΤΡΟΠΟΣ ΠΟΥ ΠΡΟΕΤΟΙΜΑΣΤΗΚΕ	ΧΩΡΟΣ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ (ΣΠΙΤΙ, ΣΤΡΑΤΟ, ΚΤΛ)
Πρόγευμα:			
Ενδιάμεσο:			

Μεσημεριανό:			
Δείπνο:			
Ενδιάμεσο:			

Συμπληρώματα διατροφής Όνομα:___________________ Ημέρα: __________________

Συμπληρώματα βιταμινών / ιχνοστοιχείων: ______________________________________

BMI =	**ΓΙΑ ΕΠΙΣΗΜΗ ΧΡΗΣΗ** **ΑΡΙΘΜΟΣ:** ________ **ΗΛΙΚΙΑ:** _______

Ημερολόγιο Διατροφής: ΗΜΕΡΟΜΗΝΙΑ ____

Όνομα:____

Ημέρες: Δευτέρα ☐ **Τρίτη** ☐ **Τετάρτη** ☐ **Πέμπτη** ☐ **Παρασκευή** ☐ **Σάββατο** ☐ **Κυριακή** ☐

ΓΕΥΜΑ	**ΕΙΔΟΣ & ΠΟΣΟΤΗΤΑ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ**	**ΤΡΟΠΟΣ ΠΟΥ ΠΡΟΕΤΟΙΜΑΣΤΗΚΕ**	**ΧΩΡΟΣ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ (ΣΠΙΤΙ, ΣΤΡΑΤΟ, ΚΤΛ)**
Πρόγευμα:			
Ενδιάμεσο:			

Μεσημεριανό:			
Δείπνο:			
Ενδιάμεσο:			
Συμπληρώματα διατροφής Όνομα:__________________ Ημέρα: _________________ **Συμπληρώματα βιταμινών / ιχνοστοιχείων: ____________________________________**			

BMI =	**ΓΙΑ ΕΠΙΣΗΜΗ ΧΡΗΣΗ** **ΑΡΙΘΜΟΣ: ________** **ΗΛΙΚΙΑ: _______**

Ημερολόγιο Διατροφής: ΗΜΕΡΟΜΗΝΙΑ ____

Όνομα:____

Ημέρες: Δευτέρα ☐ Τρίτη ☐ Τετάρτη ☐ Πέμπτη ☐ Παρασκευή ☐ Σάββατο ☐ Κυριακή ☐

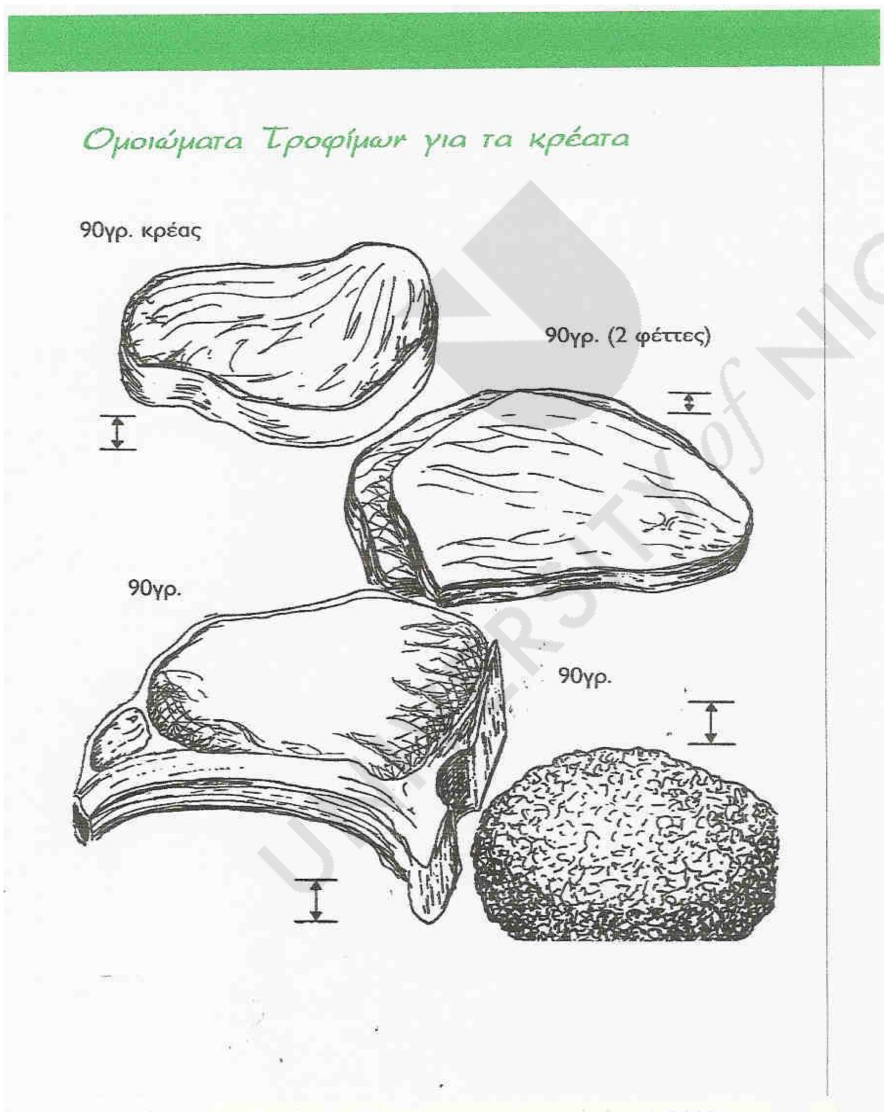
ΓΕΥΜΑ	**ΕΙΔΟΣ & ΠΟΣΟΤΗΤΑ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ**	**ΤΡΟΠΟΣ ΠΟΥ ΠΡΟΕΤΟΙΜΑΣΤΗΚΕ**	**ΧΩΡΟΣ ΠΟΥ ΚΑΤΑΝΑΛΩΘΗΚΕ (ΣΠΙΤΙ, ΣΤΡΑΤΟ, ΚΤΛ)**
Πρόγευμα:			
Ενδιάμεσο:			

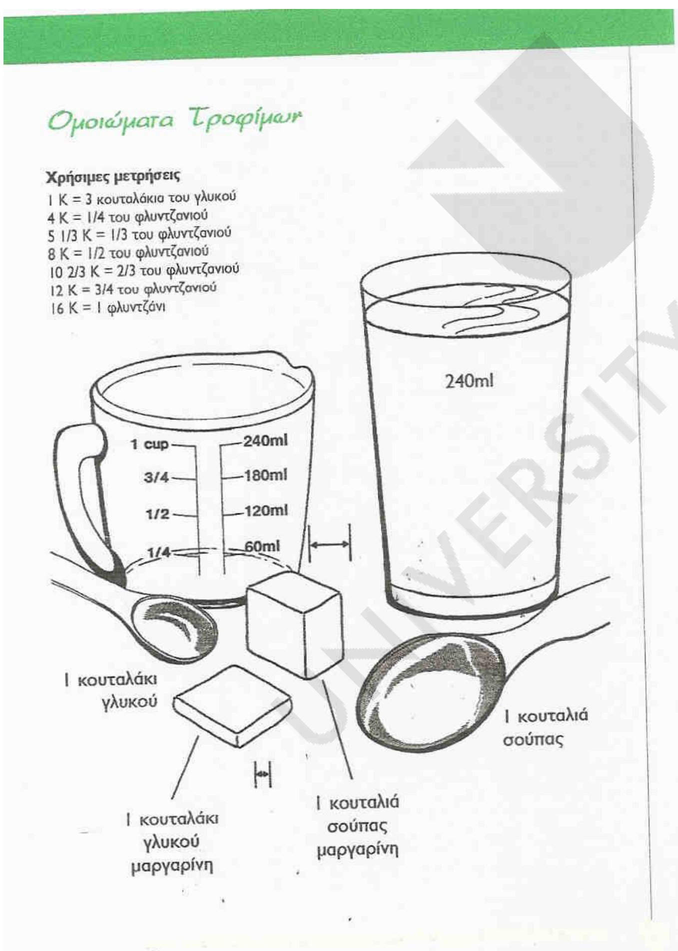
Μεσημεριανό:			
Δείπνο:			
Ενδιάμεσο:			

Συμπληρώματα διατροφής Όνομα:__________________ Ημέρα: _________________

Συμπληρώματα βιταμινών / ιχνοστοιχείων: ______________________________________

BMI =	**ΓΙΑ ΕΠΙΣΗΜΗ ΧΡΗΣΗ** **ΑΡΙΘΜΟΣ: ________** **ΗΛΙΚΙΑ: _______**

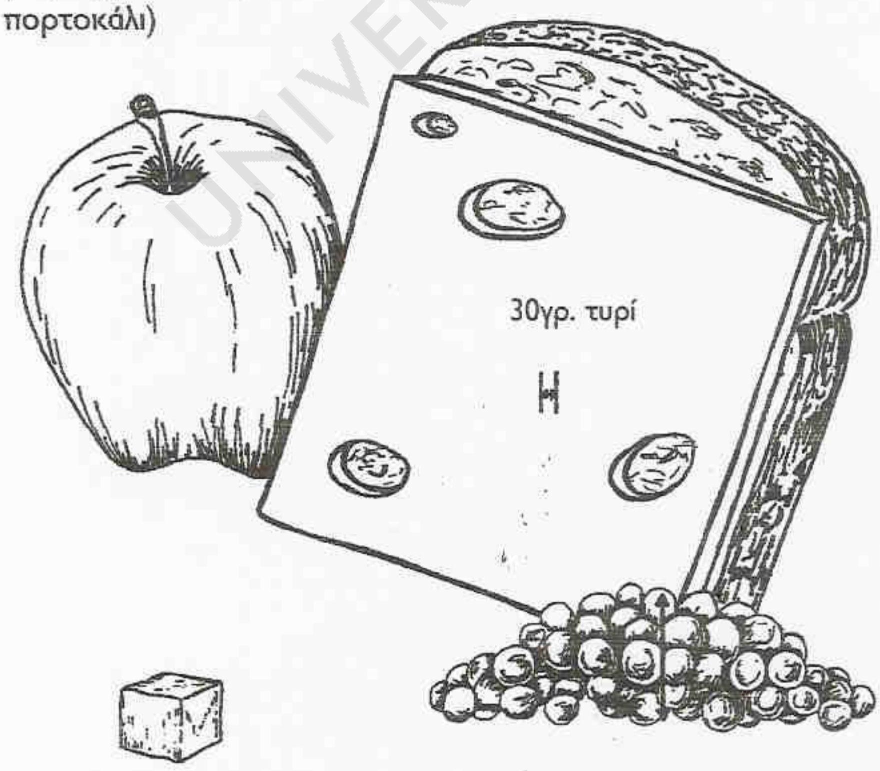



Ομοιώματα Τροφίμων
Χρήσιμες μετρήσεις
1 K = 3 κουταλάκια του γλυκού
4 K = 1/4 του φλυντζανιού
5 1/3 K = 1/3 του φλυντζανιού
8 K = 1/2 του φλυντζανιού
10 2/3 K = 2/3 του φλυντζανιού
12 K = 3/4 του φλυντζανιού
16 K = 1 φλυντζάνι
1 cup
3/4
1/2
1/4
240ml
180ml
120ml
60ml
240ml
1 κουταλάκι γλυκού
1 κουταλιά σούπας
1 κουταλάκι γλυκού μαργαρίνη
1 κουταλιά σούπας μαργαρίνη

Ομοιώματα Τροφίμων

Μέτριο φρούτο
(Μήλο, ροδάκινο,
πορτοκάλι)

1 φέτα ψωμί



APPENDIX 2

BIOETHICS APPLICATION

(REQUEST FORM FOR REVIEW OF RESEARCH PROPOSALS)

Εθνική Επιτροπή Βιοηθικής Κύπρου (ΕΕΒΚ)
Έντυπο Αίτησης για Γνωμοδότηση Ερευνητικών Προτάσεων

Α. Στοιχεία Ερευνητικής Πρότασης	
Τίτλος ερευνητικής πρότασης	Longitudinal Study on the Nutritional Habits, Body Composition, and Dietary Intake of Male Soldiers in Cyprus
Επιστημονικός υπεύθυνος έρευνας και φορέας στον οποίο ανήκει	*Καθ. Ελένη Ανδρέου* *Πανεπιστήμιο Λευκωσίας* *(Life Sciences Department, University of Nicosia)*
Φορέας χρηματοδότησης της έρευνας	*Σύνδεσμος Διαιτολόγων και Διατροφολόγων Κύπρου*

Παρακαλώ συμπληρώστε όλες τις ενότητε

Β. Στοιχεία Αιτητή/τριας	
Ονοματεπώνυμο	Eleni Andreou/Νικολέττα Ντορζή
Διεύθυνση Αλληλογραφίας	48 Themistokli Dervi str, Off. 207, Athienitis Centennial Bldg, 1066 Nicosia, Cyprus.
Αρ. Τηλεφώνου	99464040/22452288
Αρ. Τηλεομοιότυπου (Fax)	+357 22452292
Διεύθυνση Ηλεκτρονικού Ταχυδρομείου	Andreou.el@unic.ac.cy

Επαγγελματικός Τίτλος	Κλινική Διαιτολόγος RDN

Δ. Λεπτομέρειες έρευνας	***Ναι***	***Όχι***
1. Στη συγκεκριμένη έρευνα θα συμμετέχουν άνθρωποι;	***x***	
2. Η έρευνα αφορά συμμετοχή εθελοντών σε έρευνα κοινωνικών ή ανθρωπιστικών επιστημών;	***x***	
3. Υπάρχουν άτομα που αδυνατούν να συμπληρώσουν το έντυπο συγκατάθεσης;		***x***
4. Η έρευνα περιλαμβάνει ευάλωτες ομάδες ή ευάλωτα άτομα;		***x***
5. Θα συμμετάσχουν παιδιά ή ανήλικοι στην έρευνα;		***x***
6. Θα συμμετάσχουν ασθενείς στην έρευνα;		***x***
7. Θα συμμετάσχουν υγιείς εθελοντές σε ιατρική μελέτη;	***x***	
8. Η συγκεκριμένη έρευνα περιλαμβάνει οποιεσδήποτε παρεμβάσεις στους συμμετέχοντες;		***x***
9. Περιλαμβάνει επεμβατικές τεχνικές ή/και διαδικασίες;		***x***
10. Περιλαμβάνει συλλογή βιολογικών δειγμάτων;		***x***
11. Η συγκεκριμένη έρευνα περιλαμβάνει συλλογή ή/και επεξεργασία προσωπικών δεδομένων;		***x***
12. Περιλαμβάνει τη συλλογή ή/και επεξεργασία ευαίσθητων προσωπικών δεδομένων (π.χ. υγεία, σεξουαλική ταυτότητα, εθνικότητα, πολιτικές απόψεις, θρησκευτικές ή φιλοσοφικές πεποιθήσεις);		***x***
13. Περιλαμβάνει την επεξεργασία γενετικών πληροφοριών;		***x***
14. Περιλαμβάνει την παρακολούθηση ή παρατήρηση των συμμετεχόντων;	***x***	
15. Αυτή η έρευνα περιλαμβάνει περαιτέρω επεξεργασία των προσωπικών δεδομένων που συλλέχθηκαν σε προηγούμενα στάδια (δευτερεύουσα χρήση);		***x***
16. Η ερευνητική πρόταση περιλαμβάνει έρευνα που στοχεύει στην ανθρώπινη κλωνοποίηση για αναπαραγωγικούς σκοπούς;		***x***

17. Η έρευνα αυτή στοχεύει στην τροποποίηση της γενετικής κληρονομιάς των ανθρώπων μέσω κληρονομούμενων αλλαγών;		*x*
18. Παρακαλώ παραθέστε οποιαδήποτε άλλα σχόλια σχετικά με δεοντολογικά ζητήματα της παρούσας έρευνας		

Ε. Λίστα απαραίτητων εγγράφων για υποβολή αίτησης	***Σημειώστε με Χ ή ✓***
Παρακαλώ ελέγξτε και επιβεβαιώστε ότι έχουν συμπεριληφθεί τα ακόλουθα έντυπα:	
1. **Αίτηση Γνωμοδότησης για την έρευνα**	**x**
2. **Αντίγραφο του πλήρους Ερευνητικού Πρωτοκόλλου**	
3. Αντίγραφο του εντύπου πληροφόρησης/ενημέρωσης των συμμετεχόντων για λήψη της συγκατάθεσης τους (διαθέσιμο στην ιστοσελίδα της ΕΕΒΚ)	**x**
4. Σύντομο Βιογραφικό σημείωμα για κάθε άτομο – ερευνητή και να επεξηγείται ο ρόλος του κάθε ερευνητή	**x**
5. Αντίγραφο καταβολής του τέλους υποβολής το οποίο ανέρχεται στα €50 (πενήντα ευρώ) ως περιγράφεται στην σχετική ανακοίνωση της ΕΕΒΚ. Το τέλος καταβάλλεται στο λογιστήριο του Υπουργείου Υγείας ή σε ταμείο κρατικού νοσηλευτηρίου ή ηλεκτρονικά και στην Επιτροπή προσκομίζεται αντίγραφο της απόδειξης (σχετική ανακοίνωση και λεπτομέρειες καταβολής στην ιστοσελίδα της ΕΕΒΚ)	**x**
6. Σε περίπτωση προπτυχιακών ή μεταπτυχιακων φοιτητών, βεβαίωση από επιβλέποντα/πουσα καθηγητή/τρια για το εν λόγω ερευνητικό πρόγραμμα	**x**
7. Επισύναψη ερευνητικών εργαλείων – ερωτηματολογίου που θα χρησιμοποιηθούν/εί (σε περίπτωση που τα ερευνητικά εργαλεία προέρχονται από μετάφραση υφιστάμενων εργαλείων να κατατίθενται και το πρωτότυπο και η σχετική αναφορά/πηγές. Σε περίπτωση που τα εργαλεία είναι σταθμισμένα ή τίθενται θέματα copyright για να κοινοποιηθούν, να υποβάλλεται πλήρης βιβλιογραφική αναφορά και περιγραφή τους ή και γραπτή συγκατάθεση από το δημιουργό για άδεια προς τον ερευνητή για χρήση του συγκεκριμένου εργαλείου.	**x**

Τα απαιτούμενα έντυπα για υποβολή αίτησης γνωμοδότησης θα πρέπει

να κατατίθενται ταχυδρομικώς είτε δια χειρός στην διεύθυνση:

Εθνική Επιτροπή Βιοηθικής Κύπρου

Λαέρτου 22

2365 Άγιος Δομέτιος, Λευκωσία

<u>Υπεύθυνη Δήλωση</u>

Δηλώνω υπεύθυνα ότι:

A. ***Όλες οι ανωτέρω πληροφορίες είναι αληθείς και πλήρεις. Γνωρίζω ότι, εάν από καταγγελία ή αυτεπάγγελτο έλεγχο ή από οποιονδήποτε έλεγχο των αποδεικτικών στοιχείων προκύψει οποιαδήποτε διαφορά με όσα δηλώνω στην παρούσα αίτηση, τότε η αίτησή μου ενδέχεται να απορριφθεί και/ή να υποστώ ποινικές κυρώσεις.***

B. ***Δίνω την συγκατάθεση μου για ανάρτηση στην ιστοσελίδα της ΕΕΒΚ λεπτομερειών της έρευνάς μου (τίτλος, επιστημονικός φορέας, ερευνητής, πληθυσμός έρευνας, απόφαση ΕΕΒΚ).***

Υπογραφή:	Eleni P Andreou	**Ημ/νία:**	2/10/2023 15/5/2024

Consent Form

Research proposal title
Longitudinal Study on the Nutritional Habits, Body Composition, and Dietary Intake of Male Soldiers in Cyprus

Principal Investigator of the proposal/project you are invited to participate in
Prof Eleni Andreou/ Mrs Nicoletta Ntorzi, PhD (C).

Duration of the project
1.5-3 years

Brief description of the project (outline the procedure and purpose)
The Study is under the auspices of the Cyprus Dietetic and Nutrition Association and the Cyprus Ministry of Defence. Purpose: This project aims to investigate the nutritional habits, body composition changes, and dietary intake of male soldiers aged 18-20 years during their one-year military service in Cyprus. The primary objectives are to assess how these factors evolve over time and to identify potential areas for intervention to improve the health and performance of soldiers. Procedure: 1. Baseline Assessment (T1): • Soldiers' initial entry into the army. • Measurements: Height, weight, and body fat percentage. • Questionnaire: Soldiers complete a detailed questionnaire about their nutritional habits, including meal frequency, food choices, and any dietary restrictions. • Dietary Recall: Soldiers provide a three-day dietary recall to assess their current eating patterns.

2. Mid-Service Assessment (T2):
    - Conducted six months into their one-year service.
    - Measurements: Height, weight, and body fat percentage are measured again.
    - Questionnaire: Soldiers revisit the questionnaire to evaluate changes in nutritional habits since the baseline assessment.
    - Dietary Recall: Soldiers provide another three-day dietary recall to assess any shifts in their eating habits.
3. **End-of-Service Assessment (T3):**
    - Conducted at the end of their one-year service.
    - Final measurements: Height, weight, and body fat percentage are measured for the last time.
    - Questionnaire: The questionnaire is administered one final time to assess the overall changes in nutritional habits during their service.
    - Dietary Recall: A final three-day dietary recall is collected to evaluate the soldiers' dietary intake at the conclusion of their service.

Data Analysis:

- Descriptive statistics: Calculate means, standard deviations, and frequency distributions for variables.
- Paired t-tests: Assess changes within the same individuals over time.
- ANOVA or Repeated Measures ANOVA: Examine differences in nutritional habits and body composition across assessment points.
- Correlation analysis: Investigate relationships between nutritional habits, body composition, and dietary intake.
- Regression analysis: Explore factors influencing changes in nutritional habits and body composition over time.
- Chi-square or Fisher's exact tests: Analyze categorical data related to dietary habits.

Conclusion: Through this longitudinal study, we aim to gain a comprehensive understanding of how male soldiers' nutritional habits, body composition, and dietary intake change during their military service in Cyprus. The data collected will provide valuable insights that can inform strategies and interventions to enhance the health and performance of these soldiers, ensuring they are well-prepared for their duties and maintaining their well-being during their service.

Details of any risks that may exist or any inconvenience that participants may incur

In this study no risks are anticipated. However, as in any research study, it is essential to consider potential risks and inconveniences that participants may encounter. In the case of the longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus, the following risks and inconveniences should be carefully addressed:

1. Privacy Concerns:

- Risk: Participants may have concerns about the confidentiality of their personal information and health data.
- Mitigation: Researchers should ensure strict confidentiality and anonymize data to protect participants' privacy.

2. Physical Measurements:

- Risk: Measuring height, weight, and body fat percentage may cause minor discomfort or anxiety for some participants.
- Mitigation: Researchers should use trained professionals and communicate the procedure clearly to minimize discomfort. Participants should provide informed consent before measurements.

3. Dietary Recall Burden:

- Inconvenience: Providing a three-day dietary recall may be time-consuming and burdensome for participants.
- Mitigation: Researchers can assist participants in completing the recall and ensure that the process is as straightforward as possible. Compensation for time and effort can be considered.

4. Emotional Impact:

- Risk: Questions about nutritional habits may trigger emotional responses, especially if participants have concerns about their diet or body image.
- Mitigation: Researchers should approach sensitive topics with care, provide support, and ensure participants are aware that they can skip any questions they are uncomfortable answering.

5. Data Security:

- Risk: There is a risk of data breaches or unauthorized access to participants' information.
- Mitigation: Implement robust data security measures, such as encryption and secure storage, to protect participant data.

6. Incomplete Participation:

- Inconvenience: Participants may drop out or not complete all assessments due to scheduling conflicts or other commitments.
- Mitigation: Researchers should maintain open communication with participants, make the study as convenient as possible, and consider flexible scheduling options.

7. Psychological Impact:

- Risk: Some participants may experience stress or anxiety related to the study, especially if they perceive their nutritional habits negatively or if body composition measurements are concerning.
- Mitigation: Researchers should provide counseling resources and ensure participants are aware of support services available to them.

8. Environmental Factors:

- Risk: Conducting assessments in a unique environment like Cyprus may expose participants to extreme weather conditions or other environmental challenges.
- Mitigation: Researchers should take necessary precautions to ensure the safety and well-being of participants during assessments.

It is crucial to address these risks and inconveniences through informed consent processes, regular communication, ethical considerations, and appropriate support mechanisms to minimize any adverse effects on the participants and ensure their welfare throughout the study. Additionally, obtaining ethical approval from an institutional review board (IRB) or ethics committee is essential to ensure that the study is conducted ethically and with participants' well-being in mind.

Details of what data will be collected or generated for you within the project, who will have access to them and for how long

The data collected and generated for this longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus will include various types of information. It's essential to outline what data will be collected, who will have access to it, and how long it will be retained to ensure the protection of participants' privacy and compliance with ethical standards:

1. Participant Demographics:

- Data Collected: Age, gender, ethnicity, educational background.
- Access: Principal investigator and research team.
- Retention: Retained for the duration of the study and securely archived after study completion for potential future reference.

2. Anthropometric Data:

- Data Collected: Height, weight, body fat percentage.
- Access: Trained personnel responsible for data collection and analysis, under the supervision of the principal investigator.
- Retention: These measurements will be retained for the duration of the study and used for analysis. After study completion, the data may be anonymized and securely stored for potential future research purposes.

3. Questionnaire Responses:

- Data Collected: Responses to detailed questionnaires about nutritional habits, dietary preferences, dietary restrictions, and other relevant information.
- Access: Principal investigator and research team.
- Retention: These responses will be kept confidential and securely stored during the study. After study completion, the data may be anonymized and securely stored for potential future research purposes.

4. Three-Day Diet Recall:

- Data Collected: Dietary intake information provided by participants over three days.
- Access: Principal investigator and research team.
- Retention: These dietary recall records will be used for analysis during the study. After study completion, the data may be anonymized and securely stored for potential future research purposes.

5. Research Records:

- Data Collected: Administrative and logistical records related to the study, including consent forms, scheduling, and communication logs.
- Access: Principal investigator and authorized research staff.
- Retention: These records will be retained for a specific period required by institutional guidelines and regulations, typically for several years, to ensure transparency and accountability.

6. Analytical Data:

- Data Generated: Statistical analyses and aggregated results derived from the collected data.
- Access: Principal investigator, research team, and potentially collaborating researchers.
- Retention: Analytical data will be retained for reference, reporting, and publication purposes. Aggregated results may be shared publicly in accordance with ethical standards and data protection regulations.

Data Access and Security: Access to all sensitive data will be restricted to authorized personnel, and measures will be in place to protect the data from unauthorized access or breaches. Data security protocols will include encryption, secure storage, and access controls.

Data Retention and De-Identification: After the study's completion, personally identifiable information will be removed or anonymized to protect participants' privacy. The de-identified data may be retained for potential future research purposes, subject to ethical approval and data protection regulations. All data handling and retention practices will be in compliance with applicable laws, ethical guidelines, and institutional policies regarding research data management and participant privacy. Participants will be informed of data handling and retention practices as part of the informed consent process.

Expected benefit for participants
Participants in the longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus can expect several potential benefits, both directly and indirectly. These benefits contribute to the overall value of their participation in the research: 1. **Personal Health Awareness:** Participants will gain a deeper understanding of their own nutritional habits, body composition, and dietary intake. The assessments and questionnaires may lead to increased awareness of their health and dietary choices, potentially motivating them to make positive changes. 2. **Individualized Recommendations:** Based on the study's findings, participants may receive personalized feedback or recommendations related to their nutritional habits and overall health. This guidance can help them make informed decisions about their diet and lifestyle. 3. **Improved Military Performance:** The study's insights can be used to enhance the overall health and performance of soldiers. If issues related to nutrition or body composition are identified, interventions or programs may be developed to address these concerns, ultimately benefiting participants' readiness and effectiveness as soldiers. 4. **Contributing to Scientific Knowledge:** Participants will play a vital role in advancing scientific knowledge about the nutritional habits and body composition of soldiers, particularly in the unique context of Cyprus. Their participation contributes to a broader understanding of the impact of environmental factors on dietary choices and health. 5. **Public Health Impact:** The research findings can have broader implications for public health and nutrition strategies, potentially benefiting not only the participants but also future military personnel and the general population. 6. **Ethical Consideration:** The study is conducted ethically and with a focus on participants' welfare. Researchers take measures to ensure privacy, data security, and participant comfort throughout the study, enhancing the overall ethical quality of the research process.

7. **Personal Fulfillment:** Participation in a research study can be personally fulfilling for some individuals. It allows them to contribute to scientific research and gain a sense of satisfaction from being part of a meaningful project.
8. **Community Building:** In some cases, participants may develop a sense of community with fellow soldiers who are also involved in the study. This can foster camaraderie and teamwork among participants.

It's essential that participants are fully informed about these potential benefits and any associated risks or inconveniences before they provide their informed consent to participate in the study. Clear communication and transparency about the study's goals and potential outcomes will help ensure that participants have a positive experience and feel that their participation is meaningful and valuable.

Expected benefit for researchers and/or sponsors

The longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus can yield several expected benefits for both the researchers and sponsors involved in the project. These benefits can contribute to the advancement of scientific knowledge, the achievement of research objectives, and the broader goals of military and public health initiatives. Here are the expected benefits for researchers and participants and Ministry of Defense, and the Cyprus Dietetic and Nutrition Association:

Benefits for Researchers:

1. **Scientific Advancement:** Researchers can make significant contributions to the field of nutrition, military health, and public health by conducting this study. The data collected can lead to new insights, research publications, and academic recognition.
2. **Professional Development:** Engaging in a complex, longitudinal study provides researchers with valuable experience in study design, data collection, statistical analysis, and research management, enhancing their professional skills and expertise.
3. **Collaboration Opportunities:** Collaboration with other experts in the field, both within and outside the research team, can lead to networking opportunities and partnerships for future research endeavors.
4. **Publication Opportunities:** The study's findings can be published in peer-reviewed journals, further increasing the visibility and credibility of the researchers and their affiliated institutions.

5. **Contribution to Public Health:** Researchers have the opportunity to contribute valuable data that can inform public health policies and interventions, potentially benefiting not only military populations but also the broader civilian community.
6. **Funding Opportunities:** Successful completion of this study can enhance the researchers' track record, making them more competitive for future research grants and funding opportunities.

Benefits for Sponsors (e.g., Military Organizations, Funding Agencies):

1. **Improved Soldier Performance:** Sponsors, such as military organizations, can use the study's findings to develop evidence-based interventions and programs that improve the health and performance of their soldiers. This can lead to a more effective and efficient military force.
2. **Data-Driven Decision-Making:** Sponsors can make data-driven decisions regarding soldier nutrition, training, and health care based on the study's results, optimizing resource allocation and readiness.
3. **Enhanced Public Image:** Sponsors that support research aimed at improving the health and well-being of military personnel demonstrate a commitment to their troops' welfare, which can enhance their public image and reputation.
4. **Strategic Planning:** The study's findings can inform long-term strategic planning for military operations and personnel management, ensuring that the nutritional needs of soldiers are adequately addressed.
5. **Research Collaboration:** Sponsors can establish valuable collaborations with research institutions and universities, fostering ongoing partnerships for future research initiatives.
6. **Policy Development:** The study's data can contribute to the development of evidence-based policies and guidelines related to nutrition, health, and fitness for military personnel.
7. **Knowledge Transfer:** Sponsors can benefit from the knowledge and expertise gained through the research, which can be applied to ongoing training and education programs for military personnel.

Overall, the benefits for researchers and sponsors extend beyond the immediate scope of the study, potentially influencing military and public health practices, policy development, and the well-being of military personnel both in Cyprus and in broader contexts. These benefits highlight the significance of conducting research in this area and the potential positive impact it can have on various stakeholders.

Site and total duration of data collection expected under this research proposal

The site and total duration of data collection for the longitudinal study on the nutritional habits, body composition, and dietary intake of male soldiers in Cyprus will depend on the specific study design, logistics, and participant recruitment. Here is an estimated breakdown of the data collection site and duration:

Site of Data Collection: The data collection for this study will primarily occur in Cyprus, where the male soldiers are stationed during their military service. The site may include military bases, training facilities, or other locations where participants can be assessed and surveyed conveniently. Researchers will coordinate with military authorities to ensure access and cooperation.

Total Duration of Data Collection: The total duration of data collection for this study may span over an extended period to account for the longitudinal nature of the research and the multiple assessment points (T1, T2, and T3). Here is a rough estimate of the expected duration:

1. **Baseline Assessment (T1):** The initial data collection for participants as they enter the military is expected to take several weeks to a few months, depending on the number of participants and logistical considerations. This phase will include participant recruitment, informed consent processes, measurements, questionnaire administration, and dietary recall.
2. **Mid-Service Assessment (T2):** This assessment occurs six months into the participants' one-year military service. Data collection for this phase will likely require a few weeks to a couple of months to complete.
3. **End-of-Service Assessment (T3):** The final data collection point at the end of the one-year service will also take several weeks to a few months, considering the same data collection activities as in T1 and T2.
4. **Data Analysis and Reporting:** After the data collection is complete, there will be a period dedicated to data analysis, interpretation, and report writing, which may take several months.

Considering these phases, the total duration of data collection, analysis, and reporting for the entire study could span approximately 18 months to 3 years or more. However, these estimates are general, and the actual duration may vary based on factors such as the study's scale, logistics, participant availability, and data processing speed. Researchers and project managers should establish a detailed timeline and milestones to ensure the efficient execution of the study while minimizing disruptions to the participants' military service.

Description of relevant procedures in handling the data and personal information of participants who choose to withdraw from the study prior to its completion.
Handling the data and personal information of participants who choose to withdraw from the study prior to its completion is a crucial aspect of research ethics and data management. It's essential to

respect participants' decisions and protect their privacy. Here are the relevant procedures for handling such situations:

1. Informed Consent and Withdrawal Process:

- Ensure that the informed consent process clearly outlines participants' rights, including their right to withdraw from the study at any time without penalty.
- Provide participants with contact information for the research team or a designated point of contact if they wish to withdraw.

2. Timely Withdrawal Procedures:

- If a participant chooses to withdraw, promptly acknowledge their decision and confirm their withdrawal in writing (e.g., email or letter).
- Clearly communicate to the participant that their withdrawal will not affect any benefits or services to which they are entitled (e.g., military service).

3. Data Handling for Withdrawn Participants:

- Stop all data collection and assessments for the participant who has chosen to withdraw.
- Store any data collected from the withdrawn participant in a secure and separate manner to protect their confidentiality.

4. Anonymization or Removal of Identifiers:

- Anonymize any personal information or identifiers associated with the withdrawn participant's data, such as names or identification numbers.
- Assign a unique study ID or code to the participant to maintain data integrity without disclosing their identity.

5. Data Analysis and Reporting:

- Exclude the data of withdrawn participants from the final analysis and reporting to ensure that their data does not influence the study's findings.
- Clearly document the withdrawal status of participants in the study records and reports.

6. Ethical Considerations:

- Respect the participant's privacy and confidentiality by refraining from disclosing their withdrawal status or reasons to others.
- Ensure that the research team and any involved third parties (e.g., data analysts) are aware of and comply with the withdrawal procedures and ethical considerations.

7. Return of Personal Belongings:

- If the study involves physical measurements or equipment provided to participants, facilitate the return of any personal belongings, equipment, or devices they may have received as part of their participation.

8. Participant Follow-Up:

- Offer the withdrawn participant an opportunity to provide feedback on their withdrawal experience or reasons for leaving the study, if they are willing to share.

9. Reporting to Ethics Committees:

- If the study is subject to review by an institutional review board (IRB) or ethics committee, report participant withdrawals and the procedures followed in your regular reporting to the ethics committee.

10. Retention and De-Identification:

- Retain the de-identified data of withdrawn participants in a secure and separate manner for a reasonable period, as required by institutional policies, to ensure data integrity and allow for potential future audits or inquiries.

Handling the withdrawal of participants with sensitivity and in compliance with ethical guidelines is essential to maintain the trust and integrity of the research project. Researchers and research teams should adhere to these procedures to protect the rights and privacy of participants who choose to withdraw from the study.

Full contact details and title of the person to whom participants can submit complaints or grievances regarding the programme they participate in.

THEODOROS MILLIDONIS, BSc (Hons), MBA, PhD (c), ACCA
Head of Research Administration

Research & Innovation Office

46 Makedonitissas Avenue, CY-2417
P.O.Box 24005, CY-1700, Nicosia, Cyprus
t +357 22 841785 | f +357 22 355116

Full contact details and title of the person whom participants can contact for more information or clarifications about the research programme.

Prof. Eleni Andreou, RDN,DProf, FHEA

Professor of Nutrition and Clinical Dietetics

HoD Life Science

Nutrition/Dietetics Programme Coordinator

Department of Life Sciences

School of Life and Health Sciences

46 Makedonitissas Avenue, CY-2417
P.O.Box 24005, CY-1700, Nicosia, Cyprus
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Surname:	Andreou ………………………………………………..………	Name:	Eleni ………………………………………………..
Signature:	Eleni P Andreou	Date:	2/10/2023 15/5/2024

APPENDIX 3:

LETTERS OF APPROVAL OF THE STUDY BY CYPRUS DIETETIC ASSOCIATION AND MINISTRY OF DEFENCE

Review Bioethics Committee for Nutrition Research with no Intervention

Monday 2nd October 2023

To whom it may concern

This letter confirms that the School of Life and Health Sciences of the University of Nicosia are informed of the content and the processes of the project entitled "Longitudinal Study on the Nutritional Habits, Body Composition, and Dietary Intake of Male Soldiers in Cyprus " and is in agreement with the participation of the University of Nicosia faculty and students-researchers in this project. The main researcher is the PhD student of the PhD Nutrition/Dietetics programme of the University of Nicosia, Mrs Nicoletta Ntorzi.

Kind regards,

Prof. Eleni Andreou, RDN,DProf, FHEA

Professor of Nutrition and Clinical Dietetics

HoD Life Science

Nutrition/Dietetics Programme Coordinator

Department of Life Sciences

School of Life and Health Sciences

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ΣΥΝΔΕΣΜΟΣ ΔΙΑΙΤΟΛΟΓΩΝ & ΔΙΑΤΡΟΦΟΛΟΓΩΝ ΚΥΠΡΟΥ

Cyprus Dietetic and Nutrition Association
2020

Dear Mrs Nicoletta Ntorzi,

Subject: Support and Endorsement of the Study "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military"

On behalf of the Cyprus Dietetic and Nutrition Association (CYDNA), I am writing to express our full support and endorsement of the study titled "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military." We are pleased to place this important research under the auspices of our association.

The CYDNA recognizes the critical importance of understanding the dietary habits, body weight, and body composition of military personnel. This study provides valuable insights into the physical and nutritional challenges faced by soldiers during their service, and it highlights areas where targeted interventions can significantly improve their health and performance.

The findings of this study align with the CYDNA's mission to promote optimal nutrition and health for all individuals, including those in demanding professions such as the military. By supporting this research, we aim to contribute to the development of evidence-based strategies that enhance the well-being and readiness of our soldiers.

We commend the research team for their dedication and rigorous approach to this study. The comprehensive analysis of somatometric indicators, eating behaviors, and lifestyle factors provides a robust foundation for future interventions and policy recommendations. The CDNA is committed to disseminating the findings of this study through our networks and platforms to ensure that the insights gained reach a wide audience of healthcare professionals, policymakers, and military personnel.

In conclusion, the Cyprus Dietetic and Nutrition Association is proud to support and endorse the study "Impact of Military Service on Eating Behaviors, Body Weight, and Body Fat: A Cross-Sectional Observational Study of Soldiers in the Cyprus Military." We believe that this research will make a significant contribution to the field of military nutrition and health, and we look forward to collaborating on future initiatives that promote the health and well-being of our soldiers.

Thank you for your attention to this important matter. Please do not hesitate to contact us if you require any further information or support.

Yours sincerely,

Dr Eleni Andreou — Anna Pahita

President — Secretary

Cyprus Dietetic and Nutrition Association

ΚΥΠΡΙΑΚΗ ΔΗΜΟΚΡΑΤΙΑ

ΥΠΟΥΡΓΕΙΟ ΑΜΥΝΑΣ

ΣΧΕΤ : Αρ. Φακ.: 21.1.02

Αρ. Τηλ.: 22807533

Αρ.Τηλεομ.:22807686

13 Μαΐου, 2021

(ΠΡΟΣΧΕΔΙΟ)

<u>**ΕΠΕΙΓΟΥΣΑ**</u>

- ΓΕΕΦ/ΔΕΜ - ΔΥΓ

Θέμα: <u>**Μνημόνιο Συνεργασίας του ΥΠΑΜ και του ΓΕΕΦ, με το**</u>

<u>**Σύνδεσμο Διαιτολόγων και Διατροφολόγων Κύπρου (ΣυΔιΚυ)**</u>

Έχω οδηγίες να αναφερθώ στο πιο πάνω θέμα και σε συνέχεια των ταυτάρι-θμων επιστολων με ημερομηνίας 13 Μάιου 2021, καθως και να σας πληροφορήσω ότι το Υπουργείο Άμυνας πρόβηκε σε **ανανέωση** του Μνημονίου Συνεργασίας, με το Σύν-δεσμο Διαιτολόγων και Διατροφολόγων Κύπρου.

2. Το πρόγραμμα του Μνημονίου Συνεργασίας που υπογράφηκε τη **01 Ιουλίου 2019**, ανανεώνεται για ακόμη 2 χρόνια, και θα έχει διάρκεια από την ημερομηνία υπογραφής, μέχρι και την **30 Ιουνίου 2022.**

3. Στο πλαίσιο των παραμέτρων του Μνημονίου Συνεργασίας, έχει καθαρισθεί η διεξαγωγή μελέτης και έρευνας για τη διαπίστωση του **σωματικού βάρους** και των **διατροφικών συνηθειών**, των στρατεύσιμων οπλιτών της ΕΦ. Για την κατάλληλη προετοιμασία και συνέχιση της σε εξέλιξη διεξαγωγή της μελέτης και έρευνας στους στρατεύσιμους οπλίτες της 2020 ΕΣΣΟ, θα πρέπει να ορισθεί αξιωματικός Ιατρός, ως αντιπρόσωπος του ΓΕΕΦ με τον Σύνδεσμο Διαιτολόγων και Διατροφολόγων Κύ-πρου, για υλοποίηση και ολοκλήρωση της μελέτης.

4. Για τον σκοπό αυτό, σας αποστέλλεται αντίγραφο του Μνημονίου Συνεργα-σίας, και παρακαλείσθε για τον περαιτέρω χειρισμό του θέματος και αξιοποίηση των παραμέτρων Μνημονίου Συνεργασίας.

5. Για οποιεσδήποτε διευκρινίσεις ή απορίες παρακαλούμε όπως επικοινωνείτε με τον Τχη (ΕΜ) Χρίστο Πασιουλή, με τα τηλέφωνα 22807533 και 99673171.

(Τχης (ΕΜ) Χρίστος Πασιουλής)

για Γενικό Διευθυντή

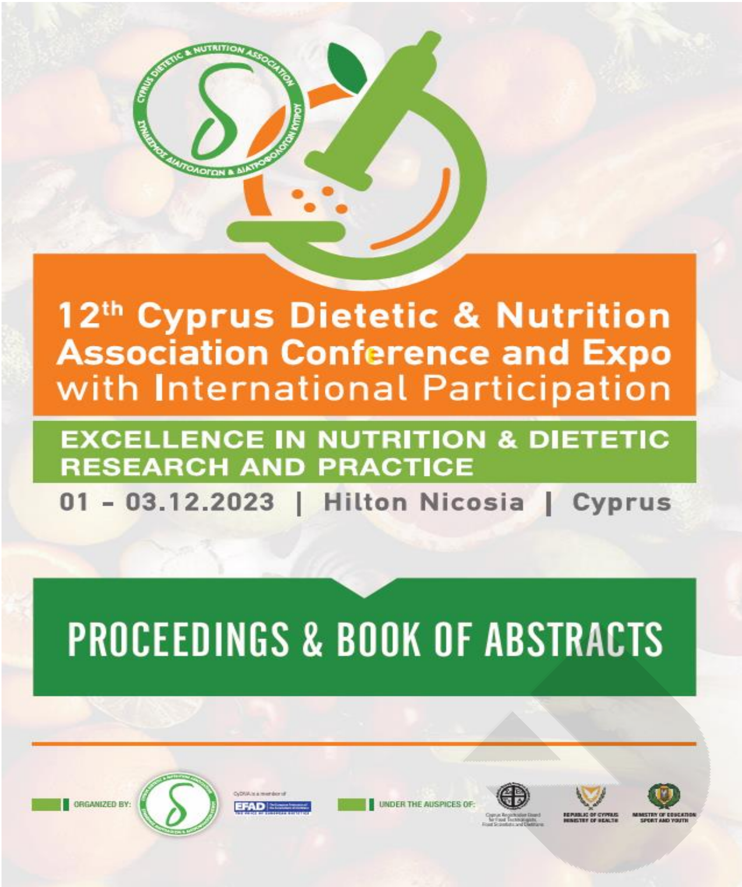
Κοιν.: - ΓΕΕΦ/ΕΓΑ

- Σύνδεσμο Διαιτολόγων και Διατροφολόγων Κύπρου

(υπόψη Δρ. Ελένη Π. Ανδρέου)

APPENDIX 4:

DISSEMINATION OF THE STUDY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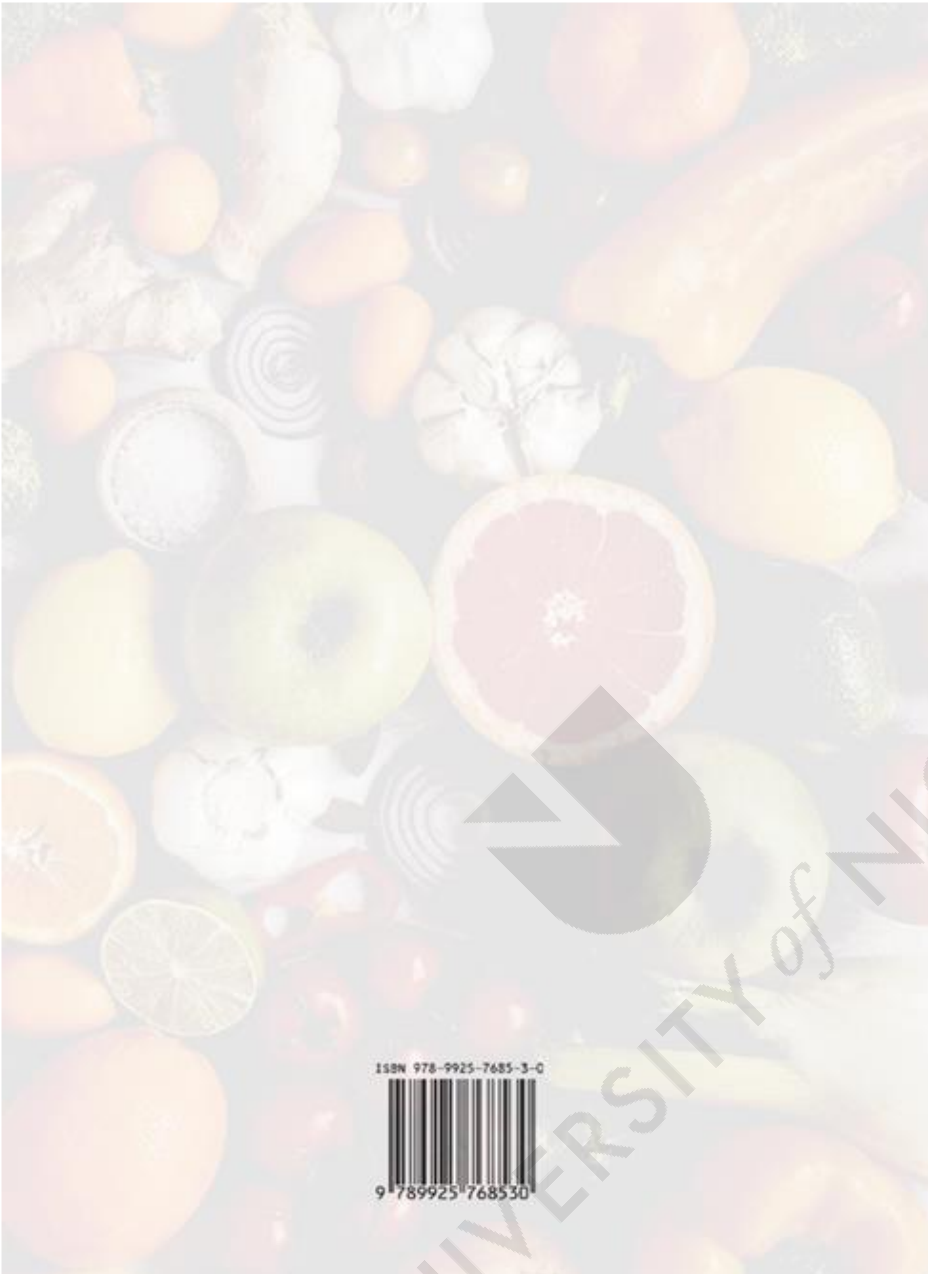
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Ntorzi Nicoletta
Phd can., RDN, CDN, MS, Clinical Dietitian, CyDNA, Cyprus

Title of Presentation

Results of Army Study in Cyprus for Weight and Eating Behavior of Soldiers

CPE Level

Level II assumes that the participant has general knowledge of literature and professional practice in the areas covered. The focus of the activity is to enhance knowledge and application by the participant.

After this presentation, the attendee will be able to:

1. Know how the body composition can change during military service.
2. Inform the contributory factors that can change during military service.

Description (Focus Statement)

Military service is a crucial phase in a young individual's life, where physical fitness and nutritional habits play an essential role in ensuring the overall well-being of soldiers. This study focuses on assessing the body composition and nutritional habits of soldiers aged 18-20 years during their 1-year service in the Cyprus Army. It aims to identify changes in their body composition and dietary choices during their military service.

Learning Outcomes Assessment

1. Assess through knowledge
2. Interactive presentation
3. Presenting the results
4. Discussion with audience
5. Post presentation question

Abstract

Introduction:

Military service is a crucial phase in a young individual's life, where physical fitness and nutritional habits play an essential role in ensuring the overall well-being of soldiers. This study focuses on assessing the body composition and nutritional habits of soldiers aged 18-20 years during their 1-year service in the Cyprus Army. It aims to identify changes in their body composition and dietary choices during their military service.

Methods:

A cross-sectional study was conducted, involving 300 soldiers aged 18-20 years who had completed their 1-year service in the Cyprus Army. Body composition measurements, including weight, height, body fat percentage, and muscle mass, were assessed at the beginning and end of their service.

Nutritional habits were evaluated through dietary recall surveys.

Results:

The study revealed significant changes in the body composition of soldiers during their military service. At the start of their service, most soldiers had a relatively normal body mass index (BMI), but by the end, there was a noticeable increase in their weight. The average body fat percentage had also increased. Muscle mass had marginally declined, indicating a shift towards higher fat-to-muscle ratio.

Nutritional habits had evolved during the service period, with soldiers reporting an increase in the consumption of high-calorie, low-nutrient foods. A decrease in fruit and vegetable intake was noted. This change in dietary choices was associated with the nature of military training and potentially a lack of access to healthier food options.

Comparison with Other Studies:

This study aligns with previous research that has shown that military service can lead to changes in body composition, including increased weight and altered dietary habits. These findings emphasize the importance of addressing soldiers' nutritional education and providing access to healthier food options within military environments to support their overall health.

Conclusion:

The study highlights the significance of monitoring the body composition and nutritional habits of soldiers during their military service. It underscores the need for targeted interventions and education to promote healthier dietary choices and overall well-being among soldiers aged 18-20 years in the Cyprus Army. Addressing these issues can contribute to their long-term health and fitness, both during and after their military service.

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Appendix 5: Viva presentation of the thesis

Chat with multiple files at once for more insights

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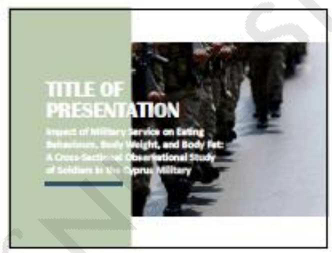

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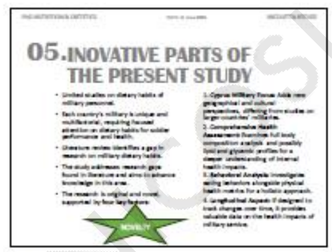

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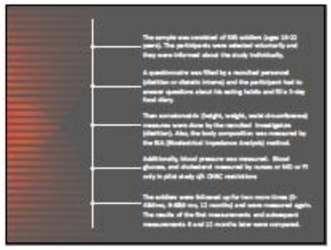

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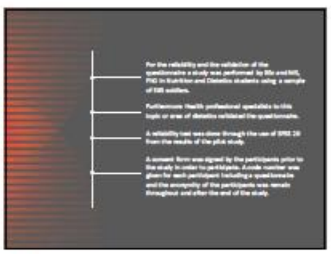

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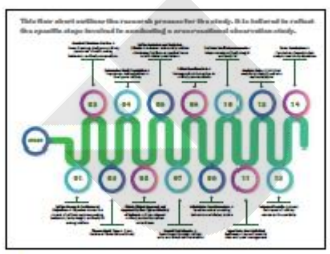

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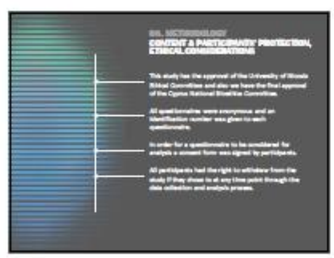

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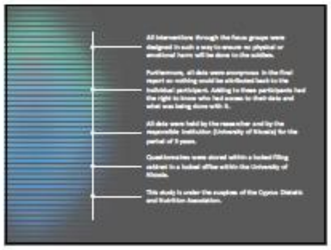

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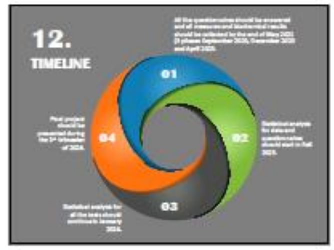

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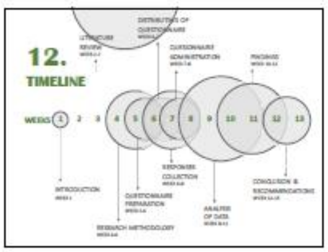

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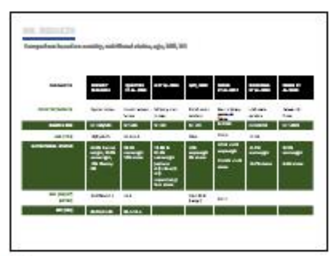

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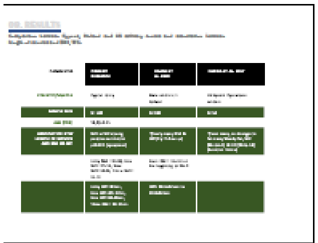

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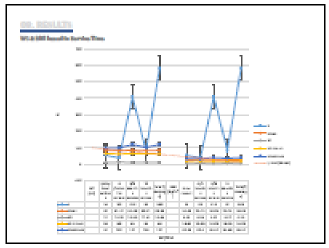

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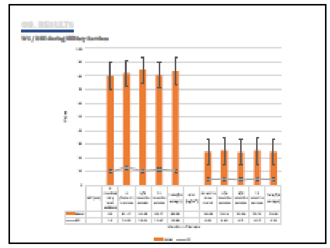

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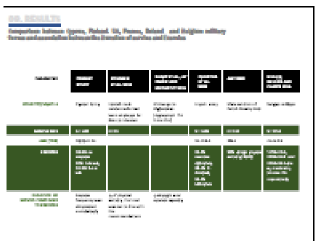

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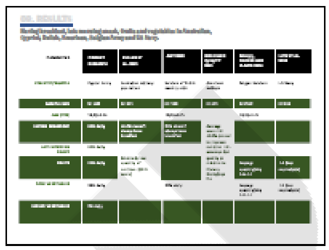

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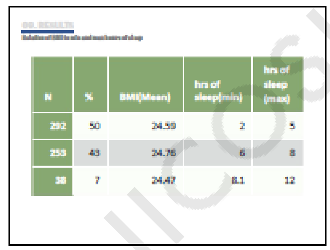

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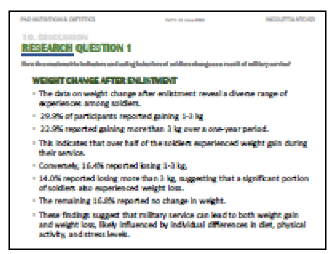

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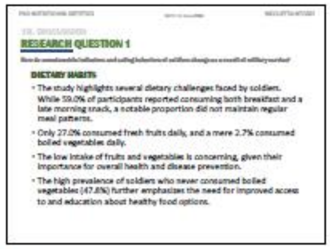

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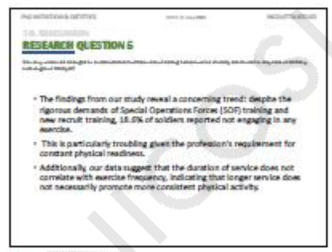

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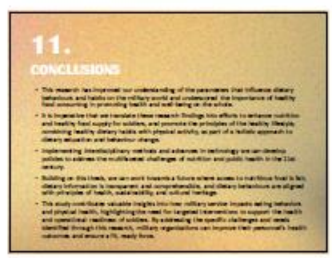

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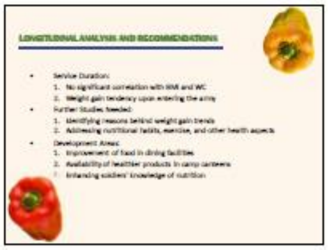

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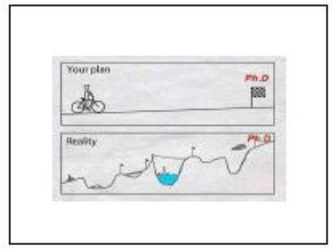

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