



# The consumption of vegetables and fruits by teenagers and their nutritional status

Spożycie warzyw i owoców przez nastolatków w odniesieniu do ich stanu odżywienia

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## Abstract

**Introduction.** Nutritional disorders in the population at developmental age constitute a significant social problem. Their occurrence is strongly influenced by incorrect dietary choices. The basis of the daily diet should be vegetables and fruits as products that provide many valuable and necessary components for the proper functioning of the body.

**Objective.** The aim of the study is to assess the consumption of fruit and vegetables by young people in relation to nutritional intake.

**Materials and method.** The research was conducted in a group of 1,999 studentinf randomly selected general secondary schools. The research tool was the author's questionnaire. BMI was calculated based on growth charts for age and gender, based on measurements of the height and weight of the subjects.

**Results.** In the examined group of adolescents, body mass deficiencies were found in a total of 8.4% of respondents (10.5% girls, 4.3% boys). The percentage of eutrophic adolescents in the study group was 77.6%. Overweight and obesity were found in 14.0% of all respondents (11.3% girls, boys 18.1%). Respondents with normal body mass declared eating vegetables several times a day less often than other adolescents. Consumption of fruits several times a day was confirmed by 46.3% of the surveyed adolescents, more often girls (49.4%) than boys (40.4%).

**Conclusions.** 1) In the studied group of adolescents, dietary mistakes were fund, consisting mainly of too few meals during the day, which occurred more often among overweight and obese adolescents than in the Rother. 2) The consumption of fruits and vegetables in the studied group of adolescents was insufficient. 3) It is necessary to improve knowledge of the principles of healthy eating as one of the factors in the prevention of diseases of civilization.

## Key words

adolescents, undernutrition, obesity, overweight, nutrition

## Streszczenie

**Cel pracy.** Zaburzenia stanu odżywienia w populacji w wieku rozwojowym stanowią istotny problem społeczny. Na ich występowanie duży wpływ mają nieprawidłowe wybory żywieniowe. Podstawę codziennej diety powinny stanowić warzywa i owoce, ponieważ produkty te dostarczają wielu cennych i niezbędnych dla prawidłowego funkcjonowania organizmu składników. Celem pracy jest ocena spożycia warzyw i owoców przez młodzież w odniesieniu do jej stanu odżywienia.

**Materiał i metody.** Badania zostały przeprowadzone w grupie 1999 uczniów liceów ogólnokształcących. Narzędziem badawczym był autorski kwestionariusz ankiety. Na podstawie przeprowadzonych pomiarów wzrostu i masy ciała badanych obliczono wskaźnik BMI w odniesieniu do siatek centylowych dla wieku i płci.

**Wyniki.** W badanej grupie młodzieży niedobory masy ciała stwierdzono łącznie u 8,4% badanych (10,5% dziewcząt, 4,3% chłopców). Odsetek nastolatków eutroficznyc w badanej grupie wynosił 77,6% (dziewczęta stanowiły 78,2%, chłopcy 76,6%). Nadwagę i otyłość stwierdzono u 14,0% ogółu badanych (11,3% dziewcząt, 18,1% chłopców). Badani z prawidłową masą ciała deklarowali spożywanie warzyw kilka razy dziennie rzadziej niż pozostała młodzież. Spożywanie owoców kilka razy w ciągu dnia potwierdziło 46,3% badanej młodzieży uczniów, częściej dziewcząt (49,4%) niż chłopców (40,4%).

**Wnioski.** 1) W badanej grupie młodzieży wykazano błędy żywieniowe, które występowały częściej wśród młodzieży z nadwagą i otyłością niż w grupie młodzieży eutroficznej. Głównym błędem jest zbyt mała liczba spożywanych w ciągu dnia posiłków. 2) Spożycie warzyw i owoców w badanej grupie młodzieży było niewystarczające. 3) Konieczne jest pogłębienie wiedzy na temat zasad zdrowego żywienia jako jednego z czynników profilaktyki chorób cywilizacyjnych.

## Słowa kluczowe

młodzież, niedożywienie, otyłość, nadwaga, żywienie

## INTRODUCTION

Disorders of the nutritional status of the adolescent population constitute an important social problem [1, 2]. Prolonged underweight leads to energy and protein deficiencies which,

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especially at a young age, can result in the inhibition of physical and intellectual development, cognitive impairment, or immunodeficiency [3]. On the other hand, obesity negatively affects health and development during childhood and has a decisive impact on health in adult life, increasing the risk of developing chronic non-communicable diseases and disabilities [4, 5, 6, 7]. Adolescents who are overweight are at an increased risk of obesity, and are definitely more at risk of developing hypertension [8,9]. Obesity also affects children's quality of life in the field of social and mental functioning.

The basis of a daily diet should be vegetables and fruits. The National Food and Nutrition Institute recommends a daily diet containing a minimum of 400 g of fruits and vegetables divided into five portions, one of which may be a glass of juice [10]. These products provide many valuable and necessary components for the body's proper functioning and contribute to reducing the risk of developing diseases, such as cardiovascular disease (hypertension, atherosclerosis, or heart failure), diabetes, and some cancers.

## OBJECTIVE

The aim of the study is to analyse the consumption of vegetables and fruits by 18-year-old high school students in Białystok, north-east Poland, in the context of their nutritional status.

## MATERIALS AND METHOD

The research was conducted among high school students in the 2011–2012 school year. In their implementation, an original, anonymous questionnaire was used to gather information about diet, including the consumption of vegetables and fruits. There were also questions included about environmental conditions.

Weight and height measurements were taken and nutritional status assessed. An electronic scale (accuracy of 0.1 kg) was used to measure body weight, and height measurements were made using a Martin anthropometer (accuracy of 0.1 cm). Assessment of the somatic development of the subjects consisted of measuring height and weight, calculating the BMI index, and comparing the obtained data with the biological reference system (growth charts for BMI), and interpreting the obtained results. BMI <5th percentile was used as a value indicating underweight, while overweight and obesity were taken as BMI ≥85th percentile. Values in the range [5–85] percentile referred to eutrophic youth.

Statistical analysis of the obtained results was carried out using the statistical package Statistica PL 8.0. The  $\chi^2$  independence test was used for the analysis. The occurrence of statistically significant differences was examined at the significance level  $p < 0.05$ . The study was approved by the Bioethics Committee of the Medical University of Białystok.

## RESULTS

The percentage of eutrophic youth was 77.6% (girls – 78.2%, boys – 76.6%). Underweight was found in 8.4% of respondents (10.5% girls, 4.3% boys). However, 14.0% of the respondents were overweight and obese (11.3% girls, 18.1% boys).

Adolescents with overweight and obesity ate fewer meals during the day compared to other groups (adolescents with underweight and eutrophic adolescents). Four or five meals a day were consumed the least by people with overweight and obesity, compared to eutrophic and underweight students (Tab. 1a, Tab. 1b).

**Table 1a.** The number of meals consumed in the studied group of underweight and eutrophic adolescents

Analyzed factor	<5 centile		[5-85] centile		p	
	n	%	n	%		
In total	1 or 2 meals	34	20.4	260	16.8	ns
	3 meals/	50	29.9	519	33.4	ns
	4 and 5 meals	83	49.7	773	49.8	ns
Girls	1 or 2 meals	30	21.9	192	18.8	ns
	3 meals	39	28.5	358	35.1	ns
	4 and 5 meals	68	49.6	469	46.1	ns
Boys	1 or 2 meals	4	13.3	68	12.8	ns
	3 meals	11	36.7	161	30.2	ns
	4 and 5 meals	15	50.0	304	57.0	ns

**Table 1b.** The number of meals consumed in the studied group of eutrophic adolescents and adolescents with overweight and obesity

Analyzed factor	[5-85] centile		≥85 centile		p	
	n	%	n	%		
In total	1 or 2 meals	260	16.8	61	21.8	ns
	3 meals	519	33.4	99	35.4	ns
	4 and 5 meals	773	49.8	120	42.8	ns
Girls	1 or 2 meals	192	18.8	36	24.5	ns
	3 meals	358	35.1	49	33.3	ns
	4 and 5 meals	469	46.0	62	42.2	ns
Boys	1 or 2 meals	68	12.8	25	18.8	ns
	3 meals	161	30.2	50	37.6	ns
	4 and 5 meals	304	57.0	58	43.6	$p < 0.05$

Eating between main meals was noted in the majority of students on most days of the week. A significant percentage, as many as 33.1% of girls and 36.7% of boys, declared eating snacks between meals several times a day. Snacking sweets was reported by 67.5% of girls and 56.9% of boys. Sweet snacks were eaten by underweight students (78.1%), normal weight students (65.3%), and students with excessive body weight (64.1%). Salty snacks were popular among 1/3 girls and 1/3 boys.

Almost 80.0% of students with normal weight and 81.3% of underweight students ate fruits as a light meal. Fruits were usually eaten by 71.2% of students with excessive body weight. Only 42.8% of young people confirmed the consumption of vegetables several times a day. Girls more often than boys declared eating vegetables several times a day (45.9% and 36.9%, respectively). The presence of vegetables in the diet several times a week was found in 11.3% of girls and 14.2% of boys. In turn, 3.7% of girls and 7.2% of boys did not eat vegetables at all. Over half of the overweight and obese girls and the girls with underweight consumed vegetables several times a day. Girls with normal weight reached for vegetables several times a day statistically significantly less

frequently than underweight girls ( $p < 0.05$ ), and more often than those with overweight and obesity. Boys with overweight and obesity and with normal weight consumed vegetables several times a day in a similar percentage, while boys with underweight statistically significantly less frequently declared eating vegetables several times a day (Tab. 2a, Tab. 2b).

**Table 2a.** Vegetable consumption in the studied group of underweight and eutrophic adolescents

Vegetable consumption	<5 centile		[5-85] centile		p	
	n	%	n	%		
In total	Never	7	4.2	77	5.0	ns
	Few times a week	73	68.1	829	53.4	$p < 0.05$
	Few times a day	87	52.1	646	41.6	$p < 0.05$
Girls	Never	2	1.5	40	3.9	ns
	Few times a week	55	40.1	530	52.1	$p < 0.05$
	Few times a day	80	58.4	449	44.0	$p < 0.05$
Boys	Never	5	16.7	37	6.9	$p < 0.05$
	Few times a week	18	60.0	299	56.1	ns
	Few times a day	7	23.3	197	37.0	ns

**Table 2b.** Eating vegetables in the studied group of eutrophic youth and overweight and obese adolescents

Vegetable consumption	[5-85] centile		≥85 centile		p	
	n	%	n	%		
In total	Never	77	5.0	13	4.6	ns
	Few times a week	829	53.4	134	47.9	0.086
	Few times a day	646	41.6	133	47.5	0.067
Girls	Never	40	3.9	5	3.4	ns
	Few times a week	530	52.1	62	42.1	$p < 0.05$
	Few times a day	449	44.0	80	54.5	$p < 0.05$
Boys	Never	37	6.9	8	6.0	ns
	Few times a week	299	56.1	72	54.2	ns
	Few times a day	197	37.0	53	39.8	ns

Fruits consumption several times a day was confirmed by less than half of the respondents, more often girls (49.4%) than boys (40.4%). Overweight and obese students and eutrophic students in a similar percentage declared eating fruits several times a day. Girls with underweight statistically

**Table 3a.** Fruits consumption in the studied group of underweight adolescents and eutrophic adolescents

Fruits consumption	<5 centile		[5-85] centile		p	
	n	%	n	%		
In total	Never	11	6.6	73	4.7	ns
	Few times a week	68	65.4	774	53.5	$p < 0.05$
	Few times a day	88	52.7	705	45.4	ns
Girls	Never	8	5.8	32	3.1	ns
	Few times a week	50	36.5	496	48.7	$p < 0.05$
	Few times a day	79	57.7	491	48.2	$p < 0.05$
Boys	Never	3	10.0	41	7.7	ns
	Few times a week	18	60.0	278	52.1	ns
	Few times a day	9	30.0	214	40.2	ns

**Table 3b.** Eating fruits in the studied group of eutrophic youth and overweight and obese adolescents

Fruits consumption	[5-85] centile		≥85 centile		p	
	n	%	n	%		
In total	Never	73	4.7	11	3.9	ns
	Few times a week	774	53.5	137	48.9	ns
	Few times a day	705	45.4	132	47.2	ns
Girls	Never	32	3.1	6	4.1	ns
	Few times a week	496	48.7	67	45.6	ns
	Few times a day	491	48.2	74	50.3	ns
Boys	Never	41	7.7	5	3.7	ns
	Few times a week	278	52.1	70	52.7	ns
	Few times a day	214	40.2	58	43.6	ns

significantly more often than eutrophic girls consumed fruits several times a day ( $p < 0.05$ ). An inverse relationship was observed in the group of underweight boys (Tab. 3a, Tab. 3b).

## DISCUSSION

The study aimed to determine the consumption by adolescents of vegetables and fruits with varied nutritional status. In the examined youth group, normal BMI values were found in 77.6% of participants. Disturbances in weight-height proportions occurred in 22.4% of respondents. Underweight (BMI < 5 percentile) was found in 8.4% of subjects, while overweight and obesity (BMI > 85 centile) was found in 14.0% of adolescents.

In Poland, according to HBSC 2018 studies, body mass deficiency occurs with a frequency of 13.6% significantly more often in girls (16.2%) than boys (10.8%), and excessive body weight (overweight and obesity) occurs in 21.3%, including obesity in 4.7% of teenagers, significantly more often in boys (29.3%, 7.0%, respectively) than girls (13.7%, 2.6%, respectively) [11].

Rational nutrition should include five meals a day, following the appropriate proportions between individual meals and fixed hours of their consumption [12,13]. It has been proven that eating the same amount of food with one or two meals (instead of the recommended five) causes faster fat deposits, contributing to the development of obesity [14,15]. The above confirm research by the authors of the current study conducted among 18-year-olds. The surveyed overweight and obese teenagers ate fewer meals per day than eutrophic teenagers. Differences in the number of meals consumed were especially visible in girls. Girls with obesity ate significantly fewer meals (one or two meals – 24.2%) than girls with normal body weight (one or two meals – 18.8%).

Children and adolescents frequently eat snacks, often highly processed products with added fat, sugar, and salt [16, 17]. Those who skipped meals consumed less fruits and vegetables but larger quantities of white bread, sweet drinks, and sweets. A study of the diet of American children showed that those who ate three snacks a day increased their daily energy intake by 20–27% [18,19].

In the current study, eating between main meals was reported by more than 90% of teenagers. A significant percentage, as many as 33.1% of girls and 36.7% of boys, declared eating snacks between meals several times a day. Snacking on sweets was reported by 67.5% girls and 56.9%

boys. Sweet snacks were eaten by underweight students (78.1%), normal weight students (65.3%), and students with excessive body weight (64.1%). Salty snacks were popular among 1/3 of adolescents girls and boys. Young people usually ate snacks after returning home from school, while watching TV, or spending time with friends [19].

A diet rich in fruits and vegetables is recommended for adolescent nutrition because it provides vitamins, minerals, fibre, and many important substances such as plant sterols, flavonoids, and antioxidants. Their daily consumption helps prevent non-communicable diseases, such as cardiovascular disease, diabetes, and cancer. The World Health Organization recommends consuming over 400 grams of fruits and vegetables daily to improve overall health and reduce the risk of disease [20]. The results of many studies indicate a deficiency in the consumption of fruits and vegetables among teenagers [21–24]. The review of fruits and vegetables consumption by adolescents indicates significant inverse relationships with systolic blood pressure, abdominal obesity, triglyceride levels, cholesterol, and metabolic syndrome [25]. Low fruits and vegetables consumption is considered a predisposing factor for overweight and obesity [26].

According to an HBSC report, only slightly more than 1/3 of teenagers consume fruits (38.2%) and vegetables (34.2%) at the recommended level, and the daily consumption of fruits and vegetables is observed in girls more often than boys. In addition, compared to the results of the HBSC 2014 research, in 2018, an increase in the percentage of daily consumption of vegetables (by 4.9%) and fruits (by 4.4%) was observed among adolescents [11]. Similarly, in the current study, the consumption of fruits and vegetables was insufficient. Girls more often than boys declared eating vegetables several times a day (45.9% and 36.9%, respectively). The consumption of fruits several times a day was confirmed by 46.3% of surveyed students, more often by girls (49.4%) than boys (40.4%).

Wall [27] found an inverse relationship between BMI and higher consumption of fruits, vegetables, legumes and nuts in adolescents. In the current study, girls with low body weight ate vegetables and fruits several times a day, statistically more often than others. They often attached great importance to external appearance, which applies to eating more vegetables and fruits as low-calorie foods. A study by Lampard et al. [28] showed that healthy weight control behaviours are more common in low-weight adolescent girls compared to overweight and obese girls. On the other hand, in the case of boys, the opposite was true. Overweight and obese boys ate more vegetables and fruits than the others. The differences in the consumption of fruits and vegetables in the studied group of teenagers were not statistically significant. Similarly, studies have not shown a relationship between fruits and vegetable consumption and the BMI of adolescents [29].

Research by Łuszczka et al. showed a statistically significant relationship between age and fruits and vegetables consumption, which increased with age in both genders [30]. Other studies carried out among children and adolescents showed that younger participants consumed significantly more portions of fruits than older participants. The percentage of people consuming five, or at least three portions a day increased significantly with higher socio-economic status, higher parental education, and lower media consumption. In addition, children who play sports outside of school and are physically active every day consume more fruits and vegetables [31].

The amount of consumed fruits and vegetables is influenced by the availability of these products at home. Children who have access to different types of fruits and vegetables tend to eat more of them. Research by Korinek et al. assessing the consumption of fruits and vegetables at school, showed that children who more often received fruits and vegetables at home also consumed more of these products during their stay at school [32]. Improving knowledge about healthy eating principles by taking into account various conditions shaping the eating habits of school about healthy eating principles, including the consumption of fruits and vegetables, as one of the factors in the prevention of civilization diseases.

## CONCLUSIONS

1. In the studied group of adolescents, dietary mistakes were found consisting mainly of too few meals during the day, which occurred more often among overweight and obese students than in the group of eutrophic students
2. The consumption of fruits and vegetables in the studied group of adolescents was low
3. It is necessary to improve knowledge about the principles of healthy eating, including the consumption of vegetables and fruits, as one of the factors in the prevention of civilization diseases.

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