



Original Research

Differences in frequency of selected risk factors of overweight and obesity in adolescents in various social environments within Slovakia



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ABSTRACT

Objectives: Analysis of subnational regional differences in frequency of selected risk factors of overweight and obesity in adolescents in Slovakia.

Study design: Cross-sectional study.

Methods: Health Behaviour in School-aged Children is an international cross-sectional questionnaire study using the standard protocol to create representative samples of adolescents. We analyse subnational regional differences in the occurrence of selected risk factors of overweight and obesity among 10–12-year-old (n = 4194) and 14–16-year-old (n = 3806) respondents of a survey conducted in Slovakia in 2022.

Results: Overweight and obesity dominated especially in the regions with the Hungarian minority among boys aged 10–12 years (29.2 %) and 14–16 years (34.0 %). Consumption of energy (24.9 % of girls and 29.9 % of boys) and sweetened (25.0 % of girls and 27.1 % of boys) drinks dominated among 14–16-year-old respondents in the poverty regions with socio-economic problems. Skipping breakfast was most widespread among 14–16-year-old girls from regions with a Hungarian minority (72.6 %). Insufficient physical activity was most frequent among 10–12-year-old respondents, namely, in the poverty regions (85.0 % of girls) and the Hungarian minority (79.6 % of boys) regions. The differences also remained significant after weighting for a possible confounding effect of family socioeconomic status.

Conclusions: The regional social environment is associated with selected aspects of adolescents' behaviour related to overweight and obesity, namely, the poverty regions and Hungarian minority environments, and can be considered as an independent determinant regardless of a family background.

1. Introduction

Overweight and obesity in adolescents currently rank among the most topical public health issues worldwide and are associated with numerous social and health consequences such as increased blood pressure, metabolic syndrome, sleep disorders, and menstrual irregularities in girls.¹ They frequently lead to psychosocial problems such as depression, low self-esteem, and body image dissatisfaction, possibly resulting in eating disorders.² Obese adolescents are also more frequently victims of bullying. Furthermore, problems related to overweight and obesity are transferred from adolescence to adulthood,³ thus significantly contributing to premature loss of health and death.

According to the latest data, the global age-standardised prevalence

of obesity itself in school-age children and adolescents has increased substantially from 1990 to 2022 both in girls (1.7 % vs 6.9 %) and boys (2.1 % vs 9.3 %).⁴ However, if we take into consideration also overweight, the occurrence is substantially higher. The global prevalence of overweight (including obesity) among children and adolescents aged 5–19 has risen dramatically from just 8 % in 1990 to 20 % in 2022. The rise has occurred similarly among both boys and girls: in 2022 19 % of girls and 21 % of boys were overweight.¹ In the European WHO Region, about one quarter (26.7 % of boys and 22.9 % of girls) of adolescents aged 10–19 years are overweight or obese.⁵ The situation in Slovakia is better; however, the gender differences are more pronounced (26.0 % of boys and 17.4 % of girls).

Several important behavioural risk factors of overweight and obesity

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in adolescents have been identified, namely, insufficient physical activity and inappropriate dietary habits including excessive intake of saccharose, low consumption of fruits and vegetables as well as breakfast skipping.^{6–8} In recent years, energy drinks have become an issue of concern due to their numerous adverse effects⁹ including an increased risk of overweight and obesity.¹⁰

The significance of the social environment in relation to behaviour was pointed out a couple of years ago.¹¹ Most studies that analyse the determinants of these risk factors are focused on personal ones, such as age, gender, family socioeconomic status (SES), etc., or nationwide ones, namely, policy measures.^{1,12} However, little is known about the roles of regional and local social environments formed within countries by their historical cultural background, shared values, rural or urban character, economic development, etc.

Slovakia is a rather heterogeneous country that includes regions with different historical cultural backgrounds and local social-economic conditions. Regions provide models of different social environments, making it possible to analyse their association with adolescents' behaviour in the context of both personal/family-related and nationwide factors.

The aim of this study is to analyse differences in the frequency of selected risk factors of overweight and obesity in adolescents across selected types of social environments within Slovakia. The analysed risk factors include regular consumption of sweetened soft drinks and energy drinks, insufficient consumption of fruits and vegetables, breakfast skipping during weekdays, as well as insufficient physical activity. The study uses Health Behaviour in School-Aged Children (HBSC) data collected in 2021/2022.

The analysis can contribute to an understanding of the role of regional social environment in a context of commonly shared nationwide influences (legislation, policy) as well as a microenvironment represented by family background. Taking into account similar patterns of population heterogeneity in numerous countries in Europe, the findings are of relevance also on an international level, namely in proposing tailored preventive measures.

2. Methods

HBSC is an international school-based study consisting of cross-sectional surveys carried out regularly every 4 years. It uses a standardised design, making it possible to create harmonised datasets appropriate for cross-country comparisons as well as for identifying changes over time. Data are collected using anonymous uniform questionnaires completed in classrooms in schools. The questionnaires include mandatory modules of questions used in every participating country, as well as optional ones containing sets of questions based on the special needs of individual countries. This paper analyses the HBSC survey carried out in Slovakia in the school year 2021/2022.

2.1. Sample

Two-step sampling was used, following the standardised research protocol¹³ to obtain representative data from all over the country. In the first step, the participating schools were randomly selected with a probability proportional to size from an official list of all schools obtained from the Slovak Institute of Information and Prognosis for Education. The sample of schools was stratified by administrative region and type of school (elementary schools that comprise the 1st–9th grade and eight-year grammar schools that comprise the 6th–13th grades). In the second step, within participating schools, classes were randomly selected to collect questionnaire data.

Data collection was performed in May–June 2022. Of the 195 schools originally selected, 94 agreed to participate (48 % school-level response rate) and of 16,040 registered eligible students, 10,163 of them responded (63 % response rate). The dropouts were mainly due to the absence of children due to illness, other personal reasons, and refusal to

participate in the study. Therefore, they were not related to the analysed variables and could not significantly bias the results.

We included in the analysis 10–12-year-old and 14–16-year-old respondents. In this way, we created two distinct age groups (younger and older) and used the largest possible part of the total sample to obtain sufficiently large subsamples. The overall analysed sample thus includes 8000 respondents (Table 1).

2.2. Analysed variables

Body Mass Index (BMI) of the respondents was calculated using data on body height and weight reported in the questionnaire and International Obesity Task Force cut-offs were used to obtain data on the prevalence of overweight and obesity.¹⁵ Breakfast skipping during weekdays was measured by the question “How often do you usually have breakfast (more than a glass of milk or fruit juice) on weekdays?”. The possible answers were: “I never have breakfast during the week”, “one day”, “two days”, “three days”, “four days” and “five days”. All answers except “five days” were considered positive.

The frequency of consumption of selected foods (vegetables, coke, or other soft drinks that contain sugar and energy drinks) was measured by a set of three questions: “How many times a week do you usually eat or drink < selected food >”? The possible answers were: “never”, “less than once a week”, “once a week”, “2–4 days a week”, “5–6 days a week”, “once a day, every day” and “every day, more than once”.

1. The answers “never”, “less than once a week”, “once a week”, “2–4 days a week” and “5–6 days a week” were considered as insufficient vegetable intake i.e. those reporting consumption less than once a day.
2. The answers “once a day, every day” and “every day, more than once” i.e. daily use were considered as excessive consumption of sweetened soft drinks (coke or other soft drinks that contain sugar)
3. All answers except: “never” and “less than once a week” were considered as excessive consumption of energy drinks i.e., weekly use.

Regular physical activity was measured by the question “Over the past 7 days, on how many days were you physically active for a total of at least 60 min per day?” The possible answers were from “0 days” to “7 days”. All answers except “7 days” were considered as insufficient physical activity.

SES of the respondents' families was measured by Family Affluence Scale (FAS) standardly used according to the HBSC protocol.¹³ A detailed description of FAS can be found in the Supplementary materials.

2.3. Selection of regions representing specific social environments

To identify regional differences in the frequency of selected risk factors of overweight and obesity, several specific types of regions representing certain sociocultural environments were selected, while three factors were taken into account: the level of urbanisation, ethnicity and socioeconomic development.

Slovakia is administratively divided into 8 self-governing regions and 79 districts. However, the delimitation of self-governing regions is highly criticised by geographers because it does not sufficiently respect the regional structure of the country.¹⁶ It was more appropriate to use districts to identify the types of social environment that can influence behaviour patterns at the regional level. Their definition and delimitation are close to the concept of daily urban systems.¹⁷ They can be considered as a spatial expression of an individual's daily life, e. g., daily commuting to work or school and related social interactions. At the level of the regional system, it concerns interactions between the district city and its suburban and rural surroundings. Thus, four types of regions representing distinct social environments were defined: Fully urbanised

Table 1
The number of respondents split by gender, age and selected social environments (HBSC Slovakia, 2021/2022).

	Fully urbanised environment of the largest cities		Urbanised environment of regional centres		Regions with Hungarian minority		Poverty regions		Total
	n	percentage	n	percentage	n	percentage	n	percentage	
girls, 10–12 y.	284	13.4	502	23.6	338	15.9	388	18.2	2127
boys, 10–12 y.	266	12.9	424	20.5	312	15.1	375	18.1	2067
girls, 14–16 y.	203	11.2	372	20.6	256	14.2	333	18.4	1805
boys, 14–16 y.	220	11.0	421	21.0	275	13.7	356	17.8	2001
Total	973	12.2	1719	21.5	1181	14.8	1452	18.2	8000

environment of the largest cities, Urbanised environment of regional centres, Regions with Hungarian minority and Poverty regions (Fig. 1). A detailed description of types of regions representing distinct social environments can be found in the Supplementary materials.

2.4. Statistical analysis

The prevalence rates of the studied risk factors are expressed as percentage values. Differences between national and regional data were analysed using logistic regression. Odds ratios with respective 95 % confidence intervals were calculated, while the rest of the nationwide data for each region were considered as the reference. Since existing differences in the distribution of SES of families across regions possibly influenced the results, regression models were controlled for FAS score. For each combination of region, risk factor, gender and age, a separate logistic regression model was built.

3. Results

Overweight and obesity were found in about one-fifth of children, while boys dominated girls both among 10-12-years-old (23.9 % vs. 14.9 %) and 14-16-year-old (24.9 % vs 13.5 %) respondents (Table 2a). Boys were significantly exceeded in environments with Hungarian minority, both 10–12 and 14–16 years (29.2 % and 34.0 %, respectively) and girls 14–16 years in poverty regions (19.4 %). On the other hand, urbanised environments of regional centres showed significantly lower prevalence rates in boys.

Weekly consumption of sweetened soft drinks varied from 13.0 % (10-12-year-old girls living in the urbanised environment of regional centres) to 27.1 % (14-16-year-old boys living in poverty regions) (Table 2b). Consumption significantly exceeded nationwide prevalence rates among respondents living in poverty regions, namely 14-16-year-old boys (27.1 % vs. 20.1 %). On the other hand, the lowest prevalence rates, significantly below nationwide levels, were observed among

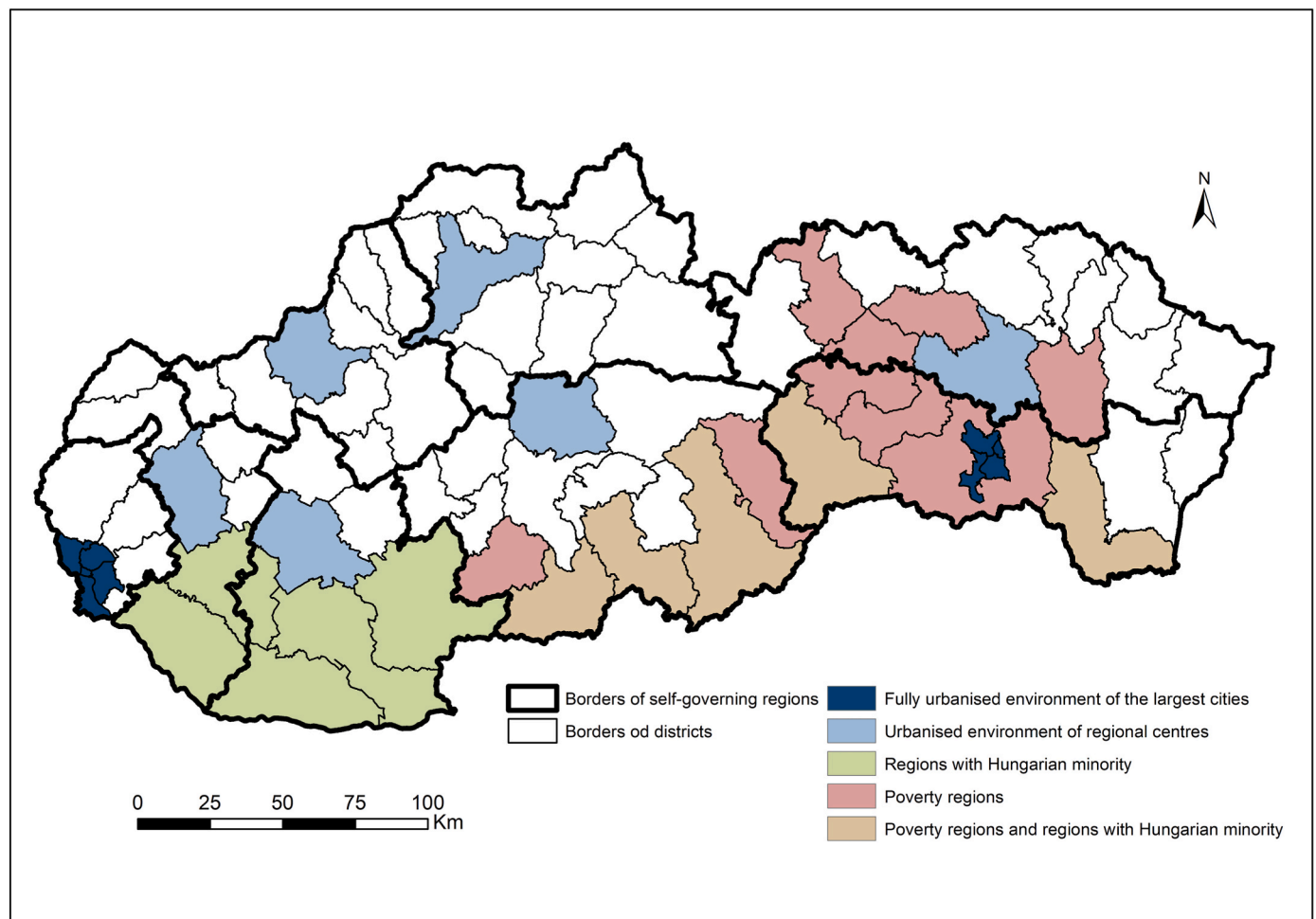


Fig. 1. Regions representing selected types of social environments in Slovakia.

Table 2

Prevalence of overweight and obesity related factors in Slovak adolescents by selected social environments (HBSC Slovakia, 2021/2022) Odds ratios were obtained from logistic regression models that controlled by FAS.

	Fully urbanised environment of the largest cities		Urbanised environment of regional centres		Regions with Hungarian minority		Poverty regions		Nationwide
	%	OR (CI95 %)	%	OR (CI95 %)	%	OR (CI95 %)	%	OR (CI95 %)	
a) Overweight and obesity									
girls, 10–12 y.	13.7	0.93 (0.60–1.44)	13.3	0.87 (0.61–1.23)	17.6	1.25 (0.87–1.79)	17.9	1.07 (0.74–1.54)	14.9
boys, 10–12 y.	19.7	0.88 (0.59–1.31)	19.5	0.67* (0.48–0.94)	29.2	1.39* (1.01–1.91)	28.4	1.32 (0.97–1.79)	23.9
girls, 14–16 y.	13.6	1.19 (0.72–1.98)	13.5	0.91 (0.61–1.36)	15.5	1.30 (0.86–1.97)	19.4	1.71** (1.17–2.50)	13.5
boys, 14–16 y.	27.2	1.10 (0.74–1.63)	19.5	0.70* (0.51–0.96)	34.0	1.81*** (1.33–2.48)	26.7	1.09 (0.79–1.50)	24.9
b) Weekly consumption of sweetened soft drinks									
girls, 10–12 y.	14.7	0.83 (0.56–1.23)	13.0	0.72* (0.53–0.99)	16.7	1.04 (0.74–1.46)	20.7	1.25 (0.92–1.70)	16.6
boys, 10–12 y.	17.5	0.82 (0.56–1.21)	20.0	0.97 (0.72–1.32)	21.1	1.15 (0.83–1.59)	22.4	1.26 (0.94–1.70)	19.8
girls, 14–16 y.	19.8	1.35 (0.91–2.00)	17.6	1.01 (0.74–1.39)	16.2	0.73 (0.49–1.09)	25.0	1.38 (1.00–1.92)	18.8
boys, 14–16 y.	21.1	1.26 (0.86–1.84)	14.1	0.61** (0.44–0.85)	23.7	1.33 (0.96–1.86)	27.1	1.45* (1.06–1.97)	20.1
c) Weekly consumption of energy drinks									
girls, 10–12 y.	8.3	1.00 (0.58–1.72)	5.7	0.79 (0.50–1.25)	6.1	0.92 (0.56–1.53)	7.9	1.29 (0.83–2.00)	6.9
boys, 10–12 y.	7.5	0.80 (0.45–1.42)	8.3	1.15 (0.75–1.75)	7.9	0.88 (0.53–1.46)	8.9	0.94 (0.59–1.49)	8.4
girls, 14–16 y.	17.6	1.18 (0.77–1.79)	17.8	1.10 (0.80–1.52)	18.5	1.23 (0.85–1.77)	24.9	1.50* (1.08–2.10)	17.1
boys, 14–16 y.	19.2	0.91 (0.62–1.35)	17.8	0.77 (0.57–1.05)	20.4	1.00 (0.71–1.41)	29.9	1.63** (1.21–2.20)	21.3
d) Eating vegetables less than once a day									
girls, 10–12 y.	57.8	0.85 (0.64–1.12)	65.4	1.17 (0.93–1.47)	64.7	1.09 (0.84–1.41)	63.2	1.03 (0.80–1.32)	62.3
boys, 10–12 y.	60.9	0.73* (0.54–0.98)	71.8	1.26 (0.96–1.64)	68.4	0.96 (0.72–1.27)	67.0	0.83 (0.64–1.08)	68.5
girls, 14–16 y.	59.7	0.93 (0.67–1.30)	66.8	1.24 (0.96–1.61)	60.5	0.80 (0.60–1.07)	66.6	0.98 (0.74–1.29)	64.6
boys, 14–16 y.	65.9	0.83 (0.59–1.17)	74.3	1.10 (0.84–1.44)	69.2	0.96 (0.70–1.30)	70.6	0.88 (0.66–1.19)	71.3
e) Eating fruits less than once a day									
girls, 10–12 y.	44.8	0.75* (0.57–0.99)	55.3	1.17 (0.94–1.45)	53.1	1.08 (0.84–1.39)	52.5	1.05 (0.83–1.33)	51.3
boys, 10–12 y.	50.2	0.66** (0.49–0.88)	62.1	1.21 (0.95–1.54)	59.3	1.00 (0.76–1.30)	58.4	0.85 (0.66–1.09)	59.3
girls, 14–16 y.	54.5	0.79 (0.57–1.09)	59.5	1.02 (0.80–1.21)	59.0	0.91 (0.68–1.21)	65.9	1.28 (0.97–1.70)	60.2
boys, 14–16 y.	67.9	0.98 (0.69–1.38)	71.9	1.11 (0.85–1.44)	70.1	1.06 (0.79–1.44)	69.7	0.97 (0.73–1.30)	69.6
f) Breakfast skipping during weekdays									
girls, 10–12 y.	57.7	0.99 (0.75–1.30)	55.3	0.89 (0.72–1.11)	64.4	1.36* (1.05–1.76)	63.0	1.27 (0.99–1.62)	58.0
boys, 10–12 y.	50.4	1.00 (0.75–1.33)	51.6	0.90 (0.71–1.14)	53.1	1.07 (0.82–1.39)	53.0	0.98 (0.77–1.25)	52.2
girls, 14–16 y.	70.2	1.18 (0.83–1.66)	63.6	0.92 (0.71–1.19)	72.6	1.37* (1.00–1.88)	67.4	1.12 (0.84–1.50)	66.7
boys, 14–16 y.	57.7	1.10 (0.80–1.52)	54.7	0.92 (0.72–1.17)	62.8	1.31 (0.99–1.75)	57.8	1.07 (0.82–1.40)	56.6
g) Insufficient physical activity									
girls, 10–12 y.	79.6	0.98 (0.70–1.39)	82.7	1.15 (0.87–1.53)	82.5	1.04 (0.76–1.43)	85.0	1.37 (0.99–1.90)	81.0
boys, 10–12 y.	74.2	1.21 (0.86–1.71)	73.9	0.99 (0.76–1.29)	79.6	1.46* (1.06–2.00)	71.6	0.77 (0.59–1.01)	73.8
girls, 14–16 y.	82.2	0.86 (0.55–1.33)	87.2	1.08 (0.75–1.54)	85.0	0.84 (0.57–1.25)	87.5	1.05 (0.71–1.57)	86.3
boys, 14–16 y.	80.4	1.19 (0.81–1.74)	77.5	0.92 (0.70–1.22)	77.1	1.22 (0.87–1.71)	76.4	0.95 (0.70–1.30)	77.0

*p < 0.05; **p < 0.01; ***p < 0.001.

OR -odds ratio.

CI95 % - 95 % confidence interval.

FAS – Family affluence scale.

10-12-year-old girls (13.0 %) and 14-16-year-old boys (14.1 %) from the urbanised environment of regional centres.

Weekly energy drink consumption was remarkably higher among older than younger respondents (Table 2c). The highest prevalence rates, significantly exceeding nationwide levels, were found among 14-16-year-old boys and girls living in poverty regions (24.9 % and 29.9 %, respectively).

Most of the respondents reported insufficient consumption of fruits and vegetables, with the highest prevalence rate among older boys and the lowest among younger girls (Tables 2d and 2e). Taking into account regional differences, the lowest prevalence rate was shown among respondents sharing a liberal environment in the largest cities, reaching a significant difference among 10-12-year-old girls (44.8 % regarding fruits consumption) and boys (50.2 % regarding fruit and 60.9 % regarding vegetables consumption).

More than half of all respondents reported breakfast skipping during weekdays, girls above boys (Table 2f). Regional differences were found among girls where respondents in Hungarian minority regions statistically exceeded the nationwide level (64.4 % in 10-12-year olds and 72.6 % in 14-16-year-olds).

More than 7 in 10 boys and 8 in 10 girls reported insufficient physical activity (Table 2g). Prevalence in poverty regions significantly exceeded nationwide data among 10-12-year-old boys (79.6 % vs. 73.8 %).

4. Discussion

The study shows a widespread occurrence of the risk factors of overweight and obesity analysed in the population of Slovak adolescents. Among them, insufficient physical activity appears to be the most frequent, followed by insufficient intake of fruits and vegetables, as well as the breakfast skipping that makes up the majority of the respondents. Consumption of soft and energy drinks is an issue of less than one third of them; however, taking into account their negative health effects, they should be reasons for concern anyway.

Considering regional differences, the findings indicate a negative impact of the social environment associated with poverty. This association remains also significant after weighting for a confounding effect of the socioeconomic situation of a family (measured through the FAS). It means that these environmental factors shared across the community affect behaviour regardless of a personal and/or family position within it.

Several authors described an association between low SES and risk behaviour of youth.^{18,19} McMurray and colleagues reported that rural children had 1.5 times greater risk of increased BMI than urban ones.²⁰ The lower urban BMI in high-income and industrialised countries can be explained at least partially by rural economic and social disadvantages, including lower education and income, lower availability and higher price of healthy and fresh foods, limited access to public transport and walking possibilities, as well as limited availability of facilities for sports

and recreational activities that account for a significant share of overall physical activity.²¹

In Slovakia, regional differences in increased BMI levels (indicating overweight and obesity) in terms of lower occurrence in the urbanised environment of regional centres were shown only among boys. Kretschmer et al. attribute higher physical activity in larger cities mainly to the fact that cities offer greater opportunities for them and boys use them more.²² However, considering the long-term development of overweight and obesity, the factors that lead to these differences should be looked for in early childhood. On the other hand, such a possible protective effect of the urban environment was not seen in the largest cities. This paradox can be explained by the remarkable increase in residents within the last decades due to moving of people from other regions. Furthermore, studies carried out in Peru and Malawi have shown a tendency to increase BMI in rural-to-urban migrating persons.^{23,24} In Slovakia, the number of residents in the Bratislava Region (the capital and its surroundings) has grown significantly in recent decades.²⁵ Assuming that such migration mostly concerns young families,²⁶ looking for better job opportunities and carriers, a significant proportion of adolescents currently living in the largest cities spent early childhood in other regions.

Our findings suggest an association between the environment of regions associated with poverty and an increased risk of consumption of sugary and energy drinks. The recently published meta-analysis indicated that higher SES resulted in lower consumption of sweets and energy drinks. Those with high SES were 48 % less likely to consume sweets and energy drinks than those with lower SES.²⁷ However, we should keep in mind that the meta-analysis included mainly studies that dealt with SES on a personal or family level.

In Slovakia, on the other hand, indicated that a possible protective effect of the urbanised environment seen in soft drinks is not present in the largest cities, again hypothesising the above-mentioned role of migration. Taking into account energy drinks, notable regional differences are observed only among older respondents, indicating that this behavioural aspect is adopted at a later age, i.e. not during early childhood and most probably regardless of family background. This finding is consistent with socialisation theory.²⁸ At an older age, children socialise more outside the family, so they have a closer interaction with the social environment in which they live. Therefore, the social environment can influence studied risk factors of overweight and obesity either in a negative sense (in the case of poverty regions) or in a positive sense (in the case of urbanised regions).

We also found significant differences in daily consumption of fruits and vegetables in favour of the urban environment, namely, in larger cities. Several studies confirm that the level of urbanisation is a relevant factor influencing behaviour patterns,^{29,30} while more emphasis is placed on a healthy lifestyle. Another possible factor can include higher income that allows the purchase of better quality food, greater parental motivation regarding healthy nutrition,³¹ as well as proximity to supermarkets in larger cities that provide better access to fruits and vegetables.³²

The findings on skipping breakfast and insufficient physical activity imply a possible association with the environment of the Hungarian minority. These findings partially correspond to national data from Hungary where almost three in four 15-year-old girls shared this risk factor.³³ However, considering that these risk factors are widespread and therefore rank among the crucial risk factors of overweight and obesity, a further analysis of their determinants presents a particular public health issue.

Some of the risk factors analysed showed regional differences only among younger (10–12-year-old) or older (14–16-year-old) respondents. We can assume that in younger adolescents influence of the social environment is mediated through their families, while as they grow up, this influence affects directly regardless of a family background. Therefore, the first situation applies to insufficient vegetable eating and physical inactivity. Consumption of sweetened and energy drinks

presents the latter mentioned one, on the other hand.

The strengths of the study include the sampling method, which provides representative results as well as uniform standardised validated questions making possible reliable comparisons with other similar studies. As limitations we should mention that the results are based on self-reports; thus, possibly varying from the actual situation. On the other hand, the used have shown appropriate validity,¹³ therefore, providing reliable results. Another limitation refers to the evaluation of BMI. In some individuals with developed musculature the higher levels of BMI may falsely assess them as "overweight". However, for majority of population, BMI appropriately corresponds to a real nutritional status, so for purposes of epidemiological analysis, this possible weakness is not expected to significantly bias the results. The sampling was primarily intended to create representative samples on a nationwide level, and logistical issues limited the maximal sample size. Therefore, it further limited the possibility of regional analyses due to the relatively small size of the subsamples. Despite these barriers, the study clearly showed several regional differences indicating a significant role for local social environments.

4.1. Conclusions

The findings imply a topicality of insufficient physical activity, eating of fruits and vegetables as significant risk factors of adolescents' overweight and obesity. The study pointed out the role of the local social environment considering the behaviour of adolescents. Namely, living in poverty regions has been shown to be associated with an increased frequency of some risk factors, namely, the consumption of energy and sweetened soft drinks. In conclusion, the social environment of local communities is associated with adolescents' behaviour independent of their family background. The local social environment as part of nationwide determinants can be considered as an independent factor of adolescent health. Therefore, preventive measures should also be tailored for such vulnerable communities. Further studies on potential causal pathways can contribute to the identification of specific areas of intervention.

Author statements

Ethical approval

This study was approved by the Ethics Committee of the Faculty of Medicine at Pavol Jozef Šafárik University in Kosice in 2021 (No. 13N/2021). Parents were informed about the study through the school administration and, using a written informed consent form, could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation. Further information on HBSC surveys in Slovakia can be found in our previous article.¹⁴

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Competing interests

None.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Writefull Revise in order to improve wording and to fix grammar mistakes. After using this tool, the authors reviewed and edited the content as needed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2025.01.025>.

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