

The Consumption of Fast Food Favors Weight Increase in Young Hellenic Navy Personnel: A 10-Year Follow-Up Study

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Abstract

Introduction: Dietary habits and physical exercise have independently been recognized as important contributors to weight loss. However, the relative effect of diet and exercise on body weight is still unclear and warrants further investigation. We investigated the causes related to changes in body mass index (BMI) in a sample of young adult Greek Navy recruits over 10 years.

Materials and Methods: We conducted a single-center prospective observational study, including consecutive healthy young adult officers and sailors (>18 years) at the Salamis Naval Base, Salamis, Attiki, Greece. BMI was calculated at the baseline visit. A questionnaire was selected to gather data regarding daily food consumption and daily physical exercise. The participants were followed up for 10 years (2005–2014).

Results: Two hundred eighty-four young adults [mean age 31.1 ± 3.1 years; 25 (8.8%) females and 259 (91.2%) males] were included. Baseline median BMI was 24.1 kg/m^2 , while 10 years later, median BMI was 24.8 kg/m^2 ($P < 0.001$). Physical activity was not significantly related to BMI change ($P = 0.153$). Multivariate logistic regression analysis showed a significant correlation between BMI increase and frequent fast food consumption ($P = 0.044$).

Conclusions: Frequent fast food consumption is linked with a significant BMI increase, irrespective of physical activity. This has obvious dietary implications and needs to be examined in the general population.

Keywords: body mass index, BMI, obesity, naval, physical exercise, weight loss

Introduction

OBESITY IS A CHRONIC, multifactorial public health disease of great concern. As recently reported by World Health Organization (WHO), more than 1.9 billion adults globally are overweight (body mass index, BMI $>25 \text{ kg/m}^2$) and over 65 million of those are obese (BMI $>30 \text{ kg/m}^2$).¹ Obesity is promptly evolving as the principal cause of avoidable death in the United States.² Of note, since 1960s, the prevalence of obesity has nearly doubled and currently,

one in three adults is obese.³ Over the last 20 years, the WHO has emphasized that obesity may have several serious comorbidities, such as type 2 diabetes mellitus, cardiovascular diseases, many types of cancer, as well as other pathologies, leading to increased morbidity and mortality.^{4,5}

Obesity in all age groups worldwide has also been related to physical inactivity and Western type of diet, that is, a diet including a high concentration of fat, sugars, and sodium, deriving mainly from processed foods.⁶ Both exercise and dietary modification have independently been recognized as

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effective approaches for weight loss.⁷ However, only a small number of studies focused on the long-term effect of diet type and frequency of exercise on weight gain in young adults.⁸

Furthermore, young adults, at military enlistment ages of 20–35 years, face the highest rates of weight increase every year.^{9,10} This increase in weight has been directly linked to deteriorating cardiovascular risk factors and development of metabolic syndrome.^{11,12} In this context, the aim of this study was to examine the 10-year effect of dietary habits and physical exercise on body weight in young naval active personnel, with the hypothesis that frequent bad dietary habits, like fast food consumption, may negatively affect the BMI, while exercise may ameliorate this effect.

Materials and Methods

This is a single-center prospective observational study, including consecutive healthy young adult officers and sailors (>18 years) at the Salamis Naval Base, Salamis, Attiki, Greece. It was part of a project investigating the dietary habits and the prevalence of metabolic syndrome in young naval active-duty personnel.¹³ Salamis Naval Base employs a large number of naval active-duty personnel (sailors and officers), as well as civilian personnel.¹⁴ The study was organized by the Internal Medicine and Diabetes Department of the Salamis Naval and Veterans Hospital, Salamis Island, Greece. It was approved by the Salamis Naval and Veterans Hospital's scientific and ethics committee and was carried out in agreement with the declaration of Helsinki Declaration of Human Rights.

Participants' demographic characteristics and medical history were recorded at the time of enrolment. Body weight and height were measured at the reference visit (year 2005) at the Salamis Naval and Veterans Hospital. BMI was calculated as body weight (kg) over the square of height (m²). The definitions of overweight and obesity were in accordance with WHO recommendations for adults (underweight: BMI <18.5; normal weight: BMI 18.5–24.9; overweight: BMI 25–29.9; and obesity: BMI >30).¹⁵ A validated structured quantitative food-frequency questionnaire evaluating the intake of a wide range of foods over the last year was used.^{13,16} The frequency of fruit, meat, and/or fast food consumption was expressed as the number of days per week that the participant consumed fruit, meat, and/or fast food. Fast food was defined as the food that can be made rapidly and sold in diners and snack bars as a quick meal or to be taken away. Physical activity was self-reported and measured by the International Physical Activity Questionnaire (IPAQ).¹⁷ The short edition of IPAQ form, "last 7-day recall" was used. Participants were followed up for a 10-year period (2005–2014). At the end of the follow-up period, the participants responded to the same questionnaires through telephonic interview. Body weight was also obtained verbally by the participants and BMI was calculated.

Statistical analysis

Biometric characteristics and questionnaire answers were examined using the SPSS (Statistical Package for Social Sciences for Windows, Version 25.0; Chicago, IL). Continuous variables are presented as mean and standard deviation or as median and interquartile range, whereas qualitative

variables are presented as relative frequencies (in percentage). Associations between categorical variables were examined by the McNemar test. Differences between BMI were investigated with the Wilcoxon signed ranks test. Multiple logistic regression analysis evaluated the association between BMI changes and dietary habits. Results are shown as beta coefficient (B), odds ratios (ORs), and their corresponding 95% confidence intervals (95% CIs). Significance was defined at the 5% level (two-tailed *P* values <0.05).

Results

Two hundred eighty-four young adults [mean age 31.1 ± 3.1 years; 25 (8.8%) females and 259 (91.2%) males] were included in the analysis. Although 832 young adults were evaluated at baseline, only 284 were followed up 10 years later. Baseline median BMI significantly increased by about 0.7 U over the follow-up (*P* < 0.001) (Table 1). Median body weight also increased by 2.95 ± 0.5 kg (*P* < 0.001). Physical exercise was not significantly linked with BMI change (*P* = 0.153, Fig. 1).

To estimate the goodness of fit for our multivariate logistic regression model, we used the Hosmer and Lemeshow (H-L) test (*P* = 0.765) which showed a significant association between weight gain and the consumption of fast food (*P* = 0.044) (Table 2). Specifically, the OR for once-weekly consumption of fast food versus no consumption was 2.56 (95% CI: 1.10–5.96), and for two or more times per week, it was 3.41 (95% CI: 1.05–11.03). Body weight variations were not significantly linked with intake of fruit, vegetables, salads, meat, refreshments/soda, and alcohol.

Discussion

This study has shown that frequent fast food consumption was significantly linked with increased BMI at 10 years in young naval active personnel. By contrast, exercise was not significantly associated with BMI change.

Military lifestyle is unique, demanding, and not followed by civilians. This may, to some extent, affect the activities of daily living and dietary habits, including fast food consumption, daily physical activity, and finally, body weight. There is only one study in Greek active navy personnel.¹⁸

TABLE 1. CHARACTERISTICS OF THE POPULATION AT BASELINE AND FOLLOW-UP

	Baseline	10-years later	P
Gender (male, %)	259 (91.2%)		
Age (years)	31.1 ± 3.1		
BMI (kg/m ²) ^a	24.1 (±4.3)	24.8 (±4.2)	<0.001
BMI status ^b			<0.001 ^c
Underweight (%)	8.8	3.5	
Normal weight (%)	51.4	49.6	
Overweight (%)	33.1	33.8	
Obese (%)	6.7	13.0	
BMI change	0.7 ± 2.9		

Values are expressed as mean ± SD or ^amedian (interquartile range) or ^bpercentages (%).

^cMcNemar test.

P value calculated using Wilcoxon signed ranks test or.

BMI, body mass index; SD, standard deviation.

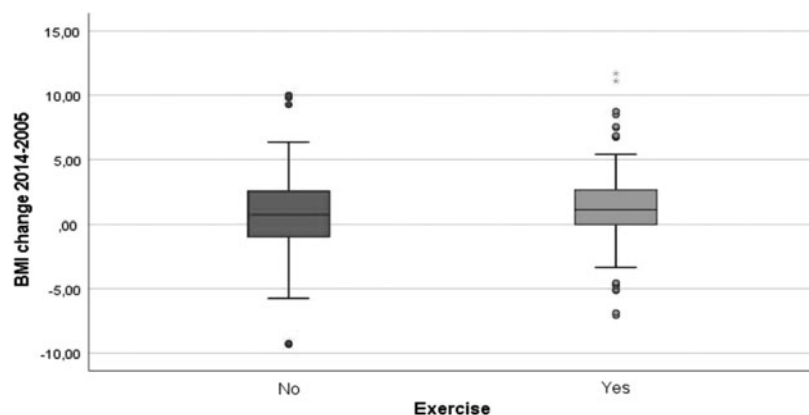


FIG. 1. Exercise and BMI changes during follow-up. BMI, body mass index.

A high proportion of overweight (26.5%) and obesity (4.7%) was observed in a young adult military population (274 men; age 19–38 years) serving on a Hellenic Navy warship.¹⁸ Military service is compulsory in Greece for adult men (>18 years), while data concerning its influence on long-term body weight management are sparse. Consequently, the study of young military active personnel is of significant importance, especially for our country.

Obesity is a common entity arising in several populations, especially in military personnel.¹⁹ A large registry study by the U.S. Army enrolled 17,41,070 participants, and investigated changes in body weight over 23 years (1989 to 2012).²⁰ The prevalence of obesity was increased from 5.6% (1989) to 8.0% (2012), peaking at 12.3% (2009), while the 2005–2009 annual prevalence exceeded 10%.²⁰ Furthermore, another large-scale survey of 4,311 adult participants from Michigan presented a steady positive correlation between the risk of obesity and regular fast food consumption.²¹ The latter includes food of high energy and high glycemic load, thereby increasing the risk of obesity.²²

It is noteworthy that during this 10-year follow-up, the obesity rate in the studied population was doubled (from

6.7% to 13%). This fact is in compliance with the existing literature, highlighting the imperative need for obesity prevention strategies.^{20,23}

The significance of systematic physical activity in the prevention and general management of obesity has been demonstrated in several studies. However, whether exercise alone may be enough to maintain an ideal body weight is still a controversial issue. In a 1-year controlled trial, 107 obese adults (≥ 65 years) were randomized to three groups, a weight-management (diet), a physical practice, and a weight-management-plus-exercise (diet-exercise) group.²⁴ The combination of exercise and weight loss provided higher enhancement in physical condition than either intervention separately.²⁴ Thus, exercise can be viewed as an adjunct to dietary interventions aiming at weight loss.

This study has some limitations. First, it was a single-center study in a selected population of active military personnel. Hence, its results may not reflect reality in the general population. Second, the relatively small number of participants requires confirmation in larger studies. Furthermore, our participants did not have a regular follow-up during the study period and this may have

TABLE 2. MULTIPLE REGRESSION MODEL FOR EVALUATION OF BODY MASS INDEX CHANGE DURING FOLLOW-UP

	n (%)	B	OR	95% CI	P
Lunch duration (15–20 min)	139 (48.9)	0.07	1.07	(0.50–2.30)	0.863
Fast food consumption (0 times/week)	84 (29.6)				0.044
Fast food consumption (1 time/week)	122 (43.0)	0.94	2.56	(1.10–5.96)	0.029
Fast food consumption (2+ times/week)	78 (27.5)	1.23	3.41	(1.05–11.03)	0.041
Fruit consumption (<3 times/week)	55 (29.6)				0.812
Fruit consumption (4–5 times/week)	37 (19.9)	0.37	1.45	(0.46–4.58)	0.527
Fruit consumption (>6 times/week)	94 (50.5)	0.18	1.20	(0.50–2.86)	0.686
Salad consumption (<3 times/week)	58 (31.2)				0.563
Salad consumption (4–5 times/week)	30 (16.1)	−0.30	0.743	(0.23–2.46)	0.627
Salad consumption (>6 times/week)	98 (52.7)	−0.50	0.61	(0.24–1.51)	0.285
Meat consumption (>4 times/week)	116 (62.4)	−0.21	0.81	(0.37–1.78)	0.602
Soda consumption (<1 cans/week)	114 (40.1)				0.899
Soda consumption (1 can/week)	36 (12.7)	−0.24	0.78	(0.25–2.43)	0.673
Soda consumption (>2 cans/week)	134 (47.2)	−0.15	0.86	(0.36–2.06)	0.740
Alcohol (<1 U/week)	44 (23.7)				0.892
Alcohol (1 U/week)	38 (20.4)	−0.26	0.77	(0.26–2.32)	0.647
Alcohol (>2 U/week)	104 (55.9)	−0.08	0.93	(0.37–2.35)	0.873
Constant		1.14	3.12		0.099

Results are presented as frequency (n), percentages (%), beta coefficient (B), odds ratios (OR), 95% confidence interval (CI), and their P value.

biased our results. In addition, physical activity was self-reported and measured by the short IPAQ form; thus, it is uncertain whether it reflects participants' activities during the 10-year follow-up.

Another concern is that although there is a strong evidence in literature regarding the positive effect of the physical activity on BMI, our data suggest that physical activity did not prevent the BMI increase in the studied population.^{7,24} This fact may be attributed to the population selection bias, given that military personnel is not a representative sample of the general population.

Finally, another limitation of our study is the lack of body composition analysis data of the studied population. Measurements of fat and fat-free mass (bone, water, muscle, and connective and organ tissue) would provide valuable information, which could possibly affect the results of our study.

In conclusion, frequent fast food consumption was significantly linked with increased BMI at 10 years in young naval active personnel. By contrast, exercise was not significantly associated with BMI change. These results appear to be relevant in practice and need careful consideration as to how the situation may be improved by dietary interventions in this setting.

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This article was written independently. The authors did not receive financial or professional help with the preparation of the article. M.R. is currently Director, Clinical Medical & Regulatory Department, Novo Nordisk Europe East and South. N.P. has been an advisory board member of TrigoCare International, Abbott, AstraZeneca, Elpen, MSD, Novartis, Novo Nordisk, Sanofi-Aventis, and Takeda; has participated in sponsored studies by Eli Lilly, MSD, Novo Nordisk, Novartis, and Sanofi-Aventis; received honoraria as a speaker for AstraZeneca, Boehringer Ingelheim, Eli Lilly, Elpen, Galenica, MSD, Mylan, Novartis, Novo Nordisk, Pfizer, Sanofi-Aventis, Takeda, and Vianex; and attended conferences sponsored by TrigoCare International, AstraZeneca, Boehringer Ingelheim, Eli Lilly, Novartis, Novo Nordisk, Pfizer, and Sanofi-Aventis. J.D. has been an advisory board member of, Abbott, AstraZeneca, Elpen, MSD, Novo Nordisk, and Sanofi-Aventis; has participated in sponsored studies by Eli Lilly, MSD, Novo Nordisk, and Sanofi-Aventis; received honoraria as a speaker for AstraZeneca, Boehringer Ingelheim, Eli Lilly, Elpen, MSD, Novo Nordisk, Sanofi-Aventis, and Vianex; and attended conferences sponsored by AstraZeneca, Boehringer Ingelheim, Eli Lilly, Novo Nordisk, and Sanofi-Aventis. The other authors report no conflicts of interest.

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