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SCHOOL ENVIRONMENT CHARACTERISTICS AND NUTRITIONAL STATUS OF NATIONALLY REPRESENTATIVE SAMPLE OF 7-YEARS-OLD BULGARIAN SCHOOLCHILDREN IN 2016

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Abstract

Starting school can be a challenging period for children due to change of daily routine, increased autonomy of choices and peer pressure. School environment characteristics (food availability at the school premises, sport facilities, physical activity, nutrition and health education classes, transportation, etc.) can play important role on the nutritional status, health and well-being of children. The aim of the present study is to assess the current school environment characteristics and nutritional status among 7-years-old Bulgarian schoolchildren.

A cross-sectional study among 7-years-old Bulgarian schoolchildren was carried out on nationally representative effective sample of 3379 children in first grade in the period from March to May 2016. The survey followed the protocol of the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative, which was jointly developed by the WHO Regional Office for Europe and the participating Member States. Questionnaire forms assessing different characteristics of the lifestyle of children, school and family environment were filled by the examiners, parents and school personnel. Weight and height were measured with standardized equipment, body mass index (BMI)-for-age was calculated and nutritional status was assessed using WHO Growth References 2007.

All schools have playgrounds and most (84.4%) have indoor gyms in which they provide on average 3 lessons/week of physical education. 91.5% of the schools include nutrition in education, but only 65.5% are advertisement free for branded foods and drinks. 68.3% of the schools have canteens, 58.8% - cafeterias and 21.6% - vending machines. The food type availability at the school premises is not optimal.

The characteristics of the school environment need further improvement. Effective public health measures may have positive effect on the nutritional status of the 7-year-old schoolchildren.

***Key words**: School nutrition, School environment characteristics, Childhood obesity, 7-year-old schoolchildren.*

1. Introduction

Changes in the nutritional status of children both in the direction of undernutrition (assessed from underweight, thinness and stunting) or the opposite - overnutrition (assessed from overweight and obesity) can have serious implications for the health, school performance and well-being of children [1, 2]. Stunting (low height-for-age (H/A) is associated with long-term consequences on individuals and societies such as: impaired cognitive and physical development, reduced school performance, reduced productive capacity and poor health, obstetric complications and increased risk of degenerative diseases such as diabetes [3, 4]. Underweight (low weight-for-age (W/A) is a composite indicator that may be more difficult to interpret and is associated with increased mortality risk [1]. Thinness (low body mass index (BMI)-for-age (BMI/A) in school-aged

children can lead to: delayed maturation, weakened or failing immune system, deficiencies in muscular strength and work capacity, osteoporosis, anemia and fertility problems later in life [3, 5]. The overweight or obese schoolchild (high BMI-for-age) also faces increased risk of many short/middle and long term consequences including but not limited to: chronic inflammation; accelerated maturation; elevated blood pressure; dyslipidaemia and cardiovascular diseases; metabolic syndrome; impaired glucose tolerance and type 2 diabetes; non-alcoholic fatty liver disease; obstructive sleep apnoea; musculoskeletal disorders; dental, skin, gastrointestinal and neurological problems, infertility; breast, kidney, cervical and ovarian cancers and psychological disorders [6]. The risks for most non-communicable diseases associated with obesity depend on the age of onset and duration of the overweight/obesity. Childhood obesity is carrying a higher risk of transitioning in adulthood, which can have serious implications for the quality of life, increased risk for morbidity and mortality from non-communicable diseases in adulthood and serious economic burden for the whole society [1, 6].

Currently Bulgaria is facing a growing problem with increasing rates of overweight and obesity among children, most pronounced in the early years of school with more boys being affected. Although of growing significance for some age groups, thinness (especially girls at the age of 16 - 18 years and women 19 - 29 years old) and the other forms of undernutrition (stunting and underweight) are not major nutritional problems in the country [7, 8, and 9].

The start of school - in Bulgaria usually at the age of 7-years [10], is a transitional period for children with many challenges due to change of daily routine (substitution of playing with structured classes, long hours spend out of home); increased autonomy of choices (broadened choice which foods to consume, how to spend the recess time, larger number of pupils per teacher) and peer pressure (growing influence of friends vs. family, increased usage of electronic devices, influences from advertisements for consumption of foods and beverages with high content of sugar, salt and fats). All those changes can have significant impact over the nutritional status and the health of children.

Accessing the nutritional status along with the lifestyle, family and school characteristics of first graders as part of a surveillance system, provides opportunity for monitoring of the trends and understanding of the driving causes of the observed changes, assessing the effectiveness of different policy measures and raising opportunities for designing effective intervention programs. Selecting the group of 7-year-old first graders for such surveillance is justified with the need for minimizing the effects of variability of changes in growth velocity, targeting age in which interventions can have positive impact later in life and focusing on suitable environment like the school that can promote change [11].

School environment characteristics can be grouped in three main areas: nutrition, physical activity and education. The effectiveness of different policy measures can be monitored through indicators assessing those areas such as availability of different types of foods and beverages at the school premises; marketing and advertisement of foods and drinks with high content of fats, sugars and salt on the territory of schools; availability of sports facilities and classes; nutrition and healthy lifestyle education and promotion programs. Interventions aiming to improve any or all of them have demonstrated success in reducing the levels of childhood overweight and obesity [2, 12].

The aim of the present study is to assess school environment characteristics and nutritional status among 7-year-old Bulgarian schoolchildren during the 2015/2016 school year as part of the fourth round of WHO European Childhood Obesity Surveillance Initiative (COSI). Based on the evaluation, further improvement of the school environment characteristics through targeted public health measures may have positive effect on the nutritional status of 7-year-old schoolchildren.

2. Materials and Methods

A cross-sectional survey among 7-year-old schoolchildren was carried out on a nationally representative sample in the period March-May 2016 in Bulgaria as part of the fourth round of WHO European Childhood Obesity Surveillance Initiative (COSI). The aim of the study was to assess the nutritional status of the first grade students and related lifestyle, family and school environment characteristics. In Bulgaria the Protocol, developed by the World Health Organization Regional Office for Europe (WHO/ Europe) in cooperation with the participating member states [13] was followed closely throughout the whole study. Detailed information about the study characteristics can be found elsewhere [13, and 14].

2.1 Sampling design

The study design included cross-sectional simple random sample of primary schools taken with probability proportional to size. The sampling unit was the primary school. In each sampled school one class was randomly selected. Within the class up to 10 boys and 10 girls with full measurements and filled questionnaires were included on random principle. A sentinel approach was employed, meaning that the same set of schools from the first round of the study in Bulgaria in 2008 was used. Only in case of closed schools or

very little number of pupils in a school (mostly in the village areas) schools were substituted with ones from the same region and same type according to the urbanization level.

2.2 Ethical approval

Ethical approval for the study included permissions obtained on 3 levels: the Ethical Commission of the National Centre of Public Health and Analyses gave approval for the study in accordance with the international ethical guidelines. The Ministry of Education gave approval and provided letters to the Directors of the schools granting access of the interviewers on the premises of the schools and claiming support from the school staff. On the third level approval was granted from the parents of the invited for participation schoolchildren. Additionally, on the day of the measurements children were given the freedom to decline participation through verbal statement recorded in a designated place in the Child Form.

2.3 Measurements

Height, weight, waist and hip circumferences were measured by trained personnel, following uniform standardized methodology [14]. Calibrated identical instruments were used throughout the country (portable digital scale Tanita UM - 072, Tokyo, Japan for weight measurement; portable stadiometres Leicester Height Measure for height measurement and retractable non-stretchable plastic tape, width 5 mm for measurement of circumferences). The weight was measured in kilograms to the nearest 0.1 kg, the height - in centimeters to the nearest 0.1 cm and the circumferences - in centimeters to the nearest 0.1 cm.

From the weight and height measurements using Anthro Plus software, H/A, W/A and BMI/A z-scores were calculated after applying weight correction factor according to the type of clothing worn by the children during the measurement (85 g for underwear only, 220 g for gym cloths, 270 g for light clothing and 590 g for heavy clothing). WHO Growth Reference for children and adolescents 5 - 19 years old, 2007 was used to assess the nutritional status of the children. Thinness was defined as the proportion of children with a BMI/A value < -2 z-scores relative to the 2007 WHO growth reference median; normal weight was defined as the proportion of children with a BMI/A value ≥ -2 and ≤ +1 z-scores relative to the 2007 WHO growth reference median; overweight (including obesity) was defined as the proportion of children with a BMI/A value > +1 z-scores relative to the 2007 WHO growth reference median; obesity was defined as the proportion of children with a BMI/A value > +2 z-scores relative to the 2007 WHO growth reference median. Stunting was defined as the proportion of children with a H/A value < -2 z-scores relative to the 2007 WHO growth reference median and underweight was defined as the proportion of children with a W/A value < -2 z-scores relative to the 2007 WHO growth reference median.

2.4 School form

For every participating school the school master or other school official was asked to fill in the mandatory School Form, along with the help and supervision of the interviewer. The questions were related to different characteristics of the school environment like food availability at the: school premises, sport facilities, physical activity, nutrition and health education classes, transportation, etc. The forms were distributed on paper. After collection, investigators checked them for consistency. In the National Centre of Public Health and Analyses (NCPHA) in Sofia, Bulgaria experienced personnel entered the data from the paper forms to online platform (Open Clinica) with some built in data quality controls. Upon completion data was extracted and additionally checked with SPSS statistical software for completeness, plausibility and consistency following uniform protocol developed by the coordinators of the initiative in World Health Organization Regional Office for Europe.

SPSS statistical software was used to perform descriptive analysis.

3. Results and Discussion

During the data collection period of the fourth round of COSI 199 schools from all the 28 administrative regions of the country (144 in towns and 55 in villages) participated with response rate 100%. Throughout the schools 3,732 students in first grade were approached. There were 122 refusals from parents, 1 child refusal and 208 absent pupils on the day of the measurement. 3,423 children were measured and all mandatory forms were filled. Out of that number 22 examined children (10 boys and 12 girls) were excluded due to age of the child on the day of the measurement out of the targeted age range (7.0 - 7.9 years old). The response rate of the student participation was 91.13%. During the data cleaning 22 children (17 boys and 5 girls) were excluded due to incomplete information on age, gender, weight, height and clothes worn during the measurement or values of HAZ (height-for-age z-score) below -6 or above +6, WAZ (weight-for-age z-score) below -6 or above +5 and BAZ (BMI-for-age z-score) below -5 or above +5 according to the criteria of WHO References 2007 for exclusion from the analyses of children with biologically extreme/implausible anthropometric indicators values. The final effective sample of the study comprised of 3,379 schoolchildren, 1,693 (50.11%) girls and 1,686 (49.89%) boys.

3.1 Nutritional status

The nutritional status of 7-year-old schoolchildren in first grade based on the WHO Growth Reference for school-aged children and adolescents is summarized in Table 1. The prevalence of overweight (including obesity) (29.2%) and obesity (13.4%) among first graders is very high. The obesity rates are higher among boys (15.4%) compared to girls (11.4%). The prevalence of thinness (3.3%), stunting (1.5%) and underweight (1.8%) among all the children is comparatively low with no significant gender differences (except for stunting more prevalent among boys) and within the range of the expected prevalence at the population level in a normal distribution of the sample.

At present in Bulgaria stunting (indicator of long-term undernutrition), underweight (composite indicator of short and/or long-term undernutrition) and thinness (indicator of short-term nutritional deprivation) among first graders are not an issue of public health importance, similar to the situation reported in other European countries [16, 17].

The high prevalence of overweight and obesity among the studied age group is clearly a serious public health problem. During the first round in 2008 of the COSI initiative for first time high levels of overweight (28.2% for boys and 27.9% for girls) and obesity (12.8% for boys and 11.8% for girls) were reported in Bulgaria in a targeted sample of first graders [8, 11]. Compared to the present fourth round of the study there is further net increase in the prevalence of obesity among boys. Previous study on nationally representative sample of schoolchildren conducted in Bulgaria in 2011 report even higher prevalence of overweight 36.8% and obesity 18.5% among subsample in the age group 7 - 9 years, assessed on the basis of WHO Growth References, with higher rates observed among girls [9]. The levels of overweight and obesity among 7-year-old schoolchildren in Bulgaria are comparable to the ones recorded in neighboring countries [18, and 19], higher than prevalence observed in northern European countries and lower than southern European countries, in line with the north-south gradient for childhood obesity indentified in previous studies [16, 17].

3.2 School environment characteristics

3.2.1 Physical activity and environment

While all surveyed schools - 100% (n = 199) reported availability of outdoor playground areas, some of them-15.6% (n = 31) did not have indoor gyms. Almost all the schools had policy allowing children to use outdoor playground areas outside school hours - 96.5% (n = 192), but only 48.2% (n = 81) had such one for the indoor gyms. Most of the schools 77.7% (n = 153) organized at least once a week outside of the school hours sport/physical activities for all the grade levels of the primary school children, 10.1% (n = 20) did only for some of the grade levels and 12.2% (n = 24) did not have such activities at all. From the schools with after school activities 81.7% (n = 143) had attendance to this classes by more than half of the children; 13.7% (n = 24) - by more than a quarter and less than half of the children and further 4.6% (n = 8) of the schools reported no or low participation of the pupils (less than a quarter). In 73.4% (n = 146) of the schools children were not allowed to play in extreme weather conditions (like rain, snow, windy, hot weather) in the outdoor playing areas.

Regarding the availability of school bus transport more than half of the schools - 56.8% (n = 113) reported the lack of such, 12.1% (n = 24) provided for all the pupils, 22.1% (n = 44) had only for pupils living in rural areas, 6.5% (n = 13) had only for pupils living far away and 2.5% (n = 5) had only for some grade levels. When assessing the safety of the routes to and from school

Table 1. Nutritional status of the study sample, differentiated by gender, assessed by BMI/A, H/A and W/A, using WHO Reference (2007) [15]

Parameters	All children (N = 3379)	Boys (N = 1686)	Girls (N = 1693)
Thinness	110 (3.3%)	57 (3.4%)	53 (3.1%)
Normal weight	2281 (67.5%)	1127 (66.8%)	1154 (68.2%)
Overweight (incl. obesity)	988 (29.2%)	502 (29.8%)	486 (28.7%)
Obesity	452 (13.4%)	259 (15.4%)	193 (11.4%)
Stunting	51 (1.5%)	32 (1.9%)	19 (1.1%)
Underweight	60 (1.8%)	31 (1.8%)	29 (1.7%)

Abbreviations: N - number of children; BMI/A - BMI-for-age; H/A - height-for-age; W/A - weight-for-age; WHO - World Health Organization

for most of the pupils to walk or ride a bicycle, using a scale from 1 to 10 where 1 stands for extremely safe and 10 for extremely unsafe route - the mean scoring result was 4.79 (range of the answers varied from 1 to 10). Only 10.5% (n = 21) of the schools rated the safety of the routes in the range 8 to 10, signifying high level of unsafety.

The recommendations of national and international action plans for counteracting childhood obesity include encouraging everyday physical activity through various and enjoyable ways of practicing [20, 21, and 22]. Every primary school child should get at least 60 minutes of moderate to vigorous physical activity a day. At least 30 minutes should be delivered in school every day through active break times, physical education, extra-curricular clubs, active lessons, or other sport and physical activity events, with the remaining 30 minutes supported by parents and carers outside of school time. Walking or cycling to school should be preferred [21]. There is recommendation for encouraging active commuting to and from school, which requires improvements in urban planning and shift in the perception for the safety of routes granting such access [20].

The data collected in 2016 demonstrates sufficient availability of playgrounds for play and suitable policy allowing the usage of these facilities after school classes and during breaks. The majority of the schools organized sports/physical activities after school classes with comparatively high student attendance. The evaluation of the safety of the routes to and from the schools is also satisfactory with only 1 in 10 schools reporting high level of unsafely. However, there is still room for improvement with more than half of the schools not granting access to the indoor gyms after school hours and general policy for not allowing play in extreme weather conditions in the outdoor playing areas, which may be particularly relevant during the winter.

3.2.2 Education

All the schools - 100% (n = 199) reported having physical education lessons included in the school curriculum. The mean duration of physical education lessons (minutes per week) for the selected in the study class for the 2015/2016 school year was 104.6 min. (equal to 3 lessons, 35 min. duration of lessons for first graders) with answers varying between schools from 35 to 180 min./week.

According to the national education standards physical education is included in the school curriculum with minimum of two lessons per week for first grade students [23]. The data reveals favorable average level of physical education lessons above the specified minimum. In one school provision of only one lesson/ week was reported. Compared to the data collected in the first round of the COSI study in 2008 [11] the mean duration of physical education lessons in Bulgaria has remained unchanged.

Of the schools 91.5% (n = 182) had nutrition education, either given as a separate lesson or integrated into other lessons as part of the curriculum. 68.3% (n = 136) of the surveyed schools reported organizing initiatives/ projects to promote healthy lifestyle (e.g. promoting physical activity and/or healthy eating) in the sampled class during the 2015/2016 school year.

Educating children about nutrition and healthy lifestyle (the whole food approach) is important element of the EU Action Plan on Childhood Obesity 2014 - 2020. The recommendation is to be implemented by integrating the nutrition education aspects as part of the school curriculum both in primary and secondary school and there is further suggestion to be combined with practical cooking classes, along with the cooperation of teachers, catering staff, school managers and school health care providers [20].

The results indicate high level of inclusion of nutrition education in the curriculum of the participating in the study schools during the 2015/2016 school year. Compared to the data from the first round of the study in Bulgaria [11] there is increase in the organized initiatives/ projects to promote healthy lifestyle from 42.4% of the schools in 2007/2008 school year to 68.3% in 2015/2016. Part of the observed change might be explained with the participation of some of the schools in the EU School Milk Scheme and EU School Fruit and Vegetable Scheme which include educational dimension [24, 25].

3.2.3 Nutrition

Two thirds of the schools - 68.3% (n = 136) have school canteens, 58.8% (n = 117) - shop or cafeteria where foods or beverages can be purchased and 21.6% (n = 43) - vending machines where children are allowed to purchase foods and beverages other than water, fruits and vegetables. On the territory of 35.2% (n = 70) of the schools there is some form of advertising or marketing (e.g. posters, billboards or banners with food company names or products featured, food company imagery or names on vending machines, and/or branded school materials such as books, sports equipment) of any energy-dense and nutrient-poor foods (e.g. cakes, pastries, sweets) and beverages that could undermine the promotion of healthy, balanced diet.

In Table 2 is presented the availability of selected foods and beverages that pupils can obtain at the school premises.

As part of the second area of action in the EU Action Plan on Childhood Obesity there is a call to improve the uptake of healthy, nutritious and high quality school meals while limiting the access to snacks and other supplementary less healthy food options at the school premises. The fourth area of action recommends the marketing and advertising of foods high in fat, sugars and salt and sugar-sweetened beverages to children to be restricted in all forms, since children and adolescents unlike adults cannot distinguish clearly when they are being targeted by advertising and that makes them vulnerable to the adoption of unhealthy dietary preferences. In the Action Plan there is a further call schools to engage in initiatives to provide fresh drinking water as a way to promote health and also serving as a substitute for sugar sweetened beverages [20]. Likewise, the EU School Milk Scheme aims to promote the consumption of milk as an alternative of sugar-sweetened beverages and the EU School Fruit and Vegetable Scheme provides school children with fruit and vegetables along with educational measures, aiming to encourage good eating habits in young people and to counteract the negative trend for low intake of fruits and vegetables among the children and young people in almost all Member States [24, 25]. Daily vegetable consumption was reported by over one in three girls and one in four boys on average across EU countries in 2013 - 2014 based on self-reported data collected by the Health Behavior in School-aged Children survey [26].

The data form 2015/2016 school year points to the need of further improvement of the nutrition in schools. While almost one third of the schools don't have

Table 2. Availability of selected foods and beverages at the school premises

Beverages					
		Free (%)	**Paid (%)**	**Free and paid (%)**	**Not available (%)**
Without or no added sugar	Water	9.5	55.8	2	32.7
	Tea	5.5	52.3	2.5	39.7
	100% Fruit juices with no added sugar	4.5	41.2	2.5	51.8
With added sugar	Fruit juices or other non-carbonated drinks containing added sugar	1	37.2	0.5	61.3
	Carbonated (soft) drinks containing added sugar	-	10.1	-	89.9
	Flavored milk with added sugar	2	18.1	-	79.9
	Hot drinks (cocoa, tea, latte)	1.5	47.2	0.5	50.8
Dairy	Milk, yoghurt, ayran	29.6	35.2	8.5	26.6
Other drinks with non-sugar sweeteners	Soft drinks (including fruit juice drinks and flavored milks)	1	23.6	0.5	74.9
Energy drinks		-	1	-	99
Foods					
		Free (%)	**Paid (%)**	**Free and paid (%)**	**Not available (%)**
Nutrient dense foods	Fresh fruits	57.3	12.6	17.6	12.6
	Vegetables	46.2	9.5	4	40.2
Foods with high content of added sugars, fats and salt	Sweet snacks (e.g. chocolate, sugar confectionery, cakes, breakfast and/or cereal bars, sweet biscuits and/or pastries)	3	43.2	3.5	50.3
	Ice-cream	-	18.2	-	81.8
	Savory snacks (e.g. potato crisps, salted popcorn, salted nuts, savory biscuits and/or pretzels)	-	32.3	-	67.7

canteen where warm, nutritious meals can be served, the percentage of schools with vending machines and some form of marketing of energy-dense and nutrient-poor foods and beverages is comparatively high. The data in Table 3 also suggests that on the territory of half of the schools can be obtained sweet snacks, in one third of them - salty snacks, different types of sugar-sweetened beverages are available from 10 to 40% depending on the category. Close to one third of the schools don't provide water, one fourth - dairy drinks, around 40% - vegetables and further 10% - fruits. The dietary habits of children are strongly influenced by the surrounding environment; therefore the school nutrition environment needs to change from obesogenic to supportive by making the easy choice of foods and beverages to be also the healthy one.

Nevertheless, when comparing the data with the first round of the COSI study in Bulgaria in 2008, there are significant improvements: more than two fold increase in the availability of fruits and dairy beverages, corresponding more than two fold decline in the availability of salty snacks, reduction with a third in the availability of sweet snacks and more than seven fold decline in the availability of cold drinks containing sugar [11]. The reasons for the observed changes are likely to be attributable to the different policy measures implemented in an attempt to halt the rise of childhood obesity since 2008. Among them, Ordinance for healthy nutrition in schools, 2009 and Recipe Book for school meals, 2012 were introduced as nutrition policy measures to ban the sale and limit the availability of specified sugary products, soft drinks, energy drinks, snacks and foods with high fat and salt content, as well as to regulate the quality of the offered meals in schools [27]. The relatively high availability of free fruits (57.3%) and vegetables (46.2%) in 2016 also suggests the high impact of the programs EU School Milk Scheme and EU School Fruit and Vegetable Scheme [24, and 25].

4. Conclusions

- The start of school can be a challenging period affecting the: nutritional status, health, school performance and well-being of children. School environment can influence profoundly the health related behaviors and choices of the young children.

- The present study highlights the serious problem of overweight and obesity among 7-year-old schoolchildren in Bulgaria. The characteristics of the school environment provide some insights for the state of the issue. Although some characteristics in the area of physical activity, education and nutrition have demonstrated improvement, partly due to the policy measures implemented since 2008 in attempt to halt the rise of childhood obesity, there is much room for improvement.

- There is further need to broaden the school policies for granting access to the indoor gyms after school hours and the general policy for not allowing play in extreme weather conditions in the outdoor playing areas. The organizing of initiatives to promote healthy lifestyle has a lot of potential to include the parents and the community. The biggest improvements need to address the field of nutrition and marketing to children - the ultimate goal being - turning the obesogenic school environment into protective for the healthy choices. This can be achieved through elimination of any form of marketing and advertisement to children at the school premises, increase of the availability and accessibility to water, fruits, vegetables and dairy products while limiting the availability of salty, sweet snacks and sugar-sweetened beverages by provision of alternatives supporting healthy, balanced diet. Some way forward might be setting the framework for healthy food procurement policies in schools.

- Innovative public health measures and strengthening the control on the effective implementation of the current ones may have additional positive effects on the nutritional status of children and in particular the group of 7-year-old first graders.

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