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Body mass index in high school students in the context of selected nutritional behaviours and declared attitude to health

Body Mass Index (BMI) is an anthropometric indicator which is important to evaluate proper development of a human being, to determine the dynamics of this development, to analyse the developmental trends in a particular period of time, to compare the developmental tendencies depending on environmental conditions or health-related behaviours (6, 7).

Besides some other methods, techniques and factors, BMI is used in diagnostics to monitor and assess the effectiveness of therapeutic procedures. In many cases it gives grounds for medical interventions, particularly in anorexia or substantial obesity (4, 12). Nowadays BMI is more and more frequently used to evaluate the risk factors of civilization diseases, including diabetes, hypertension, atherosclerosis, neoplasms, cardiovascular disease and others (3, 12).

The aim of the present study was to answer the following questions: 1) Are there any relevant differences in BMI of students depending on gender, age, selected health-related behaviours and factors conditioning them? 2) Is there a correlation between the BMI value and individual pattern of nutritional behaviours accepted in the study? 3) Does the BMI value differentiate the examined group of high school students in relation to their declared attitudes to health?

MATERIAL AND METHODS

The examinations were conducted among 386 students of randomly selected grammar schools in Lublin in January 2004. The examined group consisted of 219 (56.73%) girls and 157 (40.67%) boys aged 15–20 (lack of data – 10 students).

In the study the author's questionnaire was used, which contained closed questions. The BMI values were assessed using the measurements of body mass and growth from the last two weeks. The anthropometric BMI was the basis for qualifying the students into three subgroups: with underweight, proper body mass and overweight (obesity). In the group of students aged 15–18 a wide range of overweight/obesity was accepted, i.e. between 10 and 90 percentile, which means that the level of underweight was below 10 percentile and that of overweight – above 90 percentile (3, 10). The individuals over 18 were qualified according to WHO recommendations accepting: for women – the level of undernutrition/underweight <18.8 and normal level – 18.6–24.9 and for men <19.9 and 20.0–24.9, respectively; the level of overweight for both sexes was 25.0–29.9 and of obesity > 30.0 (11).

The proper pattern of nutrition was expressed as follows: 5–6 meals a day; meals full of various nutritional components and kinds of food products; caloricity adjusted to physical effort; avoiding excess calories, animal fat, red meat, fried and high caloric content products; consumption of vegetables and fruits several times a day; limited consumption of simple carbohydrates and salt; regular hours of meals, moderate rate of consumption; breaks between main meals; drinking about 1.5–2 l of liquids a day (e.g. non-carbonated mineral water) with no alcoholic drinks. Evaluating the attitudes to health, the five-degree scale was accepted: definitely positive, rather positive, neutral (no attitude), rather negative and definitely negative. The analysis of the material was

performed using the structure index and chi^2 Pearson test. Only the subjects with full data were taken into account.

RESULTS

The values of BMI in the examined students were found to be: underweight (undernutrition) – 57 (14.77%), normal level – 292 (75.65%), overweight – 17 (4.40%), obesity – 6 (1.55%), lack of present data – 14 (3.63%) individuals.

Table 1. BMI of adolescents according to age and gender (in %)

No	BMI value	Age		Total N (%)	Gender		Total (%)
		up to 17	18 years and more		F	M	
1	undeweight	48 (20.34)	9 (6.98)	57 (15.62)	50 (23.36)	5 (3.33)	55 (15.11)
2	normal	176 (74.58)	112 (86.82)	288 (78.90)	161 (75.23)	126 (84.0)	287 78.85)
3	overweight/ obesity	12 (5.08)	8 (6.20)	20 (5.48)	3 (1.40)	19 (12.67)	22 (6.04)
	total (%)	236 (64.55)	129 (35.34)	365 (100.00)	214 (56.79)	150 (41.21)	364 (100.00)
		chi^2 =11.3; p = 0.004			chi^2 = 42.8; p=0.001		

The chi^2 test revealed higher frequency of underweight in the group of girls (23.36%) compared to the group of boys and of overweight (obesity) in boys (12.67%) compared to girls (1.40%). Higher number of underweight students was found in the group below 17 years of age (20.34%) compared to older adolescents (6.98%), where higher percentage of individuals with normal levels was observed (Table 1).

Table 2. BMI of adolescents vs. self-evaluation of appetite (in %)

No	BMI value	Type of appetite according to the accepted terminology				Total (%)
		normal	excessive	decreased	varied	
1	undeweight	17 (13.28)	5 (10.64)	10 (22.22)	25 (16.56)	57 (15.36)
2	normal	108 (84.38)	37 (78.72)	29 (64.44)	117 (77.48)	291 (78.44)
3	overweight/obesity	3 (2.34)	5 (10.64)	6 (13.33)	9 (5.96)	23 (6.20)
	total (%)	128 (34.50)	47 (12.67)	45 (12.13)	151 (40.70)	371 (100.00)

chi ^{2} = 12.55; p= 0.05

As far as the appetite intensity is concerned (Table 2), the characteristic data are close to the statistically significant level (p=0.05). In the underweight group, decreased or variable appetite is mostly observed, in the overweight/obesity group – decreased or excessive.

Table 3. BMI of adolescents vs. breakfast consumption and declared awareness of the relation between nutrition and psychophysical effectiveness (in %)

No	BMI value	Breakfast consumption		Total (%)	Awareness of the relation			Total (%)
		yes	no		yes	do not know	no	
1	undeweight	52 (16.40)	4 (7.69)	56 (15.18)	50 (17.48)	4 (9.52)	1 (3.85)	55 (15.54)
2	normal	249 (78.55)	41 (78.85)	290 (78.59)	224 (78.32)	32 (76.19)	20 (76.92)	276 (77.97)
3	overweight/ obesity	16 (5.05)	7 (13.46)	23 (6.23)	12 (4.20)	6 (14.29)	5 (19.23)	23 (6.50)
	total (%)	317 (85.91)	52 (14.09)	369 (100.00)	286 (80.79)	42 (11.86)	26 (7.34)	354 (100.00)
		chi^2 =7.3; p=0.02			chi^2 =16.7; p= 0.002			

The analysis of consumption of breakfast showed positive answers in 95.91% of cases and significant differences between underweight and overweight/obesity groups. The data in Table 3 demonstrate that the underweight adolescents consume breakfast more often than the overweight/obese individuals (p=0.02).

The answers to the question concerning the awareness of the relation between the way of nutrition, functioning and psychophysical efficiency of the organism included: 90.91% of positive answers in the underweight group.. 81.16% in the normal body mass group and 52.17% in the overweight/obese group. The Table 3 data show the diversity of the examined group, which demonstrates that higher percentage of underweight and normal individuals is aware of the relation between nutrition and functioning compared to those with overweight/obesity (p=0.002).

Table 4. BMI of adolescents vs. individual nutritional behaviours and consultations with professionals (in %)

No	BMI value	Pattern of individual nutritional behaviours according to the accepted classification			Total (%)	Nutritional consultations			Total (%)
		proper	intermediate	improper		yes	do not know	no	
1	undeweight	21 (18.58)	33 (17.01)	1 (2.33)	55 (15.71)	8 (22.22)	4 (11.11)	43 (15.14)	55 (15.45)
2	normal	88 (77.88)	146 (75.26)	40 (93.02)	274 (78.29)	24 (66.67)	24 (66.67)	230 (80.99)	278 (78.09)
3	overweight/ obesity	4 (3.54)	15 (7.73)	2 (4.65)	21 (6.00)	4 (11.11)	8 22.22)	11 (3.87)	23 (6.46)
	total (%)	113 (32.29)	194 (55.43)	43 (12.29)	350 (100.00)	36 (10.11)	36 (10.11)	284 (79.78)	356 (100.00)
		chi^2 = 9.4; p=0.05				chi^2 =21.0; p= 0.0003			

The obtained results concerning the relation between BMI values and accepted nutritional patters – proper, intermediate and improper, are close to the statistically significant level (p=0.05). The underweight adolescents tend to stress that their way of nutrition is proper or intermediate (Table 1).

Over 10% of students consulted their way of nutrition with a physician or dietician. The identical group had no opinion about that issue. Out of 36 individuals who had consultations, every third is under -or overweight and every eleventh shows the normal body mass. The data in Table 4 confirm statistically significant differentiation of the examined group with regard to specialist consultations about nutrition (p=0.002). Over 30% (n=111) of students attempted to change their way of nutrition several times, 16.53% did it once. As regards BMI, the obtained results were not statistically significant.

The majority of students –279 (78.59) declare positive attitudes to health. The BMI value does not differentiate these attitudes in a statistically significant way. There were no significant differences in BMI values depending on the number of meals, economic conditions, possible direct influence on the quality of meals and kind of preferred nutrition (traditional, vegetarian, dietetic, their own).

Table 5. BMI of adolescents in relation to the declared attitude to health (in %)

No	BMI value	Attitude to health					Total (%)
		definitely positive	rather positive	lack of attitude (neutral)	rather negative	definitely negative	
1	undeweight	20 (19.05)	27 (15.52)	4 (8.51)	3 (15.00)	1 (11.11)	55 (15.49)
2	normal	79 (75.24)	138 (79.31)	41 (87.23)	13 (65.00)	7 (77.78)	278 (78.31)
3	overweight/obesity	6 (5.71)	9 (5.17)	2 (4.26)	4 (20.00)	1 (11.11)	22 (6.20)
	total (%)	105 (29.58)	174 (49.01)	47 (13.24)	20 (5.63)	9 (2.54)	355 (100.00)

$chi^2 = 10.65$; $p = 0.2$

DISCUSSION

The studies of the anthropometric index – BMI with regard to the developmental age are most commonly conducted to evaluate and monitor the developmental trends and to support the development of children and adolescents. For many recent years the attention has been increasingly focused on the BMI value in relation to risk factors of many civilization diseases (1, 3, 4, 10).

Some studies demonstrate a statistically significant relation between the body mass of young people and that of their parents, especially mothers (2, 7). This relation can be interpreted in two ways: as assimilation of nutritional patterns of parents (5) (including physical activity) or as a hereditary predisposition which may be reduced by health promoting behaviours or unfavourably developed by risky behaviours.

Some relevant findings are also found in longitudinal studies which demonstrate the tendency of an increase in the BMI value during human life. The above regularities impose an obligation on the young generation and its minders to care about proper body mass since the earliest years of life. Moreover, they show the intergeneration responsibilities for health of future generations (7, 13).

The differentiation of BMI values according to sex and age of the examined individuals found in our study is also observed by other authors. Moreover, the intensification of polar values in the examined groups, i.e. abnormal body mass is comparable (1, 8). The studies considering BMI deal more often with the issues of overweight and obesity than of underweight and anorexia. The per-

formed study on the relation between BMI and attitudes to health and empirical model of nutrition requires further observations and improved methodology.

It should be stressed that more precise information is needed to evaluate the phenomenon of declaring the answers more similar to the socially expected (model) ones by underweight individuals compared to overweight persons and to determine whether they result from actually higher level of health awareness, which is accompanied by consistent and favourable behaviours or reflect the tendency to hide or distort the reality deliberately.

CONCLUSIONS

1. In the group of high school students significant differences in BMI values depending on sex and age were found.

2. Higher awareness of the relation between nutrition and functioning as well as efficiency of the human organism was observed in adolescents with decreased BMI values compared to those with overweight/obesity.

3. The relation between BMI of high school students and the accepted nutritional pattern shows that the proper way of nutrition is more often indicated by underweight individuals compared to those with normal BMI and overweight/obesity.

4. The attitudes to health declared by adolescents are not statistically significantly related to the BMI value.

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SUMMARY

Nutrition is a basic factor conditioning the human growth and individual health resources. The relationship between the way of feeding and incidence of, among others, neoplastic and cardiovascular diseases has recently been more and more emphasized. The significance of shaping proper nutritional habits from the earliest stages of life is indicated. Negative effects of under- and overweight for human health are stressed. The aim of the study is to present the BMI values of high school students and to show their correlation with chosen variables. In total, the examinations comprised 386 high school students from Lublin aged 15–20. Underweight was found in 57 (14.77%), norm in 292 (75.65%), overweight in 17 (4.4%), obesity in 6 (1.55%), lack of up-to-date data in 14 (3.63%). Using the chi^2 test the correlation between BMI values and the following factors was established: age, gender, eating breakfast, declared awareness of the correlation between nutrition and psychophysical functioning, appetite, consulting the way of feeding with professionals, identified pattern of individual nutritional behaviours. No significant differences were found between the BMI value and the number of consumed meals, standard of accommodation and living, declared general attitude to health, possible direct influence on the quality of meals, kind of preferred way of alimentation, motivation for a change in the way of nutrition and declared factors affecting nutrition of the examined high school students.

Body mass index młodzieży licealnej w kontekście wybranych zachowań żywieniowych i deklarowanej postawy wobec zdrowia

Odżywianie jest zasadniczym czynnikiem warunkującym rozwój człowieka oraz jego indywidualne zasoby zdrowia. Obecnie coraz częściej podkreśla się związek między sposobem odżywiania się a zachorowalnością, między innymi na choroby nowotworowe czy układu krążenia. Wskazuje się na znaczenie kształtowania prawidłowych nawyków żywieniowych od najmłodszych lat życia jednostki. Podkreśla się ujemne skutki niedowagi lub nadwagi dla zdrowia człowieka. Celem pracy jest zaprezentowanie wartości BMI młodzieży licealnej i ukazanie jej związku z wybranymi zmiennymi. Badaniem objęto ogółem 386 uczniów szkół licealnych Lublina w wieku 15–20 lat. Niedowagę stwierdzono u 57 (14,77%) badanych, normę u 292 (75,65%), nadwagę u 17 (4,4%), otyłość u 6 (1,55%); brak aktualnych danych – 14 (3,63%) przypadków. Na podstawie testu chi^2 ustalono związek między wartością BMI a: wiekiem młodzieży, płcią osób badanych, spożywaniem pierwszego śniadania, apetytem, konsultowaniem sposobu odżywiania się z profesjonalistami, deklarowaną świadomością związku zachodzącego między odżywianiem a wydolnością psychofizyczną jednostki, zidentyfikowanym wzorem indywidualnych zachowań żywieniowych. Nie stwierdzono istotnych różnic między wartością BMI w zależności od liczby spożywanych posiłków, warunków mieszkaniowych i materialnych, deklarowaną ogólną postawą wobec zdrowia, możliwością bezpośredniego wpływu badanych na jakość posiłków, rodzajem preferowanego odżywiania się, motywacją do zmiany sposobu odżywiania oraz deklarowanymi czynnikami wpływającymi na odżywianie się badanej młodzieży.