

## METHODS USED BY ADOLESCENTS FOR REDUCING BODY MASS

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### ABSTRACT

**Background.** During adolescence teenagers undergo dynamic physical and mental changes which are accompanied by an increasing interest in changes to their external appearance. Often teens are concerned about such changes, leading to attempts at managing body mass reduction. Adolescent slimming more commonly arises due to a subjective appraisal of body mass rather than using any objective BMI indicators.

**Objective.** To evaluate nutritional status of 13 year old boys and girls living in Szczecin, Poland and to analyse the methods used for achieving body mass reduction.

**Materials and Methods.** Subjects were 1,342 adolescents consisting of 679 girls and 663 boys. Nutritional assessment was performed by anthropometric measurements; calculated BMI (Body Mass Index) and WC (Waist Circumference index). A questionnaire was also used to determine how the subjects lost body mass, their satisfaction levels, mood changes and physical activity.

**Results.** Only 73% subjects had an adequate/normal nutritional status. It was found that half of those declaring that they had used various means of losing body mass (13.04%), of whom the majority were girls, had normal BMI indicators. The most frequently used method of losing body mass were; reducing foodstuff portions and dishes, abstaining from dinner, 1-3 starvation days, increasing physical activity, reducing sweets consumption, abstaining altogether from sweets and increasing fruit and vegetable consumption. Slimming diets were undertaken by 13.1% subjects, consisting mainly of 1000-1300 kcal diets, vegetarian diets or ones recommended by a physician.

**Conclusions.** Adolescents living in Szczecin showed similar rates of adopting slimming diets for reducing body mass when compared to other regions of Poland and the rest of Europe. The methods used for this purpose were mainly either anti- or pro-healthy nutritional behaviour, but less often using physical activity or through slimming diets. It thus appears that monitoring nutritional status in adolescents, as well as providing education in pro-healthy nutrition, is necessary.

**Key words:** *adolescents, nutritional status, methods for reducing body mass, nutritional behaviour, slimming diets*

### STRESZCZENIE

**Wstęp.** U młodzieży w okresie dorastania zachodzą dynamiczne zmiany w sferze fizycznej i psychicznej, którym towarzyszy wzrost zainteresowania zmieniającym się wyglądem zewnętrznym. Częstym obserwowanym zjawiskiem jest brak akceptacji przez młodzież zachodzących zmian, która jest przyczyną podejmowania prób redukcji masy ciała.

**Cel.** Celem badań była ocena stanu odżywienia młodzieży (dziewcząt i chłopców) w wieku 13 lat w Szczecinie oraz analiza stosowanych przez nią sposobów redukcji masy ciała.

**Material i Metody.** Ocenie stanu odżywienia poddano 1342 osób w wieku 13 lat (dziewcząt, n = 679 i chłopców, n = 663) uczęszczających do 17 szkół w Szczecinie, na podstawie wykonanych pomiarów antropometrycznych i wyliczonych wskaźników BMI (*Body Mass Index*) i WC (*Waist Circumference*). Badania przeprowadzono w latach 2007 – 2010. Wśród młodzieży przeprowadzono również badanie ankietowe dotyczące stosowanych sposobów redukcji masy ciała, poczucia akceptacji, wahań nastroju oraz aktywności fizycznej.

**Wyniki.** Prawidłowym stanem odżywienia charakteryzowało się 73% młodzieży. 13.04% badanych (częściej dziewcząt) deklarowało stosowanie różnych sposobów redukcji masy ciała, pomimo że u ponad połowy badanych stwierdzono prawidłową wartość wskaźnika BMI. Najczęściej stosowanymi sposobami redukcji masy ciała były zmiany w zachowaniach żywieniowych: zmniejszenie porcji spożywanych produktów i dań, rezygnacja z posiłków, ograniczenie lub rezygnacja ze słodczy, zwiększenie spożycia owoców lub warzyw i stosowanie głodówek. Stosowanie diet odchudzających zadeklarowało 13.1% badanych, głównie: 1000-1300 kcal, vegetariańskiej i zaproponowanej przez lekarza.

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**Wnioski.** Wśród badanej młodzieży ze Szczecina odsetek osób stosujących różne sposoby redukcji masy ciała, w tym diety odchudzające, był zbliżony do stwierdzanego przez innych autorów w innych regionach Polski oraz w Europie. Redukcję masy ciała stosowały osoby nie tylko z nadwagą lub otyłością, ale również osoby z prawidłowym stanem odżywienia. Stosowanymi sposobami redukcji masy ciała były głównie anty- lub prozdrowotne zachowania żywieniowe, rzadziej zwiększenie aktywności fizycznej lub diety odchudzające. W świetle uzyskanych wyników badań koniecznym wydaje się monitorowanie stanu odżywienia młodzieży oraz prowadzenie prozdrowotnej edukacji żywieniowej.

**Słowa kluczowe:** młodzież, stan odżywienia, sposoby redukcji masy ciała, zachowania żywieniowe, diety odchudzające

## INTRODUCTION

Improper state of nutrition in the period of adolescence is not only an increased risk of cardiovascular complication but also affects - decreases the quality of life by lack of acceptance of own looks, low self-esteem [39], feeling of isolation [31], difficult relationships with peers [34], teasing by others [37], even states of depression [12]. Especially disadvantageous is visceral accumulation of fat tissue correlated with insulin-resistance, secondary hyperinsulinemia, dysglycaemia, atherogenic dyslipidemia. Also in not obese people but with visceral accumulation of fat tissue referred to as MONW (*Metabolically Obese Normal-Weight*) the above mentioned disorder is more often found [2]. To evaluate the state of nutrition in children and teenagers the anthropometric measurements are being taken and based on them indicators such as BMI, WC are calculated because it was shown that they are strongly correlated with risk factors of cardiovascular diseases [18].

Adolescents nutrition behavior, demonstrated among others by applying various types of slimming diets, overeating, or absolutely rejecting food especially during this period of life is one of the important environmental factors modifying the development in accordance with genetic potential. Irregularities in nutrition methods in adolescents and low physical activity become a threat to health, which in the period of development shows through somatic disorder among others in content and distribution of fat tissue which predisposes development of malnutrition, overweight and obesity. Excessive increase of adipocytes at the time of pubertal spurt predisposes development and fixation of obesity during the adulthood. That is why it is reasonable to conduct screening tests in adolescents during the pubertal spurt in order to find people with improper state of nutrition and nutrition behavior and provide them with modifying pro-health education, encourage them to increase their physical activity in order to achieve standard weight [6].

Therefore the objective of this study is the evaluation the nutritional status of 13-year-old adolescents both sexes living in Szczecin, Poland and to analyse the methods used for achieving body mass reduction.

## MATERIALS AND METHODS

The presented results are a part of the study constituting a unique 4-year program (2007-2010) co-funded by the Department of Health and Social Policy of the City of Szczecin, which evaluates nutritional status, the nutrition methods in Szczecin secondary schools, nutrition education and the effects of this education by means of a questionnaire.

After obtaining the approval of Local Ethical Commission (BN-001/93/07) the research was conducted in the years 2007-2010 among 1342 thirteen-year-old Polish adolescents (679 girls and 663 boys) of 68 first classes of randomly selected 17 junior high schools in Szczecin.

The children were anthropometrically examined, that is their body mass was measured with medical scales (legalized and standardized to 0.1 kg without shoes and in light clothes), body height in Frankfurt position with height meter attached to mobil stadiometr Seca 215 accurate to 0.1 cm. The waist circumference (WC) measurement was taken midway between the tenth rib and the iliac crest accurate to 0.1 cm a n anthropometric Gulick tape measure was employed with the subject in a standing position.

From the obtained measurements BMI (*Body Mass Index*) was calculated according to the formula: body mass (kg)/height (m<sup>2</sup>). The obtained values of the BMI index were referred (according to sex and age) to polish centile nets [21] and BMI value was assumed: ≤ 5 percentile as underweight; 10 – 75 percentile as normal weight, 85 – 90 as overweight, ≥ 95 percentile as obesity. The values of WC indexes were referred to polish centile nets [22] and for both indexes the assumed values were ≥ 90 percentile as a criterion of the location of the visceral fat tissue.

Questionnaire research has been conducted among adolescents regarding the application of body mass reduction methods including weight loss diets and feeling of acceptance, mood changes and physical activity. The results achieved were presented as arithmetic means and standard deviation computed in the Microsoft Excel program.

## RESULTS

Analysis of the achieved numbers from the anthropometric features of adolescents (Table 1) shows that both in girls and in boys average body mass and height, BMI and WC indicators values were proper and within the limits of 10 – 75 percentile. Proper state of nutrition was found in nearly 73% of adolescents (Table 2), underweight (more often boys) 5%, overweight (more often girls) 12% and 15% obesity (more often girls).

Table 1. Values on anthropometric attributes and the BMI, WC, WHtR indicators in 13-year old adolescents, ( $\bar{x} \pm SD$ )

Attributes and indicators	Girls (n = 679)	Boys (n = 663)
Body weight, kg	52.2 ± 10.4	53.0 ± 12.0
Body height, cm	160.2 ± 6.5	162.1 ± 8.6
BMI, kg × m <sup>-2</sup>	20.3 ± 3.3	20.0 ± 3.5
WC, cm/cm	70.0 ± 8.2	71.6 ± 9.2

Table 2. The value of the BMI indicator in 13-year old adolescents

Percentile level	BMI					
	Girls (n = 679)		Boys (n = 663)		Total (n = 1342)	
	n	%	n	%	n	%
≤ 5 <sup>th</sup> percentile (underweight)	33	4.9	41	6.2	74	5.5
10 <sup>th</sup> to 75 <sup>th</sup> percentile (normal)	464	68.3	509	76.8	973	72.5
85 <sup>th</sup> to 90 <sup>th</sup> percentile (overweight)	108	15.9	52	7.8	160	11.9
≥ 95 <sup>th</sup> percentile (obesity)	142	20.9	62	9.4	204	15.2

On the base of data from questionnaire tests it was shown that from the population under research – 1,342 people, 13.04% (175 adolescents) declared using various methods aiming at body mass reduction (Table 3), in this 9.69% girls and 3.35% boys. Taking into consideration the value of BMI indicator it was ascertained that more than a half of slimming adolescents (more often girls) had its proper value (10 – 75 percentile) and the rest of people had its over standard value (≥ 85 percentile). None of the slimming persons

Table 3. Percentage of 13 year old adolescents applying body mass reduction according to BMI value

Percentile level	BMI					
	Girls (n = 130)		Boys (n = 45)		Total (n = 175)	
	n	%	n	n	n	%
≤ 5 <sup>th</sup> percentile (underweight)	0	0	0	0	0	0
10 <sup>th</sup> to 75 <sup>th</sup> percentile (normal)	69	53.1	21	46.7	90	51.4
85 <sup>th</sup> to 90 <sup>th</sup> (overweight)	34	26.2	9	20.0	43	24.6
≥ 95 <sup>th</sup> percentile (obesity)	27	20.7	15	33.3	42	24.0

was malnourished. Taking into consideration the values of WC ≥ 90 percentile it has been found (Table 4) that nearly 33% of slimming adolescents had visceral obesity (more often boys).

Table 4. Percentage of 13 year old adolescents applying body mass reduction according to waist circumference (WC)

Range of WC	Girls (n = 130)		Boys (n = 45)		Total (n = 175)	
	n	%	n	%	n	%
< 10 <sup>th</sup> percentile (underweight)	0	0	0	0	0	0
10 <sup>th</sup> to 75 <sup>th</sup> percentile (normal)	11	8.5	2	4.4	13	7.4
90 <sup>th</sup> to 95 <sup>th</sup> percentile (overweight)	17	13.1	2	4.4	19	10.9
> 95 <sup>th</sup> percentile (obesity)	24	18.5	15	33.3	39	22.3

In the questionnaire tests adolescents mentioned as the most commonly applied methods of body mass reduction (Table 5) changes in nutrition behavior such as: decreasing the size of portions of consumed products and dishes, resigning from eating supper, 1 -3 days starvation, limiting or total resigning from eating sweets, increasing consumption of fruit and vegetables. Only few adolescents decided to increase physical activity as the method of reducing body weight.

Taking into consideration sex, girls more often than boys took the trials to reduce body weight by resigning from consumption of supper, applying 1 -3 days of starvation, limiting the portions of consumed products and dishes, increasing physical activity, limiting the amount of consumed sweets or elimination them from their diet and increasing fruit consumption. Boys tried to reduce their body mass by limiting portions of consumed products and dishes and increasing consumption of vegetables, increasing physical activity and limiting of sweets consumption.

Applying weight loss diets was declared in the questionnaire by 13.1% adolescents, these were mainly diets: 1000-1300 kcal, vegetarian and proposed by a physician. However, none of the adolescents under research declared using any pharmacological preparations for weight loss only girls (2.2%) used herbal teas for weight loss. We cannot exclude that in the group of 14% of people under research who declared slimming without saying anything about method could be people who used pharmacological preparations.

Analysis of the information from questionnaires of adolescents slimming down (Table 6) showed that 15.4% of them do not feel accepted in class by teenagers of the same age obese girls (37%) more often than boys (26.7%). The changes taking place during the puberty are not accept by 20% adolescents under research, most often overweight girls (44.1%) and overweight

Table 5. Methods used by 13 year old adolescents for reducing body mass

Kind of methods	Girls (n = 130)		Boys (n = 45)		Total (n = 175)	
	n	%	n	%	n	%
Limitation of the number of consumed meals	4	3.1	2	4.4	6	3.4
Resignation from consuming breakfast	3	2.3	0	0	3	1.7
Resignation from consuming dinner	3	2.3	1	2.2	4	2.3
Resignation from consuming supper	28	21.5	2	4.4	30	17.1
Reduction of portions of products	18	13.8	13	28.9	31	17.7
Applying (1 – 3 days) starvations	23	17.7	2	4.4	25	14.3
Limiting sweets consumption	16	12.3	5	11.1	21	12.0
Resignation from sweets consuming	21	12.0	0	0	21	12.0
Resignation from breads consuming	1	0.8	0	0	1	0.6
Resignation from meat and cold meats consumption	1	0.8	3	6.7	4	2.3
Resignation from potatoes consumption	1	0.8	0	0	1	0.6
Resignation from juices and fizzy beverages sweetened	0	0	3	6.7	3	1.7
Resignation from chips consumption	2	1.5	2	4.4	4	2.3
Resignation from fast food type dishes	0	0	1	2.2	1	0.6
Increasing water consumption	7	5.4	3	6.7	10	5.7
Increasing vegetables consumption	11	8.5	7	15.6	18	10.3
Increasing fruit consumption	16	12.3	3	6.7	19	10.9
Increasing yoghurt consumption	5	3.8	0	0	5	2.9
Food cooking	2	1.5	1	2.2	3	1.7
Applying slimming teas	2	1.5	0	0	2	1.1
Low calories diet (1000 – 1300 kcal)	10	7.7	1	2.2	11	6.3
Light food diet	0	0	1	2.2	1	0.6
“Eat according to your blood group” diet	1	0.8	0	0	1	0.6
Vegetarian diet	2	1.5	2	4.4	4	2.3
Mediterranean diet	1	0.8	0	0	1	0.6
Copenhagen diet	1	0.8	0	0	1	0.6
Diet prescribed by physician	1	0.8	1	2.2	2	1.1
Chrono biological diet	1	0.8	0	0	1	0.6
Dr Ducan diet	0	0	1	2.2	1	0.6
Increasing physical activity	17	13.1	7	15.5	24	13.7
Other methods	9	6.9	5	11.1	14	8.0

boys (26.7%). Mood changes occurring during the puberty period are felt by 88% adolescents, most often overweight girls (96.3%) and boys with proper state of nourishment (80.9%). However stress and emotional tension result in growing appetite for food in every third adolescent under research (35.4%), most often

in obese girls (44.4%) and boys with proper state of nourishment (28.6%).

Subjectively, 60% people under research defined their own way of nutrition as proper, mostly girls with obesity (63%) and boys with overweight (77.8%).

More than a half of adolescents defined their physical activity as average (51.4%) and only every third person as high. Small percentage of adolescents under research declared their activity as very high or low.

## DISCUSSION

Non-invasive, simple and the most often applied methods in appraisal of state of nutrition of children and youths are anthropometrical measurements of mass and height which allow us to calculate the BMI indicator [36]. In our own study from the population of 1,342 percentage of overweight adolescents was 11.9%, but with obesity 15.2% and this problem more often concerned girls than boys.

During the puberty period physiologically in healthy conditions boys have tendency to increase their no-fat body mass and to decrease the percentage content of fat tissue in their general body mass which is the result of androgen concentration in blood. Estrogens in girls increase the fat tissue mass around breasts, hips and buttocks thus increase its percentage share in the general body mass [30]. However, revealing during the puberty period the abdominal location of fat tissue is a significant factor of development of metabolic syndrome. In the conducted research visceral obesity was characteristic, regardless of BMI indicator, for 33.2% of the general number of people under research, more often boys (37.7%) than girls (32.5%).

Accumulation of fat tissue in body might be for adolescents not only an aesthetic but also psychological and emotional problem because dynamical changes take place not only in physical but also in mental sphere along with growing interest in physical appearance at this stage of ontogenesis. Lack of acceptance of these changes by adolescents is also an often occurring phenomenon, which is confirmed by my own research because 20% of adolescents declared in the questionnaire that they do not accept the changes taking place in their body (more often girls) connected to puberty. It was shown that adolescents have problems with self-evaluation adequate to reality of the body mass [10, 25], which is caused by mass media, especially television and color magazines for teenagers and women which create the image of slim body (sometimes even skinny) as beautiful, attributing to it such features as: success, self-confidence, attractiveness and health [26]. The study conducted by *Kololo and Woynarowska* [20] showed that the decision of losing the weight by

Table 6. Percentage of 13 year old adolescents applying body mass reduction (on the base of the questionnaire)

Questions		Girls								Boys								Total (n=175)	
		BMI 10 - 75 pc (n = 69)		BMI 85 - 90 pc (n = 34)		BMI ≥ 95 pc (n = 27)		Total Girls (n=130)		BMI 10 - 75 pc (n = 21)		BMI 85 - 90 pc (n = 9)		BMI ≥ 95 pc (n = 15)		Total Boys (n = 45)			
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
Do you feel accepted in the class?	Yes	65	92.8	28	82.4	17	63.0	110	84.6	20	95.2	7	77.8	11	73.3	38	84.4	148	84.6
	No	4	7.2	6	17.6	10	37.0	54	15.4	1	4.8	2	22.2	4	26.7	7	15.6	27	15.4
Do you accept changes taking place in your body?	Yes	59	85.5	19	55.9	24	88.9	102	78.5	19	90.5	8	88.9	11	73.3	38	84.4	140	80.0
	No	10	14.5	15	44.1	3	11.2	28	21.5	2	9.5	1	11.2	4	26.7	7	15.6	35	20.0
Do you have mood changes?	Yes	65	94.2	30	88.2	26	96.3	121	93.1	17	80.9	6	66.7	10	66.7	33	73.3	154	88.0
	No	4	5.8	4	11.8	1	3.7	9	6.9	4	19.1	3	33.3	5	33.3	12	9.2	21	12.0
Does stress and tension result in desire to eat?	Yes	25	36.2	13	38.2	12	44.4	50	38.5	6	28.6	2	22.2	4	26.7	12	9.2	62	35.4
	No	44	63.8	21	61.8	15	55.6	80	61.5	15	71.4	7	77.8	11	73.7	33	73.3	113	64.6
Do you eat properly?	Yes	41	59.4	20	58.8	17	63.0	78	60.0	12	57.1	7	77.8	8	53.3	27	60.0	105	60.0
	No	28	40.6	14	41.2	10	37.0	52	40.0	9	42.9	2	22.2	7	46.7	18	40.0	70	40.0
What is your physical activity?	Low	3	4.3	2	5.9	4	14.8	9	6.9	0	0	0	0	3	20.0	3	6.7	12	6.9
	Midium	33	47.8	20	58.8	16	59.3	69	53.1	10	47.6	4	44.4	7	46.7	21	46.7	90	51.4
	High	24	34.9	9	26.5	6	22.2	39	30.0	7	33.3	2	22.2	3	20.0	12	26.7	51	29.1
	Very high	9	13.0	3	8.8	1	3.7	13	10.0	4	19.1	3	33.4	2	13.3	9	20.0	22	12.6

adolescents depends mostly on subjective evaluation of body mass than on objective BMI indicator. Twice as many girls (46%) than boys (23%) felt that they are too fat, which can explain the results of my own research. Slightly higher percentage (56%) got *Janiszewska et al.* [16] in the research conducted among 16 years old girls with proper BMI indicator.

Adolescents perception of their own bodies in the aspect of their attractiveness and discrepancy with the promoted by mass-media canons of beauty [23] often causes frustration. Omnipresent in media incentives for using preparations and weight loss diets contribute to formation of conviction of the need of their application [3] and induce decision about body mass reduction [20]. And what is more often under the influence of family and peers criticism adolescents become almost obsessed with controlling their body weight with differences between sexes. Boys have tendency to determine their weight as too low, which is synonymous with masculinity, because it is identified with big muscle mass, especially in the upper parts of body and high physical fitness [19]. That is why they use slimming preparations and/or laxatives rarely and rarely monitor their body mass. Their nutrition concentrates more on achieving through diet proper silhouette than on reducing directly body mass [35]. Girls more often connect appraisal of their looks with other features and with lack of satisfaction from the look of their body, lowering of self-esteem can be observed which lead to application of various methods of body mass reduction [14].

Safe way of reducing body mass should be pro-health change of nutrition behavior assisted by increase

of physical activity however use of preparations and application of weight reducing diets should be done only according to medical indication under the supervision of a nutritionist. The conducted research shows that 13% of adolescents have already tried to reduce their body weight and the percentage is close to (14%) presented in the HBSC (*Health Behavior in School-aged Children*) research [9]. Similarly *Kololo and Woynarowska* [20] stated that the percentage of slimming among Polish 13 years olds was 14.4%, in this 21.7% girls and 8.3% boys. The HBSC [9] research report presented data says that among the European 13 years olds girls and boys 18% and 11% are slimming down however as in the own research girls (20.57%) more often than boys (13.39%) slimmed down, which confirms the fact that the dissatisfaction with their bodies grows among the male sex.

As long as attempting by the teenagers with overweight or obesity trials to reduce their body mass might be justified, however own research shows that more than half of the slimming down adolescents (more often girls) were the persons with proper BMI indicator values. Lower percentage of slimming down girls with proper BMI indicator value were shown by *Janiszewska et al.* [16] among 16 year old girls (33%).

Most often used methods of reducing body mass applied by people under research were changes of the nutrition behavior, which are often reckless and in disorder, random and short termed and do not guarantee weight loss and long term maintenance of the new body mass. That is why we have to agree with other authors [8, 15], that anti health behavior aiming at reduction

of body mass used by adolescents under research are: resigning from basic meals (first breakfasts, dinners and suppers), starving, resigning from various groups of nutrient products (breads, potatoes and meat) and undertaking diets and slimming teas. Resigning from eating meals, lengthening the time between meals might result in adolescents bodies not only in fluctuations in concentration of glucose in blood, changes of metabolism pace and body saving the consumed energy by putting it away in the form of fat tissue, but also in formation of hunger, lowering of concentration, limiting mental and physical activity, negative impact on effectiveness in learning. Similar problems with resignation from meals by adolescents showed other authors in their research [29, 40]. The problem of resigning from meals does not only regard Polish teenagers but also European teenagers because the research conducted by HBSC [9] showed that on average only 57% of girls and 65% of 13 year old boys consumed first breakfast however in Poland the percentage was only slightly higher (similarly 56% and 63%). Starving themselves declared 14.3% of the adolescents under research (more often girls) however *Janiszewska et al.* [16] showed higher percentage (23.3%) of 16 year old girls starving themselves.

Resigning from the consumption of various groups of food products was also watched by *Pieszko - Klejnowska et al.* [29] and *Wołowski and Jankowska* [40]. In own research adolescents resigned from breads consumption, which is an unfavorable phenomenon because especially whole grain products supply body in complex carbohydrates and mineral components (Ca, Mg, Zn, Cr), B group vitamins and fiber, components essential in body mass reduction. However resignation from meat and cold meats consumption might be the reason of anemia, lowered physical activity, psychomotor and intellectual disorder because this element is an ingredient of hemoglobin and myoglobin which are responsible for oxygen transportation.

Many authors [4, 7, 8, 11] excluding from the diet many groups of food products treats as nourishment disorder, which by unbalanced diet during this period of life might lead to delay of growth and puberty, period disorder in girls, osteopenia development, states of depression and lowered self-esteem. The positive aspect of this was that 40% of adolescents under research were conscious that their method of nutrition is not proper.

Pro health behavior used by adolescents under research as a method of body mass reduction must also include limiting of eating snacks between meals which helps accumulating fat tissue. Limiting the size of eating products or dishes portions can be considered pro-healthy only in the situation when before had been consumed bigger portions than those which could appease the feeling of hunger. Especially valuable is bringing to the diet by adolescents fruit and vegetables

which are main source of fiber, minerals and vitamins, mainly C vitamin necessary to produce collagen, hormone and transmitters synthesis, as well as to absorb non-haem iron.

Limiting or resignation from consuming pastries and/or sweets by adolescents under research is a pro-health behavior, because these products with high glycaemic indexes and loads cause excess insulin release as an answer to glucose load, poor immune response and increase of production free oxygen radicals promoting oxidation of LDL-CH fraction to atherogenic oxLDL-CH [1]. Resignation by adolescents from consuming fast food type dishes characterized by high content of fat, sugar, salt and low content of vitamins, minerals and fiber might affect and regulate body mass.

It was shown in the HBSC [9] research that 23% of 13 years old (20% girls and 25% boys) consume beverages with sugar, however in Poland the percentage was higher (25% and 35%). Limiting consumption of this group of products, containing the additive phosphates, might have positive influence on achieving peak bone mass by the adolescents under research. Although resignation from chips consumption thus limitation of consumption of saturated fatty acids, not only has influence on body mass regulation but can prevent neurotoxic action of these products resulting from the acrylamide content [24].

Increasing water consumption by adolescents under research should also be included in favorable nourishment behavior because water is calorie free carrier of many mineral ingredients. During the pubertal spurt positive balance of water is a physiological phenomenon, which contributes to regulation of feeling of thirst, metabolism improvement, secretion of digestive juices improvement, increasing exertion of unnecessary metabolism products, improves defecation, prevents irritability, insomnia and physical weakness.

Positive aspect identified in own research is the fact that there were no persons among the adolescents using pharmacological slimming preparations as a method of weight loss, which is in line with general tendency observed among teenagers among whom application of laxatives, diuretic and slimming preparations is not an often encountered phenomenon [4].

Despite the fact, that recommended by WHO action in body mass reduction should be increasing of physical activity, however in the conducted research like in the research made by *Kołoto and Woynarowska* [20], such actions were more often undertaken by boys than girls.

While using weight loss diets as a method of body mass reduction, in own research, was declared by 13.1% of adolescents and these were mainly low calorie, vegetarian and offered by a physician diets. It is generally known that applying low calories diets. Low carbohydrates and low fat diets does not give effect in long

term maintenance of body weight [32]. Paradoxically teenagers' slimming without clear medical indications and without a dietician's supervision might not acquire the desired effects in the form of "healthy weight" and "cosmetically desirable weight" but can also bring increase of body weight [28]. It was shown that adolescents of both sexes who applied restrictive diets five years later showed three times more often obesity than in the group who did not applied diets [27]. Also teenagers, who applied slimming diets at the age of 16 years were more exposed to obesity at the age of 30 than persons who did not apply diets [38].

Short and long term diet application by adolescents might result in distraction, irritability, fatigue and even in losing self-esteem in case of little or totally ineffective body mass reduction [5]. Applying weight loss diets carries risk (5 to 18 times) of deepening the nourishment disorder leading to anorexia or bulimia, to unrestricted appetite, gluttony [13] and their psychological consequences. Application of weight loss diets is seen as an introduction to the above mentioned disorders.

The cause of adolescents' under research behavior which aims at body mass reduction might be found in the declared in the questionnaire feeling of lack of acceptance by peers in the class, in mood changes and "eating up stress". It was shown that teenagers (especially girls) who have experienced criticism from peers and emerging from this states of depression and fear, are more prone to engage themselves in extreme body weight loss practices [17]. Constant monitoring of the state of nutrition of adolescents is necessary and it should be done by school nurses while doing screening tests, by physicians while doing prophylaxis health care and physical activity teachers [33]. It gives possibility of early detection of any irregularities in the state of nutrition and modifying it by working on correct nourishing habits, increasing physical activity and forming proper self-esteem.

Taking into consideration the results of conducted research all adolescents (1,342 people) were subject to pro-health nourishment education in the form of "live" workshops with nourishing products during which the rules of proper nourishing in accordance with their developing age and sex in the aspect of further physical and intellectual development and preventing the development of civilization diseases were introduced to them. After the workshops adolescents received leaflets containing basic rules of proper nourishment.

The parents of adolescents who showed the signs of improper nourishment received proposal of individual diet correction, however only 13% answered the invitation which confirms parents' low interest in health and development of their children which was also pointed in several discussions with headmasters, teachers and school educators.

## CONCLUSIONS

1. Among the adolescents from the city of Szczecin the percentage of people applying various methods of body mass reduction including slimming diets was similar to the percentage in other regions in Poland and in Europe.
2. Reducing body mass was not only done by overweight or obese adolescents but also with proper state of nutrition.
3. Methods used by adolescents for reducing body mass were mainly anti- or pro-health nutrition behaviour, less often as a result of the physical activity or using the slimming diet.
4. Taking into consideration above conclusions it seems that monitoring the state of nutrition of adolescents and providing pro-health nutrition education is necessary.

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## Conflict of interest

The authors declare no conflict of interest.

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