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ADAPTATION OF THE COSI METHODOLOGY TO THE CONDITIONS OF THE SCHOOL ENVIRONMENT AS A METHOD FOR ASSESSING THE EFFECTIVENESS OF MEASURES WITHIN THE FRAMEWORK OF THE WORLD HEALTH ORGANIZATION HEALTH-PROMOTING SCHOOLS

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Abstract

Objective: To adapt the methodology of the World Health Organization European Childhood Obesity Surveillance Initiative (COSI) to the school setting to evaluate the effectiveness of Health-promoting schools implementation measures through BMI indicators of children 8-10 years old in Kazakhstan as a basis for monitoring and influencing health promotion measures.

Methods. We adapted the data collection methodology of the World Health Organization European Childhood Obesity Surveillance Initiative to assess the effectiveness of a whole school approach through BMI scores in children aged 8-10 as a basis for monitoring and influencing health promotion measures. Using the method of a randomized controlled trial based on general education schools, we carried out anthropometric measurements of children before and after applying the whole school approach within the framework of the World Health Organization Concept of Healthy Schools.

Results. The number of students in the sample was 368 (boys n=172, 46.7%, girls n=196, 53.3%). Parents or legal representatives of children completed 349 family questionnaires, and the response rate was 77%. We conducted the study in three stages. In the first stage, the basic anthropometric parameters of children aged 8, 9, and 10 were measured, and a survey was conducted of parents and legal representatives of children. The second stage of the study consisted of calculating children's BMI, after which, in each age category, the children were divided into groups according to BMI. The overweight indicator is dominated in Nur-Sultan city, 12.24%, and East Kazakhstan region, 11.3% among children aged 10 years. There are more overweight children aged 9 (8.8%) and 10 (11.3%) in urban areas than rural areas. After the groups were formed, the school-wide approach of the HSS was applied. We also formed control groups for each weight status category. In the third stage of the study, we re-measured the anthropometric parameters of children in the experimental and control groups and calculated the BMI. In the Akmola region, normal weight indicators among children aged 8 grew by 3.27% and among children aged 10 by 0.6%.

Conclusions. The study's results showed the effectiveness of the COSI method in assessing one of the critical health indicators in childhood - weight status. The experimental group's results in achieving BMI thresholds in each weight status category were 41.4%, compared with the control group. Among underweight students, 39.7% reached the normal weight threshold. Regarding all ages, the BMI of overweight decreased by 21.4%. In turn, the adapted COSI tool is applicable to school settings to monitor weight status as one of the indicators of student health.

Key words: COSI, Health-promoting schools, Schools, World Health Organization, School Health Services.

Резюме

АДАПТАЦИЯ МЕТОДИКИ COSI В УСЛОВИЯ ШКОЛЬНОЙ СРЕДЫ КАК МЕТОД ОЦЕНКИ ЭФФЕКТИВНОСТИ МЕР В РАМКАХ КОНЦЕПЦИИ ВСЕМИРНОЙ ОРГАНИЗАЦИИ ЗДРАВООХРАНЕНИЯ ШКОЛЫ, СПОСОБСТВУЮЩИЕ УКРЕПЛЕНИЮ ЗДОРОВЬЯ.

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Цель: Адаптировать методику Всемирной Организации Здравоохранения Европейская инициатива по эпиднадзору за детским ожирением COSI в условия школы для оценки эффективности мер реализации Школ, способствующих укреплению здоровья через показатели индекса массы тела (ИМТ) детей 8-10 лет в Казахстане как основы для мониторинга и влияния на меры по укреплению здоровья.

Методы. Мы адаптировали методику сбора данных Европейской инициативы Всемирной Организации Здравоохранения по эпиднадзору за детским ожирением для оценки эффективности общешкольного подхода через показатели ИМТ детей 8-10 лет, как основы для мониторинга и влияния на меры по укреплению здоровья. Методом рандомизированного контролируемого исследования на базе общеобразовательных школ мы провели антропометрические измерения детей до и после применения общешкольного подхода в рамках Концепции Всемирной Организации Здравоохранения Школы, способствующие укреплению здоровья.

Результаты. Количество учеников в выборке составило 368 человек (мальчиков $n=172$, 46.7%, девочек $n=196$, 53.3%). Родителями или законными представителями детей были заполнены 349 семейных анкет, процент ответов составил 77%. Мы проводили исследование в три этапа. В первом этапе были измерены базовые антропометрические параметры детей 8, 9 и 10 лет, проведен опрос родителей и законных представителей детей. Второй этап исследования состоял из расчетов ИМТ детей, после которой в каждой возрастной категории дети были поделены на группы по показателям ИМТ. Показатель избыточного веса преобладают в городе Нур-Султан, 12.24% и Восточно-Казахстанской области, 11.3% среди детей в возрасте 10 лет. В городской местности детей с избыточным весом 9 лет (8.8%) и 10 лет (11.3%) больше, чем в сельской местности. После формирования групп, был применен общешкольный подход ШСУЗ. Также мы сформировали контрольные группы по каждой категории статуса веса. В третьем этапе исследования мы повторно измерили антропометрические параметры детей в экспериментальной группе и контрольной группе и рассчитали ИМТ. В Акмолинской области показатели нормального веса среди детей 8 лет выросли на 3.27%, среди детей 10 лет на 0.6%.

Выводы. Результаты исследования показали эффективность методики COSI, как инструмента для оценки одного из важных показателей здоровья в детском возрасте – статус веса. Результаты экспериментальной группы в достижении пороговых показателей ИМТ в каждой категории статуса веса составили 41.4%, в сравнении с контрольной группой. Среди учащихся с недостаточным весом 39.7% достигли порогового веса нормы. В резрезе всех возрастов показатель ИМТ с избыточным весом снизился на 21.4%. В свою очередь, адаптированный инструмент COSI применим условиях школы для мониторинга статуса веса, как одного из показателей здоровья учащихся.

Ключевые слова: COSI, Школы, способствующие укреплению здоровья, Школы, Всемирная организация здравоохранения, Службы школьного здравоохранения.

Түйіндеме

ДҮНИЕЖҮЗІЛІК ДЕНСАУЛЫҚ САҚТАУ ҰЙЫМЫНЫҢ ДЕНСАУЛЫҚТЫ НЫҒАЙТУҒА ЫҚПАЛ ЕТЕТІН МЕКТЕПТЕР ТҰЖЫРЫМДАМАСЫ ШЕҢБЕРІНДЕГІ ШАРАЛАРДЫҢ ТИІМДІЛІГІН БАҒАЛАУ ӘДІСІ РЕТІНДЕ COSI ӘДІСТЕМЕСІН МЕКТЕП ОРТАСЫНЫҢ ЖАҒДАЙЫНА БЕЙІМДЕУ

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Мақсаты: Қазақстандағы 8-10 жас аралығындағы балалардың дене салмағының индексі (ДСИ) арқылы, денсаулықты нығайту шараларын бақылау және әсер ету үшін негіз болып табылатын Денсаулықты нығайтуға

ықпал ететін мектептердің іске асыру шараларының тиімділігін бағалау үшін Дүниежүзілік денсаулық сақтау ұйымының COSI Еуропалық балалар семіздігін қадағалау бастамасының әдістемесін мектеп жағдайында бейімдеу.

Әдістері. Біз Дүниежүзілік денсаулық сақтау ұйымының Еуропалық балалар семіздігін қадағалау бастамасының деректер жинау әдістемесін денсаулықты нығайту шараларын бақылау және әсер ету үшін негіз ретінде 8-10 жас аралығындағы балалардағы ДСИ ұпайлары арқылы тұтас мектеп тәсілінің тиімділігін бағалау үшін бейімдедік. Жалпы білім беретін мектептер базасында рандомизацияланған бақыланатын зерттеу әдісін қолдана отырып, біз Дүниежүзілік денсаулық сақтау ұйымының Денсаулықты нығайтуға ықпал ететін мектептер тұжырымдамасы аясында бүкіл мектептік тәсілді қолданғанға дейін және одан кейін балалардың антропометриялық өлшемдерін жүргіздік.

Нәтижелер. Іріктемедегі оқушылар саны 368 (ұлдар $n=172$, 46,7%, қыздар $n=196$, 53,3%). Балалардың ата-аналары немесе заңды өкілдері 349 отбасы сауалнамасын толтырды, жауап беру көрсеткіші 77% құрады. Біз зерттеуді үш кезеңде жүргіздік. Бірінші кезеңде 8, 9 және 10 жастағы балалардың негізгі антропометриялық көрсеткіштері өлшенді, ата-аналар мен балалардың заңды өкілдеріне сауалнама жүргізілді. Зерттеудің екінші кезеңі балалардың ДСИ есептеуден тұрды, содан кейін әрбір жас санатында балалар ДСИ бойынша топтарға бөлінді. Артық салмақ көрсеткіші Нұр-Сұлтан қаласында 12,24% және Шығыс Қазақстан облысында, 11,3% 10 жастағы балалар арасында басым. Қалада ауылдық жерлерге қарағанда 9 (8,8%) және 10 (11,3%) жастағы артық салмақты балалар көп. Топтар құрылғаннан кейін Денсаулықты нығайтуға ықпал ететін мектептер тұжырымдамасының жалпы мектептік тәсілі қолданылды. Біз сондай-ақ әрбір салмақ дәрежесі бойынша бақылау топтарын құрдық. Зерттеудің үшінші кезеңінде эксперименталды топтағы және бақылау тобындағы балалардың антропометриялық көрсеткіштерін қайта өлшеп, ДСИ есептедік. Ақмола облысында 8 жастағы балалар арасында қалыпты салмақ көрсеткіштері 3,27%-ға, 10 жастағы балаларда 0,6%-ға жоғарылады.

Қорытындылар. Зерттеу нәтижелері балалық шақтағы денсаулықтың маңызды көрсеткіштерінің бірі – салмақ дәрежесін бағалау құралы ретінде COSI әдісінің тиімділігін көрсетті. Эксперименттік топтың салмақ статусының әрбір санатындағы ДСИ шекті мәндеріне қол жеткізудегі нәтижелері бақылау тобымен салыстырғанда 41,4% құрады. Салмағы төмен оқушылардың 39,7% қалыпты салмақ шегіне жетті. Барлық жастар арасында артық салмақпен ДСИ 21,4%-ға төмендеді. Өз кезегінде бейімделген COSI құралы оқушы денсаулығының көрсеткіштерінің бірі ретінде салмақ күйін бақылау үшін мектеп параметрлеріне қолданылуға тиімді болып табылды.

Түйінді сөздер: COSI, Денсаулықты нығайту мектептері, Мектептер, Дүниежүзілік денсаулық сақтау ұйымы, Мектеп денсаулық сақтау қызметтері.

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Relevance

The Health-promoting School (HPS) concept was first defined by the World Health Organization (WHO) in the early 1980s as a practical approach to healthy student development based on the Ottawa Charter and enshrined in the Bangkok Charter [15; 16; 8]. Kazakhstan became an official member of the European Schools Network in 1999 [1]. After determining the obligations of stakeholders as part of the implementation of the HPS concept, in 2017, a pilot implementation was implemented in 6 schools in the Mangistau and Kyzylorda regions and the cities of Almaty and Astana. As a result of the pilot implementation, schools noted an increase in the quality of knowledge and an

improvement in health indicators, an intensification of extra-curricular activities to promote health, and an increase in the quality of nutrition [2].

In 2022, the number of secondary schools in Kazakhstan was 1201 schools, 15.6% of the total number of schools in the country [3]. The concept of HPS at the school level is implemented with the help of adapted methodological guidelines aimed at developing general and specialized knowledge and health promotion skills among school community members. The Whole-School Approach to Health Promotion has six components: School Strategy for Health Preservation and Promotion; School environment; School social environment; Teaching

individual health skills and abilities; Public relations; Health Services. Schools evaluate the effectiveness of these components with a frequency of at least six months. Indicators for evaluating the effectiveness of schools are chosen independently, depending on the selected components.

Children's weight is one of the most relevant and easily interpretable indicators of the health component in the school environment [25; 17].

Purpose of the study

Adapt the methodology of the World Health Organization European Childhood Obesity Surveillance Initiative (COSI) in the school setting to assess the effectiveness of SHS implementation measures through BMI indicators of children 8-10 years old in Kazakhstan as a basis for monitoring and influencing health promotion measures.

Materials and methods

Study design and sampling

This study uses the COSI methodology to assess the effectiveness of a whole school approach through BMI scores for children aged 8-10 in Kazakhstan as a basis for monitoring and influencing health promotion measures.

COSI is an epidemiological system that measures trends in overweight and obesity among primary school children. COSI includes standardized height and weight measurements in the WHO European Region, providing representative national data for participating countries and a large regional dataset for analyzing the determinants of overweight and obesity in children. In 2015–2017 the fourth round of COSI was conducted in 36 countries of the WHO European Region, providing nationally representative data for all countries [12]. WHO Regional Office for Europe [25] and the Member States, and with minimal changes for COSI Rounds 2, 3, and 4 [18; 20; 21], the COSI protocol is in line with the International Guidelines for Biomedical Research Involving Humans [9, 10].

According to the original methodology, measurements in children are carried out by staff trained in measuring height and weight using the standardized WHO methodology. Parents or legal representatives fill out family questionnaires. The form includes questions about parents' perceptions of their child's body weight status, dietary intake, physical activity patterns, family socioeconomic characteristics, and obesity-related comorbidities [14].

The study's design was a cross-sectional, randomized, controlled study based on comprehensive schools with a representative sample of adolescents aged 8, 9, and 10.

Target group of children: children aged 8, 9, 10, students in grades 2, 3, 4. In schools, the 2nd, 3rd, 4th grades were chosen by randomization. The sample excludes boarding schools, small schools, and specialized schools for children with special needs. The class response rate was also 100%, as classes from the reserve class list replaced the 5 classes that refused to participate in the survey. A total of 96 classes were included in the study.

The total planned sample size was determined on the basis that the average number of students in a class is 20 people. The study showed that the average number of students in one class was 21.3. The total number of respondents in 24 classes is 526 people. Of these, 84 students were absent at the time of the survey, and 74

refused to participate. Thus, the response rate of schoolchildren was 70.02%.

Research stages

The first stage of the study was carried out in October 2021. The basic anthropometric parameters of children aged 8, 9, and 10 were measured, and a survey was conducted of parents and legal representatives of children based on COSI questionnaires. We digitized the data, encoded the personal data of children, formed the general population, and formed the sample population according to the inclusion and exclusion criteria.

The second stage of the study consisted of calculating the body mass index (BMI) of children, after which, in each age group, the children were divided into groups according to BMI: underweight group, normal weight group, overweight group.

After the groups were formed, the whole school approach of the WHO Vision for Health Promoting Schools was applied. Behavioral goals were developed for each group regarding nutrition, physical activity, social school environment, personal skills, and health and family support competencies. We also formed control groups for each weight group, to which no HPS measures were applied.

In the third stage of the study, to identify the dynamics and progress of measures within the framework of the HSS, in February 2022, the second stage of anthropometric measurements of children was carried out, and the calculation of BMI was carried out.

Inclusion and exclusion criteria

We only included a study of children aged 8 to 10 with complete information needed to estimate BMI weight (sex, age, height, and weight). This study also assesses parents' perception of their child's weight using a question in the form of family records. The parent or legal representative indicated the degree of relationship with the child. We included children who had at least one parent or guardian complete the form.

Statistical analysis

Descriptive statistics were calculated for all variables. A paired Student's t-test was used to assess for differences between scores before and after the intervention. These variables included age in months, height, weight, and BMI.

The Pearson chi-square test and the probability value "p" were calculated to identify statistically significant differences in the indicators of two or more compared groups. We also used Pearson's goodness-of-fit test to assess the statistical significance of differences in several relative measures.

Tools

We took the WHO European Childhood Obesity Surveillance Initiative Data Collection Methods, 2016, as the primary tool for adapting the COSI methodology [22]. This tool has been developed for a country study of overweight and obesity in children aged 6.0–9.9 years to understand the dynamics of the epidemic process and to provide comparative assessments of the situation. This document describes the data collection methods.

The adaptation was to allow any public school to systematically monitor students' weight without additional efforts or the participation of experts, using the available skills of a school nurse in the existing conditions of the school environment.

Children's weight status

To determine children's weight status, we used the height and weight references recommended by the WHO [7; 23]. The standardized COSI methodology uses thresholds to calculate BMI Z-scores by age and estimate overweight prevalence. Given the lack of skills in calculating BMI Z-scores among school health workers, in our study, we applied the standard calculation of BMI ($\text{weight}/(\text{height}/100)^2$), which is also relevant for determining children's weight status from 5 to 19 years old [24].

Parents' perception of their children's weight status

The optional family record asks, "What do you think your child's weight is: underweight; normal; slightly redundant; extremely redundant." Given that different family members filled out the family record, we distinguished between the responses of mothers and fathers. If the mother completed the family record form, the data was called "maternal perception", whereas if the father completed the form, the data was called "paternal perception".

We constructed a fit measure to indicate whether a parent correctly perceived their child's weight status compared to the WHO obesity categories. The perceived and actual weight classification of children was considered consistent in the following cases:

- (i) children with thinness were correctly classified as "underweight"
- (ii) children with normal weight as "normal weight"
- (iii) overweight children as "slightly overweight"
- (iv) obese children as "extremely overweight".

A parent's underestimation of their child's weight has been observed if:

- (i) children with normal weight were perceived as "underweight"
- (ii) overweight children were perceived as "underweight" or "normal weight"
- (iii) obese children were perceived as being "underweight", "normal weight" or "slightly overweight".

Parental reassessment of the weight status of their child was observed if:

- (i) thin children were perceived as "normal weight", "slightly overweight" or "extremely overweight"
- (ii) normal weight children were perceived as being "slightly overweight" or "extremely overweight"

(iii) overweight children (apart from obesity) were perceived as "extremely fat".

The accuracy of parents' perceptions of their child's weight status was also assessed by assessing underweight, normal weight, and overweight.

Results

The study involved eight schools (Akmola, Atyrau, Kyzylorda, East Kazakhstan regions, and Nur-Sultan) (table 1).

The total number of students in the sample was 368 (boys $n=172$, 46.7%, girls $n=196$, 53.3%). Participants from urban areas $n=204$, 55.4%, from rural areas $n=164$, 44.6%.

Table 1.

Number of schools participated in the study.

Region \ City	Total	City	Province
Akmola region	1	0	1
Atyrau region	2	1	1
Kyzylorda Region	2	1	1
East Kazakhstan	2	1	1
Nur-Sultan	1	1	0
Total	8	4	4

During the study, restrictive measures were in place concerning the coronavirus infection. Some children were on online training or were absent for various reasons. Parents or legal representatives of children completed 349 family questionnaires. The percentage of answers was 77%, of which 331 questionnaires with complete answers were analyzed. School administration responses were 100%.

Results were reported separately for children and parents before and after the intervention.

The average age for each age category was:

- (i) Group 1 - 8.50 years
- (ii) Group 2 - 9.42 years
- (iii) Group 3 - 10.50 years.

During the selection of the target group of children in the age group of 8 years (schoolchildren 8.50 ± 6 months) - their number was 111 people. The age group of 9 years (schoolchildren 9.42 ± 6 months) - their number was 134 people. Age group 10 years (schoolchildren 10.50 ± 6 months) - their number was 123 people (table 2).

Table 2.

Characteristics of children and parents by region.

Province/City	Boys, %	Girls, %	The median age in years Children from urban areas, %	Children from urban areas, %	Family registration form completed by mothers, %
Akmola region	39.6	60.4	9.4	-	96.1
Atyrau region	45.2	54.8	9.5	60.2	95.7
Kyzylorda Region	50.6	49.4	9.6	54.3	98.2
East Kazakhstan	47.4	52.6	9.4	56.7	88.4
Nur-Sultan	44.9	55.1	9.5	-	83.1

We adopted the COSI tool in three steps. As a first step, we excluded sections from the tool that implied data collection for countries, instead localizing all conditions at the school level (Table 3).

We have excluded tabular forms and items related to country codes and school codes; passport data replaced the code of the person who conducted the survey.

From the Child Record Form, we excluded the field for entering the population, region/municipality of the child,

secondary and average result of measuring height. We excluded waist circumference and hip circumference since these data are not required for the standard calculation of BMI. By excluding certain items in the forms, we also excluded the methodological recommendations for them from the text.

We translated the adapted COSI tool into Kazakh and handed it over to schools to test for understanding and relevance of the content. After discussions with the school medical staff and administration, editorial changes were made.

As a result of the first stage of BMI calculations, we found that underweight children aged eight years in the Akmola region is 1.8%, in the Ayyrau region 3.2%, in the Kyzylorda region 2.5%, in East Kazakhstan region 2.1% and in the city of Nur- Sultan 4.08%. The study did not reveal any underweight in children aged 9 and 10. The overweight

indicator is dominated in Nur-Sultan City, 12.24%, and East Kazakhstan region, 11.3% among children aged 10. When comparing the results of BMI among urban areas, underweight is also observed among children of 8 years old - 2.9% in the city and 2.4% in the village. There are more children aged 9 (8.8%) and 10 (11.3%) in urban areas than rural areas.

In the second stage of the study, we divided children in each age category into three groups based on BMI results: underweight group, normal weight group, and overweight group.

After forming the groups, the school-wide approach of the World Health Organization Concept of HSS was applied. Behavioral goals were developed for each group concerning nutrition, physical activity, social school environment, personal skills, and health and family support competencies.

Table 3.

Content of the cosi tool before and after adaptation.

Contents of the original COSI tool	Contents of the adapted COSI tool
1. Mandatory child registration form	1. Mandatory child registration form
Guidelines for filling out a child registration form	Guidelines for filling out a child registration form
List of country codes that are Member States of the WHO European Region	Excluded
List of school codes (mandatory)	Excluded
Class Code List (required)	Excluded
List of codes for children	Excluded
List of codes for examiners	Excluded
List of weight units, taking into account the form of clothing (required)	Excluded
Individual sample weights and sampling design variables (mandatory)	Excluded
2. Mandatory school registration form	Excluded
Guidelines for completing the mandatory school registration form	Excluded
3. Optional Family Registration Form	3. Optional Family Registration Form
4. Informed Consent	4. Informed Consent
Sample Parental Informed Consent Letter (Passive Approach)	Sample Parental Informed Consent Letter (Passive Approach)
Sample Parental Informed Consent Letter (Active Approach)	Excluded
5. Standardization of conditions	5. Standardization of conditions
Surveyors	Surveyors
Children	Children
Measuring instruments	Measuring instruments
Standard forms	Standard forms
Time	Time
Place	Place
6. Methods for carrying out anthropometric measurements	6. Methods for carrying out anthropometric measurements
Body weight	Body weight
Height	Height
Waist circumference	Excluded
Hip circumference	Excluded
7. Devices for anthropometric measurements	7. Devices for anthropometric measurements
Instrument Calibration Method	Instrument Calibration Method
8. References	8. References

Table 4.

BMI of students by the study regions, %

Region/City	Underweight children, %			Normal weight children, %			Overweight children, %		
	Age 8	Age 9	Age 10	Age 8	Age 9	Age 10	Age 8	Age 9	Age 10
Akmola region	1.8	-	-	19.6	23.2	16.1	10.7	5.4	8.9
Atyrau region	3.2	-	-	24.7	22.6	21.5	1.1	12.9	14.0
Kyzylorda Region	2.5	-	-	19.8	33.3	37.0	-	1.2	6.2
East Kazakhstan	2.1	-	-	24.7	39.2	15.5	5.2	2.1	11.3
Nur-Sultan	4.08	-	-	22.45	26.53	18.37	8.16	8.16	12.24
City	2.9	-	-	23.5	28.4	19.6	5.4	8.8	11.3
Province	2.4	-	-	22.0	33.5	27.4	3.7	1.8	9.1

The nutritional goals focused on managing hunger (preventing skipping meals and encouraging balanced eating and snacking), portion control, reducing excessive consumption of fatty foods, reducing consumption of sugar-based drinks, increasing fruit and vegetable intake, and changing dietary habits at home and interacting with family members.

Physical activity goals were set to increase daily activity (increased active time, personalized physical activity in PE classes, regular attendance at program group sessions at school) and reduced inactivity (reduced time spent on gadgets, computers, and/or video games).

To define personal skills and competencies goals concerning family health and support, we asked a question from the optional family record form "What do you think your

child's weight is: underweight; normal; slightly redundant; extremely redundant" to parents and legal representatives of children. The survey results were redistributed by "maternal perception" and "paternal perception". Most mothers participated in the survey, 92.3%; no legal representatives were in the study.

An analysis of the determination of the status of children by parents showed that in 87.4% of cases, fathers most realistically assess the status of children's weight. This indicator is higher by 2.4 shares in urban areas (Figure 1). Reassessment of the weight status of children's mothers, compared with fathers, exceeds 4.09 times; this figure prevails in rural areas. A realistic assessment of children's weight status was found in mothers (81.6%) and fathers (83.4) in the city of Nur-Sultan

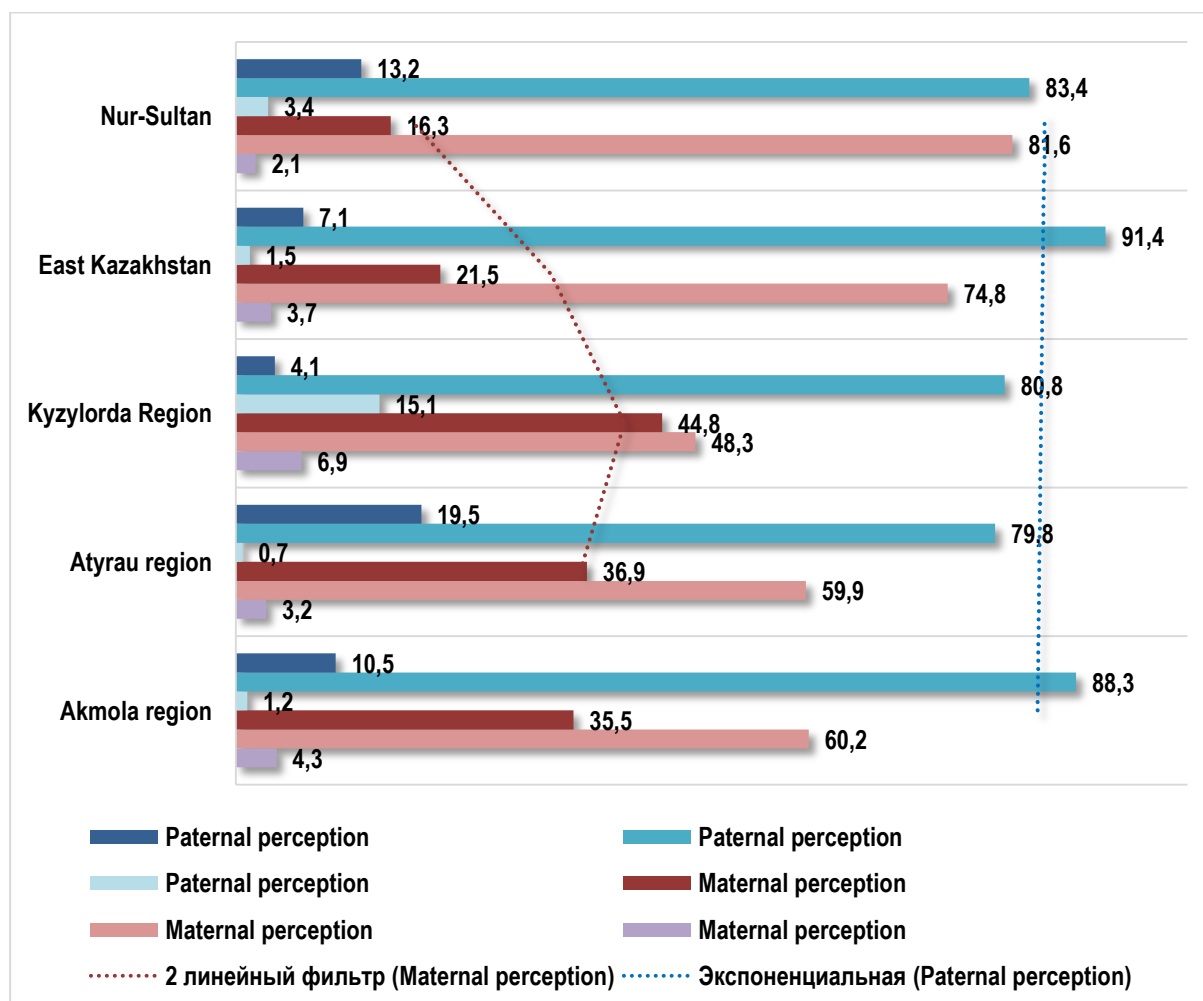


Figure 1. Parental weight determination status.

Mothers of 37.7% of cases defined overweight as "slightly overweight", and 22.6% of cases as "normal weight". The parents' answers did not reveal the accuracy of determining extremely overweight.

In the third stage of the study, to identify the dynamics of changes in the weight of students after the intervention, we carried out repeated measurements of

height and weight under the same conditions and calculated the BMI.

As a result of the interventions, in the Akmola region, the indicators of normal weight among children eight years old increased by 3.27% and among children ten years old by 0.6%. Overweight also increased among all age categories by an average of 3.5% (Table 5).

Table 5.

PUPILS' BMI by regions studied before and after the intervention, %

Region / City	Stages of BMI	Underweight children, %			Normal weight children, %			Overweight children, %		
		Age 8	Age 9	Age 10	Age 8	Age 9	Age 10	Age 8	Age 9	Age 10
Akmola region	1	2.1	-	-	19.6	23.2	16.1	10.7	5.4	8.9
	2	2.1	-	-	22.9	22.9	16.7	12.5	10.4	12.5
	dynamics		-	-	(3.3)	0.3	(0.6)	(1.8)	(5.1)	(3.6)
Atyrau region	1	3.2	-	-	24.7	22.6	21.5	1.1	12.9	14.0
	2	1.1	-	-	24.7	24.7	23.7	3.2	10.8	10.8
	dynamics	2.2	-	-	-	(2.2)	(2.2)	(2.2)	2.2	3.2
Kyzylorda Region	1	2.5	-	-	19.8	33.3	37.0	-	1.2	6.2
	2	2.5	-	-	19.8	28.4	38.3	-	1.2	4.9
	dynamics	-	-	-	-	4.9	(1.2)	-	-	1.2
East Kazakhstan	1	2.1			24.7	39.2	15.5	5.2	2.1	11.3
	2	-	1.0	-	25.8	38.1	13.4	6.2	2.1	13.4
	dynamics	-	(1.0)	-	(1.0)	1.0	2.1	(1.0)	-	(2.1)
Nur-Sultan	1	4.08	-	-	22.45	26.53	18.37	8.16	8.16	12.24
	2	-	-	-	11.00	12.00	9.00	6.00	5.00	6.00
	dynamics	(4.08)	-	-	(11.45)	(14.53)	(9.37)	2.16	3.16	6.24
City	1	2.9	-	-	23.5	28.4	19.6	5.4	8.8	11.3
	2	0.98	0.49	-	23.5	28.4	19.1	6.8	8.3	11.7
	dynamics	1.96	0.49	-	-	-	0.49	(1.47)	0.49	(0.49)
Province	1	2.4	-	-	22.0	33.5	27.4	3.7	1.8	9.1
	2	1.2	-	-	22.6	31.7	27.4	4.3	3.7	9.1
	dynamics	1.2	-	-	(0.6)	1.8	-	(0.6)	(1.8)	-

Table 6.

PUPILS' BMI from the control group.

Region / City	Stages of BMI	Underweight children, %			Normal weight children, %			Overweight children, %		
		Age 8	Age 9	Age 10	Age 8	Age 9	Age 10	Age 8	Age 9	Age 10
Akmola region	1	2.1	1.8	-	21.2	24.6	18.2	3.1	4.4	9.3
	2	2.1	1.8	-	22.9	24.6	16.3	3.1	4.9	11.6
	dynamics		-	-	(1.7)	-	1.9	-	(0.5)	(2.3)
Atyrau region	1	1.1	-	-	23.6	26.3	24.1	1.1	11.4	13.2
	2	1.1	-	-	23.8	26.3	23.7	1.1	11.4	14.1
	dynamics		-	-	(0.2)	-	0.4	-	-	(0.9)
Kyzylorda Region	1	2.5	-	-	20.9	29.2	27.5	-	3.3	6.4
	2	2.5	-	-	21.1	30.1	26.8	-	3.3	6.6
	dynamics		-	-	(0.2)	(0.9)	0.7	-	-	(0.2)
East Kazakhstan	1	2.1	-	-	23.1	33.7	17.6	1.9	2.1	10.8
	2	2.1	-	-	23.1	38.1	16.1	1.9	2.1	11.2
	dynamics		-	-	-	(4.4)	1.5	-	-	(0.4)
Nur-Sultan	1	1.8	-	-	24.5	27.9	18.1	2.7	7.4	9.8
	2	1.8	-	-	24.5	27.9	15.3	2.8	8.1	11.7
	dynamics		-	-	-	-	(2.8)	(0.1)	(0.7)	(1.9)
City	1	2.1	1.1	-	23.5	26.4	20.2	1.8	9.1	13.2
	2	2.1	1.1	-	23.5	26.4	17.3	1.9	10.7	14.9
	dynamics		-	-	-	-	2.9	(0.1)	(1.6)	(1.7)
Province	1	1.1	-	-	22.7	29.3	24.7	1.1	2.1	8.4
	2	1.1	-	-	22.6	29.7	27.4	1.1	2.6	9.1
	dynamics	-	-	-	0.1	(0.4)	(2.7)	-	(0.5)	(0.7)

If we analyze individual cases, then the BMI indicator of an 8-year-old underweight student increased by 0.37 units, although the indicator did not go over the weight norm. Among overweight participants in the Akmola region, 39.6% of them achieved a reduction in BMI by an average of 0.88 units. In the Atyrau region, we have identified a clear trend in a decline in BMI among 9-year-old children by 2.2% and among 10-year-old children by 3.2%. In the Kyzylorda region, the BMI indicator with a lack of weight moved into normal weight; also, the overweight score among the 10-year-old participants decreased by 1.2%.

The control calculation of BMI after the intervention in the East Kazakhstan region also demonstrated students' transition from underweight to normal weight; normal weight indicators increased among children of 9 years by 1.0% and children of 10 by 2.1%. In Nu-Sultan, the average BMI of normal weight among children of all age categories decreased by 11.78%. At the same time, in the city of Nur-Sultan, the indicators of BMI with excess weight among children eight years old decreased by 2.16%, among children nine years old by 3.16%, and among children of 10 years old by 6.24%. Considering the study's results in the city context, we observed a slight decrease in BMI among overweight children by 0.49%.

We did not find significant differences in the BMI of students in the control group after the second stage of measurements. However, we found an increase in BMI in children aged eight years, 1.7% and ten years, 1.9% in the normal weight category, as well as an increase in BMI in overweight children at the age of 9 years, 0.5% and ten years, 2.3% in the Akmola region. Also, an increase in BMI by an average of 1.4% in overweight children in the city of Nur-Sultan was revealed. In general, we observed a trend of increasing BMI in children of 10 years of age relatively in all study regions; in particular, these data refer to urban areas.

Discussion

The analysis shows that three months is insufficient to overcome the transition from overweight to normal weight for children with significant overweight. However, a significant positive trend regarding weight loss among overweight children is observed. Considering the recommendations of WHO regarding the effective assessment of the dynamics [26] of the progress of impacts in the framework of the whole school approach, 6 to 12 months are required [11, 12]. In turn, the COSI epidemiological survey for childhood obesity is carried out at intervals of four years for relevant dynamics [17]. We aimed to identify the effectiveness of the simplified COSI methodology for monitoring children's weight status as one of the significant indicators of student health, which is influenced by the general school environment and health promotion programs within the general education curriculum.

During the study, we observed that the adapted COSI methodology is sufficiently accessible for school health workers to understand the level of their acting skills. In the current conditions of the school medical office, there are sufficient conditions for measuring height and body weight [4].

Conclusions

We adapted the World Health Organization's European Childhood Obesity Surveillance Initiative (COSI)

methodology to the mainstream school setting to assess the effectiveness of interventions implemented within the Health Promoting Schools concept framework.

The study's results showed the effectiveness of the COSI method in assessing one of the critical health indicators in childhood - weight status. The experimental group's results in achieving BMI thresholds in each weight status category were 41.4%, compared with the control group. Among underweight students, 39.7% reached the normal weight threshold. Regarding all ages, the BMI of overweight decreased by 21.4%.

Thus, we conclude that the developed behavioral goals concerning nutrition, physical activity, the social school environment, personal skills, and competencies about health and family support within the framework of the HSS concept were selected correctly. In turn, the adapted COSI tool is applicable in the school environment to monitor the status of weight as one of the indicators of student health.

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Author Contributions Statement

Conceptualisation – Abildina A.; **methodology** – Abildina A.; **examination** – Turgambayeva A.; **formal analysis** – Abildina A., Turgambayeva A.; **writing (original draft preparation)** – Abildina A.; **writing (review and edition)** – Nakipov Zh., Dauletova G., Saurbayeva G.

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