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Research Article

Behind the Image: An Investigation of Greek Firefighter's Body Mass Index

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Abstract

Objective: This study aimed to conduct an initial investigation of obesity in Greek firefighters as determined by Body Mass Index (BMI) and identify dietary habits and factors associated with this obesity. **Methodology:** A quantitative survey was conducted for 190 firefighters serving in Northern Greece in 2015. To calculate BMI, anthropometric data were collected and data concerning the eating behaviors of firefighters were collected using a specific questionnaire. Descriptive statistics, including one way ANOVA and chi squared tests, were used to investigate factors related to obesity. **Results:** Among the total sample, 31.1% of firefighters had a normal weight ($18.5 < \text{BMI} < 24.99$), whereas 50% were overweight ($25.0 < \text{BMI} < 29.99$) and 18.9% were obese ($\text{BMI} > 30$). Analysis showed that participant age and area served were the only factors that significantly differed among firefighters with different BMI. More than 80% of firefighters agreed that there was a need for nutrition and exercise programs for firefighters, but only 4% followed a nutrition program. Firefighters indicated that the recent economic crisis had affected their food purchasing decisions. **Conclusion:** Age and area served are two factors that affect the BMI of firemen, wherein those older than 40 and serving in fire departments located in rural areas were more likely to be overweight. Although most firefighters in the study sample believed that there is a need for special nutrition and exercise programs for firefighters, few followed a nutrition program. The economic crisis in Greece and ensuing decreases in income may have affected healthy eating habits of firefighters.

Key words: Body mass index, firefighters, overweight, obesity

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The physical condition of firefighters is important both for their own health and for public safety^{1,2}. The physical requirements of the firefighting profession are high because firefighters must often work under difficult circumstances and high-risk conditions^{1,3}. Worldwide, firefighters are selected and trained according to strict criteria for fitness and health, as well as for their knowledge and experience in firefighting^{3,4}. Despite these criteria and the need for firefighters to maintain an excellent physical condition to meet the demands of their profession, the Body Mass Index (BMI), an indicator of healthy weight and physical condition of firefighters expressed as kg per meter square has followed general population trends, which have worsened over time.

In Greece, the fire brigade has an overall force of approximately 12,000 (permanent and seasonal) that is responsible for controlling fires at a local and national level. Candidate firefighters must have excellent physical condition, be able-bodied and have a suitable body type to fully meet the requirements of their mission^{5,6}. This ability is judged by medical examination and takes into account specific anthropometric data such as height, BMI and chest circumference. Candidates often also compete in specific sports and must meet certain physical expectations. Despite the demanding entry requirements, Greece has no continuous physical fitness evaluation system or special programs designed to help firefighters maintain or improve their physical condition. This situation is similar to that seen in other countries such as the United States^{2,7}.

Obesity has become a worldwide problem during the past decades⁸. The BMI is based on a weight/height ratio and is an important index used to classify population weights. By calculating BMI, populations can be classified into underweight, normal weight, overweight and obese⁹⁻¹¹. Surveys have shown that life expectancy is considerably lower for obese individuals, who are also more likely to experience serious disease^{10,12,13}. At the same time, several studies showed that there are significant healthcare costs associated with obesity, while others examined the impacts of obesity on performance and health consequences for various professions, including firefighters^{1,2,7,14,15}.

The general population in Greece has one of the highest BMI rates in Europe¹⁶. However, the BMI and obesity rates for Greek firefighters are not known. Here we conducted a survey of a representative sample of Greek firefighters to examine obesity rates using a case-specific questionnaire to assess information regarding BMI measures, identify dietary habits and factors associated with obesity.

MATERIALS AND METHODS

Study design and sample: The survey was conducted in two of the thirteen regions of Greece, Central and Western Macedonia, which are situated in the northern and northwestern part of the country, respectively. According to the 2011 census, the population of these two regions (2,165,000 residents in total) accounts for approximately 20% of the total population in Greece, whereas the total area occupied by these two regions is 27,962 km² (21.4% of total area of Greece). Around 2,000 firefighters serve Central and Western Macedonia (1,600 and 400, respectively). For this study we selected a representative random sample of 200 firefighters from both regions based on catalogs listing active firefighters. Participation in the survey was completely voluntary, anonymous and confidential, as personal and anthropometric data were collected. Questionnaires were administered through personal interviews and 200 firefighters completed the questionnaires during the first half of 2015. Of these, 190 were found to be reliable and were used to constitute the final sample. A total of 37 questionnaires were collected from the Western Macedonia region and the remaining 153 were submitted from Central Macedonia.

Measures: Firefighters provided demographic information, including their age, marital status, education and income. Moreover, information about their service, such as required tasks and duties, was collected. The questionnaire regarding eating habits of firefighters consisted of 28 questions grouped in seven sections: General views of firefighters on diet and exercise, views regarding the relationship between their profession and diet, special nutrition and exercise programs followed and whether and why such regimens were mandatory, purchase and consumption of specific foods, frequency of food purchase and criteria that influence food purchase choices outside the home.

The firefighters answered each question using a 5 or 7-point Likert-type scale. The researcher, with the assistance of a trainee, measured the height and weight of the firefighters and rechecked their measurements. An accredited medical weight scale and a stadiometer were used for the measurements.

Statistical analyses: The firefighters were grouped according to their BMI and the service area/city. The BMI groups were defined according to WHO criteria and were: "Underweight", below 18.5 kg m⁻², "Normal weight": ≥ 18.5 -24.9 kg m⁻², "Overweight": ≥ 25 -29.9 kg m⁻² and "Obese": ≥ 30 kg m⁻². The

first group of the sample to be questioned was located in an urban area (two fire departments); the second group was located in two semi-urban areas and the third group was located in two rural areas. One-way ANOVA was performed to test for group differences and the effects of age and BMI. Chi-square tests were used to test BMI and area differences. All statistical analyses were performed using the Statistical Package for Social Science (SPSS) version 20.0 for windows (SPSS Inc., Chicago, IL, USA) with a significance level of 5%.

RESULTS AND DISCUSSION

The majority of firefighters who participated in the study were male (94.5%) and married (70.5%). The number of female firefighters was low due to the high standards for physical strength. In terms of rank, 66.8% of the sample were rank firefighters, either professional or volunteer, whereas 24.8% were non-commissioned officers and 8.4% were officers. For education level, 70.5% had completed basic or secondary education, 27.9% had a university degree and 1.6% had undertaken postgraduate studies (Table 1). The majority (41%) served in the two fire departments located in the semi-urban areas, while 35.3% served in two fire departments in the urban area of Thessaloniki and the remaining 23.7% were in two fire departments in rural areas. Around one-third (32.1%) of the firefighters in this study were regular or occasional smokers, which is consistent with the percentage of smokers in the general population of Greece (32.6%), but is very high compared to the average (24%) of regular and occasional smokers in the general population of Europe¹⁷.

Anthropometric measurements for the firefighters showed an average height of 178.5 cm and an average weight of 86.5 kg. According to BMI standards, 31.1% of the total sample of firefighters were of normal weight ($18.5 < \text{BMI} < 24.99$), whereas 50% were overweight ($25.0 < \text{BMI} < 29.99$) and 18.9% were obese ($\text{BMI} > 30$) (Table 2). One way ANOVA analysis to identify differences between the three BMI groups showed that only age appeared to be statistically different among the three groups with respect to BMI (Table 2). Group I had BMI values in the normal range

were younger (Mean age: 37.83, standard deviation 6.01), whereas firefighters in group II, overweight, were older (Mean age: 39.51, standard deviation: 7.41) and the average age of obese firefighters in group III was over 43 years (Mean age: 43.03, standard deviation: 6.05).

To examine if there is a relationship between area served and BMI, the analysis moved a step forward and cross tabulations were performed (Table 3). Firefighters of normal weight, based on BMI standards, represented 31.1% of the total sample and of these 50.8% worked in urban areas. Meanwhile, 50 and 25% of overweight and obese firefighters served in semi-urban and rural areas, respectively.

To take into account the viewpoints of the firefighters regarding the relationship between nutrition and weight, a specific question was included in the survey. Results indicated that the 89% of the sample believed that firefighters should follow a specific nutritional program and 80% believed that they themselves should follow a specific exercise program in parallel to maintain optimal health and fitness levels. When asked if they followed a specific nutrition program, 37.4% of

Table 1: Demographic characteristics for fire-fighters participating in this survey

Respondent's features	Count/mean	Percentage/ standard deviation
Gender		
Male	179.0	94.2%
Married		
Yes	134.0	70.5%
Age (years)	39.6	6.9
Height (cm)*	178.5	6.8
Weight (kg)*	86.5	12.9
Smoker	61.0	32.1%
Education		
<9 years (basic)	108.0	56.8%
9-12 years (high school)	26.0	13.7%
12-14 years (college)	53.0	27.9%
15-16 years (higher)	3.0	1.6%
Rank		
Fire-fighter	127.0	66.8%
Sub Officer	47.0	24.8%
Officer	16.0	8.4%
Working area		
Urban	67.0	35.3%
Semi urban	78.0	41.0%
Rural	45.0	23.7%

Table 2: ANOVA analysis and results for respondents' age according to BMI index

Groups	Mean age	Count	Percentage	Standard deviation	Standard error
Underweight (BMI<18.5)	-	-	-	-	-
Normal (18.5<BMI<24.99)	37.83	59	31.1	6.018	0.783
Overweight (25.0<BMI<29.99)	39.51	95	50.0	7.419	0.761
Obesity (BMI>30)	43.03	36	18.9	6.056	0.054
	Sum of squares	df	Mean square	F	Significance
Between groups	608.049	2	304.025	6.713	0.002
Within groups	8469.025	187	45.289		
Total	9077.074	189			

the firefighters answered positively (Table 4). The motives/reasons for adopting a specific nutrition program were quite interesting (Table 4). Among the reasons noted for following a specific nutrition program, 10% had health problems that already existed, 76% wanted to avoid future health problems, 10% wished to increase performance at work and 4% followed specific diets for esthetic effects. Thus, the decision of firefighters to adopt specific nutrition and exercise programs was independent and was not compulsory for service.

The study further aimed to identify criteria that affect firefighters' decisions for purchasing and consuming food products (Table 5). According to their responses, calorie content was not a significant factor in food purchasing decisions as evidenced by the low value for this criterion. Similarly, the fat content had a low influence on their selection decisions. On the other hand, criteria such as expiration date and country/place of origin were the most influential in their decisions.

Table 5 reveals the results of recent studies concerning food consumption patterns during the current period of economic crisis in Greece. The ranking of the ten criteria could be influenced by the economic situation that Greek firefighters are experiencing due to the economic crisis in Greece and the severe reduction in disposable incomes of public servants^{18,19}. Thus, the firefighters in this sample were also asked whether the economic crisis affected their nutrition habits. Their answers confirmed previous findings in that 61.3% said that economic factors indeed affected their food purchasing decisions. Moreover, 51% stated that, due to the reduction in their salaries, they had to switch to cheaper food products, whereas 39.3% selected private label products.

In the general population of Greece, the percentage of adult obese men and women is 26 and 18.2%, respectively, whereas the combined percentage of overweight and obese men in the 35-64 age group is 70.3%^{16,13}. Greek firefighters have similar or lower rates than the general population, as the

percentage of overweight and obese firefighters was 68.9%, while the percentage of those who were obese was only 18.9%. The percentage of overweight and obese Greek firefighters in 2015 was lower than that shown in various studies regarding firefighters in the United States and Russia (73-88%) and higher than firefighters in the United Kingdom (66%)^{7,8,14,15,20-22}. The reasons for these differences may be that Greek firefighters do not face similar health and fitness issues as their colleagues in other countries and the differences could be related to overall differences among the general population. At European level, the average percentage of overweight and obese firefighters is 51.6% (15.9% overweight), which indicates that the percentage of obese and overweight Greek firefighters is still high.

The relationship between age and BMI among firefighters is significant and seems to be confirmed here for Greek firefighters in that increased BMI was positively associated with increased age²³⁻²⁵. This correlation may be due to a given perspective that justifies the neglect of weight regulation and

Table 3: Cross tabulation for BMI and working areas

BMI category	Working areas			Total
	Urban	Semi-urban	Rural	
Normal				
Count	30.0	16.0	13.0	59.0
Within BMI (%)	50.8	27.2	22.0	100.0
Within areas (%)	44.8	20.5	28.9	31.1
Overweight				
Count	28.0	44.0	23.0	95.0
Within BMI (%)	29.5	46.3	24.2	100.0
Within areas (%)	41.8	56.4	51.1	50.0
Obesity				
Count	9.0	18.0	9.0	36.0
Within BMI (%)	25.0	50.0	25.0	100.0
Within areas (%)	13.4	23.1	20.0	18.9
Total				
Count	67.0	78.0	45.0	190.0
Within BMI (%)	35.3	41.0	23.7	100.0
Within areas (%)	100.0	100.0	100.0	100.0

Chi square test: Pearson chi-square 9.269, df= 4, Asymp. Sig. (2-sided) = 0.055

Table 4: Fire-fighter's special needs for nutrition and exercise and special nutrition plan

Respondent's response	Count	Percentage
Firemen need a special nutrition plan?	169 yes	89.0
Firemen need a special exercise program?	151 yes	80.0
For which reason? (for those answered yes)		
For healthiness	136	90.0
Physical strength and physically fit	12	8.0
Aesthetic reasons	3	2.0
Do you follow a special nutrition plan?	71 yes	37.4
For which reason do you have to follow this specific plan (for those answered yes)		
To avoid health problem	54	76.0
There is a health problem	7	10.0
Increase work performance	7	10.0
Aesthetic reasons	3	4.0

Table 5: Criteria for choosing food products

Parameters	Mean*	Percentage
Expiration date	6.15	1.463
Country/place of origin	5.44	1.745
Nutrition facts	5.14	1.731
Food additives	5.09	1.935
Price	4.91	1.833
Antioxidants	4.76	1.863
Fat content	4.56	1.901
Packaging	4.42	1.685
Label/manufacturer	4.40	1.595
Calories (caloric content)	4.06	1.913

*min: 1, max: 7

therefore of fitness after a certain age. This perception could be related both to the type of service (workload and work intensity), as well as to the non-participation in nutrition and fitness programs.

The study results also revealed a relationship between BMI and area served. Firefighters with normal BMI mainly served in urban areas, whereas those who were overweight and obese mainly served in fire departments located in semi-urban and rural areas. This finding could be explained by the workload in each area. The frequency of fires is lower for fire stations located in semi-urban and rural areas, where firefighters mostly deal with forest fires during the summer months. In contrast, urban firefighting forces have significantly higher workloads, as fires and other incidents in urban areas occur more frequently. In 2015 the fire departments in urban areas of the study handled 3,698 cases, of which approximately 50% were urban fires. Meanwhile, departments in semi-urban and rural areas faced a total of 1,114 cases of which 237 were forest fires. The fact that the urban fire departments in this study had about triple the workload in relation to the departments in semi-urban and rural areas, which is confirmed by statistics from the Greek Fire Department^{26,27}. Apart from the limited workload, firefighters serving in rural and semi-urban areas may be harmonized with regional lifestyles and thus may have abandoned eating habits and exercise that usually characterize an urban lifestyle.

Even though Greek firefighters firmly believe that they should maintain good health and follow a specific diet and exercise program in order to perform their jobs effectively, only 37% of them do so voluntarily. Both the National Fire Protection Association (NFPA) of the United States and the International Association of Fire Fighters (IAFF) systematically publish recommendations for initiatives/periodic fitness programs so that firefighters can meet evaluation criteria set by their service and achieve sufficient performance, although specific BMI target levels are not defined^{7,28,29}. In Greece there is no established evaluation system for firefighters and no regulations are in place to require that firefighters maintain

their fitness. The absence of a system for periodic evaluation of fitness, either at a central or department level, could lessen the motivation of firefighters to participate in fitness or diet programs. At the same time, their food purchase choices were not consistent with maintenance of a healthy diet, as the firefighters in this sample gave little regard to calorie or fat content when selecting food. Instead, food choices appeared to have a stronger association with the satisfaction of nutritional needs in accordance with reasonable prices. Finally, the economic crisis in Greece is another factor that leads to a "Cheaper" and likely lower-quality diet.

In conclusion, this is the first study of obesity in Greek firefighters obesity. The results showed that Greek firefighters are far from meeting an "Apollonian" body type, despite their having lower obesity rates relative to the general population of Greece and to those of their colleagues from other countries. Age and place of work were related to BMI. Moreover, differences in workload and the effects of the recent financial crisis in Greece seem to be the most important factors that affect the "Image" of firefighters regarding their weight and eating habits. The results suggest that adoption of diet and exercise programs could help avoid an increase in the percentage of overweight and obese firefighters, whereas the introduction of systematic evaluation of physical condition in correlation with specific target levels could provide beneficial effects for the firefighters themselves and for the public they serve.

SIGNIFICANCE STATEMENTS

This study is the first to identify factors that are related to the physical condition and BMI of Greek firefighters. Even though the reasons behind obesity rates for firefighters remain unclear, the results of this study could nonetheless inform the design of strategies to decrease obesity rates for workers such as firefighters who have physically demanding jobs. The study provides the basis for recommendations for future interventions and actions that could improve the overall condition of firefighters in Greece.

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