Open Access Article

Ann. Acad. Med. Siles. (online) 2025; 79: 288–295
eISSN 1734-025X
DOI: 10.18794/aams/205578
www.annales.sum.edu.pl

PRACA ORYGINALNA
ORIGINAL PAPER

Dietary patterns and cardiovascular risk in adolescent males: An epidemiological study among high school students in Silesia, Poland

Wzorce żywieniowe a ryzyko sercowo-naczyniowe u nastoletnich chłopców: badanie epidemiologiczne wśród uczniów szkół średnich w województwie śląskim

Martyna Szymańska[1], Karolina Krupa-Kotara[2], Karolina Sobczyk[3], Beata Nowak[4], Mateusz Grajek[5]

[1]Students' Scientific Club, Department of Public Health, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

[2]Department of Epidemiology, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

[3]Department of Economics and Health Care Management, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

[4]Students' Scientific Club, Department of Epidemiology, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

[5]Department of Public Health, Faculty of Public Health in Bytom, Medical University of Silesia, Katowice, Poland

ABSTRACT

INTRODUCTION: Cardiovascular diseases (CVDs) are a major cause of mortality globally, including in Poland. Their risk factors include both non-modifiable (e.g., age or genetics) and modifiable elements (e.g., diet and physical activity). Among the latter, diet plays a pivotal role in prevention. Poor dietary habits – such as high intake of saturated fats and low consumption of fruits and vegetables – significantly increase CVDs risk. The aim of this study was to assess the risk of developing CVDs among adolescents based on their dietary habits.

MATERIAL AND METHODS: The research, conducted in May 2024, involved 583 male students from School No. 10 in Zabrze, Poland. An anonymous questionnaire gathered information on eating habits, meal composition, food preparation, and seasoning practices. Statistical analysis was carried out using Microsoft Excel, including chi-square tests and correlation analysis.

RESULTS: The results showed that 78.8% of participants had a normal body mass index (BMI), 14.1% were overweight, and 2% were obese. About 50% rated their nutritional knowledge as good. A moderate positive correlation was found between nutritional knowledge and physical activity ($r = 0.34$; $p < 0.05$). While daily vegetable consumption was 54%, fruit consumption was slightly lower, at 48%. A high intake of saturated fats and insufficient consumption of fruits and vegetables were significantly linked to increased CVDs risk ($\chi^2 = 34.36$; $p < 0.0001$).

Received: 18.04.2025 **Revised:** 14.05.2025 **Accepted:** 26.05.2025 **Published online:** 16.09.2025

Address for correspondence: Martyna Szymańska, Studenckie Koło Naukowe, Zakład Zdrowia Publicznego, Wydział Zdrowia Publicznego w Bytomiu ŚUM, ul. Piekarska 18, 41-902 Bytom, tel. +48 537 267 572, e-mail: martyna.szymanska@interia.pl

Publisher: Medical University of Silesia, Katowice, Poland

CONCLUSIONS: Despite normal BMI values among participants, the findings highlight the need to strengthen nutrition education. The unbalanced dietary pattern and excessive intake of saturated fats justify implementing preventive measures aimed at reducing cardiovascular risk and promoting healthier habits in adolescents.

KEYWORDS

risk factors, adolescents, cardiovascular diseases, nutritional education, dietary habits

STRESZCZENIE

WSTĘP: Choroby układu krążenia (*cardiovascular diseases* – CVDs) są główną przyczyną zgonów na świecie, również w Polsce. Czynniki ryzyka obejmują zarówno czynniki niemodyfikowalne (np. wiek, genetyka), jak i modyfikowalne (np. dieta, aktywność fizyczna). Spośród tych ostatnich dieta odgrywa kluczową rolę w profilaktyce. Niezdrowe nawyki żywieniowe – takie jak wysokie spożycie tłuszczów nasyconych i niskie spożycie owoców i warzyw – znacznie zwiększają ryzyko CVDs. Celem badania była ocena ryzyka rozwoju CVDs u młodzieży na podstawie ich zachowań żywieniowych.
MATERIAŁ I METODY: Badanie przeprowadzono w maju 2024 r. w grupie 583 uczniów płci męskiej z Zespołu Szkół nr 10 w Zabrzu. Zastosowano anonimową ankietę dotyczącą nawyków żywieniowych, składu posiłków, metod przygotowywania potraw oraz sposobów przyprawiania. Analizy statystyczne przeprowadzono w programie Microsoft Excel, wykorzystując testy chi-kwadrat oraz analizę korelacji.
WYNIKI: Wyniki wskazały, że 78,8% badanych miało prawidłowy wskaźnik masy ciała (*body mass index* – BMI), 14,1% miało nadwagę, a 2% było otyłych. Około 50% badanych oceniło swoją wiedzę na temat żywienia jako dobrą. Stwierdzono umiarkowaną dodatnią korelację między wiedzą na temat żywienia a aktywnością fizyczną ($r = 0,34$; $p < 0,05$). Dzienne spożycie warzyw wyniosło 54%, a owoców nieco mniej, bo 48%. Nadmierne spożycie tłuszczów nasyconych i niewystarczające spożycie owoców i warzyw były istotnie związane ze zwiększonym ryzykiem CVDs ($\chi^2 = 34,36$; $p < 0,0001$).
WNIOSKI: Pomimo prawidłowych wartości BMI u badanych wyniki wskazują na potrzebę intensyfikacji działań związanych z edukacją żywieniową. Niezbilansowana dieta i nadmierne spożycie tłuszczów nasyconych uzasadniają wdrażanie działań profilaktycznych ukierunkowanych na ograniczenie ryzyka sercowo-naczyniowego i kształtowanie zdrowych nawyków wśród młodzieży.

SŁOWA KLUCZOWE

czynniki ryzyka, młodzież, choroby sercowo-naczyniowe, edukacja żywieniowa, nawyki żywieniowe

INTRODUCTION

Cardiovascular diseases (CVDs) encompass a broad spectrum of circulatory system disorders, including heart diseases, blood vessel disorders, and metabolic disturbances, which represent a significant health concern in developed countries and remain the leading cause of death worldwide. In 2019, nearly 18 million deaths were attributed to CVDs, including 6.5 million cases among individuals under the age of 70 [1,2,3]. In 2020–2021 in Poland, these diseases were the primary cause of death, emphasizing the need for effective preventive measures [4].

CVD risk factors are classified as non-modifiable and modifiable. Non-modifiable factors include sex, age, and genetic predispositions [5]. Women are less frequently affected by CVDs, yet when they occur, they are associated with worse prognoses and higher mortality rates [6,7]. Age also plays a crucial role, with its impact amplified by other factors such as obesity, hypertension, and diabetes [8]. Genetic factors, both polygenic and monogenic, significantly influence CVD development. An example of a monogenic disease that increases the risk of premature cardiovascular complications is familial hypercholesterolemia (FH) [9,10].

Modifiable risk factors, such as diet, physical activity, body weight, and substance use, have a substantial impact on CVD development [11]. Regular physical activity improves insulin sensitivity, reduces blood pressure, and enhances endothelial function, reducing the risk of CVDs [12,13,14]. Conversely, excessive body weight, particularly visceral obesity, leads to severe metabolic disturbances and mechanical strain on the heart, increasing the risk of atherosclerosis and hypertension [15,16,17].

Diet plays a crucial role in CVD prevention. Excessive consumption of saturated fatty acids, trans isomers, and highly processed foods promotes elevated low-density lipoprotein cholesterol (LDL-C) levels and the development of atherosclerosis [18,19,20]. On the other hand, a diet rich in plant protein, fiber, and unsaturated fatty acids is associated with a lower risk of CVDs [21,22]. Excessive salt and simple carbohydrate intake can raise blood pressure and lead to dyslipidemia [23,24,25].

Effective dietary models for CVD prevention include the DASH and Mediterranean diets. The DASH diet (Dietary Approaches to Stop Hypertension)

emphasizes the consumption of vegetables, fruits, whole grains, and low-fat dairy products and the restriction of sodium. Studies have shown that this diet lowers blood pressure and LDL-C levels and reduces systemic inflammation [26,27]. The Mediterranean diet, rich in olive oil, fish, nuts, and legumes, also contributes to improved lipid profiles and reduced cardiovascular risk [28,29].

Health education plays a key role in both primary and secondary CVD prevention. Promoting healthy habits, including a proper diet and regular physical activity, helps patients make informed health decisions [30]. Early health education among children and adolescents, including nutritional education, aims to establish long--term positive health habits that reduce CVD risk in adulthood [31].

Adolescence is a crucial period in human development, during which dietary habits likely to persist into adulthood are established. Moreover, optimal nutritional intake during this stage is essential to support full growth potential and reduce the risk of developing noncommunicable diseases, including CVDs [32]. Notably, women are generally less likely to develop CVDs than men, which underscores the importance of incorporating dietary education focused on CVD prevention, particularly for adolescent males [33].

In summary, a comprehensive approach to CVD prevention should involve interdisciplinary actions based on health education, regular physical activity, and a well-balanced diet. Implementing such strategies at both the individual and societal levels can significantly reduce the global burden of these diseases, improve quality of life, and reduce health care costs.

The aim of this study was to conduct a comprehensive analysis and assessment of the risk of developing CVDs among school-aged adolescents in the context of dietary habits, considering diet quality, the frequency of consumption of specific food groups, the nutritional value of meals, and the adherence of dietary habits to current nutritional guidelines. The study aimed to identify dietary factors that may contribute to an increased risk of CVDs.

MATERIAL AND METHODS

Study design

The study group consisted of 583 male students attending high schools in the Polish region of Silesia. The sample was randomly selected from all available groups of students within the school. To ensure random selection, a stratified random sampling method was employed: each high school was treated as a separate stratum and groups were randomly selected within each stratum to achieve a balanced representation of various school types and educational profiles across the region. The representativeness of the sample was verified by comparing demographic and academic performance variables with regional statistical data provided by Statistics Poland. The selected sample size was calculated to achieve a 95% confidence level with a 10% margin of error. The formula used for this step was $n = (Z^2 \times p \times (1-p)) / E^2$, where n is the required sample size, Z is the Z-value (1.96 for a 95% confidence level), p is the estimated proportion of the population (0.5 for maximum variability), and E is the margin of error (0.10). The resulting sample size was 96.04, rounded up to 99 participants for greater reliability. To further verify representativeness, the chi--square test was conducted to compare the distributions of age, academic performance, and school type between the sample and the population. The p-values exceeded 0.05, indicating no statistically significant differences, confirming the representativeness of the sample. Questionnaires were distributed in each selected group during school hours with the consent of the school principal. This procedure minimized the risk of self-selection bias and ensured high response rates.

Research tool

The study used a questionnaire based on the Food Frequency Questionnaire (FFQ), designed to assess the frequency of consuming specific food groups, as well as food preparation methods and selection of condiments. The process of validating the tool included a pilot study with a group similar to the target population, which allowed the questionnaire to be refined in terms of the relevance and comprehensibility of the questions. The reliability of the questionnaire was assessed using Cronbach's alpha, which was 0.85, indicating high internal consistency of the tool. The stability of the results was confirmed by the test-retest correlation, which reached 0.82. The questionnaire was designed in accordance with the scientific literature, where FFQ tools are widely recognized as effective in studies of adolescents' eating habits, enabling a reliable assessment of their diet and potential health risk factors [34,35].

Research ethics

The study obtained approval from the Bioethics Committee of the Medical University of Silesia in Katowice (No. BNW/NWN/0052/KB/295/23/24, issued on 14 December 2023). The research was conducted in adherence with the principles of scientific research ethics. Participation in the study was entirely voluntary, and students had the right to withdraw at any stage without providing a reason. Personal data was not collected, and the results were presented collectively, ensuring the participants' anonymity. The study was carried out with the informed consent of the school

principal, ensuring compliance with the institution's internal regulations. It posed no physical or psychological risk to the participants. Approval from the ethical committee was not required for this specific aspect of the study, as per the Polish Medical Profession Act (Dz.U. 1997 No. 28, item 152, as amended) and the Declaration of Helsinki, due to its questionnaire-based nature. Data such as height and body weight were self-reported, eliminating the need for any intrusive procedures, such as bioimpedance measurement. The study design ensured that all ethical and legal requirements were upheld.

Data analysis

The data was subjected to quantitative analysis using Microsoft Excel. The analysis included coding responses by assigning numerical values to each answer and calculating descriptive statistics (means and standard deviation) and correlation coefficients. Statistical tests were performed, including the chi--square test for frequency comparisons and Pearson's correlation coefficient for relationships between variables. The analysis also involved calculations for the odds ratio of cardiovascular risk in the study group. Results with a p-value of < 0.05 were considered statistically significant.

RESULTS

An expanded analysis of the study, conducted on a diverse group of respondents, revealed a detailed distribution of body mass index (BMI) classifications and their associations with various health and lifestyle factors. The results indicate that 64.8% of the participants had a BMI within the normal range, suggesting a healthy body weight. However, 20.2% were classified as overweight, 7% as obese, and 8% as underweight (Figure 1). Comparing BMI distribution patterns, most respondents fell within the normal range, but nearly one in six struggled with excess body weight, emphasizing the importance of weight management education.

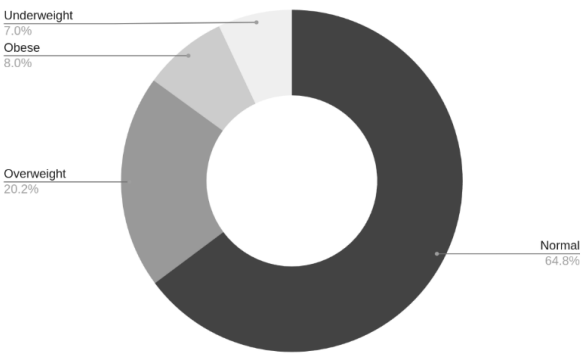

Fig. 1. Percentage distribution of the group by body mass index (BMI).

The self-assessment of nutritional knowledge varied, with 50% of the participants rating their knowledge as good, 32% as moderate, and 18% as poor. A positive correlation was observed between higher self-assessed nutritional knowledge and healthier BMI levels ($r = 0.28$; $p < 0.05$), suggesting that education on nutrition could influence weight management behavior (Table I).

Table I. Comparison of respondents' body mass index (BMI) and nutritional knowledge

BMI	n (%)	Nutritional knowledge	n (%)	r	p-value
Normal	64.8	Good	50		
Overweight and obese	27.2	Moderate	32	0.28	0.05
Underweight	8	Poor	18		

Physical activity levels were diverse, with 31% of respondents reporting very high activity, 21% high activity, 28% moderate activity, and 20% low to very low activity. A significant positive relationship was found between physical activity levels and BMI within the normal range ($r = 0.42$; $p < 0.01$; Table II). Further, nutritional knowledge and physical activity showed a moderate positive correlation ($r = 0.34$; $p < 0.05$), reinforcing the connection between health literacy and lifestyle choices.

Table II. Comparison of respondents' body mass index (BMI) and physical activity

BMI	n (%)	Physical activity	n (%)	r	p-value
Normal	64.8	High	52		
Overweight and obese	27.2	Moderate	28	0.42	0.01
Underweight	8	Low	20		

In terms of dietary habits, the consumption of cereal products was high, with 87% of respondents regularly consuming them, including 38% daily and 49% several times a week. Fruit consumption was also frequent, with 48% consuming fruit daily and 39% several times a week. Vegetable consumption surpassed fruit intake, with 54% consuming vegetables daily and 37% several times a week. The statistical analysis showed a significant difference in favor of vegetable consumption ($p < 0.05$). Those who consumed fruits and vegetables more frequently demonstrated healthier BMI levels and lower cardiovascular risk markers.

In terms of beverage preferences, 82% of the participants primarily drank mineral, table, or spring water, while 32% consumed fruit and vegetable juices regularly. Daily energy drink consumption was reported by only 12%, indicating a generally low intake of such products, which aligns with healthier consumption patterns.

Regarding meat consumption, poultry was the most consumed, with 52% selecting chicken or turkey as their primary choice, while 29% indicated uncertainty about their meat preferences. Fish consumption was reported by 19% of participants at least once a week, while red meat was consumed weekly by 34%.

The consumption of fats in the diet revealed that butter was the most frequently used fat, reported by 42% of respondents, while 27% used vegetable oils. Uncertainty about fat consumption was noted by 15% of participants. A chi-square test identified a significant association between butter consumption and higher BMI levels ($\chi^2 = 19.56$; $p < 0.01$).

The consumption patterns of salty snacks and sweets varied. Fast food, instant products, and salty snacks were consumed several times a month by 69% of the respondents and several times a week by 22%. The consumption of sweet snacks was higher among boys, with 44% consuming sweets multiple times a week and 14% reporting daily consumption. Excessive consumption here was associated with higher BMI and lower physical activity levels ($r = 0.29$; $p < 0.05$).

The data revealed that 52% of the respondents could not estimate their daily intake of salt, while the remaining participants reported consuming at least one teaspoon per day. Excess salt consumption was associated with higher reported blood pressure levels among the participants over 25 years of age ($r = 0.31$; $p < 0.01$).

Further analysis highlighted that 42% of respondents fell into a high-risk group for CVDs due to poor diet quality, excessive body weight, and low fruit and vegetable intake. A chi-square test confirmed a significant association between saturated fat consumption and cardiovascular risk ($\chi^2 = 34.36$; $p < 0.0001$). Moreover, a logistic regression model identified high BMI, low physical activity, and frequent processed food consumption as significant predictors of cardiovascular risk (OR = 2.3, CI 95% [1.7–3.2], $p < 0.001$; Table III).

Table III. Cardiovascular risk predictors in the study group

Cardiovascular risk predictors	OR	CI	p-value
High BMI	2.3		0.001
Low physical activity	2.1		0.001
Poor nutritional knowledge	N/A		NS
Consumption of processed foods	2.5	95%	0.001
Consumption of saturated fats	N/A		NS
High salt intake	N/A		NS
Consumption of sweet snacks	1.9		0.001

BMI – body mass index; OR – odds ratio; CI – confidence interval.

DISCUSSION

Adolescence is a critical period for establishing lifelong health behaviors, including dietary patterns and physical activity levels. Given the increasing prevalence of obesity and related health conditions among adolescents worldwide, it is essential to investigate factors that influence nutritional habits and their potential impact on cardiovascular health. This study explored dietary behaviors, nutritional knowledge, and physical activity patterns among adolescents, shedding light on both positive trends and areas requiring targeted health education. The findings contribute to the broader discourse on health promotion among adolescents and provide insight for public health interventions aimed at fostering balanced nutrition and reducing cardiovascular risk in this population.

The study reported that 78.8% of the participants maintained a BMI within the normal range, while 14.1% were classified as overweight and 2% as obese. These findings mirror global trends reported by the World Health Organization (WHO), which highlights a rising prevalence of adolescent obesity, particularly in developed nations, where high-calorie diets often lack nutritional quality [23]. The self-reported nature of the BMI data used in this study could have introduced an underreporting bias, as observed in previous population health surveys comparing self-reported and measured BMI values [36].

The percentages of overweight and obese adolescents in the study group were 14.1% and 2%, respectively, which are lower than the global figures provided by the WHO. The organization indicates that globally, the prevalence of overweight and obesity among adolescents has increased significantly in recent years, reaching values above 20% in some regions [23]. The lower results obtained in our study may be due to regional differences, the level of health education, and cultural habits. At the same time, it should be taken into account that the results may be underestimated in part due to the survey methodology, in which the participants self-reported their weight and height. This approach runs the risk of underestimating BMI due to the tendency to underreport weight or overestimate height. In addition, the study group were at a developmental age characterized by dynamic changes in height and weight. These factors may further affect the final interpretation of the results. Although the incidence of overweight and obesity in the study group was lower than the global average, the problem still affects one sixth of the participants. This underscores the need for further educational and preventive measures, especially in terms of reducing

the consumption of high-calorie products and promoting physical activity.

Nutritional knowledge was found to have a moderate positive correlation with physical activity. This association is consistent with findings from previous studies emphasizing the role of health literacy among adolescents in promoting healthier lifestyle choices, including increased physical activity and improved diet quality [37,38]. However, the cross-sectional design of the study precludes causal inferences. Longitudinal studies are recommended to clarify the directionality of these relationships.

The study also revealed a difference between intake of vegetables (54% daily consumption) and fruits (48% daily consumption). This imbalance contrasts with national dietary guidelines advocating balanced intake from both groups due to their combined nutritional benefits, including fiber, antioxidants, and essential vitamins [39]. Increased fruit consumption has been associated with a reduced risk of CVDs in multiple cohort studies [40]. This indicates a potential area for targeted dietary education focusing on balanced consumption of fruits and vegetables. The high proportion of the study group who consume vegetables (54%) and fruits (48%) daily is a positive result in the context of WHO data, which emphasizes the importance of regularly consuming these food groups in terms of preventing CVD [40]. The difference between vegetable and fruit consumption may be related to their greater availability, lower price, or regional taste preferences. Dietary recommendations point to the need for a balanced intake of both groups of products due to their complementary nutritional values, such as fiber, vitamins, and antioxidants [39]. Further educational efforts should focus on raising awareness of dietary balancing and eliminating barriers to accessing fruit, especially among groups with lower economic status.

Regarding beverage consumption, most participants (82%) reported regular water intake, with only 12% consuming energy drinks daily. This positive trend diverges from European data showing energy drink consumption rates as high as 40% among adolescents [41]. The low intake of energy drinks in this study is encouraging, as the high caffeine and sugar content of such beverages has been linked to increased cardiovascular risk, including hypertension and arrhythmia [42]. The noticeably low percentage of daily consumption of energy drinks (12%) in the study group represents a positive departure from European data, which indicate that up to 40% of adolescents regularly consume such products [4]. This result may be related to a greater emphasis on health education in the region, the relatively limited availability of sweetened beverages, or a preference for water, which was the main choice of 82% of the participants. However, it is worth expanding the research in this area to explore what environmental and social factors may be influencing youth preferences in Poland. Further efforts should focus on maintaining these positive trends by promoting healthy habits in this population.

The survey questions regarding fat revealed that 42% of the respondents preferred butter as their primary fat source, while only 27% used vegetable oils. Butter, rich in saturated fats, has been strongly associated with elevated LDL cholesterol levels and heightened cardiovascular risk [4]. In contrast, unsaturated fats from vegetable oils, such as olive oil, have demonstrated cardioprotective properties [43]. These findings suggest the need for improved nutritional education that promotes healthier fat choices among adolescents.

Salt consumption also emerged as a concern, with 52% of participants unable to estimate their intake and the remainder reporting a minimum of one teaspoon daily. Excessive salt consumption has been consistently linked with hypertension, a major risk factor for cardiovascular events [26]. The WHO has recommended global strategies for salt reduction as a cost-effective intervention for improving cardiovascular health in the population [44].

The study identified a significant relationship between high saturated fat intake, low fruit and vegetable consumption, and increased cardiovascular risk. This observation is in line with extensive epidemiological evidence that plant-based diets low in saturated fats are protective against CVDs [28,34,45].

The strengths of this study include its relatively large and diverse sample size, the use of standardized questionnaires, and the application of validated statistical techniques. However, limitations such as self-reported data and a cross-sectional design should be noted. Self-reported dietary behaviors often result in the underreporting of unhealthy choices due to social desirability bias [46].

To address the identified cardiovascular risk factors in adolescents, targeted interventions are essential. Our study highlights the need for comprehensive educational programs that promote a balanced diet and regular physical activity. Evidence from previous studies indicates that school-based health education initiatives can effectively reduce cardiovascular risk by encouraging healthier lifestyle choices among adolescents [4,18–42]. These programs should focus on reducing the intake of saturated fats and processed foods, increasing awareness about balanced fruit and vegetable consumption, and emphasizing the importance of regular exercise. Implementing such interventions could significantly mitigate the risks identified in this study, particularly for adolescents with high BMI, low physical activity levels, and poor dietary habits. The behaviors of adolescents, including dietary habits and physical activity levels, play a crucial role in determining their long-term cardiovascular

health. Our study demonstrates a significant association between these behaviors and increased cardiovascular risk. Adolescents with high BMI, low physical activity, and excessive consumption of saturated fats exhibited an odds ratio (OR) of 2.3 (95% CI [1.7–3.2], $p < 0.001$) for developing CVDs. These findings align with the existing literature, which emphasizes that unhealthy habits formed during adolescence can persist into adulthood, significantly elevating the risk of cardiovascular events later in life [4,23,26,28,30–44]. Preventive measures targeting this age group are therefore critical. Early interventions, such as providing nutritional education and promoting active lifestyles, are effective strategies for reducing the future burden of CVDs. Such measures could contribute to fostering long-term healthy behaviors, thereby reducing the incidence of cardiovascular events in adulthood.

Future research should aim for more objective measures of dietary intake, such as food diaries, biomarker analysis, and repeated measures to ensure accuracy. Broader studies incorporating multiple regions would enhance the generalizability of the findings. Interventional studies focusing on dietary education, particularly addressing the consumption of healthy fats and balanced fruit and vegetable intake, could further validate these findings.

Strengths and limitations

The study included a relatively large and diverse sample size, providing a solid base for analysis. Quantitative data collection and statistical analysis were conducted using established methods, ensuring reliability. A wide range of dietary habits and health-related variables were examined, allowing for comprehensive insights. However, the self-reported nature of the data may have introduced a response bias or inaccurate reporting of dietary habits. The study focused on a specific population, limiting the generalizability of the results to other groups. The cross-sectional design prevents the establishment of causal relationships between variables. Additionally, some participants expressed uncertainty regarding their dietary choices, which could have affected the accuracy of the findings.

CONCLUSIONS

Most participants had a healthy BMI, but there was a significant minority facing overweight and obesity issues, which may require targeted interventions. There was a moderate, positive correlation between nutritional knowledge and physical activity levels, indicating that better-informed individuals tend to engage in more physical activity. Vegetable consumption was significantly higher than fruit consumption, suggesting the need for balanced dietary education focusing on both food groups. The strong preference for water and low consumption of energy drinks is a positive trend in beverage choices. Poultry was the most frequently consumed meat, but a significant portion of the respondents were uncertain about their meat consumption habits, indicating a need for better dietary awareness. The preference for butter over vegetable oils and the uncertainty about fat consumption could be addressed through targeted nutritional education emphasizing healthy fat choices.

The findings highlight the importance of comprehensive nutritional education to address gaps in knowledge and promote healthier eating patterns.

Authors' contribution

Study design – M. Szymańska, M. Grajek
Data collection – M. Szymańska, K. Krupa-Kotara, K. Sobczyk
Data interpretation – M. Szymańska, K. Krupa-Kotara, K. Sobczyk
Statistical analysis – M. Szymańska, B. Nowak
Manuscript preparation – M. Grajek
Literature research – M. Szymańska, K. Krupa-Kotara, K. Sobczyk, B. Nowak

REFERENCES

1. Thiriet M. Cardiovascular disease: An introduction. In: Vasculopathies. Biomathematical and Biomechanical Modeling of the Circulatory and Ventilatory Systems. Vol 8. Springer. Cham 2019, p. 1–90, doi: 10.1007/978-3-319-89315-0_1.

2. Cardiovascular diseases (CVDs). WHO, 2021 [online] https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) [accessed on 11 April 2025].

3. Gózd-Barszczewska A.I., Panasiuk L. Prevalence of modifiable cardiovascular risk factors in patients hospitalized due to symptomatic coronary artery disease in the Lublin Province. [Article in Polish]. Med. Og. Nauk. Zdr. 2021; 27(4): 453–560, doi: 10.26444/monz/144082.

4. Pahwa R., Jialal I. Atherosclerosis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023, https://www.ncbi.nlm.nih.gov/books/NBK507799/ [accessed on 11 April 2025].

5. Shahjehan R.D., Sharma S., Bhutta B.S. Coronary artery disease. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023, https://www.ncbi.nlm.nih.gov/books/NBK564304/ [accessed on 11 April 2025].

6. Khaku A.S., Tadi P. Cerebrovascular disease. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023, https://www.ncbi.nlm.nih.gov/books/NBK430927/ [accessed on 11 April 2025].

7. About peripheral arterial disease (PAD). CDC, May 15, 2024 [online] https://www.cdc.gov/heart-disease/about/peripheral-arterial-disease.html [accessed on 11 April 2025].
8. Global atlas on cardiovascular disease prevention and control. WHO, 12 May 2011 [online] https://www.who.int/publications/i/item/9789241564373 [accessed on 11 April 2025].
9. Umieralność w 2021 roku. Zgony według przyczyn - dane wstępne. Główny Urząd Statystyczny, 16.05.2022 [online] https://stat.gov.pl/obszary-tematyczne/ludnosc/statystyka-przyczyn-zgonow/umieralnosc-w-2021-roku-zgony-wedlug-przyczyn-dane-wstepne,10,3.html [accessed on 11 April 2025].
10. Timmis A., Townsend N., Gale C.P., Torbica A., Lettino M., Petersen S.E. et al. European Society of Cardiology: Cardiovascular Disease Statistics 2019. Eur. Heart J. 2020; 41(1): 12–85, doi: 10.1093/eurheartj/ehz859.
11. STEPS Manual / Part 1: Introduction and roles / Section 1: Introduction. WHO, 2023 [online] https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps/manuals#Part1 [accessed on 11 April 2025].
12. Kopeć M. Zachowania zdrowotne młodych osób dorosłych w kontekście profilaktyki chorób układu sercowo-naczyniowego. [MA Thesis]. Uniwersytet Jagielloński w Krakowie 2023, https://ruj.uj.edu.pl/xmlui/handle/item/316037.
13. Surma S., Szyndler A., Narkiewicz K. Świadomość nadciśnienia tętniczego i innych czynników ryzyka chorób układu sercowo-naczyniowego w populacji osób dorosłych. Chor. Serca Naczyń 2018; 15(1): 14–22.
14. Gao Z., Chen Z., Sun A., Deng X. Gender differences in cardiovascular disease. Med. Nov. Technol. Devices 2019; 4: 100025, doi: 10.1016/j.medntd.2019.100025.
15. Di Giosia P., Passacquale G., Petrarca M., Giorgini P., Marra A.M., Ferro A. Gender differences in cardiovascular prophylaxis: Focus on antiplatelet treatment. Pharmacol. Res. 2017; 119: 36–47, doi: 10.1016/j.phrs.2017.01.025.
16. Maas A.H., Appelman Y.E. Gender differences in coronary heart disease. Neth. Heart J. 2010; 18(12): 598–602, doi: 10.1007/s12471-010-0841-y.
17. Rodgers J.L., Jones J., Bolleddu S.I., Vanthenapalli S., Rodgers L.E., Shah K. et al. Cardiovascular risks associated with gender and aging. J. Cardiovasc. Dev. Dis. 2019; 6(2): 19, doi: 10.3390/jcdd6020019.
18. Steenman M., Lande G. Cardiac aging and heart disease in humans. Biophys. Rev. 2017; 9(2): 131–137, doi: 10.1007/s12551-017-0255-9.
19. Vrablik M., Dlouha D., Todorovova V., Stefler D., Hubacek J.A. Genetics of cardiovascular disease: How far are we from personalized CVD risk prediction and management? Int. J. Mol. Sci. 2021; 22(8): 4182, doi: 10.3390/ijms22084182.
20. Cybulska B. Rodzinna hipercholesterolemia – zalecenia dietetyczne. NCEZ, 28 stycznia 2020 [online] https://ncez.pzh.gov.pl/choroba-a-dieta/rodzinna-hipercholesterolemia-zalecenia-dietetyczne/ [accessed on 11 April 2025].
21. Bays H.E., Taub P.R., Epstein E., Michos E.D., Ferraro R.A., Bailey A.L. et al. Ten things to know about ten cardiovascular disease risk factors. Am. J. Prev. Cardiol. 2021; 5: 100149, doi: 10.1016/j.ajpc.2021.100149.
22. Pinckard K., Baskin K.K., Stanford K.I. Effects of exercise to improve cardiovascular health. Front. Cardiovasc. Med. 2019; 6: 69, doi: 10.3389/fcvm.2019.00069.
23. Obesity and overweight. WHO, 2024 [online] https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [accessed on 11 April 2025].
24. Zhang Y., Liu J., Yao J., Ji G., Qian L., Wang J. et al. Obesity: pathophysiology and intervention. Nutrients 2014; 6(11): 5153–5183, doi: 10.3390/nu6115153.
25. Schwartz M.W., Seeley R.J., Zeltser L.M., Drewnowski A., Ravussin E., Redman L.M. et al. Obesity pathogenesis: An Endocrine Society Scientific Statement. Endocr. Rev. 2017; 38(4): 267–296, doi: 10.1210/er.2017-00111.
26. Filippou C.D., Tsioufis C.P., Thomopoulos C.G., Mihas C.C., Dimitriadis K.S., Sotiropoulou L.I. et al. Dietary Approaches to Stop Hypertension (DASH) diet and blood pressure reduction in adults with and without hypertension: A systematic review and meta-analysis of randomized controlled trials. Adv. Nutr. 2020; 11(5): 1150–1160, doi: 10.1093/advances/nmaa041.
27. Ravera A., Carubelli V., Sciatti E., Bonadei I., Gorga E., Cani D. et al. Nutrition and cardiovascular disease: Finding the perfect recipe for cardiovascular health. Nutrients 2016; 8(6): 363, doi: 10.3390/nu8060363.
28. Casas R., Castro-Barquero S., Estruch R., Sacanella E. Nutrition and cardiovascular health. Int. J. Mol. Sci. 2018; 19(12): 3988, doi: 10.3390/ijms19123988.
29. Malikowska K., Grabańska-Martyńska K. History of the Mediterranean diet in prevention of diseases of cardiovascular system. [Article in Polish]. Acta Medicorum Polonorum 2016; 6(1): 41–49.
30. Kubica A., Sinkiewicz W., Szymański P., Bogdan M. Edukacja zdrowotna w chorobach układu krążenia – możliwości i zagrożenia. Folia Cardiol. Excerpta 2006; 1(4): 177–188.
31. Profilaktyka pierwotna. Portal Gov.pl, 2017 [online] https://www.gov.pl/web/zdrowie/profilaktyka-pierwotna [accessed on 11 April 2025].
32. Sinai T., Axelrod R., Shimony T., Boaz M., Kaufman-Shriqui V. Dietary patterns among adolescents are associated with growth, socioeconomic features, and health-related behaviors. Foods 2021; 10(12): 3054, doi: 10.3390/foods10123054.
33. Suman S., Pravalika J., Manjula P., Farooq U. Gender and CVD – does it really matters? Curr. Probl. Cardiol. 2023; 48(5): 101604, doi: 10.1016/j.cpcardiol.2023.101604.
34. Willett W. Nutritional Epidemiology. 3rd ed. Oxford University Press. New York, NY 2013, doi: 10.1093/acprof:oso/9780199754038.001.0001.
35. Cade J., Thompson R., Burley V., Warm D. Development, validation and utilisation of food-frequency questionnaires – a review. Public Health Nutr. 2002; 5(4): 567–587, doi: 10.1079/PHN2001318.
36. Shields M., Gorber S.C., Tremblay M.S. Estimates of obesity based on self-report versus direct measures. Health Rep. 2008; 19(2): 61–76.
37. Nutbeam D. Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. Health Promot. Int. 2000; 15(3): 259–267, doi: 10.1093/heapro/15.3.259.
38. Spear B.A. Adolescent Growth and Development. In: J. Stang, M. Story [ed.]. Guidelines for Adolescent Nutrition Services. University of Minnesota: Minneapolis, MN, USA, 2005, p. 1–8.
39. Piramida Zdrowego Żywienia i Aktywności Fizycznej dla dorosłych. M. Jarosz i in. [oprac.]. Instytut Żywności i Żywienia. Narodowe Centrum Edukacji Żywieniowej, 31.03.2021 [online] https://ncez.pzh.gov.pl/sdm_downloads/piramida-zdrowego-zywienia-i-aktywnosci-fizycznej-dla-osob-w-wieku-starszym/ [accessed on 11 April 2025].
40. He F.J., Nowson C.A., MacGregor G.A. Fruit and vegetable consumption and stroke: meta-analysis of cohort studies. Lancet 2006; 367(9507): 320–326, doi: 10.1016/S0140-6736(06)68069-0.
41. European Food Safety Authority (EFSA). Scientific Opinion on the safety of caffeine. EFSA J. 2015; 13(5): 4102, doi: 10.2903/j.efsa.2015.4102.
42. Seifert S.M., Schaechter J.L., Hershorin E.R., Lipshultz S.E. Health effects of energy drinks on children, adolescents, and young adults. Pediatrics 2011; 127(3): 511–528, doi: 10.1542/peds.2009-3592.
43. Schwingshackl L., Hoffmann G. Monounsaturated fatty acids, olive oil and health status: a systematic review and meta-analysis of cohort studies. Lipids Health Dis. 2014; 13: 154, doi: 10.1186/1476-511X-13-154.F
44. Sodium reduction. WHO, 7 February 2025 [online] https://www.who.int/news-room/fact-sheets/detail/sodium-reduction [accessed on 11 April 2025].
45. Malczyk E. Nutritional status of children and youth in Poland on basis of literature from last ten years (2005–2015). [Article in Polish]. Ann. Acad. Med. Siles. 2016; 70: 56–65, doi: 10.18794/aams/58971.
46. Lissner L., Troiano R.P., Midthune D., Heitmann B.L., Kipnis V., Subar A.F. et al. OPEN about obesity: recovery biomarkers, dietary reporting errors and BMI. Int. J. Obes. 2007; 31(6): 956–961, doi: 10.1038/sj.ijo.0803527.