BODY MASS INDEX, CENTRAL OBESITY, AND DIETARY PATTERNS IN A GROUP OF YOUNG ADULT MEN

Polikandrioti M.,[1] Kotronoulas G.,[2] Liveri D.,[3] Giovaso S.,[3] Varelis G.,[3] Kyritsi E. [4]

1. Laboratory Instructor, Nursing A Department, Technological Educational Institution (TEI) of Athens Greece,
2. RN, Msc,
3. Undergraduate Nurse,
4. Professor in Nursing A Department, Technological Educational Institution (TEI) of Athens Greece

Abstract

Over the last decades, obesity has been increased in alarming rates not only in our country but also worldwide, tending to become one of the major health problems in the western world.
Purpose: The purpose of the present study was to explore the relationship between dietary patterns and body mass index, as well as central obesity in young adult men.
Method and Material: Study sample consisted of 1,000 army recruits and data was collected during their first referral for medical examination post recruitment. Collection of data was performed by means of a specifically designed questionnaire, which recruits were asked to complete themselves. Basic anthropometric measures were calculated and recorded by the examining physicians. Analysis of data was performed using the SPSS 15 statistical package and one-way ANOVA and t-tests were applied for the statistical process.
Results: Regarding age, 13.8% of participants were 19-21 years old; 50.8% were 22-24 years old, and 30.7% were 25-27 years old, while 4.7% of participants were 28-30 years old. Regarding educational background, a 4.7% had received only basic education; 31.6% had received high-school education; and 63.7% had attended some college or university. 54.8% of participants considered their weight being "normal"; 5.1% considered weight being slightly or excessively above normal rates; and 40.3% reported that their weight was below normal rates. However, measurement results showed that only 58.7% of recruits were actually of normal body weight; 37.2% were overweight; and 4.1% were obese. Regarding central obesity, 50.3% of responders were classified as belonging to "low risk" group, with a 48.6% belonging to "moderate risk" group, and another 1.1% to "high risk" group. Statistic analysis of data revealed that the specific pattern of nourishment is associated to body mass index and to central obesity. More in advance, it was found that persons possessing optimal body weight were consuming significantly more frequently poultry, fish, or roast beef, p=0,022, as well as less bread, p=0,036 compared to the overweight participants. In addition, persons possessing optimal body weight were found to consume more frequently refreshers, sports drinks or soft drinks, p=<0,001, as well as snacks and desserts, p=<0,001 compared to both overweight and obese persons. Interestingly, persons with normal body weight reported consuming significantly more frequently fast-food meals, eggs, and sandwiches in their lunch-time, p=0,007 and p=0,040, respectively. Relatively to central obesity, recruits in "moderate risk" consumed significantly more frequently fast-food meals, p=0,005, more bread, p=0,035 and less fruit, p=0,030 than those in "low risk" for central obesity.
Conclusions: Results of the present study suggest that the pattern of nourishment is not directly correlated to body mass index, but rather to central obesity

Keywords: Body weight – Body Mass Index – Dietary patterns – Central obesity

Corresponding author:
Polikandrioti M. Athens, Greece.
E-mail : mpolik2006@yahoo.com

Introduction

Obesity constitutes a significant universal issue of public health as regards both the developed countries and the developing ones, because of its increased frequency and prevalence as well as its serious consequences on health.[1,2]

Obesity was first identified as a nosologic entity in antiquity by Hippocrates, who maintained that: "sudden death is more frequent among the obese rather than the thin individuals".[3] Nowadays, incidence of obesity increases rapidly.

Over the last decade, prevalence of obesity among adults in developed countries has been increased by 37%. Approximately 250,000,000 individuals, that is, 7% of adult population, are considered to be obese, while the phenomenon is extended even in young adults. It is estimated that in the US more than 50% of men and women are overweight, while 25% of them are clinically obese.[4,5]

The World Health Organisation (WHO) describes obesity as being among the modern epidemics, which put at risk the lives of a considerable part of human population, and predicts that in 21st century it is going to be reformed into a plague with raging consequences for public health and social insurance systems. Since 1948, the WHO has included obesity in its list of diseases. Although obesity represents the second more prevalent cause of death, it surely can be prevented.[6,7]

By the term "obesity" it is described the pathologic increase of deposition of fat in the human body, which causes an increase in human body weight way over the normal standards. Obesity produces as a result of excessive intake of calories, more than those required by a person's energy need (Energy Intake – Energy Consumption). Obesity is associated to genetic and environmental factors influence endocrine, metabolic and regulatory processes of the body, resulting in several problems and chronic affections, such as diabetes, hypertension or cardiovascular diseases. Additionally, it is related to increased morbidity, poor quality of life and decreased life expectancy.[8,9]

Obesity's negative impact on health is classified in short-term consequences such as orthopedic, respiratory, cardiovascular, or psychological problems, and long-term ones. Early prevention of obesity constitutes a major issue of interest, given the lack of an explicit definition of diagnostic criteria. What is more, body weight by itself does not represent a criterion for the diagnosis of obesity. Anthropometric measures for the evaluation of obesity such as the body mass index (BMI) and the hip-to-waist ratio (HWR) are among the most frequently used for the diagnosis of the disease, since they are cost-effective and easily performed.[1,3,10]

According to the literature, adopting a Mediterranean pattern of nutrition, which is described as containing high proportion of mono-unsaturated fat acids versus saturated fats, contributes in the preservation of body weight, while expands longevity and life expectancy. This nutritional model has been adopted by many countries and it is diversified according to the cultural and socio-economic features of each country. Several research studies have commented on the beneficial effects of the Mediterranean diet in the preservation or decrease of body weight, in the primary or secondary prevention of coronary disease, in the maintenance of high density cholesterol (HDL) and triglycerides within normal rates, as well as in the significant reduction in mortality rates.[11,12,13,14] Besides the Mediterranean nutritional pattern, increase of physical activity or avoidance of a sedentary lifestyle, can also contribute to the control of body weight.

Purpose

The purpose of the present study was to explore the relationship between dietary patterns and body mass index, as well as central obesity index in young adult men.

Material and Methods

Study sample consisted of 1,000 army recruits and data was collected during their first referral for medical examination post recruitment.

Collection of data was performed by means of a specifically designed

questionnaire, consisted of 71 self-report items for dietary pattern and practices plus a special section asking for respondents' demographic data. Evaluation of obesity was performed by calculating the body mass index (BMI) and the waist-to-hip ratio (WHR). These anthropometric measures were calculated and recorded by the examining physicians. Individuals were categorised in relation to the aforementioned measures on the basis of the classification suggested by the World Health Organisation.

The body mass index (BMI) constitutes the most frequently used measure for the evaluation of obesity and it is defined as the individual's body weight (in kilograms) divided by the square of their height (in metres). The formulas universally used in medicine produce a unit of measure of kg/m^2. For adult population, the current value settings are as follows: a BMI of 18.5 to 25 kg/m^2 may indicate optimal weight; a BMI of above 25 to 30 kg/m^2 may indicate the person is overweight while a number above 30 kg/m^2 suggests the person is obese. According to the literature, BMI is an assessment tool that can not precisely reflect the sustained condition since it does not take into account the varying proportion of body fat. BMI estimates the total amount of fat, but it can not thoroughly determine the distribution of body fat.[15]

Central obesity was estimated using the hip-to-waist ratio (WHR) that refers to the comparative distribution of body fat by measuring the hip circumference at its widest part (in centimetres) and dividing that into the waist circumference (in centimetres). A WHR lower than 0.88 is associated to low risk for health status; a WHR of 0.88 to 0.95 shows moderate risk; a WHR of above 0.95 to 1.0 shows high risk while in persons with a number above 1.0 WHR has been associated to very high risk for their general health.

For the exploration of dietary pattern and practices, frequency of consumption of selected meals (such as refreshers, alcohol, fruit, snacks, fast-food, meat, etc.) was used.
Statistic analysis was conducted using the Statistical Package for Social Sciences 15 (SPSSInc.; Chicago) and one-way ANOVA and t-tests were applied for the statistical process.

Results
a. Descriptives
Regarding age, participants were classified as follows: 13.8% were 19-21 years old; 50.8% were 22-24 years old; 30.7% were 25-27 years old while 4.7% of participants were 28-30 years old.

Regarding educational background, 4.7% had received only basic education; 31.6% had received high-school education; and 63.7% had attended some college or university.

In terms of residence, 27.3% of the respondents were living in a metropolitan area; 50.7% were living in a small town while 21.9% were living in some village.

In terms of current occupational status, 4.4% were unemployed; 2.5% were health professionals; 16.4% were laborers; 51.5% were qualified professionals currently off work; and 25.1% were clerks, (Table 1).

5% of the sample had been earlier diagnosed a medical disease that required compliance to a special diet, while 20.6% of the sample had known trophic allergies.

54.8% of participants considered their weight being "optimal"; 5.1% considered weight being slightly or excessively above normal rates; and 40.3% reported that their weight was below normal rates. However, measurement results showed that only 58.7% of recruits were actually of normal body weight; 37.2% were overweight; and 4.1% were obese.

Regarding central obesity, 50.3% of responders were classified as belonging to "low risk" group, with a 48.6% belonging to "moderate risk" group, and another 1.1% to "high risk" group, (Table 2).

b. Statistics
Statistic analysis of data revealed that participants with optimal body weight were consuming significantly more frequently poultry, fish, or roast beef, p=0,022, as well as less bread, p=0,036 compared to the overweight participants, (Table 3,4).

In addition, persons possessing desirable body weight were found to consume more

frequently refreshers, sports drinks or soft drinks, p=<0,001, as well as snacks and desserts, p=<0,001 compared to both overweight and obese persons, (Table 5,6).

Table 1. Demographic characteristics of the study sample.

Demographic Characteristics		
AGE	n	%
19-21 years old	137	13.8
22-24 »	505	50.8
25-27 »	305	30.7
28-30 »	47	4.7
EDUCATIONAL BACKGROUND		
Basic Education	163	16.3
High-school	28	24.8
College or University	505	50.6
Postgraduate studies	82	8.2
OCCUPATION		
Unemployed	42	4.4
Laborer	156	16.4
Clerk	238	25.2
Health professional	24	2.5
Qualified professional (currently unemployed)	489	51.5
RESIDENCE		
Metropolitan area	270	27.3
Small town	502	50.8
Village	217	21.9

Table 2. Classification of the study sample based on BMI results, central obesity estimations, and own beliefs regarding the body weight group they belong.

Anthropometric characteristics		
BMI	n	%
Desirable-optimal body weight	586	58.7
Overweight	372	37.2
Obese	41	4.1
CENTRAL OBESITY		
Low Risk	494	50.3
Moderate Risk	478	48.6
High Risk	11	1.1
SAMPLE STUDY OWN BELIEFS REGARDING BODY WEIGHT		
Optimal body weight	543	54.6
Above normal rates of body weight	51	5.1
Below normal rates of body weight	401	40.3

Table 3. Comparison of mean white meat and red meat consumption in regard with Body Mass Index.

BMI	MEAT CONSUMPTION		
	n	$\overline{X} \pm SD$	
Optimal body weight	586	8.72 ± 6.08	
Overweight	372	7.78 ± 6.45	p=0,022
Obese	41	6.81 ± 5.41	

Table 4. Comparison of mean bread consumption in regard with Body Mass Index.

BMI	BREAD CONSUMPTION		
	n	$\overline{X} \pm SD$	
Optimal body weight	586	10.72 ± 10.03	
Overweight	372	11.28 ± 12.47	p=0,036
Obese	41	19.57 ± 14.91	

Table 5. Comparison of mean refreshers, sports drinks, and decoctions consumption in regard with Body Mass Index.

BMI	CONSUMPTION OF REFRESHERS, SPORTS DRINKS & DECOCTIONS		
	n	$\overline{X} \pm SD$	
Optimal body weight	586	11.50 ± 7.89	
Overweight	372	9.59 ± 8.03	P=<0,001
Obese	41	8.08 ± 5.50	

Table 6. Comparison of mean snacks and desserts consumtion in regard with Body Mass Index.

BMI	SNACKS AND DESSERTS CONSUMPTION		
	n	$\overline{X} \pm SD$	
Optimal body weight	586	12.20 ± 8.69	
Overweight	372	9.71 ± 8.93	P=<0,001
Obese	41	9.64 ± 7.99	

Interestingly, persons with normal body weight reported consuming significantly more frequently fast-food meals, eggs, and sandwiches in their lunch-time, p=0,007 and p=0,040 respectively, (Table 7,8).

Relatively to central obesity, recruits in "moderate risk" consumed significantly more

frequently fast-food meals, p=0,005, more bread, p=0,035 and less fruit, p=0,030 than those in "low risk" for central obesity, (Table 9,10,11).

Finally, it was found that the older a person was, the higher the body mass index.

More in detail, BMI in the 28-30 age group significantly differed from all respective ones in the other age groups, that is 19-21 age group, p=0,001; 22-24 age group p=<0,001 and 25-27 age group, p= <0,001.

Table 7. Comparison of mean fast-food consumption in lunch-time in regard with Body Mass Index.

BMI	FAST-FOOD CONSUMPTION		p=0,007
	n	$\overline{X} \pm SD$	
Optimal body weight	586	11.90 ± 9.32	
Overweight	372	9.89 ± 10.11	
Obese	41	10.56 ± 8.39	

Table 8. Comparison of mean "easy-to-prepare" food (eggs, sandwiches) consumption in regard with Body Mass Index.

BMI	EGGS & SANDWICHES CONSUMPTION		p=0,040
	n	$\overline{X} \pm SD$	
Optimal body weight	586	8.11 ± 6.66	
Overweight	372	7.07 ± 7.13	
Obese	41	6.55 ± 5.81	

Table 9. Comparison of mean fast-food consumption in lunch-time in regard with Central Obesity estimation.

CENTRAL OBESITY	FAST-FOOD CONSUMPTION		p=0,005
	n	$\overline{X} \pm SD$	
Low risk group	494	10.26 ± 9.05	
Moderate risk group	489	11.98 ± 10.16	

Table 10. Comparison of mean bread consumption in regard with Central Obesity estimation.

CENTRAL OBESITY	BREAD CONSUMPTION		p=0,035
	n	$\overline{X} \pm SD$	
Low risk group	494	10.36 ± 10.98	
Moderate risk group	489	11.86 ± 11.36	

Table 11. Comparison of mean fruit consumption in regard with Central Obesity estimation.

CENTRAL OBESITY	FRUIT CONSUMPTION		p=0,030
	n	$\bar{X} \pm SD$	
Low risk group	494	22.22 ± 14.76	p=0,030
Moderate risk group	489	20.17 ± 14.81	

Discussion

The actual incidence of obesity in Greece remains unknown, since certain statistical data reflecting the extent of the problem are still unavailable. So far, obesity's estimation of prevalence within the Greek adult population was based on mere conjectures deriving from limited local research studies, which used to enroll small, non-representative samples.

According to the results of the present study, body mass index assessment showed that 58.7% of the male participants had optimal body weight, while 37.2% were overweight, and 4.1% were obese. A study conducted by the Hellenic Medical Association turned up with similar results, concluding that 41.1% of men were overweight, and 26% were obese. More in detail, it was found that obesity was prominent in 11.4% of those included in the 20-30 years old age group, while its proportion firmly varied between 26.0% and 28.0% within the 21-70 years old age group.[16]

It is worth mentioning that the aforementioned study conducted by the Hellenic Medical Association in collaboration with the Ministry of National Education and Religious Affairs, was the first Panhellenic epidemiologic study to identify the incidence of obesity in Greece as well as that of the associated medical conditions. Its purpose was to plan and determine a nationwide policy for the treatment and prevention of obesity.

In the present study it was found that regarding central obesity, 50.3% of responders were classified as belonging to "low risk" group, with a 48.6% belonging to "moderate risk" group, and another 1.1% to "high risk" group. Relevant studies suggest that the minimum body fat percentage should reach 7% in males and 12% in females. However, body fat percentage varies depending on the individual and may be twice as the minimum required.[15,16,17]

In the literature it is cited that central obesity is associated to increased health risk. The reasons are that the abdominal adipose tissue is more sensitive to hormonal stimuli and to alterations in fatty acids' deposition and in metabolism. Moreover, abdominal fat cells are closest to the flow of blood towards the liver, in portal circulation. This means that there it is generated a significant increase in the flow of non esterised fatty acids towards the liver through portal vein's blood especially as regards patients with central obesity.

Statistic analysis of data revealed that the specific pattern of nourishment is associated to body mass index and to central obesity.

Determination of the specific type of obesity by using the Body Mass Index (BMI) or the Hip-to-Waist Ratio (WHR) constitutes an area of major scientific interest and relevant studies conducted usually refer to these different measures.

A comprehensive review of literature as regards the assessment of obesity in association with BMI and central obesity leads to a conclusion that, besides dietary pattern and practices, there other factors to be taken into account as well such as demographic characteristics, socio-economic status, as well as person's educational background and the extent of proper information.[16,17-25]

Kasiam Lasi On'kin et al.[18] found that BMI was negatively correlated to individuals' age, while, similarly to the results of the present study, central obesity was more frequent before the age of 20 years old and in the 40-60 years old age group.

Relevant research has shown that the higher the body mass index and the severer the central obesity, the higher the risk for occurrence of diabetes (type II), as well as development of cardiovascular or renal diseases.[16,17]

In the present study it was found that individuals with optimal body weight were consuming significantly more frequently poultry, fish, or roast beef, as well as less bread compared to the overweight participants. A balanced diet significantly contributes to the maintenance of an optimal body weight; this fact is based on relevant research suggesting that in those persons consuming protein-containing meals blood sugar levels are not increased abruptly and subsequently insulin levels remain low, thus leading to rare feelings of hunger soon after a meal; the opposite seems to happen after carbohydrates uptake.[13,14,16]

Several studies have concluded that stability of body weight and decrease in the incidence of heart attack were observed in those routinely consuming fish. However, it still remains unclear whether that decrease is down to fish fat or to scattered elements found over the whole body of fish.[13,14,15,16,19] ω-3 fatty acids' beneficial effects are accomplished through consumption of either 30 grams of fish daily or one complete fish meal per week. In addition, consumption of fresh, non-specially processed products allows for the uptake of more vitamins and mineral nutrients, thus leading to stability of body weight.[13,14,15,16]

Furthermore, it was found that persons possessing desirable body weight were found to consume more frequently refreshers, sports drinks or soft drinks, as well as snacks and desserts compared to both overweight and obese persons. This result contraddicts previous findings suggesting that scarce consumption of refreshers, even fruit juice, successfully prevents development of obesity; however, this seems to be a matter of concern within scientific community. Over the last decade, several theories have been suggested in an effort to explain why some people maintain a stable body weight easier than others, even if the latter exert a balanced dietary pattern as well. Many researchers have commented on this discrepancy, but they have later concluded with negative correlation between BMI and ailments probably leading to development of obesity. One possible explanation may be that individuals with a normal BMI rarely worry for the actual quality of their nutrition, thus exerting a relatively unhealthy dietary pattern in comparison with obese individuals who may tend to consume types of food that regard as less fattening. Another explanation could also be that obese persons do not always reveal the actual quantity of food they consume.[20,21,22]

Interestingly, we found that persons with normal body weight reported consuming significantly more frequently fast-food meals, eggs, and sandwiches in their lunch-time. This finding also seems to be inconsistent with literature, where it is underpinned that fast-food (which nowadays has in part substituted traditional home-made food) constitutes a threat for health, since it contains chemically processed ingredients of low nutritional value and rich in sugar, as well as excessive amount of salt, conservatives and saturated fats. Several reasons are to be held responsible for this turn of modern people (and especially the young) to this type of nutrition: fast-food is cheaper, more attractive and tasty, easily prepared and straightforwardly taken over. Given these features in combination with woman's introduction to marketplace, emulation of western patterns, and increase of modern demands people today more than ever resort to fast-food to fulfill their alimentary needs.[23,24,25,26] According to the literature, BMI is directly and strongly correlated to fast-food consumption, while risk for obesity increases as fast-food consumption becomes more frequent.[27,28]

Relatively to central obesity, recruits in "moderate risk" consumed significantly more frequently fast-food meals, more bread and less fruit than those in "low risk" for central obesity. It is also known that fast-food consumption dramatically increases the risk for central obesity.[27,28,29,30]

As it was previously mentioned, central obesity (that is deposition of fat around the waist) is implicated for greater risk than deposition of fat elsewhere on the body. In the literature it is stated that size of waist

periphery constitutes by itself an important predisposal factor for the occurrence certain health problems. Men with waist periphery of >102 cm and women with waist periphery of >88 cm are considered of being in greater risk. Central obesity and associated health conditions have led to the introduction of a novel type of syndrome, known as metabolic syndrome, which is described by an increased concentration of fat around the abdomen, increased resistance to insulin, high blood levels of LDL, and increased blood pressure. Thorough evaluation of central obesity's severity should also take into consideration the aforementioned important factors.[31,32,33,34,35]

Conclusions

The findings of the present study suggest that it is the specific type of nutrition (dietary pattern) that is associated in greater extent and in a direct way to body mass index, as well as central obesity ratio. In addition, BMI and WHR tend to increase proportionately to age, while young adult men seem to underestimate their actual body weight, and to be oblivious to optimal (desirable) body weight.

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