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DIETARY HABITS AND PHYSICAL ACTIVITY IN YOUNG ADULTS WITH INAPPROPRIATELY HIGH BODY MASS INDEX – A CROSS-SECTIONAL STUDY IN MEDICAL STUDENTS

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Abstract

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Introduction: An early detection of overweight and its basic risk factors in population studies increase the efficiency of preventive actions.

The aim of the study was to assess the determinants of the occurrence of inappropriately high BMI, according to dietary habits and physical activity patterns in young subjects.

Materials and methods: A cross-sectional study was conducted in 604 medical students, 298 males and 306 females, aged 20.6 ± 2.0. The participants were divided into two groups, according to their BMI value, the group of 106 students with BMI ≥ 25 kg/m^2 and the group of 498 subjects with BMI < 25 kg/m^2.

Results: Inappropriately high BMI was found in 17.4% students, more frequently concerning males than females ($p<0.001$). Persons with BMI ≥ 25 kg/m^2 more often reported the use of diet rich in fat (OR=2.21, 95% CI: 1.31, 3.73) as well as frequent alcohol drinking (OR=1.88, 95% CI: 0.93, 3.76). The adjustment to gender did not confirm the results.

Conclusions: The study confirms neither dietary habits nor physical activity influence on inappropriately high BMI. The role of methodological issue, including epidemiological concern and statistical analysis, should be taken into account in data interpreting.

Key words: *overweight, diet, BMI, questionnaire, epidemiology*

Introduction

It is estimated that overweight occurs in over 60% adults in Poland (1). In recent years in all age groups, an increasing trend towards the spread of obesity has been observed (2), however the prevalence differs depending on gender and age – it is the highest in males aged 45-49 and females aged 60-74, amounting to 17.5 and 23.5%, respectively (1). Although in children and youth aged 7-17 the percentage is lower (below 5%), one ought to mark that the sequelae of obesity usually appear only just in several years' time (2,3), particularly in the form of diabetes type 2 (4), hypertension (5), coronary heart disease (6), and arthritis (7).

An early detection of overweight and its basic risk factors in population studies increase the efficiency of preventive actions, both in primary and secondary prophylaxis (8-10). In the subject literature it is emphasized that improper diet and low physical activity are the factors that increase the risk of becoming overweight remarkably (4,11).

The aim of the study was to assess the determinants of overweight prevalence, according to dietary habits and physical activity patterns in young adults, medical students. Additionally, this article presents some important concerns regarding methodological problems in data interpretation in a cross-sectional study based on a questionnaire method.

Materials and Methods

An epidemiologic cross-sectional study was conducted in 2004/2005. The subjects were students at the Medical University of Silesia, Poland. The number of 604 volunteers from the group of 1000 invited students agreed to participate in the study (the participation rate 60.4%). All students were informed about the procedure and gave their informed consent. The study was approved by the local ethical committee.

The data describing dietary habits and physical activity were obtained by an author-designed questionnaire. Food patterns concerned the practice of eating dairy products, fruit and vegetables, sweets, food rich in fat or salt, and drinking coffee and alcohol. Physical activity was assessed according to the frequency of exercises and leisure-time physical activity, declared in a questionnaire. The prevalence of smoking habit was analyzed additionally. All questions were in the close-

format with all multiple questions with one choice. The choices in each question were scaled as follows: 'everyday', 'few times a week', 'few times a month', 'more rarely' and 'never'. When dichotomized answers were crucial for analysis, the category of 'regular' practice was defined. 'Regularity' was recognized when categories 'everyday' or 'few times a week' were reported. The questionnaire reliability had been assessed before by a validation procedure (12) in a random sample of 100 students. The results of inter-observer agreement ratio estimation (% of repeatability in test-retest) and Kappa statistic revealed very good repeatability of five key questions of the questionnaire (12,13).

The prevalence of overweight was determined basing on self-reported height and weight. Body mass index (BMI) was calculated as body weight divided by height squared. The participants were divided into two subjectively defined groups, according to students' BMI value; the group of 106 subjects with inappropriately high BMI and the group of 498 persons with proper BMI. Inappropriately high BMI was defined as BMI ≥ 25 kg/m^2, covering overweight and obesity, and proper BMI was found if BMI < 25 kg/m^2 (even if BMI < 18.5 kg/m^2).

The statistical analysis was performed with EpiInfo 6.0 procedures. Descriptive statistics are presented as percentages, means, and standard deviations. Student's t test and non-parametric Kruskal-Wallis test were used to calculate statistical differences between means. The chi-square test and Fisher's exact test were used to compare categorical variables. Additionally, Cochran-Mantel-Haenszel chi-square tests were used to examine the relationship between the prevalence of inappropriately high BMI and dietary habits, and physical activity, controlling for gender as a potential confounder. A 'p' value equal or less than 0.05 was considered to be statistically significant.

Results

The students participating in the study were 604 in number, 298 males (49.3%) and 306 females (50.7%). The mean age of the subjects was 20.6 ± 2.0 years. The characteristic of the subjects, considering the differences in gender and BMI status, is shown in Table 1 and 2. It has been revealed that inappropriately high BMI occurred in 17.4% students and was six times more frequent in males than females (p<0.001), with the difference in BMI mean values exceeding 3 kg/m^2. Overweight was documented in 16.6% and obesity – in 0.8% of the surveyed. It has been shown that persons with BMI ≥ 25 kg/m^2 were older than students with BMI < 25 kg/m^2 (p<0.01).

Table 1. *Demographic and anthropometric variables*

Variable	All	Females	Males
No of subjects (%)	604	306 (50.7)	298 (49.3)
Age (years)	21.2 ± 1.9	20.6 ± 1.2	21.8 ± 2.2
Height (cm)	173.7 ± 8.9	167.2 ± 5.7	180.3 ± 6.5*
Weight (kg)	66.6 ± 13.0	56.9 ± 6.6	76.4 ± 10.2*
Body mass index (kg/m^2)	21.8 ± 2.8	20.3 ± 2.1	23.4 ± 2.6*
BMI categories:*			
BMI < 18.5 kg/m^2 (%)	9.9	18.3	1.7
BMI 18.5 – 24.9 kg/m^2 (%)	72.7	76.8	68.5
BMI 25 – 29.9 kg/m^2 (%)	16.6	4.9	28.1
BMI ≥ 30 kg/m^2 (%)	0.8	0	1.7

BMI – body mass index; * p<0.05, males vs. females

Table 2. *Demographic and anthropometric variables, according to BMI status and gender*

Variable	Students with BMI ≥ 25 kg/m^2			Students with BMI < 25 kg/m^2		
	All	Females	Males	All	Females	Males
No of subjects (%)	106	15 (14.2)*	91 (85.8)	498	291 (58.4)	207 (41.6)
Age (years)	21.9 ± 2.8	20.5 ± 1.6*	22.2 ± 2.9	21.1 ± 1.6**	20.7 ± 1.3*	21.7 ± 1.9
Height (cm)	178.2 ± 8.8	166.0 ± 7.3*	180.2 ± 7.3	172.7 ± 8.7**	167.3 ± 5.7*	180.3 ± 6.1
Weight (kg)	83.7 ± 11.5	68.7 ± 8.3*	86.2 ± 10.0	62.9 ± 10.1**	56.3 ± 5.9*	72.2 ± 6.8
BMI (kg/m^2)	26.5 ± 2.0	25.6 ± 0.9	26.0 ± 2.1	20.9 ± 1.9**	20.0 ± 1.7	22.0 ± 1.4

BMI – body mass index; * p<0.05, males vs. females in subsequent groups; ** p<0.05, students with BMI ≥ 25 kg/m^2 vs. students with BMI < 25 kg/m^2

Table 3. Food patterns and physical activity of subjects

Variable	Females		Males		All	
	n	%	N	%	N	%
Regular food intake	175	58.1	157	53.0	332	55.6
Regular fruit and vegetables intake	277	91.4	261	88.5	538	90.0
Regular physical activity	150	49.5	181	61.4*	331	55.4
Physical activity as a way of spending leisure time	107	41.6	134	59.6*	225	46.6
Regular intake of diet rich in salt	85	28.1	106	35.9*	191	31.9
Regular intake of diet rich in fat	161	53.1	220	74.6*	381	63.7
Regular sweets intake	240	79.2	225	76.3	465	77.8
Regular coffee drinking	193	73.7	168	70.3	361	72.1
Regular alcohol drinking	10	3.9	43	15.7*	53	10.0
Smoking habit	62	20.5	88	29.8*	150	25.1

* p<0.05, males vs. females

Table 4. *Possible determinants of inappropriately high BMI occurrence in subjects*

Determinant		Students with BMI ≥ 25 kg/m^2	Students with BMI < 25 kg/m^2	OR (95%CI)
Male gender	Yes	91/298*	207/298	8.53 (4.64÷15.92)
	No	15/306	291/306	
Regular food intake	Yes	51/332	281/332	0.69 (0.44÷1.08)
	No	55/265	210/265	
Regular intake of diet rich in salt	Yes	39/191	152/191	1.30 (0.82÷2.07)
	No	67/407	340/407	
Regular intake of diet rich in fat	Yes	82/381*	299/381	2.21 (1.31÷3.73)
	No	24/217	193/217	
Regular coffee drinking	Yes	87/492	405/492	0.96 (0.54÷1.74)
	No	19/104	85/104	
Regular sweets intake	Yes	78/465	387/465	0.76 (0.45÷1.27)
	No	28/133	105/133	
Regular dairy intake	Yes	91/532	441/532	0.70 (0.36÷1.38)
	No	15/66	51/66	
Regular fruit and vegetables intake	Yes	96/538	442/538	1.09 (0.51÷2.39)
	No	10/60	50/60	
Regular alcohol drinking	Yes	15/53**	38/53	1.88 (0.93÷3.76)
	No	83/479	396/479	
Smoking habit	Yes	28/150	122/150	1.08 (0.83÷3.72)
	No	78/447	369/447	
Regular physical activity	Yes	60/303	243/303	1.19 (0.75÷1.9)
	No	41/239	198/239	
Physical activity as a way of spending leisure time	Yes	47/225	178/225	1.25 (0.77÷2.03)
	No	45/258	231/258	

OR – odds ratio; 95%CI – 95% confidence interval; * p<0.05, students with BMI ≥ 25kg/m^2 vs. students with BMI < 25kg/m^2; ** p=0.05, students with BMI ≥ 25kg/m^2 vs. students with BMI < 25kg/m^2

Table 3 shows the dietary habits and physical activity of the students, considering the differences in gender. Males, more often than females, reported regular intake of food rich in salt and fat, regular alcohol drinking and physical activity (p<0.05). The results of the nutrition patterns analysis revealed that persons with inappropriately high BMI, in comparison to the students with BMI < 25 kg/m^2, statistically significantly more often reported the use of diet rich in fat (OR=2.21, 95% CI: 1.31, 3.73, p<0.05) as well

Table 5. *Possible determinants of inappropriately high BMI occurrence, controlling for gender*

Determinant	Females	Males	'p'*
	OR (95%CI)	OR (95%CI)	
Regular food intake	1.47 (0.44-5.12)	0.63 (0.37-1.07)	0.2
Regular intake of diet rich in salt	1.30 (0.37-4.35)	1.09 (0.63-1.89)	0.7
Regular intake of diet rich in fat	3.37 (0.94-17.23)	1.20 (0.65-2.24)	0.1
Regular coffee drinking	1.15 (0.23-7.76)	1.13 (0.57-2.23)	0.7
Regular sweets intake	0.71 (0.20-2.78)	0.81 (0.44-1.50)	0.4
Regular dairy intake	0.25 (0.07-1.03)	1.11 (0.49-2.53)	0.6
Regular fruit and vegetables intake	**	1.08 (0.46-2.57)	0.6
Regular alcohol drinking	0 (0-11.99)	1.21 (0.57-2.54)	0.8
Smoking habit	0.58 (0.09-2.86)	0.92 (0.51-1.64)	0.6
Regular physical activity	1.42 (0.39-5.37)	0.87 (0.5-1.52)	0.4
Physical activity as a way of spending leisure time	1.05(0.24-4.4)	0.92 (0.52-1.63)	0.9

OR – odds ratio; 95%CI – 95% confidence interval; * 'p' value is for the Cochran-Mantel-Haenszel chi-square for general association, controlling for gender; ** OR not possibile to estimate because of '0' value

as frequent alcohol drinking (OR=1.88, 95% CI: 0.93, 3.76, p=0.05). No significant differences have been revealed as far as regular intake of food rich in salt, dairy products, sweets, vegetables and fruit, coffee drinking and smoking habit are concerned. The results of the observation are presented in Table 4. Because of revealed abovementioned differences between males and females, the analysis was also performed with adjustment to gender as a potential confounder. The results of Cochran-Mantel-Haenszel chi-square tests did not confirm the influence of the assessed dietary habits on inappropriately high BMI occurrence (Table 5). It should be mentioned that females with BMI ≥ 25 kg/m^2 less frequently reported regular dairy intake, in comparison to females with proper BMI (OR=0.25, 95% CI: 0.07, 1.03; p=0.05). It has also been revealed that persons with BMI ≥ 25 kg/m^2, more frequently than students with proper body mass index, reported practicing sport regularly, adequately: 57.5% vs. 54.8% (p=0.1). There were some differences between genders (59.3% in overweight males vs. 46.7% in overweight females; p<0.05). Furthermore, no differences have been shown in the frequency of choosing physical activity as a way of spending leisure time between the analyzed groups.

Discussion

The aim of the study was the assessment of the potential determinants of the occurrence of inappropriately high BMI in young adults in a cross-sectional study. Methodological impact on reliability of obtained results was also of great importance.

In the study, inappropriately high BMI, defined as BMI ≥ 25 kg/m^2, concerned nearly 17.6% of the students, more often males than females (p<0.05). Overweight was recognized in 16.6% participants and obesity in 0.8% of the surveyed. The results coincide with most data available in literature. Ali et al. (14) assess that overweight occurs in about 18.4% of females, aged 18-34. The results of the multi-center survey among the European countries students revealed that the frequency of overweight is 8%, however the percentage differed significantly between particular countries (15). Moreover, Janssen et al. (16) revealed that overweight most frequently concerns young adults in the countries of North America and South and West Europe. Data concerning Polish students say that the frequency of overweight is 13-16.7% (17,18). Taking the presented data into account, the results obtained in the survey can be considered reliable and reflecting the importance of the problem in the medical students.

The results of the analysis revealed no significant influence of improper diet on the occurrence of inappropriately high BMI, whereas, suggested that students with BMI ≥ 25 kg/m^2, more frequently than their peers with BMI < 25 kg/m^2, were physically active (57.5% vs. 54.8%), however the result was not statistically significant (p=0.1). Smoking habit appeared to be of no importance. In the light of literature data, there are plenty of discrepancies concerning the information about the influence of diet on overweight prevalence in young people. Despite the proven influence of excessive highly energetic products intake on obesity by Scali et al. (19), still in the multivariate analysis, the dietary habits determined merely 18.5% of the current BMI value in females and 14.6% in males. On the one hand, there is no doubt that inappropriate lifestyle in long-term dimension promotes overweight and obesity incidence in adults, which was confirmed in prospective epidemiologic surveys (20-23). On the other hand, as far as food patterns are concerned, the results are consistent with the investigations conducted among youth and adults by Grabauskas et al. (9), Kolarzyk et al. (17), Janssen et al. (24), Patrick et

al. (25), Maffeis et al. (26), Oblacinska et al. (27) and Jeszka et al. (28). The latter are in agreement with the suggestions that the nutrition patterns have a merely weak, however positive effect on BMI (especially in overweight category), whereas obesity incidence is more complex and remarkably genetically determined (19). The comparisons are additionally blurred by geographical differences of possible overweight risk factors and their longitudinal trends (29).

The relationship between physical activity and overweight prevalence seems to be interesting. Although complete explanation of this effect is not possible, two major factors seem to influence the result remarkably. To begin with, it has been recorded that overweight persons more often attempt to be physically active (8). Socio-economical status of subjects (medical students) is also of great importance. People with higher education level and larger income tend to be more conscious as far as the need of overweight reduction is concerned, and are more liable to the physicians' suggestions concerning the increase of everyday physical activity (14,30). Although it is proven that behavioral changes in lifestyle play major role in the treatment of obesity, there is unquestionable evidence that longitudinal interventions are more effective than short-term ones (4). More to the point, both physical activity and diet are important and separate factors in weight loss. However a decrease in energy intake is generally more important for weight loss, while physical activity is generally more important for weight maintenance (4).

Finally, the methodological issue of the study has the crucial impact. The BMI value assessment on the basis of self-reported height and weight is generally used in population epidemiological studies. Firstly, the remarkable difference in overweight between men and women, and in fact the remarkably lean female population in general, raise a great concern on underreporting of the female participants (31,32). It becomes even more important given the fact that self-reported BMI is almost always lower then measured BMI (32). In addition, women generally underreport their actual weight making the BMI less accurate. This may explain the differences in the prevalence of overweight, and obesity between men and women. Although data obtained in the present study are believed to be reliable, this limitation in concluding should be taken into consideration. Secondly, not only the assessment of overweight prevalence, but also self-reported diet patterns and physical activity are frequently influenced by a measurement error (33). More to the point, a questionnaire method, that is also employed in this research, is likely to give imprecise and excessively generalized information which may result in regression dilution bias. These are present especially in relation to nutrition characteristics (e.g. lack of data about the frequency of the intake of several nutrition product groups that are important for obesity and overweight like grain products, meat, sweet drinks, different kinds of fat) and physical activity (e.g. lack of more detailed data concerning numbers of hours of exercises, additional or coming from the everyday activity, or other weight lose activities in overweight subject at present). Thirdly, two additional methodological concerns desire attention. The study design employed (a cross-sectional one) does not allow to observe new incidences of disease in population and identify risk factors utterly (as it takes place in cohort studies) (34). It seems to be important to conduct cohort studies to obtain the relationship between improper lifestyle and obesity properly, especially in young subjects. Additionally, the assessment of cause-and-effect relationship should take into account noise of possible confounders, as showed the results of Mantel-Haenszel analysis in the present study. Investigators should be encouraged to use some more advanced statistical techniques (e.g. stratification or multivariate analysis) to reduce the possibility of making misleading conclusions.

Conclusion

In conclusion, the presented data confirm neither dietary habits nor physical activity influence on overweight prevalence in young adults. The design of the survey employed constitutes the restriction of the concluding. The role of methodological issue, including epidemiological concern and statistical analysis, should be taken into account by investigators in data interpreting.

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