

EATING BEHAVIOURS AND ASSOCIATED LIFESTYLE FACTORS IN A SAMPLE OF SLOVAK ADOLESCENTS

Diana Vondrová¹, Ľubica Argalášová¹, Michael Weitzman², Martin Samohýl¹, Alexandra Filová¹, Katarína Hirošová¹, Jana Jurkovičová¹, Kvetoslava Rimárová³, Erik Dorko³, Jana Babjaková¹

¹Institute of Hygiene, Faculty of Medicine, Comenius University in Bratislava, Bratislava, Slovak Republic

²Department of Pediatrics, New York University School of Medicine, New York, United States of America

³Department of Public Health and Hygiene, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Košice, Slovak Republic

SUMMARY

Objectives: An unhealthy lifestyle, inappropriate eating habits, and inadequate physical activity are the most common risk factors affecting health and causing the premature onset of non-communicable diseases. The study aimed to evaluate lifestyle factors, eating habits, and daily regimens in a sample of Slovak adolescents.

Methods: The sample involves 524 students aged 15–22 years attending selected secondary schools from the model region of Bratislava, the capital of Slovakia. We assessed the prevalence of selected lifestyle factors and investigated the relationship between negative lifestyle factors and the presence of overweight and obesity.

Results: We found eating irregularities including avoidance of school lunch, inadequate daily consumption of vegetables, dairy products and wholegrain foods, and the high consumption of sweets and sweetened beverages. The prevalence of excess weight and obesity in the sample was 18.4%. Compared to the non-obese, overweight or obese students had significantly lower daily consumption of vegetables and used to avoid sports more frequently. Almost 37% of students did not do sports at all. Students who were not doing sports on regular basis used to skip breakfast more frequently, they ate fewer vegetables and more sweets and spent considerable time in sedentary activities.

Conclusion: In the sample of secondary school students, we investigated several negative lifestyle factors and the relatively high prevalence of overweight and obesity. The results of the study can be used for the development of preventive measures to protect and promote the health of children and youth.

Key words: adolescents, eating habits, daily activities, overweight, obesity

Address for correspondence: E. Dorko, Department of Public Health and Hygiene, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Šrobárova 2, 041 80 Košice, Slovak Republic. E-mail: erik.dorko@upjs.sk

<https://doi.org/10.21101/cejph.a7893>

INTRODUCTION

Adolescence is a transitional period between childhood and adulthood, which generally lasts from puberty to legal adulthood (1, 2). It is one of the most rapid periods of human development, characterized by a lot of physical, psychological, and social changes. Development patterns of adolescence are varying across time and place and involve components of biological growth and social transformation (2). Adolescents are in a higher probability of risk-taking behaviours and emotional reactivity. They used to experiment with different aspects of life, accept new challenges, find out how things work, and use this process to form their identity and knowledge about the world. However, risky behaviour can have uncertain consequences with a negative effect on health (3).

This period of life is also characterized by increased autonomy. Adolescents used to spend less time with their parents and more time with friends, which is associated with higher vulnerability to acquiring bad lifestyle habits from their peers. Both social and developmental changes are influenced by external environmental and internal factors, which elicit and emphasize behaviours (1).

The transition period between childhood and adulthood is critical for several lifestyle behaviours. An unhealthy lifestyle such as poor dietary choices, a sedentary lifestyle, and a lack of physical activity are the most common modifiable risk factors affecting health and can lead to the premature onset of diseases (4). Evidence showed that dietary habits obtained during childhood often persist through adulthood (5). Due to the global obesity crisis in recent years, childhood nutrition has gained increasing attention (4, 6). Nutrition has been related to obesity not only in terms of the volume of food consumed but also in terms of the composition and quality of the diet. Unhealthy eating patterns include inadequate consumption of fruit and vegetables, higher intake of fat and sugar or irregularities in eating, especially breakfast omission, which is associated with overweight and obesity and risk behaviour typical for adolescents (sedentary activities, smoking, psychoactive substance use) (6, 7).

Due to the changing environment, which has made daily activities mostly sedentary, it is very difficult to maintain rates of physical activity within sufficient levels. Adolescents belong to the group of highly risky sedentary behaviour because they spend more time in school. These days study requirements are higher

than ever before, which can reduce the time dedicated to physical activities (4). Data from European countries show that only 34% of adolescents are physically active enough to meet guidelines, whereas eastern countries are more affected by sedentary behaviour. Also, socioeconomic factors play a role, countries with low income have less free time and limited availability of leisure activities compared to countries with higher income. In most EU countries boys were more active than girls but a decline with age was seen in both sexes (8).

This study aimed at evaluating selected lifestyle factors, eating habits, and daily activities in a sample of secondary school students. We were mostly focused on the association between lifestyle factors and the prevalence of overweight and obesity in the study sample. These factors are of great importance for disease prevention and health promotion in adolescents and young adults.

MATERIALS AND METHODS

This study is a part of the Youth and Parents Risk Factor Behaviour Survey (YABS) held in Slovakia, which is an ongoing cross-sectional survey of students and their parents, and has begun during the years 2015–2016 in Bratislava, the Slovak capital, as a model region (7, 9, 10). It originates from the Behavioural Risk Factor Surveillance System (BRFSS) and the Youth Risk Behaviour Surveillance System (YRBSS), originally designed by the Centers for Disease Control and Prevention (CDC), Atlanta, USA (11, 12). The BRFSS was a random telephone survey of US residents aged 18 years and older focused on behavioural factors such as sedentary lifestyle, physical activity, nutrition, safety, tobacco and alcohol usage, etc. (11). The YRBSS was developed in 1990, monitoring six categories of priority health-risk behaviours among youth and young adults (aged 15–19 years) in public and private schools in the USA (12).

The data were collected using two separate standardized questionnaires: “Questionnaire for Students” and “Questionnaire for Parents”. Only the data from “Questionnaire for Students” are presented in this paper. It included questions on the residence, family, school, health and safety, eating habits and behaviour, nutrition, body weight and height, lifestyle and physical activity, and socioeconomic background of adolescents. A pilot validation of the Slovak version of the questionnaire was performed on 20 respondents and then the questions were finalized. The questionnaires were anonymous and voluntary. Informed consent was obtained from all participants involved in the study. For students under 18 years of age, informed consent was provided by their parents.

The study was conducted according to the Declaration of Helsinki and was approved by the Ethics Committee of the Faculty of Medicine, Comenius University and University Hospital on 25 July 2017, No. 87/2016.

There were 798 student questionnaires distributed with a 64% response rate. The sample involves 524 adolescents aged 15–22 years from eight selected secondary schools from a total of 101 secondary vocational and grammar schools in Bratislava – in total, there were 22,723 students in Bratislava on the 1st of January 2016. Schools were selected to obtain diverse range of secondary schools, including grammar schools, vocational schools, and schools with specialized programmes. There were two grammar

schools (40.2%), three vocational schools (hairdressers/makeup artists, masons, transportation school) (30.3%), one school of art (3.2%), business academy (5.3%), and a nursing school (21.0%).

The body mass index (BMI) was calculated according to the formula: $BMI = \text{weight}/\text{height}^2$. Weight and height were obtained from self-reported data. To evaluate overweight and obesity levels, sex and age-specific percentile charts were used for students under 18 years of age and adult students were classified according to the World Health Organization (WHO) BMI chart (13). The category of underweight consisted of 3.0% of students, the category of normal weight involved 78.6% of students, in the overweight category there were 12.3% of students, and 6.1% of students were obese. For some of the analyses, we divided the sample into the category of underweight and normal weight students (81.6%), and overweight and obese students (18.4%) (Table 1).

The statistical package SPSS, version 25 (International Business Machines Corp., New Orchard Road, Armonk, NY, USA) was applied for data analysis. Descriptive statistics provided simple summaries of the sample and the observations that have been made. Relationships among categorical data (eating behaviours and lifestyle factors related to sex, BMI category, and physical activity) were evaluated by contingency tables and chi-square test. Multivariable logistic regression was used to obtain adjusted odds ratios and 95% confidence intervals. The statistical significance level was set at $\alpha < 0.05$.

Table 1. Characteristics of the student's sample ($N = 524$)

| Variables ^a | | n (%) |
|-------------------------|---------------|------------|
| Sex | Male | 199 (38.4) |
| | Female | 323 (61.6) |
| Age groups (years) | 15–16 | 263 (50.9) |
| | 17–18 | 119 (23.1) |
| | 19–22 | 134 (26.0) |
| Nationality | Slovak | 476 (91.0) |
| | Other | 47 (9.0) |
| Type of school | Grammar | 210 (40.2) |
| | Professional | 155 (29.5) |
| | Vocational | 159 (30.3) |
| Siblings | Yes | 424 (82.5) |
| | No | 93 (17.5) |
| Residence | Urban | 305 (58.5) |
| | Rural | 211 (41.5) |
| Family | Complete | 360 (69.8) |
| | Incomplete | 156 (30.2) |
| Feeling a lack of money | Never | 220 (43.1) |
| | Sometimes | 284 (55.7) |
| | Always | 6 (1.2) |
| Body mass index | Underweight | 15 (3.0) |
| | Normal weight | 388 (78.6) |
| | Overweight | 61 (12.3) |
| | Obesity | 30 (6.1) |

^aThere were missing data in some variable categories.

RESULTS

The study group consists of 38% boys and 62% girls, 91.0% of Slovak nationality, the average age of students was 16.78 ± 1 years; 82.5% of students had at least one sibling, 58.5% of them lived in urban areas and 70% of them had complete families. A lack of money was observed in almost 57% of students' families (Table 1).

Nutritional habits and lifestyle factors in the sample of secondary school students differed among selected groups (Table 2). Breakfast omission was found in 58% of students (58.0% boys

and 57.7% girls). School lunch was mostly omitted, only 30% of students used to eat lunch at the school canteen. Daily consumption of fruits, vegetables, dairy products, and wholegrain foods did not reach the 50% limit. Only 45.9% of adolescents used to eat vegetables at least once a day. There were significant differences between boys and girls in fruit consumption. A significantly higher number of girls used to eat fruits on daily basis compared to boys (61.8% vs. 47.6%, $p < 0.01$). A significantly higher number of boys drank sweetened beverages daily compared to girls (38.5% vs. 20.3%, $p < 0.001$). Sedentary activities highly exceeded physical activities (9.4 hrs vs. 5.3 hrs) in the total sample. Only 8.9% of

Table 2. Eating behaviours and lifestyle factors of the study sample in relation to sex ($N = 524$)

| Variables ^a | | Total | Boys ($n = 199$) | Girls ($n = 323$) | p-value |
|-------------------------------|--------------------|-------------|-----------------------|------------------------|---------|
| | | n (%) | n (%) | n (%) | |
| Breakfast | Regular | 213 (42.01) | 81 (41.97) | 132 (42.31) | 0.940 |
| | Omitted | 294 (57.99) | 112 (58.03) | 180 (57.69) | |
| School lunch | Regular | 151 (29.96) | 50 (26.32) | 101 (32.37) | 0.151 |
| | Omitted | 353 (70.04) | 140 (73.68) | 211 (67.63) | |
| Dairy | Daily | 238 (48.77) | 91 (50.00) | 146 (48.03) | 0.482 |
| | Weekly | 228 (46.72) | 70 (38.46) | 111 (36.51) | |
| | Occasionally/never | 22 (4.51) | 21 (11.54) | 47 (15.46) | |
| Fruits | Daily | 236 (56.87) | 68 (47.55) | 168 (61.76) | 0.003 |
| | Weekly | 168 (40.48) | 51 (35.66) | 84 (30.88) | |
| | Occasionally/never | 11 (2.65) | 24 (16.78) | 20 (7.35) | |
| Vegetables | Daily | 188 (45.85) | 58 (41.43) | 130 (48.15) | 0.395 |
| | Weekly | 201 (49.02) | 57 (40.71) | 101 (37.41) | |
| | Occasionally/never | 21 (5.12) | 25 (17.86) | 39 (14.44) | |
| Wholegrain | Daily | 142 (34.72) | 58 (42.30) | 84 (30.90) | 0.065 |
| | Weekly | 211 (51.59) | 63 (46.00) | 148 (54.40) | |
| | Occasionally/never | 56 (13.69) | 16 (11.70) | 40 (14.70) | |
| Fast food | Daily | 41 (9.69) | 17 (12.14) | 24 (8.48) | 0.154 |
| | Weekly | 316 (74.70) | 62 (44.29) | 109 (38.52) | |
| | Occasionally/never | 66 (15.60) | 61 (43.57) | 150 (53.00) | |
| Sweets | Daily | 191 (46.59) | 53 (39.85) | 138 (49.82) | 0.084 |
| | Weekly | 191 (46.59) | 48 (36.09) | 94 (33.94) | |
| | Occasionally/never | 28 (6.83) | 32 (24.06) | 45 (16.25) | |
| Sweetened beverages | Daily | 111 (26.49) | 55 (38.46) | 56 (20.29) | <0.001 |
| | Weekly | 241 (57.52) | 49 (34.27) | 90 (32.61) | |
| | Occasionally/never | 67 (15.99) | 39 (27.27) | 130 (47.10) | |
| Watching TV | < 3 hrs/day | 462 (91.12) | 168 (87.96) | 292 (92.99) | 0.054 |
| | ≥ 3 hrs/day | 45 (8.88) | 23 (12.04) | 22 (7.01) | |
| Using PC | < 3 hrs/day | 205 (40.35) | 80 (42.11) | 123 (38.92) | 0.480 |
| | ≥ 3 hrs/day | 303 (59.65) | 110 (57.89) | 193 (61.08) | |
| Physical education attendance | Yes | 396 (77.80) | 153 (79.69) | 241 (76.51) | 0.404 |
| | Avoidance | 113 (22.20) | 39 (20.31) | 74 (23.49) | |
| Sport activities | Yes | 318 (63.10) | 137 (72.11) | 180 (57.51) | 0.001 |
| | No | 186 (36.90) | 53 (27.89) | 133 (42.49) | |

^aThere were missing data in some variable categories. The p-value was calculated based on the differences between boys and girls.

students used to watch TV for more than 3 hours a day, but almost 60% of them were using a PC for more than 3 hours a day; 22.2% of students were avoiding physical education (PE) and around 37% of them were not doing sports at all. A significantly higher number of boys were doing sport on regular basis compared to girls (72.1% vs. 57.5%, $p<0.01$).

The prevalence of excess weight and obesity in the sample was 18.4% (29.7% of boys and 11.3% of girls). Compared to the non-obese, overweight or obese students reported a significantly lower daily consumption of vegetables (32.3% vs. 48.6%, $p<0.05$), and also lower daily consumption of fruits but with no

significant difference (46.9% vs. 59.3%). On the other hand, daily consumption of sweets was reported to be significantly lower compared to students with normal weight (32.2% vs. 49.6%, $p<0.01$). Overweight and obese students used to avoid PE more frequently (31.5% vs. 20.2%, $p<0.05$), and a higher number of them were not doing sports on regular basis (44.8% vs. 33.9%, $p=0.05$) (Table 3).

In Table 4, we split the file into the group of physically active and inactive adolescents. Breakfast omission was significantly more frequent in adolescents with no sports activities (68.0% vs. 52.2%, $p=0.01$). Also daily consumption of vegetables was

Table 3. Eating behaviours and lifestyle factors of the study sample in relation to BMI category

| Variables ^a | | Normal weight (n = 403) | Overweight/obesity (n = 91) | p-value |
|-------------------------------|--------------------|----------------------------|--------------------------------|---------|
| | | n (%) | n (%) | |
| Breakfast | Regular | 172 (43.99) | 31 (35.23) | 0.133 |
| | Omitted | 219 (56.01) | 57 (64.77) | |
| School lunch | Regular | 121 (30.95) | 23 (26.44) | 0.407 |
| | Omitted | 270 (69.05) | 64 (73.56) | |
| Dairy | Daily | 182 (48.15) | 45 (52.94) | 0.725 |
| | Weekly | 141 (37.30) | 29 (34.12) | |
| | Occasionally/never | 55 (14.55) | 11 (12.94) | |
| Fruits | Daily | 197 (59.34) | 30 (46.88) | 0.148 |
| | Weekly | 102 (30.72) | 24 (37.50) | |
| | Occasionally/never | 33 (9.94) | 10 (15.62) | |
| Vegetables | Daily | 159 (48.62) | 21 (32.31) | 0.016 |
| | Weekly | 122 (37.31) | 27 (41.54) | |
| | Occasionally/never | 46 (14.07) | 17 (26.15) | |
| Wholegrain | Daily | 109 (33.54) | 27 (42.19) | 0.238 |
| | Weekly | 119 (36.61) | 24 (37.50) | |
| | Occasionally/never | 97 (29.85) | 13 (20.31) | |
| Fast food | Daily | 36 (10.71) | 4 (6.35) | 0.128 |
| | Weekly | 143 (42.56) | 21 (33.33) | |
| | Occasionally/never | 157 (46.73) | 38 (60.32) | |
| Sweets | Daily | 164 (49.55) | 19 (32.20) | 0.003 |
| | Weekly | 113 (34.14) | 20 (33.90) | |
| | Occasionally/never | 54 (16.31) | 20 (33.90) | |
| Sweetened beverages | Daily | 91 (27.16) | 16 (25.00) | 0.852 |
| | Weekly | 110 (32.84) | 20 (31.25) | |
| | Occasionally/never | 134 (40.00) | 28 (43.75) | |
| Watching TV | <3 hrs/day | 358 (92.03) | 79 (88.76) | 0.321 |
| | ≥3 hrs/day | 31 (7.97) | 10 (11.24) | |
| Using PC | <3 hrs/day | 155 (39.74) | 37 (41.57) | 0.751 |
| | ≥3 hrs/day | 235 (60.26) | 52 (58.43) | |
| Physical education attendance | Yes | 312 (79.80) | 61 (68.54) | 0.021 |
| | Avoidance | 79 (20.20) | 28 (31.46) | |
| Sport activities | Yes | 258 (66.15) | 48 (55.17) | 0.053 |
| | No | 132 (33.85) | 39 (44.83) | |

^aThere were missing data in some variable categories.

Table 4. Eating behaviours and lifestyle factors of the study sample in relation to physical activity

| Variables ^a | | Regular sports activities (n = 318) | No sports activities (n = 186) | p-value |
|-------------------------------|--------------------|--|-----------------------------------|---------|
| | | n (%) | n (%) | |
| Breakfast | Regular | 150 (47.77) | 58 (32.04) | 0.001 |
| | Omitted | 164 (52.23) | 123 (67.96) | |
| School lunch | Regular | 97 (31.29) | 52 (28.57) | 0.526 |
| | Omitted | 213 (68.71) | 130 (71.43) | |
| Dairy | Daily | 157 (51.82) | 76 (43.43) | 0.208 |
| | Weekly | 105 (34.65) | 72 (41.14) | |
| | Occasionally/never | 41 (13.53) | 27 (15.43) | |
| Fruits | Daily | 162 (61.36) | 73 (49.66) | 0.070 |
| | Weekly | 77 (29.17) | 55 (37.41) | |
| | Occasionally/never | 25 (9.47) | 19 (12.93) | |
| Vegetables | Daily | 136 (51.91) | 51 (35.17) | <0.001 |
| | Weekly | 97 (37.02) | 59 (40.69) | |
| | Occasionally/never | 29 (11.07) | 35 (24.14) | |
| Wholegrain | Daily | 95 (36.40) | 45 (31.03) | 0.090 |
| | Weekly | 101 (38.70) | 49 (33.79) | |
| | Occasionally/never | 65 (24.90) | 51 (35.17) | |
| Fast food | Daily | 22 (8.43) | 17 (10.83) | 0.677 |
| | Weekly | 105 (40.23) | 64 (40.76) | |
| | Occasionally/never | 134 (51.34) | 76 (48.41) | |
| Sweets | Daily | 108 (42.19) | 83 (55.33) | 0.009 |
| | Weekly | 90 (35.16) | 49 (32.67) | |
| | Occasionally/never | 58 (22.66) | 18 (12.00) | |
| Sweetened beverages | Daily | 64 (23.97) | 47 (31.54) | 0.113 |
| | Weekly | 86 (32.21) | 51 (34.23) | |
| | Occasionally/never | 117 (43.82) | 51 (34.23) | |
| Watching TV | < 3 hrs/day | 285 (91.05) | 169 (90.86) | 0.942 |
| | ≥ 3 hrs/day | 28 (8.95) | 17 (9.14) | |
| Using PC | < 3 hrs/day | 137 (43.77) | 62 (33.51) | 0.024 |
| | ≥ 3 hrs/day | 176 (56.23) | 123 (66.49) | |
| Physical education attendance | Yes | 266 (83.65) | 127 (68.65) | <0.001 |
| | Avoidance | 52 (16.35) | 58 (31.35) | |

^aThere were missing data in some variable categories.

significantly lower in this group (35.2% vs. 51.9%, $p < 0.001$), and they were consuming sweets in a higher percentage compared to adolescents who reported being physically active (55.3% vs. 42.2%, $p < 0.01$). From lifestyle factors, a significantly higher percentage of physically inactive adolescents spent more than 3 hours a day using PC (66.5% vs. 56.2%, $p < 0.05$) compared to students with regular sports activities. The avoidance of PE was also significantly higher in adolescents with no sports activities (31.4% vs. 16.4%, $p < 0.001$).

In multivariable regression analysis, we have found associations of negative lifestyle factors and presence of overweight and obesity in the study sample. Students who skipped breakfast on daily basis and had inadequate consumption of vegetables had a

higher chance to be overweight and obese (breakfast omission – AOR = 2.25, 95% CI: 1.04–4.77; and inadequate consumption of vegetables – AOR = 3.24, 95% CI: 1.17–8.99). On the other hand, there was inverse significant association with low consumption of wholegrain food (AOR = 0.35; 95% CI: 0.14–0.84), which means that students with lower consumption of wholegrain food had also lower chance to be overweight/obese. Also, there was inverse association of frequent consumption of sweets with presence of overweight and obesity (AOR = 0.30, 95% CI: 0.28–0.69) in terms of lower chance of overweight/obesity in students who ate sweets on daily basis. A lack of physical activities was positively associated with the presence of overweight and obesity (AOR = 1.98, 95% CI: 1.10–4.07) (Table 5).

Table 5. Association of selected negative lifestyle variables with overweight and obesity in the study sample^a (N=524)

| Independent variables | AOR | 95% CI |
|---|------|------------|
| Breakfast omission | 2.25 | 1.04–4.77* |
| School lunch omission | 0.78 | 0.37–1.64 |
| Inadequate consumption of dairy | 0.45 | 0.14–1.43 |
| Inadequate consumption of fruits | 0.76 | 0.22–2.65 |
| Inadequate consumption of vegetables | 3.24 | 1.17–8.99* |
| Inadequate consumption of wholegrain food | 0.35 | 0.14–0.84* |
| Frequent consumption of fast food | 0.61 | 0.30–1.23 |
| Frequent consumption of sweets | 0.30 | 0.28–0.69* |
| Frequent consumption of sweetened beverages | 0.82 | 0.40–1.70 |
| Watching TV ≥ 3 hrs/day | 1.60 | 0.45–5.68 |
| PC usage ≥ 3 hrs/day | 0.68 | 0.32–1.45 |
| Avoidance of physical education | 1.45 | 0.65–3.19 |
| Lack of sport activities | 1.98 | 1.10–4.07* |

^aMultivariable logistic regression analysis; AOR – adjusted odds ratio; CI – confidence interval; *p<0.05. Data were adjusted for age and sex. The dependent variable is overweight/obesity according to BMI. The reference category is normal weight.

DISCUSSION

The presented study showed the existence of an unhealthy lifestyle in secondary school students and the relationship among different BMI categories, sex, and sedentary behaviour.

Skipping breakfast is common among adolescents (58% in our study). Avoiding of school lunch in canteen was prevalent (70%). According to the Health Behaviour in School-aged Children (HBSC) study (4), eating breakfast is more common among boys and differs across countries. There was no notable difference between boys and girls in our sample. Regularity in breakfast eating is considered an important part of children's lifestyle and is positively associated with improved cognitive functions, concentration, and performance during school time (14). Encouraging consistent meals can prevent snacking and improve nutrient intake (4). An avoidance of lunch at the school canteen is linked to negative eating habits as well. The school canteen is an educational facility, which role is to provide adequate nutrition during the school day (15). Consumption of fruit and vegetables during childhood is associated with many positive health outcomes, such as a lower risk of non-communicable diseases (NCDs) in adulthood. The daily dose of fruits and vegetables according to the WHO is 400 g per day, but adolescents usually eat inadequate amounts (4). In our sample, the daily consumption of fruits, vegetables and wholegrain food did not or slightly reach 50%. Sweets and sweetened beverages should be limited to special occasions. A greater intake of sugar-sweetened beverages was associated with a higher prevalence of obesity, type 2 diabetes, cardiovascular diseases (CVD), and total mortality with graded effects according to dose (16, 17). Soft drink consumption is often higher in adolescents than in other age groups (4). The important factor causing frequent soft drink consumption is their constant availability at home, at school, and basically at every place, which adolescents tend to visit (18). Our results show that daily consumption of soft drinks is significantly higher in boys compared to girls. On the other hand, girls had a slightly higher consumption of sweets compared to boys.

In this age group, sedentary activities usually exceed physical activities. Daily physical activity contributes to mental and physical well-being, improves adaptability to the mental load at school, and copes with stressful situations (19). Most sedentary activities during free time involve screen-based activities. In our study, almost 60% of students spent more than 3 hours a day using a PC. Digital media use increased markedly during the last decade. Children and adolescents spent hours being online, texting, and gaming on electronic devices (20, 21). Interest in watching TV has decreased, only 9% of students spent more than 3 hours a day watching TV in our sample. Studies had shown that adolescents spent today less time on print media, TV and movies compared with adolescents in previous decades (22).

Attendance at PE was at the level of 78% and around 63% of students were doing some kind of sport on regular basis. Similar results were found in a study where the number of physically active students did not exceed 60% (23). Significantly more boys were doing sports compared to girls.

In many studies (6, 24, 25) overweight and obesity were strongly linked with negative lifestyle factors and unhealthy eating habits. Following these studies, we confirmed some patterns of unhealthy lifestyles in obese and overweight students. There was a significantly lower consumption of vegetables and a higher frequency of avoidance of PE and sports activities compared to students with normal weight. There was a significantly lower consumption of sweets compared to students with normal weight, which is in line with studies where liking sweets was inversely associated with obesity level. These studies often showed no association between increased BMI and junk food consumption (24, 25). Sweets were usually preferred by lean subjects, obese individuals tended to prefer fat-and-salt liking. In the study of Borraccino et al. (6), they found higher consumption of unhealthy food in the group of normal-weight students with the explanation that parents of overweight adolescents control their food intake more strictly.

After splitting the file into groups of physically active and inactive adolescents we investigated a significantly higher omission of breakfast, lower consumption of vegetables and whole grains, and higher consumption of sweets in the group of students with a lack of physical activities. Also, students from the inactive group spent more time using PC and had higher avoidance at PE. Children and adolescents with a low level of physical activity are often associated with longer time spent with digital media and a higher risk of obesity. Data from a previous YRBS study among US adolescents showed a 25% increased risk of being overweight in less active students compared to students who were physically active (26). More than 30% of students who do not engage in regular physical activities are used to avoiding PE, which is consistent with the previous study findings, that adolescents with the predominance of sedentary activities do not compensate for their sedentary lifestyle with an increased interest in physical activities (27). Schools should provide possibilities to reduce sedentary activities besides PE, such as special equipment or rooms for sports activities during school breaks. Regular physical activity in adolescents is associated not only with better eating habits but also with physical and mental well-being and a lower presence of risk behaviour (28).

According to the multivariable regression analysis, we found a significant association between overweight and obesity and breakfast omission, irregular vegetable consumption and a lack of physical activities. On the other hand, inadequate consumption of wholegrain foods and higher consumption of sweets were inversely associated with overweight and obese students compared to non-obese ones, which means that overweight/obese students in our sample used to eat more wholegrain foods and avoid sweets. These findings are comparable with our results mentioned above. Preference of healthier types of food in overweight/obese individuals is frequently seen in studies that are aimed at the evaluation of nutritional habits and it may be the result of food intake control or under/over estimation while answering the questionnaire (6, 24, 25).

The strength of our study is in the fact, that it is a comprehensive study, based on the combination of two validated studies within the framework of the international YABS project. Parents are directly involved in research, posing challenges for analysis and future prevention and intervention.

This study does, however, have some limitations. The first limitation of this research is its the cross-sectional hypothesis-generating approach, which simultaneously analyses participants' exposure and results, making it difficult to infer a causal association. The sample primarily includes young people who are enrolled in secondary schools in the city of Bratislava, which is the second limitation. The fact that this is only a questionnaire survey and that the information on height and weight is self-reported is the third limitation. However, studies have demonstrated that self-reported weight and height can be utilized as a straightforward technique for measuring BMI in epidemiological research. Self-report bias can be important in predicting overweight and obesity at the individual level (29, 30). The fourth limitation is related to the missing data. Missing data occurred because of no response. There were no significant differences between the occurrence of missing data in the exposed and control groups, and we considered them to be randomly missing and did not affect the reported associations.

CONCLUSIONS

In the sample of secondary school students, we investigated several negative lifestyle factors and the relatively high prevalence of overweight and obesity. There were not many considerable associations between the presence of overweight and obesity and inadequate eating habits, overweight and obese students used to skip breakfast more often, they had lower consumption of vegetables, but also lower consumption of sweets compared to students with normal weight. However, avoidance of sport activities were predominant in the group with a higher BMI. Lack of physical activities was related to the preference for unhealthy eating patterns (breakfast omission, lower vegetables and higher sweets consumption) and excessive time spent with screen-based activities. Understanding children's dietary choices is crucial for protecting and promoting their health, but the major focus should be on eliminating sedentary behaviour and promoting active living in the home and school settings. These findings underscore the importance of promoting healthy eating habits, physical activity, and reducing sedentary behaviour among adolescents. As it serves as a model for the development of healthy lifestyles, further research is required to determine how school and home environments can affect young people's behavioural characteristics.

Acknowledgements

This work was supported by grants KEGA 008UPJŠ-4/2020, 010UPJŠ-4/2021, 015UK-4/2022, 001UPJŠ-4/2024, 003UPJŠ-4/2024 of the Ministry of Education, Research, Development and Youth of the Slovak Republic, and the Youth and Parents Behavioural Survey in Slovakia, O-15-101-/0001-00.

Conflicts of Interest

None declared

Authors' Contribution

DV and LA contributed equally to this work.

REFERENCES

1. Jaworska N, MacQueen G. Adolescence as a unique developmental period. *J Psychiatry Neurosci*. 2015;40(5):291-3.
2. Sawyer SM, Afifi RA, Bearinger LH, Blakemore SJ, Dick B, Eze AC, et al. Adolescence: a foundation for future health. *Lancet*. 2012;379(9826):1630-40.
3. Igra V, Irwin CJ. Theories of adolescent risk-taking behavior. In: Diclemante R, Hanson WB, Ponton LE, editors. *Handbook of adolescent health risk behavior*. New York: Plenum Press; 1996. p. 35-51.
4. Currie C, Roberts C, Morgan A, Smith R, Settertobulte W, Samdal O, et al., editors. *Young people's health in context: Health Behavior in School-aged Children (HBSC) Study: international report from 2001/2002 survey*. 2004. Copenhagen: WHO Regional Office for Europe; 2004.
5. Brown R, Ogden J. Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health Educ Res*. 2004;19(3):261-71.
6. Borraccino A, Lemma P, Berchialla P, Cappello N, Inchley J, Dalmasso P, et al.; Italian HBSC 2010 Group. Unhealthy food consumption in adolescence: role of sedentary behaviours and modifiers in 11-, 13- and 15-year-old Italians. *Eur J Public Health*. 2016;26(4):650-6.
7. Babjakova J, Vondrova D, Jurkovicova J, Samohyl M, Filova A, Janko Z, et al. Risk behavioral survey in the sample of Slovak adolescents. *Bratisl Med J*. 2019;120(12):899-907.

8. World Health Organization. Physical Activity Strategy for the WHO European Region 2016–2025. Copenhagen: WHO Regional Office for Europe; 2015.
9. Argalasova L, Vondrova D, Babjakova J, Hirosova K, Filova A, Samohyl M, et al. Behavioural, psychosocial and life-style risk factors in a sample of Slovak adolescents. *J Infect Dis Treat*. 2019;5(2):36.
10. Samohyl M, Babjakova J, Vondrova D, Jurkovicova J, Stofko J, Kollar B, et al. Factors associated with non-attendance at dental preventive care in Slovak high school students. *Int J Environ Res Public Health*. 2021;18(3):1295. doi: 10.3390/ijerph18031295.
11. Xu F, Mawokomatanda T, Flegel D, Pierannunzi C, Garvin W, Chowdhury P, et al. Surveillance for certain health behaviors among states and selected local areas—Behavioral Risk Factor Surveillance System, United States, 2011. *MMWR Surveill Summ*. 2014;63(9):1-149.
12. Kann L, Kinchen S, Shanklin SL, Flint KH, Kawkins J, Harris WA, et al. Youth risk behavior surveillance—United States, 2013. *MMWR Suppl*. 2014;63(4):1-168.
13. World Health Organization. BMI Charts [Internet]. Geneva: WHO [cited 2020 Nov 01]. Available from: <https://www.who.int/toolkits/growth-reference-data-for-5to19-years/indicators/bmi-for-age>.
14. Widenhorn-Müller K, Hille K, Klenk J, Weiland U. Influence of having breakfast on cognitive performance and mood in 13- to 20-year-old high school students: results of a crossover trial. *Pediatrics* 2008;122(2):279-84.
15. Beresova J, Ostrihonova, T. [Eating in facilities for children and youth - theory and practical experience]. In: Jurkovicova J, Stefanikova Z, editors. [Living conditions and health]. Bratislava: Public Health Authority of the SR; 2013. p. 167-173. Slovak.
16. Yang Q, Zhang Z, Gregg EW, Flanders WD, Merritt R, Hu FB. Added sugar intake and cardiovascular diseases mortality among US adults. *JAMA Intern Med*. 2014;174(4):516-24.
17. Malik VS, Li Y, Pan A, De Koning L, Schernhammer E, Willett WC, et al. Long-term consumption of sugar-sweetened and artificially sweetened beverages and risk of mortality in US adults. *Circulation*. 2019;139(18):2113-25.
18. Schneider S, Schilling L, Osenbrugge N. Determinants of soft drink consumption among children and adolescents in developed countries – a systematic review. *Cent Eur J Public Health*. 2021;29(4):290-300.
19. Kopcakova J. [Social determinants of schoolchildren's health]. In: Madarasova-Geckova A, editor. [Leisure activities]. Košice: Public Health Authority of the SR; 2019. p. 91-111. Slovak.
20. Perrin A. Social media usage: 2005-2015: 65% of adults now use social networking sites a nearly tenfold jump in the past decade [Internet]. Washington DC: Pew Research Trust; 2015 [cited 2020 Nov 01]. Available from: <https://www.pewresearch.org/internet/2015/10/08/social-networking-usage-2005-2015/>.
21. Argalasova L, Vondrova D, Babjakova J, Filova A, Hirosova K, Samohyl M, et al. [The use of selected IT devices in relation to lifestyle in adolescents in the Y. A. B. S. project]. In: Hudeckova H, Jakusova V, Svihrova V, Baska T, editors. [Current problems of public health in research and practice IV]. Martin: Jessenius Faculty of Medicine, Comenius University in Martin; 2019. p. 9-16. Slovak.
22. Twenge JM, Martin GN, Spitzberg BH. Trends in U.S. adolescents' media use, 1976–2016: the rise of digital media, the decline of TV, and the (near) demise of print. *Psychol Pop Media Cult*. 2019;8(4):329-45.
23. Moreno-Gómez C, Romaguera-Bosch D, Tauler-Riera P, Bennasar-Veny M, Pericas-Beltran J, Martinez-Andreu S, et al. Clustering of lifestyle factors in Spanish university students: the relationship between smoking, alcohol consumption, physical activity and diet quality. *Public Health Nutr*. 2012;15(11):2131-9.
24. Haerens L, Vereecken C, Maes L, De Bourdeaudhuij I. Relationship of physical activity and dietary habits with body mass index in the transition from childhood to adolescence: a 4-year longitudinal study. *Public Health Nutr*. 2010;13(10):1722-8.
25. Lampuré A, Castetbon K, Deglaire A, Schlich P, Péneau S, Hercberg S, et al. Associations between liking for fat, sweet or salt and obesity risk in French adults: a prospective cohort study. *Int J Behav Nutr Phys Act*. 2016;13:74. doi: 10.1186/s12966-016-0406-6.
26. Eisenmann JC, Bartee RT, Wang MQ. Physical activity, TV viewing, and weight in U.S. youth: 1999 Youth Risk Behavior Survey. *Obes Res*. 2002;10(5):379-85.
27. Jakubec L, Frömel K, Chmelík F, Groffík D. Physical activity in 15-17-year-old adolescents as compensation for sedentary behavior in school. *Int J Environ Res Public Health*. 2020;17(9):3281. doi: 10.3390/ijerph17093281.
28. Erfle SE, Gamble A. Effects of daily physical education on physical fitness and weight status in middle school adolescents. *J Sch Health*. 2015;85(1):27-35.
29. Elgar FJ, Roberts Ch, Tudor-Smith Ch, Moore L. Validity of self-reported height and weight and predictors of bias in adolescents. *J Adolesc Health*. 2005;37(5):371-5.
30. Fonseca H, Silva A, Matos M, Esteves I, Costa P, Guerra A, et al. Validity of BMI based on self-reported weight and height in adolescents. *Acta Pædiatr*. 2010;99(1):83-8.

Received May 24, 2023

Accepted in revised form May 19, 2024