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COMPARISON OF PHYSICAL DEVELOPMENT OF SCHOOL CHILDREN IN ASTANA AND VILNIUS AND LINKS BETWEEN NUTRITIONAL STATUS AND LIFESTYLE OF CHILDREN IN ASTANA

Master Theses

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ABBREVIATIONS

BMI – body mass index

CDC – Centers for Disease Control and Prevention

COSI – Childhood Obesity Surveillance Initiative

HBSC – Health Behavior in School-aged Children

IOTF – International Obesity Task Force

NCD – Non Communicable Diseases

NW – normal weight

OB – obesity

OW – overweight

SDG – Sustainable Development Goals

UW – underweight

WHO – World Health Organization
CONCEPTS OF TERMS

**Nutritional status** - the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity

**Eating behavior** - is a complex interplay of psychological, social, and genetic factors that influence meal timing, quantity of food intake, and food preference

**Healthy dietary behavior** - eating a variety of foods that give you the nutrients you need to maintain your health, feel good, and have energy. These nutrients include protein, carbohydrates, fat, water, vitamins, and minerals

**Lifestyle** – a way of life or style of living that reflects the attitudes and values of a person or group; the aggregation of decisions by individuals which affect their health, and over which they more or less have control
INTRODUCTION

Primary school years are a time of active growth of children, as well as constant mental workload. Particularly, at the younger school age, the purposeful training and upbringing begins, which plays a crucial role in the formation and development of children’s habits, behavioral characteristics and lifestyle in general. Early identification of children of primary school years who are at risk of developing increased weight may prevent or at least significantly slow down the formation of characteristic consequences. Some scientists are paying attention to the fact that children overweight and obesity in school-aged children is still a serious public health problem that affects on many countries, including Lithuanian and the Republic of Kazakhstan.

Actuality of the problem. The prevalence of overweight and obesity among children has grown significantly and steadily over the past thirty years [1]. The relevance of childhood obesity, and factors provoking it, including unhealthy nutrition, low physical activity, lack of evidence on the development of an obesity epidemic among primary school children, set the goal of implementing a strategy to prevent childhood obesity through epidemiological surveillance and monitoring the prevalence of overweight and obesity. In the countries of the European Region, including Lithuania, childhood obesity is also an urgent problem. As part of building a scientific base of indicators on overweight and obesity among children, to promote and support policies to address the epidemic of childhood obesity and monitoring, the WHO founded the European Childhood Obesity Surveillance Initiative (COSI) study. Lithuania have an understanding of the seriousness of the problem of childhood obesity and the need to join the epidemiological monitoring system of the COSI in order to develop priority and effective areas of work in the field of population and individual prevention of childhood obesity entered into a COSI study and became one of the first countries- participants. Health Ministry of the Republic of Kazakhstan joined the WHO European initiative on the surveillance of childhood obesity and conducted a multicenter study only in the 2015-2016 school years. In Kazakhstan, issues of quality and rational nutrition, increasing physical activity are a priority of public health policy in several State programs for the development of health care. As for the fight against overweight and obesity of all countries, there are a number of highly relevant goals and objectives, including the Sustainable Development Goals (SDGs). In particular, SDG 3 refers to ensuring healthy lifestyles and promoting well-being for all at any age and includes a goal by 2030 to reduce by one-third the premature mortality from non communicable diseases (NCDs). SDG 2, dedicated to zero hunger, includes a goal to end all forms of malnutrition by 2030. In regards to that, all measures to prevent, treat, and limit the spread of childhood obesity among school-age children are among the priority.
**Novelty of the problem.** The physical development analysis of primary school children of Astana (Kazakhstan) and Vilnius (Lithuania) was conducted for the first time and can be used by students, teachers and medical personnel in both countries.

**Practical use.** The results allow us to assess the situation by the prevalence of children with elevated weight among schoolchildren of 7 and 8 years old, to make comparisons between countries as part of a master's thesis, to develop preventive measures for healthy eating, increasing physical activity at the level of family, school, community, and taking into account regional characteristics.

**Personal input.** I personally conducted a cross-sectional survey of children’s parents using Family questionnaire and objective anthropometric measurements of children of the first-second grade in schools of Astana (Kazakhstan). The relevant data from Lithuania was taken for comparison from schools of Vilnius (Lithuania).
1. AIM AND OBJECTIVES OF THE STUDY

Aim of the study

To compare physical development of 7 and 8 year old children in Astana and Vilnius and to analyse links between lifestyle and nutritional status of first-grade school children in Astana.

Objectives:

1) To analyse physical development of 7 and 8-year-old school children of Astana and Vilnius;

2) To assess nutrition habits and physical activity of primary school age children in Astana;

3) To evaluate the links between nutritional status and lifestyle of primary school age children in Astana.
2. REVIEW OF THE LITERATURE

2.1 Childhood overweight and obesity

Overweight and obesity in children is a serious health problem, which affects many countries, including the Republic of Kazakhstan and Lithuania. The prevalence of overweight and obesity among children is significant and has been growing steadily over the past decades, since 1960. Surveys such as that conducted by de Onis M., Blossner M. and Borghi E. in 2010 have shown that 43 million of children (35 million in developing countries) were estimated to be overweight and obese; 92 million were at risk of overweight. The worldwide prevalence of childhood overweight and obesity increased from 4.2% (95% CI: 3.2%, 5.2%) in 1990 to 6.7% (95% CI: 5.6%, 7.7%) in 2010. This trend is expected to reach 9.1% (95% CI: 7.3%, 10.9%), or 60 million, in 2020, with a relative increase of 36% from 2010 [1,2].

Obesity can be defined in simple terms as a condition of abnormal or excessive fat accumulation in the adipose (fat) tissue of the body, leading to health risks and implications. Overweight and obesity are often assessed by body mass index (BMI). This is weight (in kilograms) divided by height (in meters) squared (kg/m²). For adults, the World Health Organization (WHO) defines overweight and obesity as BMI values equal or above 25 and 30 kg/m², respectively [3]. At the same time there are some difficulties to describe children as overweight or obese on the basis of BMI alone, i.e., without taking into account some more direct measure of body fat recognition of the difficulties inherent in obtaining more proximate measures of body fat and lack of references to interpret them has resulted in BMI-for-age alone being used to define overweight and obesity. For children and teens, the BMI interpretation is age and gender specific as the amount of body fat changes with age and differs between the genders. BMI, reasoning logically, provides only a crude measure of body fatness, as it does not distinguish between weight associated with muscle and that associated with fat [4]. Measurement of abdominal fat is important, as an excess of abdominal fat (independently of total body fat) is associated with metabolic abnormalities such as hyperinsulinemia and dyslipidemia. In addition, large waist circumference in childhood continues well into adulthood [5]. Hip measurements provide additional valuable information on gluteofemoral muscle mass and bone structure. Therefore, it is recommended that waist and hip circumferences be measured on to characterize a population in terms of abdominal fat distribution. The WHO opted for a cautious approach because these children are still growing and thus far there are little data on the functional significance of the cut-offs for the upper end of the BMI-for-age distribution for such an...
optimally healthy population. The WHO standards sample was prescriptive, and unhealthy weights for length/height were excluded prior to constructing the curves [6].

In concluding what is said above we can say that childhood overweight and obesity for almost half a century in most countries increased, and the problem becomes threatening.

### 2.2 Etiology of childhood obesity

Overweight and obesity represent as increased or excessive accumulation of fatty deposits that can be harmful to health. The main reason for the development of obesity is the imbalance between calorie intake and expenditure, between content in food ration and energy costs in the body. Consumption of products with high energy value and high-fat content along with a sedentary way of life, caused by a decrease in physical activity [7].

In connection with the global spread of childhood obesity, it is necessary to know the main leading causes:

**Genetics** plays a role in childhood obesity; the gene pool does not change fast enough to take into account the global prevalence of overweight children. Based on approximately fifty studies of twin families that are consistent or inconsistent with obesity, Bouchard et al. (2003) concluded that genetic factors contributed to 25 to 40% of the variation in weight [8].

**Dietary factors** have been extensively studied for possible contribution to the growth of obesity indicators. Dietary factors that have been studied include fast food consumption, sweet drinks, snacks, and serving sizes. Nutritious foods that are high in calories contribute to the energy disequilibrium, which is secondary to accessibility, ease of consumption and replacement of other, more nutritious substances. In addition, the study showed that very young children seem to be able to adjust their food intake to match their outflow of energy. When children grow, their food intake becomes more dependent on external signals, such as the amount and type of food presented. Other studies have concluded that the child's environment contributes to obesity. By increasing the availability of snacks, reducing physical education in schools and increasing the length of screen time (computer and television viewing), the environment contributes to an imbalance in energy consumption and expenditure, which leads to an increase in the number of overweight children [9].

**Behaviors** that influence excess weight gain include not getting enough physical activity, sedentary activities such as watching television or other screen devices, medication use, and sleep routines. In contrast, consuming a healthy diet and being physically active can help children grow as well as maintain a healthy weight throughout childhood. Balancing energy or calories consumed from foods and beverages with the calories burned through activity plays a
role in preventing excess weight gain. The Physical Activity Guidelines for Americans recommends children aged 6 years or older do at least 60 minutes of physical activity every day [10].

Breastfeeding is also described as a source proposed for a protective effect against obesity. A study showed that breastfeeding, although not a permanent factor has a diminishing effect on the total weight of children [11].

Family factors have also been associated with an increase in cases of obesity. The types of food available in the home and the preferences of family members for food can affect the foods that children eat. In addition, family meals can affect the type of food consumed and its amount. In addition, family mealtimes can influence the type of food consumed and the amount thereafter. The food structure is important with data showing that families who eat together consume more healthy food. In addition, eating or watching TV while eating is associated with higher fat intake. The style of parental nutrition is also significant [12]. Previous studies have explored that having an overweight mother and living in a single parent household are associated with overweight and childhood obesity [13].

Socioeconomic status – there is an inverse relationship between socioeconomic status indicators and the prevalence of overweight or obesity. That is, low status within each socioeconomic variable, such as family income, mother's education level, household class, contributed to a more likely appearance of childhood excess weight or obesity. Surveys such as that conducted by Hilpert (2017) shown that children with low socioeconomic status were more likely to be obese. In this study, the time children spent watching television was inversely related to socioeconomic status and higher for those with a migration background compared to their counterparts [14]. As in previous studies of European countries [15], children with a migration background were significantly less likely to participate in organized sports or to be physically active in their leisure time.

The basal metabolic rate was also studied as a possible cause of obesity. The basal metabolic rate is accounted for 60% of the total energy expenditure in sedentary adults. It has been suggested that obese people have lower basal metabolic rates.

Psychological causes. The problem of childhood obesity is not limited only to malnutrition or lack of physical activity. There are also many psychological factors caused by relationships in the family or in the company of peers, which contribute to the growth of excess weight. It is known that peers often refer to children and teenagers negatively, laugh at them, do not take them into their companies or take on any secondary roles. Children, feeling and painfully experiencing, often resort to food as a comforter. Particularly well consoles a delicious food, that is, excessively fatty and sweet. The child is affected by an environment that contributes to
obesity, which is characterized by the availability of high-calorie food, poor in the content of nutrients, a reduction in opportunities for physical activity. In response to the impact of the environment, the child has biological and behavioral reactions. Behavioral reactions are formed in children under the influence of family habits, cultural norms, socio-economic status and are passed on from generation to generation. In this regard, the choice of healthy foods for children from infancy is very important, since it is in childhood that food preferences are laid down for a person. Feeding a child with high-calorie food, high in fat, sugar, and salt is a key factor in the development of childhood obesity.

**Built environment**

The built environment is a recently invented phrase used to describe many areas where children are brought up. The studies described the constructed environments as developed areas where schools and playgrounds do not exist within walking distance; there is a lack of sidewalks, and clusters of fast food restaurants and convenience stores are at hand. As a result, the time of the car is increased and easy access to the food of bad food. Studies have shown that this may have further contributed to higher trends in obesity in children [16,17].

**Family requirements**

Recent studies show that parents are particularly important as models, promoters and contributing to physical activity in children and adolescents. Their roles include everything from buying sports equipment and taking children to practice and pay for praise [18,19]. Other important factors related to the involvement of active children are the levels of fathers' activity and positive reinforcement, mother participation, marriage and time spent outdoors [20].

Most of the studies reviewed the curable causes of obesity in children, by examining the intersection of the environment and behavior. Fierro (2002), author of the Disease Control Guide, outlined in the health policy report "poor nutrition and physical inactivity are the leading causes of obesity and represent the best opportunities for prevention and treatment." In conclusion, it was pointed out that the abundance of fast food, the lower consumption of home-made food, inadequate physical activity, the influence of parents and the environment are factors contributing to obesity in childhood.

**2.3 Nutrition habits and physical activity of school-aged children**

In the development of many diseases, the nutritional factor plays an important role. In a number of diseases, a deficiency or excess of one or the other nutrient is the true cause. If there are other abnormalities in the state of health, the imbalance of diets appears as a risk factor. Many alimentary-dependent diseases can be prevented by normalizing the chemical composition
of the dietary habits of children. In the modern period, education is faced with the problem of changing children's health. Nutrition habits are formed in childhood and to prevent obesity in adults, it is desirable that individuals acquire appropriate dietary habits in childhood.

According to the Swedish scientists (S. Wamala, M. Richardson, N. Stenström, A. Jansson, M. Risbeck, S. Rashid, A. Fahlvik), the school is one of the few public institutions where equal opportunity, accessibility, organization of daily physical activity and nutrition habits of the younger generation. The beginning of primary school age is determined by the moment the child enters the school. Currently, the boundaries of this age are set from 7-8 years. At this age, further formation of the body (musculoskeletal system, cardiovascular, pulmonary and immune systems) continues. At this age of particular importance is the question of organizing proper nutrition. It is one of the most important conditions for maintaining the health of the schoolboy, provides his body with the necessary energy for growth and development, and plastic material. Insufficient, inefficient nutrition at the younger school-age leads to a lag in weight and height, physical and mental development, and, according to experts, the consequences of this after 13 years can no longer be adjusted by improving the diet [12,15,21,22].

Changes in the diet of children cannot and should not be considered in isolation from other social changes. On the main streets of many of our cities and towns throughout Europe and Asia, the same outlets and fast-food outlets are increasingly appearing. The aspirations of many young people are shaped by international youth culture. Local traditions and culture play an ever-smaller role in the food and food that people eat. In most European countries, the average income is growing, and all these previously mentioned characteristics also affect to the schoolchildren. The revolution in children's lifestyles and eating habits that has occurred over the past twenty-five years can be largely due to changes in the family environment and in the social environment as a whole [23]. Such changes include the growing tendency of women to work outside the home; a marked decrease in the birth rate and the number of families; remarkable achievements in the agriculture, fisheries and food industries (with the result that a wide range of food products is now available constantly); rapid urbanization of the population, universal access to medical services and education; the growing and homogenizing influence of television; ever earlier age when children start going to school (where they usually get a significant portion of their daily diet); and an increase in the disposable wealth of minors (which allows them to buy and consume food without parental control) [24]. It should be emphasized that a very significant number of children of preschool and school age are under inadequate parental supervision in relation to the number of meals, snacks and the amount of food consumed. This is largely due to the fact that many children every day stay at home alone for a long time, without any company other than television, a game console and a refrigerator filled with products of any description. In
addition, many children have breakfast or lunch not at home, but in the school cafeteria or in a nearby cafeteria. In such circumstances, children, as a rule, choose “portable” snacks (sweets, cakes, soft drinks, etc.), which should be eaten outside the home, whether alone or with friends. Family educational level and socio-economic status have a significant impact on children's lifestyle and eating habits [25]. The level of education of the mother is one of the best factors determining the type and quality of the child's diet, although the level of education of the father can also have an impact. A number of studies have shown that children from more educated families tend to consume more milk, dairy products, and fruit juices, as well as less sugar and processed fast foods. In addition, various studies have shown that children from richer families tend to consume more protein, meat, fish, milk, and green vegetables, while children from poorer families tend to consume more calories and consume more processed fast food [25], [26]. Similarly, “habitat” can affect children's lifestyle and eating habits. In industrialized societies, differences in diet between urban and rural populations are gradually becoming less significant. Despite this, urban and city residents tend to have easier access to a wider range of food. In addition, there are differences related to differences in the socio-economic level and the preservation of traditional food habits in rural areas (especially with regard to local agricultural or fishery products). In addition, television clearly conveys conflicting reports on eating habits. Thus, television encourages the consumption of certain foods and beverages that are presented as “socially prestigious”, “healthy” (i.e. you can eat as much as you like) and / or simply “tasty”. Permissiveness and tolerance of many parents also contribute to the fact that children often eat "on TV." It is estimated that Spanish children watch television on average by the hour and 30 minutes a day, which means that during this time, children between four and twelve years of age see an average of 54 advertisements [27]. Most television food advertisements are for high-yielding “unhealthy foods” with limited nutritional value and high calorie content, and, as a rule, with a large amount of fat (especially saturated fats and trans-isomers of fatty acids), free sugars, cholesterol and / or salt, and, as a rule, with a small amount of trace elements or without it. It is shown that the proportion of junk food advertised on television in a child’s diet correlates with the amount of time a child spends watching TV.

Although for children of primary school age, the need for high motor activity is natural. With the transition from preschool education to systematic schooling in children 6-7 years old, the volume of motor activity is reduced by 50%. During the training sessions, the motor activity of schoolchildren not only does not increase during the transition from a class to class but, on the contrary, decreases more and more. Therefore, it is extremely important to ensure that the children, in accordance with their age and state of health, have a sufficient amount of diurnal motor activity. The health of schoolchildren deteriorates as they grow older: malnutrition, stress,
and lack of movement cause the most common diseases among schoolchildren - diseases of the digestive system, kidneys, nervous and endocrine systems, as well as metabolism and the immune system.

Scientific studies confirm that moderate intensity, but regular physical activity improves health, and plays an important role in the development of the child's body, preventing an unwanted increase in body weight and the occurrence of many diseases. In addition, physical activity and physical exercise have a positive effect on the development of children's motor skills. It has been proven that children with motor deficiencies in junior school age have problems with reading and writing skills, which can be important for academic achievements in the study of Swedish and mathematics. Scientists argue that there is a clear link between the practice of regular physical activity and the mental health of schoolchildren, primarily through increasing self-esteem and gaining experience of social interaction. In this regard, the tendency to provide physical activity with special emphasis on primary school age children is confirmed and widely disseminated [16,20,28]. The results of the Health Behavior in School-aged Children (HBSC) study show that the behavior of a significant number of young people in many countries does not meet the requirements for the level of optimal physical activity [29]. According to the multivariate multilevel study of Gomes (2017) more than 90% of schools in Portugal involved children in sports or clubs of physical activity. About half of the schools allow pupils to have access to sports equipment outside the school hours, but only 8.7% of them allow to have access to playground equipment during school hours [28].

In concluding what is said above we can say that preservation and strengthening of the health of school-aged children, the formation of their need for physical improvement and a healthy lifestyle is one of the main tasks of educational institutions, parents, and public health departments.

2.4 Health complications related to childhood obesity

There is sufficient scientific evidence that obesity in childhood has various serious health consequences and an increased risk of premature disease and death in adulthood. Obesity effects for health include increased risk of developing metabolic syndrome, cardiovascular diseases, type 2 diabetes, diseases of the musculoskeletal systems (for example, osteoarthritis), certain cancers and other non-communicable diseases [30,31]. There are the following complications of obesity in children and adolescents:

- **Cardiovascular system**: dyslipidemia, high blood pressure, chronic heart failure, atherosclerosis, stenocardia [32].
- **Digestive system:** pancreatitis, constipation, chronic cholecystitis, hemorrhoids, cholelithiasis; the deposition of fats in the liver leads to inadequate liver function due to the replacement of normal fatty tissue [33].

- **Musculoskeletal system:** deformation of the skeleton, destruction of articular cartilage, slipped capital femoral epiphysis, fractures, hyperostosis, flat feet, valgus deformation of the knees [32].

- **Endocrine system:** impaired glucose tolerance, diabetes mellitus, insulin resistance, early or late puberty — in young men often "female" timbre of voice, false gynecomastia; in girls — dysmenorrhea, polycystic ovary syndrome, reproductive dysfunction [34].

- **Skin:** acanthosis nigricans, fungal lesions, hirsutism [32].

- **Nervous system:** a violation of the function of memory and learning.

- **Sleep disorders** — children with obesity often have sleep disorders as snoring, apnea (episodes of lack of breathing) [32].

Obesity in childhood also leads to problems of psychological health, causing a decline in the quality of life, an increased risk of behavioral and emotional violations, stigmatization. Over 60% of children with overweight in the pre-pubertal period have a significantly greater risk of overweight in adulthood, leading to the early emergence of noncommunicable diseases and increased costs of the health care service for long-term treatment [35]. It is clear that childhood obesity is associated with a wide spectrum of adverse outcomes, including many complications that are similar to those seen in adults.

### 2.5 Childhood Obesity Surveillance Initiative

Childhood obesity is one of the greatest health challenges of the 21st century. In countries of the WHO European Region, childhood obesity is also an urgent problem. As part of the creation of a scientific database of indicators on overweight and obesity among children to promote and support policy responses to the epidemic of childhood obesity and monitoring, a standardized system for the surveillance of overweight and child obesity (WHO European Childhood Obesity Surveillance Initiative – COSI) was established in several countries in the WHO European Region. This system is regular, every two to three years measures trends in overweight and obesity among children of primary school age, aged 6-9 years. The results allow to assess the prevalence of obesity at the national and regional levels among this population group, make comparisons between countries within the WHO European Region and develop preventive measures for healthy nutrition, physical activity, the development of an environment...
conducive to a healthy lifestyle at the family level, school, community, taking into account the intersectoral approach [36], [37].

The first round of data collection took place in the 2007-2008 school years, in which 13 countries participated, including Lithuania. 18 countries participated in the second round in the 2009-2010 school years, the third round was held in 2012-2013 among 22 countries, the fourth round of data collection for the 2015-2016 school year involved 35 countries, including the Republic of Kazakhstan.

According to WHO COSI in 2007, the prevalence of overweight among boys was in the range from 19.3% to 49.0% and among girls from 18.4% to 42.5%, while the prevalence of obesity ranged from 6.0% to 26.6% among boys and from 5.1% to 17.3% among girls. As a result of the first round of data collection in the 2007-2008 academic year based on WHO development standards, it was found that on average overweight or obesity affects 24% of children between the ages of six and nine [36].

In the second round of data collection (2009-2010), there was an increase in the prevalence of overweight to about 33% of the total sample, although some countries, such as Italy, Portugal, and Slovenia made significant progress.

In the third round of COSI (2012-2013) 21 countries participated, more than 160 000 children were covered by the study.

In the 4th round (2015-2017), in which 35 countries of the WHO European Region participate, it is planned to measure over 250,000 children.

In the 5th round (2018-2019) more than 40 countries participated in the COSI study.

COSI is currently approaching adolescence (he is almost 10 years old). Now, 32 countries participating in this survey, indicates that the circle of participants is steadily expanding. Only those who work in this field can fully assess the challenges that the creation of entails and the almost ten-year implementation of such a project. The best example and incentive for those who are currently involved in the work can be the countries participating in the implementation of this program since its inception (Belgium, Greece, Latvia, Spain, etc). The countries participating in the project from the first days are firsthand aware of the difficulties and how difficult it is to ensure the consistent implementation of the project [38]. From the point of view of the WHO European Region, comprising 53 Member States at different stages of economic growth, one can only assume that the socioeconomic gap in childhood obesity will develop in the coming decades. This situation underscores the need to continue documenting trends in obesity in children and related health indicators through international monitoring efforts. In addition to the implications for the integration of surveillance in public health obligations of European
countries, the findings have interesting implications for the prevention of obesity based on the population [39].

The main recommendations of WHO in the field of child nutrition are: exclusively breastfeeding from birth to 6 months, the introduction of complementary foods from 6 months with continuation of breastfeeding up to 2 years, feeding the child with healthy food by the extent of growing up, limiting the consumption of fats, sugars and salt, daily consumption fruits, vegetables, legumes, whole-grain products. Physical activity at all stages of human life contributes to the prevention of chronic non-infectious diseases. Adherence and good physical activity skills that a child has acquired in childhood and adolescence are more likely to survive in adulthood. On the basis of scientific data, the recommended level of physical activity from moderate to high activity for children and adolescents was developed, which is not less than 60 minutes per day [40].

Given the role of overweight and obesity in the development of non-communicable diseases, one of WHO's six global goals on nutrition, to achieve by 2025 is to counteract the growth of childhood obesity, that is, to achieve a 0% increase in the prevalence of childhood obesity [41].

2.6 Prevalence of overweight and obesity in childhood

Now the situation like this: over 340 million children and adolescents aged 5-19 were overweight or obese in 2016. The prevalence of overweight and obesity among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The rise has occurred similarly among both boys and girls: in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016 [7]. Deshmukh-Taskar (2006) found that over 60% of children with overweight in the pre-pubertal period have a significantly greater risk of overweight in adulthood, leading to the early emergence of noncommunicable diseases and increased costs of the service health care for long-term treatment [42].

The recent systematic study presents a complete picture of trends in mean BMI and prevalence of BMI categories that cover a severe range of obesity among children and adolescents aged 5-19 years, for all countries of the world with the longest observational period and compare trends with those adults. In 2017, Abarca-Gómez and co-workers demonstrated in his study increasing trends in the BMI of children and adolescents in many high-income countries, albeit at a high level, but accelerated in parts of Asia. Overall, this globally systematic
study highlight existing specific initiatives by governments, community groups, schools, and prominent individuals that have increased public awareness of overweight and obesity in children, leading to changes in diet and activities that are sufficient to contain the growth of the average BMI in countries with high and middle-income [43].

A recent systematic literature review concluded a significant difference in the prevalence of child nutrition and obesity from 2.9% to 44.4% in different countries [21,44,45]. Lithuania has participated in all four rounds of COSI data collection of first-formers in randomly selected schools in all districts. In an analysis of Tutkuvienë (2007) found the prevalence of overweight varied from 1.5%/2.6% up to 10.5%/9.9% in girls/ boys in 1985 and 2000 years respectively. The prevalence of obesity varied from 0.0%/0.0% up to 2.9%/4.37% in 1985/2000 years [46]. In a recent cross-sectional study, Smetanina (2016) investigated whether that the prevalence of underweight, overweight, and obesity among boys and girls was 6.9 and 11.7%, 12.6 and 12.6 % and 4.9 and 3.4%, respectively. All research was conducted in the Kaunas region, Lithuania. In this study, she concluded that obesity was significantly more prevalent in the 7-9 years old group (6.7 and 4.8 % in boys and girls, respectively) [47].

In Lithuania assessments from the first round (2007/2008) of the WHO European Childhood Obesity Surveillance Initiative (COSI) show that among 7-year-olds, 24.8% of boys and 21.0% of girls were overweight and 9.4% and 7.2%, respectively, were obese. In the 2009/2010 school year, according to the protocol to WHO COSI study a total of 3,779 children, aged between 6 and 9 years, were measured and the IOTF cut-offs were used [48]. Between 2008 and 2013 in Lithuania, the levels of overweight and obesity were not high and there remained a sizeable proportion of children who are underweight. On the 9th and 11th COSI meeting (June 2016), Lithuanian representatives showed and reported about the latest developments and the process of collecting data for the project. The fieldwork in Lithuania was carried out in all 10 counties as in previous rounds.

2.7 Body mass index criteria for measuring overweight and obesity in children

There are two worldwide used BMI cut-offs criteria to access children nutritional status, the one developed by Cole et al. [49] and adopted by the International Obesity Task Force (IOTF), and the criteria from World Health Organization (WHO), that are divided in two growth references, one from 0-60 months [1] and other from 5-19 years (50).
Table 2.7.1 Two main international cut-offs for evaluation of BMI for children

<table>
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<tr>
<th>Organization</th>
<th>Definition of Childhood Obesity</th>
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<tbody>
<tr>
<td>World Health Organization</td>
<td>WHO Reference (ages 5 to 19) [6]</td>
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<tr>
<td></td>
<td>• Underweight: BMI &lt; 2 standard deviations below the WHO growth standard median</td>
</tr>
<tr>
<td></td>
<td>• Overweight: BMI &gt; 1 standard deviation above the WHO growth standard median</td>
</tr>
<tr>
<td></td>
<td>• Obese: Body mass index (BMI) &gt; 2 standard deviations above the WHO growth standard median</td>
</tr>
<tr>
<td>International Obesity Task Force</td>
<td>• Provides international BMI cut points by age and sex for overweight and obesity for children age 2 to 18 [51]</td>
</tr>
</tbody>
</table>

Data on prevalence showed great differences not only between the criteria but also within the limits of the criterion with age. However, a higher prevalence of underweight was detected with both sexes for both sexes, and WHO estimated a higher prevalence for overweight and obesity, and in both sexes. Earlier [52] noted a change in age within the limits of the criteria and confirmed the need for prudence when comparing the BMI groups that differ in age. With regard to overweight and obesity, there were also significant differences between the methods [53–56]. Discrepancies between the criteria may arise due to differences in the data sets used in its development, in the smoothing methods and in the approach to setting the cut-off points [56,57]. At the age of 6 to 10 years, the IOTF criteria for obesity are usually higher than the values of the CDC or WHO criteria. This may explain a lower prevalence estimate obtained with IOTF. WHO criteria may be preferably used at the population level to classify groups of individuals as obese or overweight [58].
3. METHODS

3.1 Study design

In carrying out the survey two types of research were performed:
- Objective anthropometrical measurements of children;
- Cross-sectional survey of children using Family questionnaire.

The study was conducted from March 2019 to April 2019 in Astana (Kazakhstan). The participants of the survey were 7-8-year-old children and their parents.

This final work consists of two parts. The first part includes analysis of an objective instrumental survey of children in schools of Astana (Kazakhstan) and Vilnius (Lithuania). For the comparison of growth parameters, the analogical anthropometric data of the 2016-year survey in Lithuanian were used.

The second part of the final work covers the analysis of lifestyle of 7-8-year-old children in Astana and the links between their nutritional status (according to BMI), nutrition habits and physical activity.

3.2 Investigation of schoolchildren

Anthropometric measurements of study participants were done at schools in Kazakhstan. The measurements performed following the protocol created by country principal investigators and by using standardized equipment, recommended by WHO. All measurements were carried out of children dressed in vests and pants. Height measured to the nearest 0.1 cm using a portable SECA stadiometer (Seca®214). The measurement procedure was as follows: the feet were placed together with heels, buttocks and shoulder blades against the wall and head in the Frankfurt plane with an anthropometric square. The head was unscratched and the child was encouraged to relax the shoulders and breathe normally. The timing of the measurements was in the mornings or early afternoons. An average of three readings was taken. Weight was measured once with electronic SECA scales (SECA 899) to the nearest 0.1 kg. Waist circumference and hip circumference measured in centimeters and recorded to the last completed millimeter (0.1 cm) by non-elastic tape with a blank lead. The information recorded on to personal recording sheet.

Data of study participants' dietary habits, physical activity, and other children’s lifestyle peculiarities were collected by Family questionnaire, which was formed of modified WHO questionnaires (created by COSI study groups). The modified and shortened questionnaire
included questions about nutrition habits (ex., “How often does your child eats breakfast?”) and peculiarities of physical activity (ex., “Is your child involved in some sport or dancing club activities?”) of children.

3.3 Organization of the survey

The permissions of the Bioethics Committee from LSMU and the Republic of Kazakhstan for organizing the survey were obtained. Considering that the majority of children in the target age group (7-8 years old) are studying in both the first and second grades, it was decided to recruit children of these first two grades. The survey questionnaires were translated from English to Kazakh and Russian languages. The consent from the school principals with the indication of the purpose, objectives, description of the procedure for the survey of schoolchildren was taken before the beginning of the study. Parents were fully informed about all research procedures. A passive method of informed consent was used, which provided information about the study in the form of a letter and in case of the parents refusing the child to participate in the study, the parents return the signed letter with the refusal within the specified time frame. Confidentiality of all data collected and archived was guaranteed. Identification numbers are assigned to children, and in all registries, only these numbers are indicated. Parents can learn about the growth and body weight of their children upon request. The names of the children were not included in the electronic data files. On the day of the survey, the oral consent of the children to take measurements was asked.

Inclusion criteria:
- Age 7-8 years old;
- Lives in (Astana) Kazakhstan and (Vilnius) Lithuania;
- Absence of any chronic, endocrine or genetic diseases which might influence weight and metabolism;
- No long-term (> 1 month) treatment with glucocorticoids orally or intravenously;
- Study agreement consent is written by his/her parents.

3.4 Statistical analysis

This survey includes anthropometric data of 346 7-8 years old school-children from schools of Astana and Vilnius. Analysis includes growth parameters of children from Astana (Kazakhstan) and Vilnius (Lithuania) of the same age.
Statistical analysis was performed using the SPSS version 20.0 software package for Windows. Categorical variables were expressed as numbers and percentages. The association between nutritional status of children and the possible explanatory variables (dietary and physical activity/inactivity) were analyzed through the Pearson chi-square test. The two-sided z tests with Bonferroni correction were used to assess differences between study groups.

Body mass index (BMI) was calculated by using the standard equation: \( \text{BMI} = \frac{\text{weight (kg)}}{\text{height (m}^2)} \). The BMI category (underweight (thinness grade 3 (very very thin), thinness grade 2 (very thin), thinness grade 1), normal, overweight, and obesity) was defined using a type of the cut-offs IOTF criteria according to age and gender. The degrees of overweight and obese children were combined into one elevated weight group for getting more significant results. During the analysis, all three degrees of the thinness of children were combined into one underweight group. The decision to combine three different degrees of thinness into one was made since a small number of children were found in these groups and there is not much importance in order to keep them in different groups for further analysis. A p-value <0.05 was considered significant.
4. RESULTS

4.1 Characteristics of study participants

The study population includes 346 7-8 years old children from Vilnius (Lithuania) and Astana (Kazakhstan). Both groups of children are living in capitals. The sample size of the study participants is equal in Vilnius and Astana. Table 4.1.1 shows the distribution of study participants in Vilnius and Astana by gender.

Table 4.1.1 Distribution of study participants according to gender

<table>
<thead>
<tr>
<th>Country</th>
<th>Boys, number (%)</th>
<th>Girls, number (%)</th>
<th>Total, number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>87 (25.1)</td>
<td>85 (24.6)</td>
<td>172 (49.7)</td>
</tr>
<tr>
<td>Astana</td>
<td>88 (25.4)</td>
<td>86 (24.9)</td>
<td>174 (50.3)</td>
</tr>
<tr>
<td>Total</td>
<td>175 (100.0)</td>
<td>171 (100.0)</td>
<td>346 (100.0)</td>
</tr>
</tbody>
</table>

According to the collected data, 216 (62.5%) children of 7 years and 130 (37.5%) children of 8 years were included in the study. The mean age of all study participants is 7.4±0.4 years. Table 4.1.2 shows the distribution of study participants in Vilnius and Astana by age.

Table 4.1.2 Distribution of study participants according to age

<table>
<thead>
<tr>
<th>Country</th>
<th>7 years, number (%)</th>
<th>8 years, number (%)</th>
<th>Total, number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>114 (52.8)</td>
<td>58 (44.6)</td>
<td>172 (49.7)</td>
</tr>
<tr>
<td>Astana</td>
<td>102 (47.2)</td>
<td>72 (55.4)</td>
<td>174 (50.3)</td>
</tr>
<tr>
<td>Total</td>
<td>216 (100.0)</td>
<td>130 (100.0)</td>
<td>346 (100.0)</td>
</tr>
</tbody>
</table>
4.2 Analysis of anthropometric data of children in Astana and Vilnius

According to the collected data, the average weight of all children is 28.4±5.2 kg. The distribution of the average weight of boys and girls is different. In addition, comparing the data of children from Astana and Vilnius differences in body weight of study participants is observed. According to the collected data, the average weight of children in Astana is a bit higher than in Vilnius, p<0.05 (Table 4.2.1). Almost the same average weight of boys and girls is found in Astana, p= 0.036; however, the average weight of boys in Vilnius is higher than girls, p= 0.027.

Table 4.2.1 Average weight of schoolchildren by gender and country

<table>
<thead>
<tr>
<th>Country</th>
<th>Gender</th>
<th>N</th>
<th>Average weight±SD (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vilnius (Lithuania)</strong></td>
<td>Boys</td>
<td>87</td>
<td>29.2±5.3**</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>85</td>
<td>27.1±4.2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>172</td>
<td>28.1±4.9</td>
</tr>
<tr>
<td><strong>Astana (Kazakhstan)</strong></td>
<td>Boys</td>
<td>88</td>
<td>28.6±5.4***</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>86</td>
<td>28.5±5.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>174</td>
<td>28.6±5.4*</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Boys</td>
<td>175</td>
<td>28.9±5.3</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>171</td>
<td>27.8±4.9</td>
</tr>
</tbody>
</table>

* p<0.05 in comparison with total number in Vilnius
** p<0.05 in comparison with girls in Vilnius
*** p<0.05 in comparison with girls in Astana

In the course of the study, it was revealed that the distribution of the average weight of boys and girls of the same age is different. So, 7 years old boys and girls have approximately the same average weight. But the boys of 8 years old have predominantly greater weight compared with the same age girls, p= 0.04 (Table 4.2.2).
Table 4.2.2 Distribution of boys according to age and average weight

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>N</th>
<th>Average weight ±SD (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>7 years</td>
<td>112</td>
<td>27.9±5.3</td>
</tr>
<tr>
<td></td>
<td>8 years</td>
<td>63</td>
<td>30.6±5.0</td>
</tr>
<tr>
<td>Girls</td>
<td>7 years</td>
<td>104</td>
<td>27.1±5.2</td>
</tr>
<tr>
<td></td>
<td>8 years</td>
<td>67</td>
<td>28.8±4.3</td>
</tr>
</tbody>
</table>

Based on collected data, the difference in the average weight of 7 and 8-year-old study participants also turned out to be different, so the weight of 8 years old children is higher than the weight of 7 years old children, p= 0.0297. The average weight of all children in Kazakhstan and Lithuania showed almost the same average weight in children of 7 years old in both countries. However, Astana schoolchildren of 8 years old have an average weight higher than children of the same age in Vilnius, p= 0.039 (Table 4.2.3).

Table 4.2.3 Average weight of schoolchildren aged 7-8 years according to age and country

<table>
<thead>
<tr>
<th>Country</th>
<th>Age</th>
<th>N</th>
<th>Average weight±SD (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>7 years</td>
<td>114</td>
<td>27.8±5.2</td>
</tr>
<tr>
<td></td>
<td>8 years</td>
<td>58</td>
<td>28.8±4.1</td>
</tr>
<tr>
<td>Astana</td>
<td>7 years</td>
<td>101</td>
<td>27.2±5.3</td>
</tr>
<tr>
<td></td>
<td>8 years</td>
<td>73</td>
<td>30.5±5.1</td>
</tr>
<tr>
<td>Total</td>
<td>7 years</td>
<td>216</td>
<td>27.5±5.2</td>
</tr>
<tr>
<td></td>
<td>8 years</td>
<td>130</td>
<td>29.7±4.8</td>
</tr>
</tbody>
</table>

According to the collected data, the average height by age of children also showed that children 8 years old are higher than children of 7 years old, p= 0.049 (Table 4.2.4).
Table 4.2.4 Average height of study participants by age

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Average height ±SD (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 years</td>
<td>216</td>
<td>129.5±4.5</td>
</tr>
<tr>
<td>8 years</td>
<td>130</td>
<td>132.5±4.6</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>130.6±4.8</td>
</tr>
</tbody>
</table>

The average height in Vilnius (Lithuania) and Astana (Kazakhstan) showed almost the same average height of children in both countries, p= 0.27 (Table 4.2.5).

Table 4.2.5 Distribution of schoolchildren according to average height in Vilnius and Kazakhstan

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>Average weight ±SD (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>172</td>
<td>131.1±5.1</td>
</tr>
<tr>
<td>Astana</td>
<td>174</td>
<td>130.1±4.3</td>
</tr>
</tbody>
</table>

According to the collected data, the boys’ average height is higher than the average height of girls in total, p= 0.047. However, the average height has not strong differences of all school children of Vilnius (Lithuania) and Astana (Kazakhstan), p= 0.27 (Table 4.2.6).

Table 4.2.6 Distribution of schoolchildren aged 7-8 years according to average height and age in Vilnius and Astana

<table>
<thead>
<tr>
<th>City</th>
<th>Gender</th>
<th>N</th>
<th>Average weight ±SD (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>Boys</td>
<td>87</td>
<td>132.6±4.9</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>85</td>
<td>129.6±5.0</td>
</tr>
<tr>
<td>Astana</td>
<td>Boys</td>
<td>88</td>
<td>130.2±4.5</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>86</td>
<td>130±4.1</td>
</tr>
<tr>
<td>Total</td>
<td>Boys</td>
<td>175</td>
<td>131.4±4.8</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>171</td>
<td>129.8±4.5</td>
</tr>
</tbody>
</table>
According to the collected data, the average BMI by gender shows that the average BMI of boys is almost the same with girls, p= 0.36 (Table 4.2.7).

**Table 4.2.7 Average BMI of study participants by gender**

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Average BMI±SD (kg / m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>175</td>
<td>16.6±2.2</td>
</tr>
<tr>
<td>Girls</td>
<td>171</td>
<td>16.4±2.1</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>16.5±2.2</td>
</tr>
</tbody>
</table>

Based on the collected data, the average BMI of children 8 years old is slightly higher than the average BMI of 7 years old children, p= 0.037 (Table 4.2.8).

**Table 4.2.8 Average BMI of school children by age**

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Average BMI±SD (kg / m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 years</td>
<td>216</td>
<td>16.3±2.3</td>
</tr>
<tr>
<td>8 years</td>
<td>130</td>
<td>16.9±1.9</td>
</tr>
</tbody>
</table>

The distribution of average BMI in Lithuania and Kazakhstan showed that the mean BMI of children in Astana higher than in Vilnius, p= 0.037 (Table 4.2.9).

**Table 4.2.9 Average BMI of study participants by country**

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>Average BMI (kg / m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilnius</td>
<td>172</td>
<td>16.2±2.1</td>
</tr>
<tr>
<td>Astana</td>
<td>174</td>
<td>17.6±2.2</td>
</tr>
</tbody>
</table>

According to the data collected in this study, the majority of all study participants have normal body weight. However, one-fifth of children are overweight or obese. Every tenth of children is underweight (Fig. 4.2.1).
The distribution of all study participants according to their nutritional status, evaluated by BMI in two countries, Lithuania and Kazakhstan, showed that there is significant differences in normal weight of school-aged children in Vilnius (Lithuania) and Astana (Kazakhstan), $p=0.034$. In addition, there are more children with elevated weight in Astana than in Vilnius, $\chi^2=3.79$, $df=1$, $p=0.04$ (Fig. 4.2.2).

**Fig. 4.2.1** Distribution of all analyzed schoolchildren aged 7-8 years by nutrition status

**Fig. 4.2.2** Distribution of all analyzed schoolchildren aged 7-8 years by nutrition status and country

$p^*<0.05$ in comparison with children in Vilnius; $p^{**}<0.05$ in comparison with children in Astana
According to the collected data, the distribution of all study participants according to their nutritional status and gender, evaluated by BMI in Lithuania and Kazakhstan, showed that there is significant differences in normal weight of boys in Vilnius (Lithuania) and Astana (Kazakhstan), \( p=0.04 \), however, there are more boys and girls with elevated weight in Astana than in Vilnius, \( p=0.03 \). In addition, there is significant differences found of underweight boys in Vilnius and Astana (\( p=0.027 \)) (Fig. 4.2.3). However, there is no association found in children of underweight, normal and elevated weight between 7 and 8 years old in Vilnius and Astana \( p=0.367 \).

![Fig. 4.2.3 Distribution of all analyzed schoolchildren aged 7-8 years by gender, nutrition status and country](image)

\( \chi^2=2.98, \, df=2, \, p^*<0.05 \) in comparison with boys in Astana; \( p^{**}<0.05 \) in comparison with boys in Vilnius; \( p^{***}<0.05 \) in comparison with girls in Vilnius; \( p^#<0.05 \) in comparison with boys in Vilnius.

So, school-aged children from Vilnius and Astana showed different average weight of 7 years children and 8 years children (\( p=0.039 \)). Also, it was found that study participants have almost the same average height in both countries (\( p=0.275 \)). The prevalence of children with elevated weight was 22.4% in Astana and 17.4% in Vilnius (\( p=0.04 \)).
4.3 Assessment and analysis of the links between the nutritional status and lifestyle of children in Astana

Dietary habits of 7-8-year-old children in Astana

Further analysis in our study is performed on the data from the schools of Astana. The assessment and relationship between the nutritional status and lifestyle of 7 and 8 years old children in Astana is considered.

The analysis of data of Family questionnaire in Astana (Kazakhstan) about dietary habits showed that only 8.6% of schoolchildren had their breakfast every day; most days (4-6 days per week) had breakfast at home one third of schoolchildren and less than half – sometimes (1-2 days per week). Additionally, there are no differences found in the daily breakfast consumption according to gender (p= 0.37).

![Fig. 4.3.1 Distribution of children by gender on breakfast consumption per week](image-url)

According to collected data, as seen in Fig. 4.3.2, parents’ statements on the frequency of breakfast consumption, 11.7% of said that their child never eats breakfast, 76.5% of parent’s state that their children have breakfast some or most days, while only 8.4% of them stated that their child eats breakfast every day.
Fig. 4.3.2 Distribution of children by nutritional status and breakfast consumption per week

\[ p^* < 0.0001 \] compared with normal weight

Also, breakfast eating rate analysis showed that schoolchildren aged 7-8 years with elevated weight skipped breakfast more often than those of normal children (23.1% and 10.4% respectively).

Children’s food and beverage consumption, according to Family questionnaire, are presented in Table 4.3.1. 36.3% of children eat vegetables (excluding potatoes) most of the days or every day, 44.1% of them have stated that their children eat vegetables some days per week, and 16.2% of children eat vegetables less than once a week or never. It can be observed that in spite of the recommendation on daily consumption of fresh fruit and vegetables, only 38.6% of children consume fresh fruits four or more days a week, while 38.5% eat fresh fruits some days a week and 19.6% less than once a week. The consumption of freshly squeezed juice is only 5.6% of school-aged children of Astana. An important indicator is the parents' statement that their children do not consume drinks in the form of flavored milk, sugar drinks (lemonade) and low-calorie drinks (such as light Coca-Cola) every day. Recommendations on the use of these beverages at least once a week, and it is better not to use them at all. Furthermore, parents have stated that their children drink a natural home-grown fat dairy on daily basis in 1.7% of children, at the same time 9.5% of children consume yogurt, curd, white cheese daily. Additionally, 22.3% of the surveyed children consume meat most days, and 26.8% of children consume meat on a daily basis. 25.7% of children eat meat less than once a week and 2.8% never. Results related to fish consumption are significantly lower, 8.4% of children consume fish most or every day,
while only 3.4% children consume fish every day, and 57.6% of children eat fish less than once a week or never. However, the frequency of consuming cheese snacks is higher, 21.3% of children eat cheese snacks every day or most of the days in the week. When it comes to sweets, the results are different. Only 11.2% of children eat chocolate, candy, and other sweets daily or on most of the days in the week and 27.4% of children between one and three days a week. And lastly, the proportion of 1.1% of children eat fast/fried foods such as pizza or French fries most of the days or every day, 17.3% of children between one and three days a week and 46.4% less than once a week and 31.8% never.
### Table 4.3.1 Distribution of participants by food and beverage consumption frequencies according to Family questionnaire

<table>
<thead>
<tr>
<th>Food/ Drinks</th>
<th>Never (%)</th>
<th>Less than once a week (%)</th>
<th>Some days (1-3 days/week) (%)</th>
<th>Most days (4-6 days/week) (%)</th>
<th>Every day (%)</th>
<th>Total (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh fruit</td>
<td>0.0</td>
<td>19.6</td>
<td>38.5</td>
<td>23.5</td>
<td>15.1</td>
<td>173</td>
</tr>
<tr>
<td>Vegetables (excluding potatoes)</td>
<td>1.7</td>
<td>14.5</td>
<td>44.1</td>
<td>20.1</td>
<td>16.2</td>
<td>173</td>
</tr>
<tr>
<td>100% of the juice</td>
<td>7.3</td>
<td>40.8</td>
<td>30.7</td>
<td>11.7</td>
<td>5.6</td>
<td>172</td>
</tr>
<tr>
<td>Flavored milk drink</td>
<td>35.2</td>
<td>38.5</td>
<td>21.8</td>
<td>1.1</td>
<td>0.0</td>
<td>173</td>
</tr>
<tr>
<td>Sugar beverages (lemonade)</td>
<td>48.6</td>
<td>30.2</td>
<td>15.1</td>
<td>2.2</td>
<td>0.0</td>
<td>172</td>
</tr>
<tr>
<td>Low caloric beverages (such as light coca cola)</td>
<td>69.8</td>
<td>23.5</td>
<td>2.8</td>
<td>1.1</td>
<td>0.0</td>
<td>172</td>
</tr>
<tr>
<td>A natural home-grown or grown-up fat dairy (3.5%)</td>
<td>20.7</td>
<td>45.3</td>
<td>17.9</td>
<td>11.2</td>
<td>1.7</td>
<td>173</td>
</tr>
<tr>
<td>Meat</td>
<td>2.8</td>
<td>25.7</td>
<td>19.0</td>
<td>22.3</td>
<td>26.8</td>
<td>173</td>
</tr>
<tr>
<td>Fish</td>
<td>8.4</td>
<td>49.2</td>
<td>27.9</td>
<td>8.4</td>
<td>3.4</td>
<td>174</td>
</tr>
<tr>
<td>Low and medium fat milk (1-2.5%)</td>
<td>10.1</td>
<td>35.8</td>
<td>22.3</td>
<td>19.0</td>
<td>10.1</td>
<td>174</td>
</tr>
<tr>
<td>Chicken</td>
<td>4.5</td>
<td>49.2</td>
<td>25.7</td>
<td>14.0</td>
<td>3.9</td>
<td>174</td>
</tr>
<tr>
<td>Red meat (pork, beef, lamb, game, etc.)</td>
<td>8.4</td>
<td>50.3</td>
<td>27.9</td>
<td>9.5</td>
<td>1.1</td>
<td>172</td>
</tr>
<tr>
<td>Chocolate/sweets</td>
<td>14.0</td>
<td>44.7</td>
<td>27.4</td>
<td>11.2</td>
<td>0.0</td>
<td>174</td>
</tr>
<tr>
<td>Fast food (pizza, fries, fries, roasted potatoes, hamburgers, hot dogs)</td>
<td>31.8</td>
<td>46.4</td>
<td>17.3</td>
<td>1.1</td>
<td>0.0</td>
<td>173</td>
</tr>
<tr>
<td>Cheese snacks (potato chips, spiked maize, peanuts</td>
<td>7.8</td>
<td>40.2</td>
<td>27.9</td>
<td>17.9</td>
<td>3.4</td>
<td>174</td>
</tr>
<tr>
<td>Yogurt, curd, white cheese, etc. dairy products</td>
<td>10.1</td>
<td>38.5</td>
<td>24</td>
<td>15.1</td>
<td>9.5</td>
<td>174</td>
</tr>
</tbody>
</table>
Food preferences by nutritional status and gender are shown in Tables 4.3.2 the consumption of vegetables is not having strong differences compared consumption of fresh fruits in school children of both sexes. A difference in the consumption of meat of girls with underweight, normal weight, and elevated weight was found in comparison with boys, $p=0.036$. But, generally, schoolchildren consume meat almost equally high regardless of weight which cannot be noted in fish consumption. Most children do not follow the recommendations of a healthy diet when consuming fish and the proportion of children consuming this product is low among children of Astana. According to collected data, a difference in the consumption of the low and medium fat milk (1-2.5%) of boys with underweight, normal weight, and elevated weight was found in comparison with girls, $p=0.023$.

Table 4.3.2 Proportion of children using recommended foods at least 4 days a week by nutritional status and gender

<table>
<thead>
<tr>
<th>Food/ Drinks</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Elevated weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>30.0</td>
<td>30.0</td>
<td>39.3</td>
</tr>
<tr>
<td>Green and boiled vegetables (except potatoes)</td>
<td>50.0</td>
<td>60.0</td>
<td>30.4</td>
</tr>
<tr>
<td>100 percent of the juice</td>
<td>0.0</td>
<td>10.0</td>
<td>19.7</td>
</tr>
<tr>
<td>Low and medium fat milk (1-2.5%)</td>
<td><strong>40.0</strong></td>
<td>20.0</td>
<td><strong>30.3</strong></td>
</tr>
<tr>
<td>Meat products</td>
<td>50.0</td>
<td><strong>60.0</strong></td>
<td>48.2</td>
</tr>
<tr>
<td>Fish products</td>
<td>20.0</td>
<td>0.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Chicken</td>
<td>0.0</td>
<td>0.0</td>
<td>17.9</td>
</tr>
<tr>
<td>A natural home-grown or grown-up fat dairy (3.5%)</td>
<td>10.0</td>
<td>0.0</td>
<td>11.6</td>
</tr>
<tr>
<td>Yogurt, curd, white cheese, etc. dairy products</td>
<td>20.0</td>
<td>20.0</td>
<td>23.3</td>
</tr>
</tbody>
</table>

$p^* < 0.05$ in comparison with the boys; $p^{**} < 0.05$ in comparison with the girls
According to the collected data (Table 4.3.3), girls with underweight and elevated weight consume higher intake of chocolate/ sweets and cheese snacks compared to boys, p= 0.027. The consumption of other products is mostly the same of underweight, normal weight and elevated weight children and has not significant differences in it.

Table 4.3.3 Proportion of children using non recommended foods at least once a week by nutritional status and gender

<table>
<thead>
<tr>
<th>Food/ Drinks</th>
<th>Underweight Boys</th>
<th>Underweight Girls</th>
<th>Normal weight Boys</th>
<th>Normal weight Girls</th>
<th>Elevated weight Boys</th>
<th>Elevated weight Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beverages (lemonade)</td>
<td>0.0</td>
<td>10.0</td>
<td>19.7</td>
<td>11.9</td>
<td>27.8</td>
<td>38.1</td>
</tr>
<tr>
<td>Red meat (pork, beef, lamb, game, etc.)</td>
<td>50.0</td>
<td>40.0</td>
<td>35.7</td>
<td>42.4</td>
<td>38.9</td>
<td>38.0</td>
</tr>
<tr>
<td>Chocolate/sweets</td>
<td>20.0</td>
<td>60.0*</td>
<td>42.9</td>
<td>35.6</td>
<td>33.3</td>
<td>47.6*</td>
</tr>
<tr>
<td>Fast food (pizza, fries, fried, roasted potatoes, hamburgers, hot dogs)</td>
<td>10.0</td>
<td>0.0</td>
<td>17.9</td>
<td>27.1</td>
<td>16.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Cheese snacks (potato chips, spiked maize, peanuts)</td>
<td>40.0</td>
<td>60.0*</td>
<td>57.1</td>
<td>42.3</td>
<td>42.8</td>
<td>61.1*</td>
</tr>
</tbody>
</table>

p* < 0.05 in comparison with boys

Based on the collected data (Table 4.3.4), children with elevated weight consume significantly high intake of sugary beverages and fast food in comparison with underweight children in Astana, p= 0.0214.
Table 4.3.4 Proportion of children using non recommended foods at least once a week by nutritional status

<table>
<thead>
<tr>
<th>Food/ Drinks</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Elevated weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beverages (lemonade)</td>
<td>5.0</td>
<td>14.8</td>
<td>33.4*</td>
</tr>
<tr>
<td>Red meat (pork, beef, lamb, game, etc.)</td>
<td>45.0</td>
<td>39.2</td>
<td>38.4</td>
</tr>
<tr>
<td>Chocolate/sweets</td>
<td>40.0</td>
<td>39.2</td>
<td>41.1</td>
</tr>
<tr>
<td>Fast food (pizza, fries, roasted potatoes, hamburgers, hot dogs)</td>
<td>5.0</td>
<td>28.0</td>
<td>15.4*</td>
</tr>
<tr>
<td>Cheese snacks (potato chips, spiked maize, peanuts)</td>
<td>50.0</td>
<td>50.5</td>
<td>51.3</td>
</tr>
</tbody>
</table>

* p < 0.05 in comparison with underweight children

Physical activity of school-aged children in Astana (Kazakhstan)

Regular physical activity is an important factor in the prevention of obesity. Regular habits of physical activity can develop in school-age children in various ways, such as participating in sports/dance activities or reducing the time spent on sedentary activities. Another way to control the level of physical activity of children is to track the time spent on sedentary activities, such as doing homework on weekdays/weekends, and the frequency of physical activity at school. According to Table 4.3.5, more than half of family houses are located at a distance of up to 4 km from the school, the rest a little further.
Table 4.3.5 Distribution of children by distance between the school and home, according to a family questionnaire

<table>
<thead>
<tr>
<th>Distance</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 km</td>
<td>5</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>%</td>
<td>6</td>
<td>13.3</td>
<td>9.8</td>
</tr>
<tr>
<td>1-2 km</td>
<td>27</td>
<td>34</td>
<td>61</td>
</tr>
<tr>
<td>%</td>
<td>32.1</td>
<td>37.8</td>
<td>35.1</td>
</tr>
<tr>
<td>3-4 km</td>
<td>28</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>%</td>
<td>33.3</td>
<td>22.2</td>
<td>27.6</td>
</tr>
<tr>
<td>5-6 km</td>
<td>6</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>%</td>
<td>7.1</td>
<td>8.9</td>
<td>8.0</td>
</tr>
<tr>
<td>More than 6 km</td>
<td>11</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>%</td>
<td>13.1</td>
<td>11.1</td>
<td>12.1</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>90</td>
<td>174</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

With regard to active transport to school (walking or cycling), presented in Table 4.3.6, almost every second child, 75 (43%) children out of 173 of them, go to school either by bus or parents' driving, 32% of children combines walking or riding with coming to school by bike or private transport, and only 25% of children aged 7-8 years go to school on foot or by bike.

Table 4.3.6 Distribution of children by way of transportation to school, according to a family questionnaire

<table>
<thead>
<tr>
<th>Transportation to school</th>
<th>Going on foot or riding a bike</th>
<th>%</th>
<th>Carried by private or public transport</th>
<th>%</th>
<th>Combination of walking/riding a bike or carried by public/private transport</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>21</td>
<td>25.3</td>
<td>41</td>
<td>49.3</td>
<td>21</td>
<td>25.3</td>
<td>83</td>
<td>100</td>
</tr>
<tr>
<td>Girls</td>
<td>22</td>
<td>24.4</td>
<td>34</td>
<td>37.8</td>
<td>34</td>
<td>37.8</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>24.8</td>
<td>75</td>
<td>43.3</td>
<td>55</td>
<td>31.8</td>
<td>173</td>
<td>100</td>
</tr>
</tbody>
</table>
According to collected data, more than half of the children do not attend any sports sections. At the same time, sports club attendance is more common in boys than in girls (p=0.029). According to collected data, there is no association found between attendance in sport/dance clubs and elevated weight of children (p=0.239). However, according to the collected data, 79(87%) of children spend from 1 to 2 hours per week participating in physical activities within a sports or dance club, and the duration of girls’ activity is higher than that of boys. So, only 11(12%) children spend 3-4 hours per week participating in sport/dance clubs. In regards to the attendance of children at sport/dance clubs, the significant result found between underweight, normal weight and elevated weight children. So, the children with elevated weight do not spend 3 or more hours in sport/dance clubs in comparison with underweight and normal weight children, (p=0.036).

**Fig. 4.3.3** Distribution of children by nutritional status and attendance of sport clubs

*p* < 0.05 in comparison with elevated weight children

Active gaming habits are a key way to exercise in children’s free time and in the course of the data obtained, very low physical activity of children on weekdays and weekends was revealed. According to on the data, 43.1% of children, both boys, and girls spend less than 1 hour in an active game on weekdays and 30.4% spend about 1 hour in active gaming on weekends (p= 0.04). Physical activity was evaluated by the relation of sedentary time, as doing homework, reading the books daily/per week and active time spent in sports. Detailed analysis showed that sedentary time was not associated with gender (p=0.341). In addition, active sports gaming on weekends was more used by normal weight children than children with elevated...
weight (p= 0.037). Schools play a key role in providing youth the opportunity to be physically active and in turn achieve and maintain a healthy weight. Schools can help the children become more active by increasing the length of physical education classes, as well as integrating physical activity into lessons in other classes, and during breaks between lessons. However, according to the collected data, the association of nutritional status and the number of lessons of physical activity at school was not found (p=0.283).
5. DISCUSSION

The alarming growth trend in childhood obesity makes it a serious and pressing health problem, and therefore politicians in different parts of the world focus on various activities in the fields of education, medicine, and health, aimed at slowing its growth [55], [56]. However, the best way to develop and implement an effective strategy is to truly understand the condition. Health-related behavior associated with childhood obesity is determined by many factors; because family and school are considered the primary environmental environment for children, taking health initiatives through a multi-level approach that brings parents and guardians into schools will help fight the multifactor nature of childhood obesity [57]. The prevalence of overweight is high among school-age children throughout Europe, with growing trends and particularly alarming prevalence in southern European countries (such as Italy, Spain, Cyprus, and Greece) [44,54]. From the other side, the US Centers for Disease Control and Prevention (CDC), as well as some European centers, reported on the prevalence of overweight and obesity even declines, especially in children [62,63]. Using the IOTF criteria for pediatric BMI, we established the prevalence of elevated weight in 7-8 years old children of Astana (Kazakhstan) and Vilnius (Lithuania). The present study revealed a high frequency of elevated weight (22.4%) among school-age children in Astana (Kazakhstan) in comparison with Vilnius (Lithuania) children (17.4%). Comparing to data from a study by Vaitkeviciute, in 2019 in Lithuania, the prevalence of overweight, including obesity, among 7-8-year-old children is about 20% [64]. This indicator has increased significantly compared with 2008. At the same time, there was a slight increase in the prevalence of underweight children in Lithuania, and in 2016 it was about 10% [65], while the proportion of underweight children in Vilnius in our survey is 8.1%. Our study showed that elevated weight prevalence in school-age children was significantly higher in girls than boys in both countries (see Fig. 4.2.3). Of note, in most studies, using the WHO as compared to IOTF standards resulted in a significantly higher prevalence of overweight/obesity [66,67]. As compared with the data published in other countries, Lithuania still has the lowest prevalence of overweight among school-age children in Europe, being similar to that in Poland and Latvia [68,69]. However, according to Kazakhstan COSI report (2017) the prevalence of overweight among children 8 years old, including obesity, was 18.7% (18.6% boys and 18.7% girls) [38], [70]. Comparing to data from this report, in our study from Astana a higher prevalence of elevated weight was found in both sexes (21.4% of boys and 23.3% of girls). The Kazakhstan COSI report also provides data on the prevalence of overweight of school-age children in the urban and rural areas, 8.0% and 4.1% respectively [70,71], which was not done in our study.
It is known that maintaining a healthy lifestyle since childhood is of great importance for the prevention of obesity when many characteristics of adulthood are acquired and/or summarized in this age group, which makes it important to evaluate determining factors such as dietary habits and physical activity [71]. Regarding the latter, it is important to emphasize that the practice of physical activity among children should be constantly stimulated, since, although most diseases associated with a sedentary lifestyle occur only in adulthood, it is known that their development can begin in childhood or in adolescence [72]. According to our study, analysis of the frequency of meals for breakfast showed that schoolchildren aged 7–8 years old children with elevated weight skip breakfast more often than normal or underweight children (see Fig. 4.3.2). Whereas breakfast skipping is associated with increased weight, this observation explains the prevalence of overweight and obesity among boys and girls [44]. The present studies showed that only a third of children in Astana consume fresh fruits and vegetables 4 or more days a week. The significant results of our research were the ratio of the use of certain products and their relationship with elevated weight. Thus, the consumption of meat increased in all groups of children (UW, NW, and OW). This is due to the national characteristics of the Kazakh population since all traditional dishes are prepared exclusively with the addition of meat. For comparison, only 3.4% of parents indicated that their children consumed fish every day. In addition, most of the parents reported that their children do not use sugar beverages (lemonade), low caloric beverages (such as light coca cola), chocolate / sweets, fast food (pizza, fries, fries, roasted potatoes, hamburgers, hot dogs) every day, but still the use of such products at least once a week is associated with elevated weight in schoolchildren of 7-8 years old. Some scientists have noted that various restrictions can only be effective temporarily. For example, restricting the consumption of candy, junk or fatty foods for a longer period of time may have the opposite effect, that is, the child will prefer foods high in fat and sugar [73,74]. Since the cross-sectional design of our study does not allow drawing conclusions about the reasons, we can only assume that the children of our study are subject of strict parental control on the use of the above-mentioned products, but also the omission of other useful products. For example, only a few parents noted the use of a natural home-grown fat dairy (3.5%) every day by their child. It is also associated with the residence of children in such a large town as Astana. Also, our study shows that girls with the UN, NW, and OW consumed significantly more chocolate, sweets and cheese snacks than boys.

The twentieth century marked the emergence of a “universal” child, where children more or less are living in industrialized adult societies. As in most other countries, Kazakhstan has experienced significant changes in the family and at work, in the urban environment and the impact of globalization on national policies, lifestyles, food culture and level of physical activity.
Additionally, some studies show the societies display an increased tendency toward sedentary lifestyles, including resting, watching TV, traveling by car to and from school and performing less physical activity [75]. It has been shown that a sedentary lifestyle is associated with a higher BMI, weight gain and obesity in children and adolescents [76]. Some studies results highlighted TV screen-time association with overweight in children, and it was directly associated with having a television in the bedroom [77]. Some authors believe that the negative effect of using a TV/computer may be associated with an increase in the consumption of sweets and snacks, both because of the effect on eating behavior changes and because of the wider advertising of foods high in sugar and fat [78,79]. More than 50% of children's television commercials are food related, and watching television helps reduce energy costs and increase energy consumption [80]. A daily drive to and from school on foot or by bike can also contribute to children's physical activity and given the remoteness of the school from the house. According to the Kazakhstan COSI report [70], children living in rural and urban areas have not significant differences in gender and distance to/from school. Based on the data obtained, it was found that the distance from school to home for most children is from 1 to 4 km (see Table 4.3.5). Walking or cycling to/from school, known as active school transportation behavior, has been identified as a potential opportunity for the accumulation of moderate to vigorous physical activity among children and youth [81]. However, according to data collected, children in Astana prefer movement more by public and private cars or a combination of walking / riding a bike and carried by public/private transport (see Table 4.3.6). This can be explained by the fact the target group of our research was a child of 7 and 8 years old. Astana is one of the largest megacities of Kazakhstan, and parents often prefer to carry their children on personal or public transport for safety and pass the time on the road. Additionally, on the basis of data collected, we did not establish the association between nutritional status of school-age children and their attendance to sports/dance clubs. The results of the present study warrant further confirming no association between nutritional status groups and frequency of physical activity lessons at school.

**Strengths and limitations of the study**

One of the strengths of the study was the use of identical questionnaires and used validated measurement tools for assessing the study factors for the children of Astana and Lithuania. The strengths also included the use of multilevel models in examining the factors associated with the elevated weight of children taking into account a few aspects. One of the limitations of this study was that dietary habits and physical activity were evaluated in a cross-sectional study, so it was impossible to determine whether the cause or consequence of a higher BMI in children was.
addition, other characteristics of the child’s personality or character may influence eating habits. Furthermore, the questionnaire, which was designed, filled in by the parents themselves, so answers may be less reliable due to the bias of respondents. Objective anthropometric measurements of the representative sample of 7-8 years old children were performed using the standardized methodology for the comparison of children from Vilnius (Lithuania) and Astana (Kazakhstan). Due to historical and national features, Kazakhs differ in their dietary habits from other countries, but similar trends in overweight and obesity issues are becoming more and more relevant. The Kazakhstan COSI report [66] data showed trends of increasing rates of excess body weight and the presence of underweight. These problems are growing, but since parents are responsible and have the greatest influence on the diet of children in their early years, it is very important to determine how nutrition status is linked to physical development and dietary habits of children. In addition, in questions about the physical activity of children, use of computer was missing. The questions were only about reading books, preparing for the lessons and the time near the computers could not be considered as the inactive time of children by parents.
6. CONCLUSIONS

1) The average weight of school-aged children from Vilnius and Astana showed almost the same in children of 7 years old in both cities, but the average weight of 8 years old children in Astana was higher than of children of the same age in Vilnius (p= 0.039). It was found that study participants from Vilnius and Astana had almost the same average height in both countries (p= 0.275). The average BMI of 7 and 8 years old children in Astana is higher than in Vilnius; the prevalence of children with elevated weight in Astana is significantly higher than in Vilnius (22.4% and 17.4% respectively). The prevalence of overweight, including obesity in Astana among 7-8 years old girls is higher than among boys (23.3% and 21.4% respectively).

2) Most of the children in Astana have inappropriate eating habits and low physical activity, both at school and in their free time from school on weekdays and weekends. Girls consume breakfast every day slightly higher than boys 7 and 8 years old in Astana (5.2 % and 3.4 % respectively). In spite of the recommendation on daily consumption of fruit and vegetables, only one third (36.3%) of children in Astana consume vegetables four or more days a week and 38.6% of children eat fresh fruits most of the days or every day. Almost half (49.1%) of 7- and 8-years old children in Astana consume meat more than four days a week. Children with elevated weight in Astana consume a significantly high intake of sugary beverages and fast food in comparison with underweight children. Girls with underweight and elevated weight in Astana have a higher consumption of chocolate/ sweets and cheese snacks in comparison with boys.

3) One-fourth (23.1%) of children with elevated weight in Astana skipped daily breakfast in comparison with underweight children (10.4%). Children of 7 and 8 years old with the normal weight used to spend more time in active sports gaming on weekends than children with elevated weight. Spending 3 and more hours in sport/dance clubs is associated with underweight of children.
7. PRACTICAL RECOMMENDATIONS

1. In connection with the high prevalence of children with elevated weight among 7 and 8 years old children in Kazakhstan, requires careful regular follow-up of children with elevated weight. School-aged children with elevated weight should be screened and followed regularly for overweight-related complications.

2. As nutrition habits of children are not very healthy, the elevated weight strategy pediatric guidelines should be oriented to involve parents in Kazakhstan. Moreover, such a strategy should be the complexion of psychological coaching, dietary management and physical training/sedentary behavior reducing related to children with elevated weight and gender differences, probably for boys and girls separately.

3. Promoting healthy nutrition in Kazakhstan. The ongoing development and implementation of regional programs based on informing, introducing and disseminating behavioral patterns among children and their parents, promoting healthy food choices and limiting the consumption of foods rich in sugars, fats, and salt. Dietary management should include parental education and responsibility to motivate children by their pattern to have daily breakfast and eat regularly during the day.

4. Increase physical activity of children in Kazakhstan. It is necessary to introduce comprehensive programs promoting physical activity and restricting sedentary behavior among children of 7 and 8 years old, including creating an environment that is conducive to for walking, cycling, for exercise, for informal activities and sports.
8. REFERENCES


Dear parents, this study is carried out to the master thesis of Lithuanian University of Health Sciences. The purpose of the study is to monitor the growth of children, to study the nutritional and physical activity characteristics and associations between nutritional status and lifestyle of first grade children. This is a continuous international study, which is being conducted for the fourth time. The study involves 35 European Union countries (Belgium, Sweden, Norway, the United Kingdom, Italy, the Czech Republic, Slovenia, Latvia, Malta, Kazakhstan, etc.) Your child's class was randomly chosen to participate in this study, which will measure your child's height and weight. Please respond to the questions in the questionnaire. Each of your participation is very important to us, in order to ensure that the research data are reliable and represent Lithuania.

We kindly ask you to fill out this form and return the children's classroom teachers at least a week later. By submitting the data, you agree to participate in the study. We ensure that the information provided by you is completely confidential and will use only for research purposes, accessible only to the encoding person, who uploads the data to the computer database. Data analyzed will provide digital codes instead of personal information. By collecting the questionnaire data to the computer database, the personal data of all the investigators will be destroyed immediately. Investigator of research Meruyert Saberbekova (MPH student of LSMU). Sincerely thank you for the cooperation.

(Underline the answer or select ☑)

Meruyert Saberbekova  
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tel. +77072488892  
msaberbekova@gmail.com

1. Your child's name ...................., surname ..................................., nationality .....................
2. Your child's date of birth: 20........ y. ....................... month ....... d
3. How do you assess the current weight of your child?  
   1) insufficient     2) normal     3) slightly excessive     4) very excessive
4. How do you assess the current health of your child?
1) great 2) good 3) moderate 4) bad

5. Does your child often have breakfast at home?
   1) never 2) sometimes (1-3 days per week) 3) usually (4-6 days per week) 4) daily

6. How many teaspoons of sugar a child put into a cup of tea? ......spoons (If you do not use, type "0")

7. How often does your child eat and drink these foods and beverages during a regular week? (Tick one box ☐ in each row)

<table>
<thead>
<tr>
<th>Food products</th>
<th>Never</th>
<th>Less than a week</th>
<th>Sometimes (1-3 days)</th>
<th>Frequently (4-6 days)</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Fruit</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Green and boiled vegetables (except potatoes)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cossacks or flakes</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>100 percent of juice</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sugar beverages with sugar (lemonade)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Low caloric beverages (such as light coca cola)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Flavored milk drink</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Low and medium fat milk (1-2.5%)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>A natural home-grown or grown-up fat dairy (3.5%)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Enzyme Cheese</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Yogurt, curd, white cheese, etc. dairy products</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Any meat and meat products</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Chicken</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Red meat (pork, beef, lamb, game, etc.)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Meat products (sausage, sausages, smoked products)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fish (including herring)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cheese snacks (potato chips, spiked maize, peanuts,)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
9. How often does your child go to school and return home?

1) going on foot or riding a bike
2) is carried by private or public transport
3) walking (or riding a bike) AND is being transported by private or public transport

10. How far away from your home is the child's school?

1) less than 1 km 2) 1-2 km 3) 3-4 km 4) 5-6 km 5) more than 6 km

11. Does your child go to a sports or dance group (football, swimming, tennis, basketball, etc.)?

1) yes 2) no

12. If yes, how many hours per week does your child spend in sports and / or dance classes (in total)? (Check the appropriate answer  ☐)

☐ not one ☐ 4 hours per week ☐ 8 hours per week
☐ 1 hour per week ☐ 5 hours per week ☐ 9 hours per week
☐ 2 hours per week ☐ 6 hours per week ☐ 10 hours per week
☐ 3 hours per week ☐ 7 hours per week ☐ 11 hours per week

13. How many hours per day is your child's do activity (running, jumping, playing outdoor games, or actively moving and practicing indoors)? (Check the appropriate answer ☐)

on weekdays: on weekends:
☐ not doing anything at all ☐ not doing anything at all
☐ less than 1 hour per day ☐ less than 1 hour per day
☐ about 1 hour per day ☐ about 1 hour per day
☐ about 2 hours per day ☐ about 2 hours per day
☐ about 3 hours and more per day ☐ about 3 hours and more per day

14. How many lessons of physical activity in at school?

☐ not one ☐ 4 hours per week ☐ 8 hours per week
☐ 1 hour per week ☐ 5 hours per week ☐ 9 hours per week
☐ 2 hours per week ☐ 6 hours per week ☐ 10 hours per week
☐ 3 hours per week ☐ 7 hours per week ☐ 11 hours per week

15. How you evaluate physical activity of your child?
1) Inadequate  2) moderate  3) high  4) hyperactive

16. How many hours does your child spend on preparing lessons, reading books, etc? (Check the appropriate answer ☐)

<table>
<thead>
<tr>
<th>on weekdays:</th>
<th>on weekends:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ not doing anything at all</td>
<td>☐ not doing anything at all</td>
</tr>
<tr>
<td>☐ less than 1 hour per day</td>
<td>☐ less than 1 hour per day</td>
</tr>
<tr>
<td>☐ about 1 hour per day</td>
<td>☐ about 1 hour per day</td>
</tr>
<tr>
<td>☐ about 2 hours per day</td>
<td>☐ about 2 hours per day</td>
</tr>
<tr>
<td>☐ about 3 hours and more per day</td>
<td>☐ about 3 hours and more per day</td>
</tr>
</tbody>
</table>

Name of the child .................................. .....................................................

Date of birth: 20 ..... y........... months ..... d

Date of the survey: 20 .......... m ......................... .... d

Body weight: .................., .... (kg) .................., .... (kg)

Height: .................., .... (cm) ..................,. ... (cm)

Investigator code: ........, signature ............................
DĖL PRITARIMO TYRIMUI


*Pastaba: šis pritarimas neatsidžia tyrojų nuo atsakomybės ir prievoles gaut nacionalinio arba regioninio bioetikos komiteto leidimą pagal LR Biomedicininių tyrimų etikos įstatymo numatytas nuostatas.

S. Elektas Pulučas