

## REVIEW

## Childhood obesity in Kazakhstan: behavioural health risks associated with diet and physical activity

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### ABSTRACT

**Goal:** The lack of a standardized surveillance system for childhood obesity among elementary school children in Kazakhstan has revealed the need for a national study to be carried out on the prevalence of overweight and obesity among children in the country and the associated family lifestyle factors.

**Materials and methods:** The research methodology was based on the WHO European Childhood Obesity Surveillance Initiative (COSI) protocol. The study involved taking body measurements of third and fourth grade pupils at mainstream schools in the Republic of Kazakhstan selected on the basis of a representative national sample, and also using data obtained from parents. The eight risk factors associated with nutrition and five risk factors associated with physical activity were used as a basis for calculating the respective behavioural risk scores for each child based on their diet and physical activeness.

**Results:** The proportion of overweight and obese children aged nine in Kazakhstan was 18.6% (CI 95% 15.8–21.5), with 5.5% being clinically obese (CI 95% 3.9–7.1). The average behavioural risk score associated with diet among nine-year-olds was 2.8 (CI 95% 2.5–3.0) out of a possible 8. The average behavioural risk score for physical activity was 1.6 (CI 95% 1.5–1.7) out of a possible 5.

**Conclusion:** The results indicate a need for intersectoral cooperative measures aimed at supporting an environment conducive to a healthy diet and increased physical activity, as well as the need for interventions at the level of individual families, schools and primary healthcare aimed at preventing and managing childhood obesity in the Republic of Kazakhstan.

**Keywords:** CHILDHOOD OBESITY, OVERWEIGHT, DIET, PHYSICAL ACTIVITY, KAZAKHSTAN

### INTRODUCTION

Overweight and obesity among children is a serious healthcare issue that is widespread in both developed and developing countries, and it is acquiring alarming trends in Kazakhstan (1, 2).

Overweight and obesity among children is due to a range of causes and factors, including: genetic predisposition, lifestyle and behaviour, family life, and an environment conducive to an unhealthy diet and low physical activity (3–6).

The consumption of high-calorie foods with high levels of sugar, fat and salt content and poor nutritional quality, combined with decreased physical activity and the spread of sedentary forms of activity, cause an imbalance in energy consumption and expenditure. Accordingly, poor nutrition and low physical activity are the main lifestyle factors that contribute to the development of obesity (7).

The rise in childhood obesity and the lack of national epidemiological surveillance systems in a number of WHO European Region countries based on age-standardized body mass index (BMI) have created the need to develop a unified system for monitoring childhood obesity among elementary school children. Since 2007, the WHO Childhood Obesity Surveillance Initiative (COSI) has regularly analysed the prevalence of overweight and obesity among children aged 6 to 9 and is seen as a basis for monitoring childhood obesity and identifying priority policies in this area (8).

In the Republic of Kazakhstan, monitoring of children under the age of five is carried out as part of Multiple Indicator Cluster Surveys (MICS). The proportion of overweight (including obese) children aged 0–5 in Kazakhstan was 11.3% in 2006 and 13.3% in 2010 (14.8% among boys and 11.8% among girls). In 2015, the percentage of children aged five and below whose weight to height ratio was two standard deviations above the median established by the WHO for this age group was 9.3% (9).

The prevalence of overweight and obesity in Kazakhstan among children of elementary school age, with measurable comparable cross-country data, has not been assessed. Therefore, the National Centre for Problems of Healthy Lifestyle Development under the Ministry of Healthcare of the Republic of Kazakhstan supported the WHO European Childhood Obesity Surveillance Initiative and carried out a national study in the 2015/2016 academic year.

The aim of the study was to assess the prevalence of overweight, obesity and several home and school environment factors among elementary school children in the Republic of Kazakhstan. The assessment was carried out on the basis of epidemiological surveillance of obesity among children with the aim of developing measures to prevent and fight childhood obesity (10). This article presents the results of the national study on the prevalence of overweight and obesity, and analyses nutritional and physical activity/inactivity behavioural indicators among nine-year-olds.

## MATERIALS AND METHODS

The study's methodology is based on the WHO European Childhood Obesity Surveillance Initiative (COSI) Protocol (11).

### FORMING A SET SAMPLE

The population studied was elementary school children. The target age group for studying the prevalence of overweight and obesity was children aged nine — third and fourth grade pupils in accordance with the Kazakhstani education system. The sample of schools was determined on the basis of the list of mainstream schools registered in seven regions of the Republic of Kazakhstan: Mangystau Oblast, Kyzylorda Oblast, Karaganda Oblast, Pavlodar Oblast and East Kazakhstan Oblast (representing the Western, Southern, Central, Northern and Eastern regions, respectively), plus two cities – Almaty and Astana. A two-stage cluster sample was used, with elementary schools serving as the primary sampling units and individual classes serving as the secondary sampling units.

1. Elementary schools were chosen randomly with probability proportional to their size.
2. A third or fourth grade class was chosen at random from each school selected.
3. All children from the chosen classes were included in the sample.

The schools were classified on the basis of the region and type of locality (rural or urban) in which they are located. The relative

sample size of each classification group was proportional to the distribution of third- and fourth-graders among those groups.

The sample size was increased on the basis of the following factors: participation in the survey was not mandatory; some subjects might not be physically present during the examination; some subjects might not belong to the required age group. In addition, the need to obtain regional data for the Kyzylorda and Mangystau oblasts also meant that the sample size for these regions was increased. A total 142 mainstream schools and 5537 children took part in the study. This was the sample size.

## DATA COLLECTION PROCEDURES

A procedure for assessing the characteristics of the target population was implemented. The methodology used to construct the weighted coefficients of the sample was based on a predictive approach to regressive analysis. Specifically, a calibration estimator was constructed based on the general category of estimation models (12). This procedure included calculating the weighted coefficient for each child included in the sample by calculating the probability of including both the primary and secondary sampling units and calibrating the weighted coefficient of the sample for known data on the population of interest. Data on the number of nine-year-old boys and girls living in the country were obtained from the official population statistics for 2015. The calibration variables used to produce the calibrated weights were: sex, age, school grade, region/city and level or urbanization.

## ANTHROPOMETRIC MEASUREMENTS

Field workers trained in the standardized procedures took weight, height and waist measurements of children in every class included in the sample. The children wore light clothing and removed their footwear. Weight was measured in kilograms and rounded to the nearest 100 grams. Height was measured in centimetres and rounded to the nearest millimetre. Body weight was adjusted in order to account for the weight of the clothing worn by the children during the measurement.

Body mass index (BMI) was calculated using the formula: (weight in kg)/(height in m<sup>2</sup>). BMI Z-scores (standard deviation) by age were determined in accordance with the WHO Growth Reference for School-Aged Children and Adolescents (13). Children with extreme BMI values (Z-scores +/-5 for their age)

were excluded from the analysis. Normal weight was determined as the proportion of children with BMIs of  $\geq -2$  and  $\leq +1$  for their age in terms of their Z-score. Children with a BMI of  $+1$  Z-score for their age relative to the median were considered overweight, while children with a BMI of greater than  $+2$  Z-score for their age were considered obese. According to the WHO definition, the prevalence of overweight includes obese individuals (14). This article presents information on the prevalence of overweight and obesity among nine-year-olds.

## DATA COLLECTION QUESTIONNAIRE FOR FAMILIES

A registration form was produced for each child. The form records demographic data about the child and includes his or her anthropometric measurements. In addition, parents and guardians were required to fill in a family questionnaire for the purposes of the study. The questionnaire contained questions about the family's socioeconomic status and dietary intake, as well as child's physical activity and sedentary behaviour.

For the purposes of statistical analysis, answers to the questions regarding dietary habits and physical activity were classified as behavioural health risks associated with diet and physical activity as follows:

1. Regular breakfasts. Not eating breakfast on a daily basis (less than seven times per week) is a sign of an unhealthy diet and may contribute to the onset of obesity (15, 16). In the article, the lack of a daily breakfast is regarded as a nutritional health risk.
2. Frequency of consumption of certain types of food and beverages. Not eating fruit and vegetables on a daily basis (less than seven times per week) is seen as a nutritional risk factor, as these products should be a part of the child's everyday diet on account of their high vitamin, mineral and complex carbohydrate content (17, 18). Consuming non-alcoholic drinks with added sugar; products such as potatoes, corn chips, popcorn or peanuts; chocolate or sweets; biscuits, cakes, doughnuts or pies; or pizza, chips, hamburgers, sausages and meat pies more than three times per week is seen as a nutritional health risk factor. These food groups are characterized by their high calorie content and their increased levels of sugar, saturated fat and salt, and they should be consumed in limited amounts.

3. Physical activity. The WHO recommends that children and adolescents engage in physical activity of moderate to high intensity at least 60 minutes per day (19), including exercises for major muscle groups at least twice per week (20). Physical activity does not just mean taking part in sports and physical fitness, it also includes everyday activities such as walking, active games, dancing, etc. (19). In the article, the following physical activity indicators are seen as risk factors: not walking to and from school (travelling by car or other vehicle); taking part in sports and dance classes for less than two hours per week; taking part in active games and other physical activities for less than one hour per day.

It is common for children and adolescents to spend their time watching television or playing with other electronic devices. A sedentary lifestyle and passive leisure activities are risk factors in the development of non-communicable diseases and are associated with poor health (19, 21, 22). Sitting in front of the television and other electronic devices for more than two hours per day is seen as a behavioural health risk.

4. Sleep duration. Scientific research suggests that insufficient sleep is a risk factor for childhood obesity. Children aged 10 should get between 8 and 10 hours of sleep per day (23–25). The National Sleep Foundation in the United States recommends that children aged 6 to 13 should get between 9 and 11 hours sleep per day (26). Sleeping less than nine hours per day is seen as behavioural risk factor of obesity associated with physical activity.

## BEHAVIOURAL RISK SCORE

Scores for behavioural risks associated with nutrition and physical activity were calculated for each child in accordance with the family questionnaire filled in by parents/guardians. Scores for behavioural risks associated with nutrition were calculated as the sum of the following eight indicators: eating breakfast  $< 7$  days per week; eating fruit  $< 7$  days per week; eating vegetables  $< 7$  days per week; drinking non-alcoholic drinks with added sugar  $> 3$  days per week; consuming products such as potatoes, corn chips, popcorn and peanuts  $> 3$  days per week; consuming chocolate or sweets  $> 3$  days per week; consuming biscuits, cakes, doughnuts or pies  $> 3$  days per week; and consuming pizza, chips, hamburgers, sausages or meat pies  $> 3$  days per week.

Scores for behavioural risks associated with physical activity were calculated as the sum of the following five indicators: not walking / cycling to and from school; taking part in sports and dance classes  $< 2$  hours per week; taking part in active games

and other physical activities <1 hour per week; spending  $\geq 2$  hours per day in front of the television or other electronic device; getting < 9 hours sleep per day.

The presence of a behavioural risk factor equalled 1 point, and the absence of a behavioural risk factor equalled 0 points. Scores for behavioural risks associated with nutrition ranged from 0 (no behavioural risks identified) to 8 (all behavioural risks identified).

Scores for behavioural risks associated with physical activity ranged from 0 (no behavioural risks identified) to 5 (all behavioural risks identified).

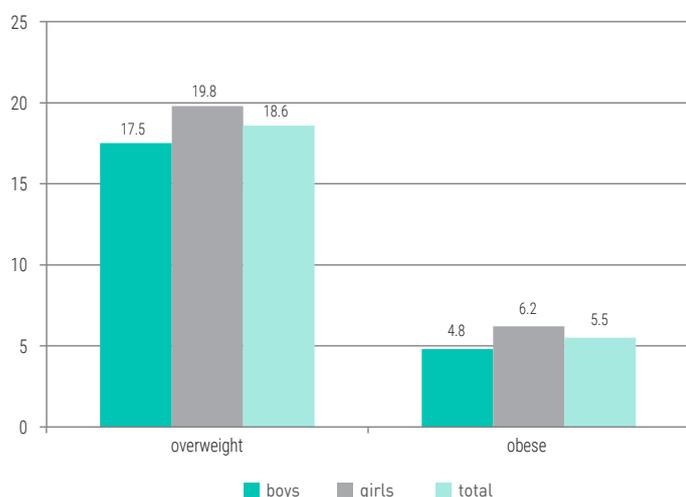
Statistical processing of the research material was carried out using Microsoft Excel and SPSS 15.0 for Windows.

The prevalence indicators were calculated using the Descriptive Statistics method in SPSS 15.0 for Windows and a two-dimensional analysis between non-metric variables with the creation of contingency tables (Crosstabs). A 95% confidence interval was computed by calculating the sample ratio and standard error.

## RESULTS

A total of 5535 children (2807 boys and 2728 girls) took part in the study. Data was recorded with regard to their age, sex and anthropometric measurements. Of these 5535 nine-year-olds, 2903 (1481 boys and 1422 girls) were found to be overweight or obese. A total of 4932 family questionnaires were completed (a response rate of 89.1%).

**FIG. 1. PREVALENCE OF OVERWEIGHT AND OBESITY AMONG NINE-YEAR-OLDS IN KAZAKHSTAN, 2016 (%)**



The study found that the prevalence of overweight among nine-year-olds in Kazakhstan was 18.6% (CI 95% 15.8–21.5): 17.5% (CI 95%, 14.2–20.8) for boys; and 19.8% (CI 95%, 15.6–24.0) for girls. The prevalence of obesity among nine-year-olds in Kazakhstan was 5.5% (CI 95% 3.9–7.1): 4.8% (CI 95% 3.2–6.5) for boys; and 6.2% (CI 95% 4.0–8.5) for girls (Fig. 1).

The indicators for dietary intake, physical activity, sedentary lifestyle and sleep duration are presented in Table 1.

The average score for behavioural risks associated with nutrition among nine-year-olds was 2.8 (CI 95% 2.5–3.0) out of a possible 8. A total of 0.4% of children scored the maximum in terms of negative indicators (8 points), while 5.0% of children did not exhibit any of the above-mentioned risk factors (scoring 0 points). Furthermore, 29.4% of children exhibited three risk indicators, and 24.9% exhibited two risk indicators.

The average score for behavioural risks associated with physical activity was 1.6 (CI 95% 1.5–1.7) out of a possible 5. Not a single child scored the maximum 5 points for physical activity risks (one point for each of the negative behavioural indicators). Conversely, 14.3% of children scored 0 points – that is, they did not demonstrate any of the negative behaviours. Approximately one third of the children surveyed demonstrated one or two of these negative behaviour indicators (32.9% and 34.5%, respectively), while 15.7% demonstrated three such behaviours.

## ANALYSIS

Overweight and obesity is quite prevalent among children in Kazakhstan, with almost one fifth of children in the target group being overweight or obese. A little over half of the children surveyed do not eat breakfast every day. Only one third of them eat fruit and vegetables on a daily basis. Children consume food and drinks with a high sugar content more frequently than they consume savoury foods, salty foods and fast food. The study revealed that a low proportion of children attend sports and dance classes, and those that do are not spending enough time there on average. What is more, 31.9% of children demonstrate levels of physical activity below the recommended norm, and almost one quarter of children spend two or more hours per day in front of the television or other electronic device. Almost one quarter of the children surveyed demonstrated two or three poor nutritional habits as defined by the behavioural risks above. One third of the children demonstrated one or two negative habits in terms of physical activity.

**TABLE 1. PREVALENCE OF BEHAVIOURAL HEALTH RISKS AMONG NINE-YEAR-OLDS IN THE REPUBLIC OF KAZAKHSTAN**

Behavioural health risk indicators		Prevalence (%)	CI 95%
Frequency with which breakfast and certain types of food and beverages are consumed			
1.	Breakfast < 7 days per week	52.4	47.6–57.2
2.	Eating fruit < 7 days per week	66.0	60.6–71.4
3.	Eating vegetables < 7 days per week	68.1	63.0–73.3
4.	Drinking non-alcoholic drinks with added sugar > 3 days per week	23.7	20.7–26.6
5.	Consuming products such as potatoes, corn chips, popcorn and peanuts > 3 days per week	14.3	10.2–18.4
6.	Consuming products such as chocolate and sweets > 3 days per week	23.7	18.5–28.9
7.	Consuming products such as biscuits, cakes, doughnuts and pies > 3 days per week	19.5	14.8–24.3
8.	Consuming products such pizza, chips, hamburgers, sausages or meat pies > 3 days per week	10.5	6.9–14.0
Physical activity, sedentary lifestyle and sleep duration			
1.	Not walking/ cycling to and from school	21.0	16.5–25.5
2.	Taking part in sports and dance classes < 2 hours per week	61.5	56.0–66.9
3.	Taking part in active games and other physical activities < 1 hour per week	31.9	25.3–38.6
4.	Spending ≥ 2 hours per day in front of the television or other electronic device	24.6	21.4–27.8
5.	Getting < 9 hours sleep per day	21.2	16.9–25.5

## DISCUSSION

The prevalence of overweight (18.6%) and obesity (5.5%) among nine-year-olds in Kazakhstan is slightly lower than in other WHO European Region countries where similar studies have been carried out for children aged 6–9. The results of the first round of data collection during the 2007/2008 academic year demonstrated that 24% of children aged 6–9 were either overweight or obese. The results of the second round (conducted in 2010) showed an increase in this figure, to approximately 33% of the total sample, although some countries made significant positive progress. According to the 2010 COSI study, the prevalence of overweight and obesity among nine-year old girls in various countries was as follows: Lithuania – 21.3%; Republic of Ireland – 30.3%; Slovenia – 33.6%; Italy – 37.4%. The prevalence of overweight and obesity among nine-year old boys in these countries was as follows: Lithuania – 27.3%; Republic of Ireland – 32.2%; Slovenia – 36.8%; Italy – 43.8%. The following

levels of obesity were recorded: Lithuania – 5.9% for girls and 11.3% for boys; Republic of Ireland – 6.8% for girls and 10.3% for boys; Slovenia – 13.6% for girls and 22.3% for boys; Italy – 13.0% for girls and 21.9% for boys (8).

The data obtained as a result of the survey are alarming nevertheless, as almost one in five children aged nine in Kazakhstan is overweight. The widespread prevalence of negative nutritional habits, low levels of physical activity and adverse environmental factors contributing to obesity need to be addressed in order to prevent an epidemic of childhood obesity.

An evaluation of the health-risk behaviours on nutrition and physical activity among children and adolescents has been carried out as part of studies in a number of WHO European Region countries. These health-risk behaviours were assessed both individually and as part of a complex of wider behaviours. In addition to carrying out a study into the lifestyles of children

in 2007–2008, the five countries participating in the WHO European Childhood Obesity Surveillance Initiative (Bulgaria, the Czech Republic, Lithuania, Portugal and Sweden) assessed the behavioural health risks associated with nutrition and physical activity according to a points system (27). The research data for Kazakhstan is comparable to the results produced as a result of the COSI studies in these countries. The age group of the children in this comparative study was 6–9. We can also compare the results with research data from the 2013–2014 Health Behaviour in School-Aged Children (HBSC) study, although the target group for this research was children and adolescents aged 11–15 (28). An analysis of the results of these studies reveals that nine-year-olds in Kazakhstan skip breakfast much more frequently than children in the five countries where the comparative analysis was carried out (27), and more frequently than the eleven-year-olds who took part in the HBSC study (52.4% to 28%). The low level of fruit and vegetable consumption in Kazakhstan (34% and 31.9%, respectively) is comparable to that among children in Europe (27, 28). Thus, HBSC data reveals that just 44% of eleven-year-olds eat fruit on a regular basis. Consumption of foods rich in sugar, saturated fats and salt in Kazakhstan is similar to that in a number of Eastern European countries that are part of the Childhood Obesity Surveillance Initiative. The results of the study reveal that children in Kazakhstan take some kind of transport to and from school less frequently than children in the other countries, and they spend less time in front of the television or other electronic device. The low proportion of children attending sports and dance classes and playing outside is comparable to other countries, as is the poor sleep duration. In this article, we used a points system for scoring behavioural risk that was very similar to the methodology used in the abovementioned work carried out in the five countries participating in the WHO European Childhood Obesity Surveillance Initiative. The average behavioural risk score associated with diet among nine-year-olds was 2.8, which is almost identical to the results obtained for Lithuania (3 points), lower than those for Bulgaria (4 points) and higher than those for the Czech Republic (2 points), Portugal and Sweden (1 point each).

The average behavioural risk score for physical activity in Kazakhstan was 1.6, which is comparable to Bulgaria, Lithuania and Portugal (2 points each) and higher than the Czech Republic and Sweden (1 point each).

## CONCLUSION

The results of the research conducted among elementary school children in Kazakhstan using international standardized methodology produced national data that will support the development of approaches to fighting childhood obesity in the country and allow cross-country comparisons to be made. The findings indicate a high prevalence of overweight and obesity among children. An analysis of negative nutritional and physical activity/sedentary lifestyle factors made it possible to identify the levels of behavioural risk associated with obesity among elementary school children. The results indicate a need for intersectoral cooperative measures aimed at supporting an environment conducive to healthy eating and increased physical activity, as well as the need to intervene at the level of individual families, schools and primary healthcare in order to prevent and fight childhood obesity in the Republic of Kazakhstan.

**Research Ethics:** The research procedure and methodology were subject to an ethics review by the Local Ethics Commission, which it passed without issue. Parents were informed about the research procedure in writing, with a consent form attached (passive approach). The confidentiality of all data collected and archived was protected. On the day of the examination, the children were asked to give their verbal consent to being measured.

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**Conflicts of interests:** None declared.

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