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Influence of Socio-economic, Dietary and Behavioral Factors on Overweight and Obesity in Bulgarian Men

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ABSTRACT The aim of this paper is to study the influence of some social, economic, and demographic factors, nutritional habits and lifestyles on the prevalence of overweight and obesity among male adult population in Bulgaria. A cross-section population study of a sample of 860 men aged 30-50 years from the town of Plovdiv, Bulgaria was undertaken. Overweight and obesity were defined according to the International Obesity Task Force's cut-off points for Body Mass Index in adults. The information about marital status, residency, income and education level of each person is obtained by interview. The data regarding eating habits, preferred food, alcohol consumption, smoking status and leisure activities was collected using a questionnaire. The statistical analysis was made by SPSS 19. Findings show that the marital status, education, tobacco and alcohol consumption are the significant factors affecting overweight and obesity. The risk increases considerably in men with primary and secondary education (OR=1.80, $p<0.05$), ex-smokers (OR=3.007, $p<0.01$), heavy drinkers (OR=2.22, $p<0.01$), and married men (OR=0.54 $p<0.05$). At the same time the absence of a family, higher education and smoking reduce this risk to a great extent. The model did not identify a significant connection between overweight or obesity and the factors including place of residence, eating habits, preferred food and leisure activities. In conclusion, the results show alarming trends in the spread of overweight and obesity conditions among adult men in Bulgaria. The strategy for counteracting this alarming trend involves increasing education and income, applying a correct nutrition model, reducing smoking and abstinence from drinking.

INTRODUCTION

The number of people suffering from obesity is growing worldwide, making it one of the most alarming and quickly developing health problems of the present time. Due to the serious medical (Yehia et al. 2015; Rodríguez et al. 2011; Ishikawa-Takata et al. 2002) and economic consequences of overweight and obesity, public health experts, scientists and politicians are looking for the best strategies to fight this trend (World Health Organization 2006, 2013; Katz et al. 2005; Doak et al. 2006; Ortega et al. 2013). This requires a better understanding of the reasons for its occurrence and identification of the factors that define it (Hanife 2015; Todd 2015). It is known that obesity has a multifactor etiology. It is a result of the interaction of genetic and environmental factors (Hetherington and Cecil 2010). Considering the fact that the genetic basis of the population does not change quickly, the environmental factors are those that account for the dramatic spread of obesity in the last few decades (Roth et al. 2004; Swinburn et al. 1999; Grabauskas et al. 2003). The increased incidence of obesity worldwide is connected to the changes occurring in nutrition and the easy access to high calorie foods (Cao et al. 2014). There is high rate of consumption of cakes, buns, soft drinks and meat products and low consumption of fruit and vegetables (Aranceta et al. 2007; Lobstein et al. 2004). Bad nutrition habits, in combination with a sedentary life favour a positive energy balance resulting in gradual accumulation of fats (Swinburn et al. 2004).

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Many studies show that obesity is an undesired result of modern lifestyle and the effect of urbanization. The processes of urbanization come with less energy consumption in the workplace, during housework, due to the use of public transport, automobiles and elevators, to mention a few (Bell et al. 2002; Singh et al. 2007). Sedentary lifestyles, related to continuous watching TV or playing computer games, are stated as a significant factor for obesity (Gortmaker et al. 1996**).** In this sense, if one excludes the hereditary predisposition, which is undoubtedly important, the environment is an obvious component that contributes to the development of the condition today (Lazarevich et al. 2013).

There is convincing proof that positive changes in nutrition habits and physical activity may help prevent the problem (Kapoor et al. 2006). The prevention of obesity must begin during the earliest stages in life. It is clear that encouraging healthy nutrition and lifestyle habits during childhood is better than breaking bad habits at a mature age (Aranceta et al. 2007).

Obesity is increasing at an alarming rate in Bulgaria as well. The country ranks fifth in obesity in Europe, after FYR, Greece, Romania, and the Czech Republic. A number of studies show that around fifty-six percent of the Bulgarians are overweight, and eighteen percent are obese. In comparison only twenty-two percent of the Bulgarians had this problem back in the 70's of the twentieth century. Bulgaria is a country in East Europe, which is currently undergoing an economic and demographic transition. Some unfavorable characteristics and trends in nutrition are observed (Koleva et al. 2000). With the establishment of fast food chains in Bulgaria, the consumption of foods they sell, like burgers, snacks, crisps, soft drinks and chocolates, has increased (Study of the National Centre of Public Health and Analyses). Both unhealthy nutrition models and low physical activity account for the increased occurrence of overweight and obesity in the country. The annual report of the Ministry of Healthcare of Bulgaria on the health of the population and the implementation of the National Health Strategy 2013, shows that only two percent of the population exercise regularly, but seventy-eight percent never do, which is the highest rate among all EU countries (Annual Report of the Ministry of Health in Bulgaria on the State of The Health of Citizens and the Implementation of the National Health Strategy for 2013, Sofia). One in four Bulgarians is not motivated to exercise due to lack of time, facilities or infrastructure. The low social status of a significant part of the population, the wide use of tobacco, increased consumption of alcohol, bad diet and the sedentary lifestyle are among the risky behavioral factors related to the spread of obesity and the associated risk of metabolic and cardiovascular diseases in adults. These account for the need to create standardized and harmonized systems for monitoring obesity on a national level as a basis for the development and implementation of the health policies in the country. Hence, monitoring obesity in the country is of paramount importance as a tool to build national health policies on this issue (Petrova et al. 2012).

In this connection, the aim of the present research is to study the impact of some social, economic and demographic factors, nutrition habits and lifestyles on the spread of overweight and obesity among the male adult population.

METHODOLOGY

A cross-section population study of a sample of 860 working men aged 30-50 years of age (mean age of 39.08 ± 6.68 years) was conducted in 2004-2008 in the second largest city of Bulgaria, Plovdiv. The written informed consent of each person included in the research group was obtained, in accordance with the ethical principles for medical research involving human subjects in the Helsinki Declaration of World Medical Association (2000).

The height of the body is taken in a standing position, barefoot, with precision of 0.1 cm with the help of an original anthropometer GPM. The body weight is measured via a digital scale Tanita BC 465, barefoot, with precision of up to 0.1 kg. The BMI (Body Mass Index) was calculated on the basis on the data received, as weight to height ratio (kg/m^2). The BMI values are divided according to the International Obesity Task Force cut-off points for Body Mass Index in adults as follows: normal weight (BMI>18.5< 24.9 kg/m^2), overweight (BMI 25.0-29.9 kg/m^2), and obesity (BMI $\geq$ 30 kg/m^2). The demographic and social and economic status (single, married), residence (urban, rural), level of education and income are obtained via an interview. The level of education is classified in the following categories: primary education (eight years of school-

ing), secondary education or secondary school (twelve years of schooling), secondary vocational (thirteen years of schooling), and higher education (sixteen years of education). According to the National Institute of Statistics the average salary in 2008 in Bulgaria was BGN 412.98 per month (National Statistical Institute, Demographic and Social Statistics, Income of Households, Monthly Income per 2008). On the basis of this information, the average categories of monthly salaries were calculated as follows: low income (less than BGN 400), middle income (BGN 400-800), and above average income (over BGN 800). The data regarding lifestyle and behavior was collected via a questionnaire. Under consideration were eating habits (regular meals at a designated time or irregular meals), number of meals per day (two, three or more than three meals), preferred food on the menu (pork/chicken, milk/dairy products, sweets, fruit/vegetables or mixed food), alcohol consumption (never, rarely, moderately, heavily), smoking status (non-smoker, ex-smoker, smoker), level of smoking (lightly, moderately, heavily and very heavily), leisure activities or cultural activities (walks, reading books, going to the movies, theatre), agricultural activities (tilling land, farming or growing vegetables, animal breeding), and sports (minimum 60 minutes per week).

The statistical analysis of the data is completed using the software package SPSS version 19.0. The descriptive statistics are used (frequencies, cross tabulations, and chi-square test) to describe the main values. The connection between the selected predictor values and being overweight is evaluated by means of a logistic regression analysis. In the regression model, the dependable variable overweight is dichotomic, where BMI $\geq$ 25.00 or BMI > 25.00. The independent variables (marital status, residence, income, education, eating habits, number of meals, preferred food, alcohol consumption, smoking, level of smoking, leisure) are category values and a referent category has been chosen for each of them. The level of significance is $p < 0.05$ and $p < 0.01$.

RESULTS

The mean value of body height and the weight of the men included in the study are 172.52±6.65 cm and 80.74±13.26 kg. The mean value of the BMI of the studied sample is 27.11±4.06 kg/m^2. Of all men in the study, 33.3 percent fall in the category of normal body weight, 44.5 percent are overweight and 22.2 percent are with obesity. These results are summarized in Table 1.

The percentage of men with different BMI levels, classified on socio-economic and demographic characteristics is given in Table 2.

In the group of single men, the normal weight predominates (48.1%), whereas in the married men group the largest group is the overweight (45.6%). In both groups, the percentage of men with obesity is smallest, but it is more frequent among married men (22.7%), compared to the singles (16.5%). The majority of the men who reside both in the urban areas (44.8%) and in the villages (43.0%) are overweight. Men with lower monthly income are more frequently overweight (45.2%, 45.6%), while high-income men have normal weight (44.2%). Of the three groups with different income, those with middle income have the highest percentage of obesity (24.7%). Almost half the men with higher education have normal weight (49.3%), while those with secondary and primary education are overweight (over 40%) and obese (over 20%).

The percentage of men with different BMI levels, classified on the basis of eating habits is presented in Table 3. Overweight is observed both, among men with regular eating habits (48.4%) and among those who do not take regular meals (40.2%). It is remarkable that normal weight is more frequent among the groups eating two meals a day (40.1%), whereas overweight predominates the groups having three or more

Table 1: Statistical features of men from Plovdiv (Bulgaria)

Height	*Weight*	*BMI*	*Categories of BMI*		
N =860	*N=860*	*N=860*	*Normal weight*	*Overweight*	*Obesity*
Mean (SD)	*Mean (SD)*	*Mean (SD)*	*N (%)*	*N (%)*	*N (%)*
172.52 (6.65)	80.74 (13.26)	27.11 (4.06)	286 (33.3%)	383 (44.5%)	191 (22.2%)

Table 2: Percentage of men in different BMI levels classified on the basis of socio-economic characteristics

Men's characteristics	*Normal weight*	*Over-weight*	*Obesity*	*N*	*Pearson Chi-square*
		Socio-economic variables			
Marital Status					
Single	48.1	35.4	16.5	81	0.004
Married	31.7	45.6	22.7	779	
Residence					
Town	33.4	44.8	21,8	746	0.789
Village	32.5	43.0	24.6	114	
Income					
Low	36.0	45.2	18.8	292	0.036
Average	29.7	45.6	24.7	482	
Above average	44.2	36.0	19.8	86	
Education					
Basic education	30.5	43.2	26.3	259	0.032
Secondary education (high school)	29.7	42.2	28.1	64	
Secondary education (technical school)	32.8	47.0	20.3	464	
Higher education	49.3	35.6	15.1	73	

meals per day (46.8%, 44.9%). On the other hand, the percentage of obese men in the group with three or more meals per day (18.8%) is lower than the percentage of the obese in the other two groups (22.6%, 22.9%). It is also remarkable that normal body weight is most frequent in the group preferring fruit and vegetables (38%), whereas overweight and obesity are highest in the group preferring to eat pork and chicken (46.8 % and 25.0%, respectively).

The percentage of men with different BMI, classified on the basis of their behavioral characteristics is presented in Table 4. The highest percentage of men with normal weight is found in the group that does not drink alcohol (41.8%). The highest frequency of overweight and obesity is observed among those who drink moderately (46.3% and 25.1%, respectively) and heavily (48.6% and 25.8% respectively). Overweight predominates both among the non-smokers (46.0%), and among the ex-smokers (43.8%) and the smokers (44.1%). The largest number of obese men is in the group with the ex-smokers (39.3%), while in the smokers' group they are two times less (18.6%). On the other hand, the level of smoking affects the body mass of both ex and current users of tobacco.

Heavy smokers have the greatest chances for normal weight (40.3%). It is worth remarking that overweight predominates in physically active men (45.3%) and in men undertaking cultural activities (45.2%) or agricultural work (43.4%).

Table 3: Percentage of men in different BMI level classified on the basis of eating habits

Men's characteristics	*Normal weight*	*Over-weight*	*Obesity*	*N*	*Pearson Chi-square*
		Diet variables			
Eating Habits					
Regular	30.7	48.4	20.9	450	0.047
Not regular	36.1	40.2	23.7	410	
Number of Meals					
2 meals	40.1	37.3	22.6	177	0.030
3 meals	30.3	46.8	22.9	545	
More than 3 meals	36.2	44.9	18.8	138	
Type of Preferred Food					
Meat/chicken	28.2	46.8	25.0	128	0.803
Milk/products	36.4	39.4	24.2	66	
Sweets	33.9	44.1	22.0	59	
Fruit/vegetables	38.0	45.5	16.5	121	
Mixed	32.1	45.3	22.6	486	

Table 4: Percentage of men with different BMI levels classified on the basis of behavioral characteristics

Men's characteristics	*Normal weight*	*Over-weight*	*Obesity*	*N*	*Pearson Chi-square*
	Behavioral variables				
Alcohol Consumption					
Do not consume alcohol	41.8	36.2	22.0	91	0.060
Rarely consume alcohol	37.1	44.4	18.5	340	
Moderately consume alcohol	28.6	46.3	25.1	367	
Heavily consume alcohol	27.4	48.6	25.8	62	
Smoking Status					
Non smoker	29.9	46.0	24.1	224	0.000
Ex smoker	16.9	43.8	39.3	89	
Smoker	37.3	44.1	18.6	547	
Level of Smoking					
Lightly	28.2	53.8	17.9	39	0.032
Moderately	25.0	54.5	20.5	112	
Heavily	35.8	42.5	21.7	346	
Very heavily	40.3	36.7	23.0	139	
Leisure Activities					
Cultural activities	34.3	45.2	20.5	449	0.359
Agricultural work	30.7	43.4	25.9	316	
Sports	36.8	45.3	17.9	95	

Table 5 presents the results of a logistic regression analysis of the selected variables with BMI. The analysis compares men with normal weight with overweight and obese men. The results show that there is a significant connection between overweight and the marital status of the studied men. Single men have a smaller chance of being overweight than married ones (OR=0.54 $p<0.05$). The probability for being overweight is sixty-three percent higher among men with middle income, compared to men with high income. This relationship however, is insignificant. Education however, seems to be a significant factor for spread of overweight. Men with secondary education have an eighty percent greater chance of being overweight than men with higher education. (OR=1.80, $p<0.05$).

Men preferring milk and vegetables have a smaller chance of gaining weight than those who prefer pork or chicken or carbohydrates, though the connection is insignificant. Those who take two meals per day have an eighty-nine percent lesser chance of becoming overweight than those who take three or more meals per day. The connection is insignificant. The regularity of the food intake is also insignificantly connected to being overweight.

There is a statistically significant positive connection between overweight and alcohol consumption. Among the moderate drinkers, overweight is eighty-seven percent more frequent compared to non-drinkers (OR=1.87, $p<0.05$). The chances increase with the increase of alcohol consumption and the probability for overweight among the heavy drinkers is one hundred and twenty two percent greater than in those who do not take alcohol (OR=2.22, $p<0.01$). Men who do not smoke are more likely to be overweight than smokers (OR=2.205). The chances are even higher among ex-smokers (OR=3.007). Chances for them being overweight is over two hundred percent compared to the rest, and the relation is statistically significant ($p<0.01$). The level of smoking is, however of paramount importance. The least probability for overweight and obesity exists among the heavy smokers (OR=1.22, $p<0.01$).

The men who do some sort of sports exercise in their leisure time are less prone to overweight compared to those doing cultural activities or farm work, but the relation is statistically insignificant.

DISCUSSION

Fighting overweight and obese people among the Bulgarian population is a basic priority of the national nutrition and health policies. That is why the question demands a better understanding of the reasons, in order to foster the necessary prevention and management. Bulgaria is a country that recently acceded to the European Union. It suffered an intensive social and economic transition. After the Soviet Union dis-

Table 5: Results of logistic regression analysis for selected variables with BMI

Independent variables	*Odds ratio*	*Confidence interval*
Marital Status		
Single	0.54*	0.32-0.90
Married (Ref)	1.00	
Residence		
Urban	1.07	0.66-1,72
Rural	1.00	
Income		
Low	1.38	0.79-2.42
Average	1.63	0.97-2.76
Above average (Ref)	1.00	
Education		
Basic education	1.74	0.92-3.27
Secondary education (high school)	2.08	0.96-4.48
Secondary education (vocational school)	1.80*	1.01-3.20
Higher Education (Ref)	1.00	
Way of Eating		
Regular	1.11	0.81-1.54
Not regular (Ref)	1.00	
Number of Eatings		
2 meals	0.89	0.54-1.47
3 meals	1.19	0.78-1.82
More than 3 meals (Ref)	1.00	
Type of Preferred Food		
Meat/chicken	1.05	0.67-1.64
Milk/products	0.77	0.43-1.38
Sweets	1.17	0.62-2.18
Fruit/vegetables	0.73	0.46-1.14
Mixed (Ref)	1.00	
Alcohol Consumption		
Rarely consume alcohol	1.24	0.74-2.06
Moderate consume alcohol	1.87*	1.10-3.17
Severely consume alcohol	2.22*	1.04-4.72
Do not consume alcohol	1.00	
Smoking Status		
Non smokers	2.205	0.11-43.58
Ex smokers	3.007**	1.62-5.57
Smokers (Ref)	1	
Level of Smoking		
Lightly	2.03	0.85-4.81
Moderately	2.47	1.36-4.51
Heavily	1.22**	0.79-1.90
Very heavily (Ref)	1.00	
Free Time		
Cultural activities	1.06	0.63-1.81
Agricultural work	1.25	0.71-2.20
Use of any form of sport (Ref)	1.00	

*Significant at 0.05 level .
** Significant at 0.01 level.

integrated and the Bulgarian economy shifted from a planned centralized one to a market economy, Bulgaria faced economic changes and nutritional challenges. The country underwent a significant crisis in inflation, the population's income, and the production and distribution of food (Rangelova 2003; Ivanova et al. 2006). This caused a decline in the food quality and deterioration of the health. The only BMI data on adult population in Bulgaria comes from reports that are limited in range and scope.

The current study is conducted in the city of Plovdiv, the second largest administrative, industrial, and cultural center of Bulgaria. It makes an attempt to connect some social-economic, demographic, nutritional factors and lifestyles with different BMI levels, as the effect of these factors on the nutritional status of the population in this region has not been sufficiently researched until now.

The percentage of overweight for the entire population included in the study is 44.5 percent, and of obesity is 22.2 percent. This means that almost every other man included in the study is overweight, and almost one in four is obese. In comparison, the researchers can point out the fact that the percentage of overweight men in Sofia, the capital city of Bulgaria is almost the same that is, 44. 8 percent, but the share of the obese men is much lower at 6.0 percent (Ivanova et al. 2008). Similar alarming data has been cited by Yordanov et al. (2006) as a representative for a Bulgarian anthropological study of the population at the end of the 20th century. The study shows that more than fifty percent of men in the country fall in the category of overweight with a tendency to secular increase.

The results coincide also with the results of a monitoring study of the spread of obesity in Bulgaria made in 2004-2006 by the National Centre of Public Health and Analyses. According to its findings, the mean rate of overweight men aged 30-59 is within the range thirty-three to fifty percent, whereas obesity reaches 22.1 percent (Petrova et al. 2012). Similar rates of occurrence of some BMI categories of adult men have been registered in some neighboring countries like Serbia **(**Pavlica et al. 2010**)** and Turkey (Gultekin et al. 2009).

The results of the different studies show that obesity is a social phenomenon (McLaren 2007). This research's analyses also confirm the impact of social economic factors of obesity. With the increase of the educational level there is a trend towards reducing overweight and obesity. Probably the level of education of the men plays a part in their increased knowledge and interest in a health lifestyle. Men with income above the

average more often than not have normal weight, whereas men with lower income have the highest probability of being overweight, and those with middle income, would most likely have obesity. These results may be due to wrong nutritional models in the poorer households, compared to the households with a higher living standard. This study also reveals that overweight and obesity are more likely to occur in married men than in single ones. Similar results are cited in other studies, which remark that overweight and obesity affect to the highest extent, married couples (Ortega et al. 2013), as well as people of lower social and economic status (Moli and Mini 2012; Osella et al. 2014) and vice versa that is, the occurrence of normal weight among single persons and persons with higher levels of education, increases (Hajian-Tilaki and Heidari 2010).

Some studies report that BMI in men is not related to their place of residence (Gudjonsdottir et al. 2015). The results of this study also show that the place of residence does not have a significant role in the nutrition status. The frequency of men with overweight and obesity in rural areas is quite similar to that of residents in urban areas. This differs from the data of neighboring Serbia, where there is a rise of obesity in the rural population (Grujic et al. 2009).

Many reports suggest that BMI is affected by the eating behavior and habits (Peltzer et al. 2014; Sengupta et al. 2014; Salameh et al. 2014; Nmor et al. 2014). A study made in the country reports that consumption of basic food products per capita has fallen after the transition to a market economy in 1991 (Ivanova et al. 2006). Although there is a registered fall in food consumption, due to constrained income, there have been no significant changes in nutritional behavior. The current study shows that there are no great differences in occurrence of overweight and obesity in men with different eating habits, between those who take regular meals and those who do not eat regularly. People who consume more than 3 meals a day are at a higher risk of overweight. Eating mainly fruit and vegetables ensures greater chances for regular weight, whereas eating meat in the form of pork and chicken increases the chances for overweight and obesity. A similar study of overweight and obesity, in connection with nutritional behavior and habits was done in 2000 among workers in a nitrogen fertilizer factory. It showed a sixty-seven percent occurrence of overweight, hyper energy intake of food among all ages of workers, with a marked cellulose deficit and mineral salt misbalance. Most of the people included in the study had three meals per day, dinner being the main meal of the day (Koleva et al. 2000).

The results of this study show that alcohol consumption, in all the defined quantities (rarely, moderately, heavily) is related to greater frequency of overweight and obesity than in abstinent men. Similarly, the greatest numbers of obese men are to be found among the ex-smokers, the fewest are among current daily smokers. The findings correspond to other research studies, which conclude that the risk of overweight is higher after quitting smoking (Ortega Anta et al. 2013).

In terms of overweight and obesity, no significant differences are to be observed between people performing different activities (cultural, sports or agricultural) at leisure. A number of studies of physical activities of people document the inverse relationship between sports and overweight (Hajian-Tilaki and Heidari 2007). Physical exercises and workouts in most cases have a positive effect and are a valuable weapon in the battle against obesity.

In order to find the connection between overweight/obesity with the selected variables and to define the risk of gaining weight in the studied sample of men, the researchers applied a logistic regression analysis. The marital status, education, tobacco and alcohol consumption stand out as the main factors affecting overweight and obesity. The risk increases considerably in men with primary and secondary education, ex-smokers, heavy drinkers and married men. At the same time, the absence of a family, higher education and smoking reduce this risk to a great extent. The model did not identify a significant connection between overweight/obesity and the factors such as place of residence, eating habits, preferred food and leisure activities.

CONCLUSION

Although the study is limited to a part of the population of Plovdiv, the gathered data is valuable, considering the total lack of adult obesity data in this central region of Bulgaria. The results provide a “snapshot” of the status quo, which helps perceive the potential connection between overweight and obesity and some social, economic, demographic and behavioral determinants. The data outlines the role of educa-

tion, smoking, marital status and alcohol consumption as important predictors of body weight. The results show alarming trends in the spread of overweight and obesity in Bulgaria, a country, which is still in a difficult economic situation.

RECOMMENDATIONS

The strategy for counteracting this alarming trend involves increasing education and the family income, applying a correct nutrition model, reducing smoking and practicing abstinence from drinking. The efforts in this direction are a good prevention method from overweight and obesity, which is a necessary condition for improving the health status and the quality of life for Bulgarians.

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