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## CONCEPTUAL GUIDELINES OF RESEARCH

### **Actuality and the importance of the approached topic, theoretical and practical premises.**

Childhood obesity is a major health problem with global pandemic expansion, which is difficult to control among the pediatric population [1, 6, 27, 29, 30].

The multiple studies conducted by Ogden CI et al., 2007; Trudy MA et al., 2014; Spinelli A. et al., 2019 confirms the fact that the constant increase in obesity in the last forty years persists, both in adults and in children, taking on the scale of a global pandemic.

The WHO informs that in 2016 approximately 41 million children under the age of 5 and 340 million children and adolescents aged 5-19 were overweight or obese. This increase is equally distributed among children and adolescents of both sexes [31].

According to the estimates of Ogden C. and Yanovski S., by 2025 the number of obese people will increase to 300 million, of which more than 60 million will be children. At the same time, the increase in the number of obese children will exceed the increase in the number of obese adults.

Since 1980, various research have been carried out worldwide, confirming the increased incidence of obesity, but it was only in 1997 that the WHO officially recognized the global nature of the obesity epidemic.

The exact prevalence of obesity was difficult to assess especially in children, as the results varied significantly according to age, ethnic differences, sample selection, reference systems used to define obesity among children, etc. [33].

Accordingly, there is a need to use modern and complex approaches for diagnosis, prophylaxis and early treatment of childhood obesity.

In 2006, the WHO European Childhood Obesity Surveillance Initiative (COSI) was established to monitor primary school-aged children with overweight and obesity in more than 40 countries in the European region. In 2006 - 2007, the WHO issues the growth standards - WHO 2007, which presents a revision of the growth standards established by the US National Center for Health Statistics (NCHS) with unique references, which can be used to assess the physical development and nutritional status of children aged 5-19 years. The results of the COSI study from the 2016-2017 round, indicate that among the evaluated children, aged between 7 and 9 years, 29% boys and 27% girls were overweight, while 12% boys and 9% girls respectively were obese [29, 34].

Childhood obesity is associated with a wide range of serious medical complications. Early medical consequences of obesity include orthopedic complications [28], type 2 diabetes [33], ischemic heart pathologies and hypertension [33]. Childhood obesity also has an immediate impact on a child's physical appearance and can lead to additional psychosocial consequences such as low self-esteem, lack of self-confidence, discrimination and, for girls, depression [7].

Long-term follow-up studies confirm that obese children tend to become obese adults [27]. Branca F. et al. [26] argue that childhood obesity reduces life expectancy, because more than 60% of children who are overweight before puberty will be overweight in early adulthood. Moreover, adults who were obese children have an increased risk of morbidity and mortality, independent of their weight in adulthood [19].

And researchers Whitaker RC et al. argue that the probability that a child before puberty will remain obese in adulthood varies between 20 - 50%, while after puberty the probability increases to 50 - 70%. This fact proves that obesity in childhood and adolescence is a predictive factor for obesity in adulthood, with all the complications that this disease associates.

Thus, the main risks of childhood obesity is its persistence in adulthood, being responsible for the subsequent development of cardiovascular, orthopedic, metabolic complications and some forms of cancer, reducing the average age for the development of non-communicable diseases (NCDs) and greatly increasing the burden on health services.

Obesity has many determining factors – biological, individual, and environmental [1, 5, 17].

According to data previously collected by scientists, there are essential differences in the prevalence of overweight and obesity between the countries of the European region and between the socio-economic groups of these countries. These differences indicate the important impact of the environment and socio-cultural determinants for nutrition and physical activity, being considered as key factors contributing to the rapid development of obesity among children. (Rothon C., 2012; Wood JJ, 2012; Ganuzin VM, 2013; Gaspar T., 2014; Elgar FJ, 2015; Demmler JC, 2017; WHO, 2017).

Thus, according to the WHO, a person's lifestyle has a 50% influence on health, while the environment and the hereditary factor have a significance of 20%, and medicine has a contribution of only 10% for the person's health.

Irrational eating and lack of physical activity are believed to be largely influenced by technological progress. Thus, the accessibility of personal transport and public transport, elevators, escalators in shops and the subway, etc., as well as the unlimited use of modern means of information and socialization: television, mobile phones, computers, etc., favor sedentarism both among the adult population, as well as children [32].

From the policies developed and promoted by the WHO and the national health ministries in the European region, it appears that early preventive intervention with the annual monitoring of BMI, while also evaluating the diet and the level of physical activity for all children with age between 5 – 18 years [26, 27, 34].

Campbell K. et al., 2001; Swinburne B. et al. 2013; Brown T. et al., 2019, believes that children and adolescents' diet and physical activity behaviors are influenced by many sectors of society, including family, communities, schools, etc.

But Kumanyika S. et al., 2002 claims that children's health is largely determined by the family and school environment. Thus, interventions for the prevention of childhood overweight and obesity appear in various contexts involving community-school and school-parental partnerships that seem to be the most effective in normalizing body weight in children [31].

Given that most children spend a significant part of their day at school, many preventive interventions have used schools as an entry point to improve the obese environment by promoting physical activity in physical education classes and recreation, setting up school playgrounds as well as improving nutritional options in school canteens and providing healthy lifestyle education in classes or other school policies (Cedecova M. et al. 2016).

**The degree of research of the problem.** In the Republic of Moldova, researches were mainly focused on addressing the particularities of food and physical activity, the promotion of a healthy lifestyle as well as the aspects of the clinical assessment of obesity in children, adolescents and adults by the following researchers: Caun E., Cernelev O., Cernetchi O., Croitoru C., Cojocari L., Gutțu A., Gaur M., Dulapciu E., Friptuleac Gr., Lesco G., Mariț A., Moroșan R., Obreja G., Revenco V., Sava P., Zavalisca A., Zepca V. etc. [5, 7, 14, 19, 21, 23, 25].

Obesity, without a doubt, is a serious public health problem worldwide. Many scientific studies have demonstrated the serious medical consequences of obesity and therefore justify the recommendations regarding weight normalization and weight maintenance among populations. Also, studies have established a significant impact of obesity on the physical and psychological development including the academic success of an individual [7, 21, 25, 31, 33, 34].

Humanity tried to fight to overcome this pathology and its complications, but it was a long fight and without much success. If this trend of increasing the incidence of obesity among children is not stopped, then by the year 2030 it is estimated that approximately 3.3 billion people worldwide will be affected by this pathology [32].

**Epistemic landmarks** for the solution of the research problem, it offers the results of scientific knowledge, related to the purpose of the research, such as: study of the prevalence of pediatric obesity

abroad Branca F. et al [26], Ogden Cl. et al. [27], Spinelli A. et al. [29] and in the country Cernelev O. [7], Obreja G. [20], Rivenco E. [21] Zavalisca A. et al. [2. 3]; methodologies to increase the degree of effectiveness of the physical education lesson for primary school children Bragarenco N. [2], Carp I. [4], Caun E. [5], Ciorba C. [8] Grimalschi T, [12], Sava P. [22]; theoretical and methodological approaches for solving the correction of obesity in children through physical therapy and physical education Balint T. [1] and Caun E. et al. [6] etc.

Currently, there are several methods of obesity treatment: drug therapy, surgical interventions, diet therapy, different types of physical activities. But for the treatment of obese children, of all the accepted existing methods, they are based on the correction of diet and physical activity, and physical therapy is also indicated [10, 14, 17, 23].

The basic principle of maintaining the child's health is the orientation with a prophylactic character, depending on this, the importance of physical therapy as a medical branch has increased, which aims to restore some diminished functions of the body or is used as a method of increasing the functional level in various ailments. By paying due attention to the problems of obesity prevention, medical science encourages the detection of the disease in the primary stages of functional disorders - when the treatment is not complicated and proceeds more efficiently. In these cases, physical therapy, dietary nutrition and massage can be the main means, even exclusive in the treatment of obesity in children [1, 5, 25].

In multiple studies, it has been shown that physical exercise is a fundamental means of improving physical and mental health. And systematic physical activity is one of the keys to counteracting the current epidemic of overweight and obesity. However, within the obesity treatment methods, described in the specialized literature, they practically do not consider the role of physical education. However, it is obvious that the physical exercises used in physical therapy sessions do not differ from the physical exercises performed in physical education lessons. The differences are found in the intensity of the physical activity and the duration of their execution. Taking this into account, we can conclude that to recover obese students, a wider application of curative exercise is necessary in physical education lessons, especially in primary education.

Physical education is considered the only discipline in the school curriculum that aims to prepare children for a healthy lifestyle and that transmits important social values, having an essential contribution to their harmonious physical and mental development. The physical education lessons held in school fulfill a special role both in the process of training and development of the students' personality, as well as in physical development and health education [22].

Harmonious physical development allows the body to sufficiently maintain the necessary motor activity. Children learn to perceive and correctly use the various motor actions needed to perform different physical exercises. At the same time, performing a wide range of physical exercises will allow to achieve good results in the development of various physical qualities, which ultimately determine the level of physical development. However, it is necessary to consider the stages of growth, which are characterized by certain "sensitive" periods, favorable for the development of certain physical qualities [24].

**The motivation and premises of the choice of theme.** Analyzing the annual reports provided by the National Public Health Agency (ANSP), the National Bureau of Statistics (BNS) and the National Center for Health Management of Moldova (CNMS) we found that there are no targeted identification statistics of overweight and obesity in children of low school age at country level. There is only a small number of private studies, carried out by local researchers, as follows: Caun E., Zavalisca A. et al. (2012), Cernechi O. (2013), Friptuleac G. (2017), Dilapciu E. (2018) Obreja G. (2019) etc. in which the objectives were to study and analyze the health status of children and adolescents from the Republic of Moldova, including the assessment of the incidence of overweight and obesity among them. Thus, we proposed to carry out a retrospective analysis of the research

results of these publications and, at the same time, to carry out our own study to determine the incidence of obesity among children of small school age in our country. Another important topic that derives is the analysis of the factors that predispose to the development of pediatric obesity, and, at the same time, the methods indicated in the recovery of children of small school age.

In the specialized literature, increased attention is paid to the use of physical education as a factor for preventing physical deficiencies in children of small school age, but regarding metabolic disorders and obesity in particular, there are few studies in the Republic of Moldova.

The actuality of this study derives both from the real situation characterized by the impact on the population of modern factors that facilitate the development of obesity in children, and from the need to strengthen intersectoral efforts by educating and promoting a healthy lifestyle for obese primary school students. Taking into account the mentioned, the importance of the addressed topic is highlighted by the need to update the results of the studies conducted in the Republic of Moldova in a European context by presenting some modern approaches regarding the recovery of obesity in primary school students.

**The purpose of the theses:** Basing the methodology of increasing the effectiveness of the physical education lesson and improving the recovery process of obese primary school students.

**Research objectives:** 1. Studying the prevalence of obesity among school-age children, based on the results of our own epidemiological study and comparing these data with the data of official statistics in the country and abroad. 2. Studying the problem of correcting excess weight in children of small school age and analyzing theoretical and methodological approaches for its solution. 3. Evaluation of the level of physical development and motor training of primary school students. 4. Elaboration, implementation, and argumentation of the effectiveness of the experimental model, adapted for the recovery of students with obesity.

**Research hypothesis:** we claim that the degree of effectiveness of physical education lessons in the primary cycle will increase, if a kintotherapeutic program will be introduced within them, developed according to the requirements of the school curriculum, with exercises for general physical development and a complex of respiratory gymnastics, which will facilitate strengthening health and the normalization of the body weight of students with obesity.

**Synthesis of research methodology and justification of chosen research methods.**

**The methodology of scientific research.** Research in the field of harmonious physical development of children is of particular importance, as it allows revealing the basic laws of individual development, as well as determining the functional capabilities of the body of children of primary school age.

According to the theoretical study in chapter I, the problem of recovering obese primary school students is not fully resolved and requires the development of new models to be applied in physical education lessons.

**Scientific novelty and originality** for the first time in the Republic of Moldova, an experimental model of physical education was developed and applied, adapted for the recovery of obese children from primary classes. Within this model, general development exercises (prescribed by the school curriculum), posture correction exercises in combination with breathing exercises (prescribed in the kinetotherapeutic program, considering the specifics of obesity in children) were used, which contributed to strengthening health and normalizing their body weight.

**Scientific problem solved.** The results obtained in the thesis demonstrate, from a scientific and methodological point of view, the necessity and effectiveness of using the means of physical therapy in the physical education lesson with obese primary school students. The application of the proposed experimental model made it possible to normalize the function of the cardio-respiratory system, optimize general motor skills and improve the health of the children included in the study.

**The theoretical significance of the theses** consists in expanding the area of knowledge of theoretical-methodical concepts regarding the methodology of organizing and conducting physical education lessons in primary classes with obese students in order to educate a healthy lifestyle and highlight the role of physical education in strengthening and preserving the health of the population.

**Application value results from the possibility of using the research results** in order to optimize the general motor skills and body functionality of obese students in physical education lessons. The methodological benchmarks can be used in the process of developing didactic projects for the physical education lesson in primary education by physical education teachers and in the development of physical therapy programs in the recovery of obesity in children.

**Implementation of scientific results.** The experimental content of the research program was applied for the purpose of strengthening health and normalizing the body mass index (BMI) in obese school-age students and was implemented in physical education lessons in "Minerva" Theoretical High School and "Pro Succes" Theoretical High School" from the municipality of Chisinau, a fact that is confirmed by the implementation certificates.

**Summary of the sections of the thesis.** The research is structured in three chapters, one theoretical and two dedicated to experimental studies, the work containing annotations (in Romanian, Russian and English), list of abbreviations, list of tables, list of figures, introduction, three chapters, general conclusions and recommendations, bibliography from 268 sources, 10 annexes and being perfected on 121 pages of basic text.

**The Introduction section** argues the topicality and importance of the researched problem, the need for scientific research, the aim and objectives of the study are formulated, the scientific novelty of the obtained results is described, the theoretical importance and applied value of the thesis and the approval of the study results is reported.

**Chapter 1 of the thesis** "Theoretical aspects regarding the health problems of obese school-age students and their recovery" includes a synthesis of specialized literature with data on the incidence of obesity in children and adolescents, the etiological and pathogenetic factors involved in the occurrence and progression of the condition; data are presented on the comorbid conditions of obesity in children, as well as their impact on health and quality of life. Also, the accepted methods of treating obesity in school-aged children were described.

**In Chapter 2** "Methodology and stages of the research" 2 stages and directions of the study are presented, principles for selecting the study groups (number of children, inclusion and exclusion criteria), research methodology (dietary questionnaire and evaluation of the level of physical activity, assessment of anthropometric indices, tests to assess the functionality of the cardio-respiratory system as well as tests to assess physical fitness indicators). Likewise, the statistical analysis methods used in the study are presented.

**In Chapter 3** "Argumentation of the effectiveness of the experimental model in physical education, adapted for the recovery of obese children from primary classes with the use of specific means" the results of the own epidemiological study are presented, with the estimation of the share of overweight and obese children in the country. The physical development of the children included in the study is appreciated based on somatic and physiological indices; the results of the questionnaires are analyzed and the effectiveness of applying the experimental model to the physical education lesson is argued.

The thesis is completed with general conclusions and practical recommendations that include the results of the study, at the same time, the practical recommendations regarding the treatment and prevention of obesity in primary school students are presented.



## THESIS CONTENT

### 1. THEORETICAL ASPECTS REGARDING HEALTH PROBLEMS IN SCHOOL AGE STUDENTS WITH OBESITY AND THEIR TREATMENT

(summary of the first chapter)

The World Health Organization (WHO) states that obesity is one of the most obvious health problems, but often ignored by society.

Researchers Bray G. and Bouchard C. state that in most cases obesity in adulthood has its origin in childhood, considering that approximately 75% of overweight children, between the ages of 3 and 10, remain overweight in early adulthood. And the risk is 3 to 10 times greater if the child's weight exceeds the 95th percentile for his age. Also, in 54-60% of adults with excess weight present in childhood, it continues to progress, favoring serious complications at the level of all vital systems of the body [26].

The contemporary global epidemic, caused by excess weight in children, causes many debates regarding the etiological nature of this phenomenon. Data on the risk factors of childhood obesity are not well established due to differences in lifestyle, behaviors and social culture between different nations, countries and regions [23, 26, 27]

If we refer to genetic factors and nutrition in the first year of life, in a series of works (Korotkova et al., 2002; Petry et al. 1997; Meznell 2002; McMillen et al., 2005; Dulapciu E. and Revenco N. 2017), the authors associate the nutritional character of women during pregnancy and the character of the infant's diet have both short-term and long-term consequences, being the main risk factors for the development of obesity and NCDs throughout the offspring's life.

Researchers Ickes et al., 2014, Brown T. et al., (2019), who conducted studies on the incidence and etiology of childhood obesity, believe that hypodynamia is a key factor underlying the development of this condition in children.

In the specialized literature published in the Republic of Moldova, we have identified a small number of studies aimed at the incidence of obesity in primary school children, as well as their evaluation and treatment methodology. Authors Caun E. and Dorgan V. (2007), Zavalîşca A. et al. (2012), Cernetchi O. (2013), Friptuleac G. (2017), Dilapciu E. (2018) Obreja G. (2019) in their works analyzed the health status of children and adolescents in the country and emphasized the benefit of education physical and physical therapy in the recovery of childhood obesity.

Doctors and researchers in the field are all aware of the fact that the current generation of children have poorer health than their parents. Overweight and obese children are at risk for immediate and long-term health consequences such as: cardiovascular and metabolic risks and additional comorbidities including obstructive sleep apnea [21], non-alcoholic fatty liver disease [33] and musculoskeletal disorders [28] most of these can be prevented.

Simultaneously with the increase in body weight, the mechanical load on the musculoskeletal system increases. In obese children, the spine is the most exposed. And since the muscular corset of the trunk is poorly developed, attitude deficiencies are installed in children of small school age. Over time, therefore, sensory and motor disturbances are established that affect the lower limbs. Thus, the muscles of the thighs and calves are subject to atrophy, and as a consequence, orthopedic deficiencies develop with a high frequency of genu valgum (55.1%) and a lower frequency of genu recurvatum (24.2%), favoring the flattening of the plantar arch with subsequent deregulation of walking [25, 28].

The dominant share of cardiovascular diseases in the structure of mortality and morbidity among the growing population, led to the formation of an idea of a cardiovascular continuum based on a clinical evaluation of risk factors for the development of cardiovascular complications. The relevance of this problem is also facilitated by the fact that worldwide there is a constant increase in

the weight of overweight children, which may mean a possible increase in cardiovascular pathology in the near future.

It is clearly imperative that obesity be targeted as an area of immediate and priority action. Thus, there is a need to develop comprehensive and productive strategies to face the challenges generated by the expansion of childhood obesity in a sustainable way. Also, a mandatory competence presents the encouragement of the development and implementation of programs for early diagnosis, prevention and treatment of obesity in children.

During schooling, the child's body, under the influence of changing social conditions, environmental and biological factors, undergoes complex morphological and functional changes, these overlap with the processes of functional and psycho-emotional adaptation to academic tasks [4, 5, 7].

The physical education lessons held in the school fulfill a special role both in the process of formation and development of the students' personality, as well as in the process of physical development and health education. Physical education is the only discipline in the school curriculum that aims to prepare children for a healthy lifestyle and that transmits important social values, having an essential contribution to their harmonious physical and mental development [2].

Studies conducted by hygienists and physiologists indicate that up to 82-85% of the day, students are in a static position (sitting). Children's physiological need for physical activity is often satisfied through independent, spontaneous movements, which cover only 18-20% of the daily norm. On the days when the children participate in the physical education lesson, up to 80% is ensured, and in their absence, the children receive up to 40% less of the required physical activity (Bezrukikh M. and Sonkin VD., 2001).

In modern literature, the issue of the optimal number of physical education lessons for primary school students is widely discussed. According to physiologists, two physical education lessons per week provided by the school curriculum cannot fully satisfy children's physiological need for movement. Thus, some authors argue that the number of these hours should be increased, including through extracurricular activities [22, 14].

Since overweight and obese children hardly cope with the norms of the school program, it is necessary to find other solutions to include them in physical activities and to ensure their optimal level of physical development and normalization of body weight.

According to the hypothesis put forward by us, in this pedagogical experiment, if we introduce a kintotherapeutic program, developed according to the requirements of the school curriculum with exercises for general physical development and a complex of respiratory gymnastics, it will allow us to increase the degree of effectiveness of the education lessons physics in the primary cycle and will facilitate the strengthening of health and the normalization of the body weight of students with obesity.

## **2. RESEARCH METHODOLOGY AND STAGES**

(summary of the second chapter)

Research in the field of harmonious physical development of children is of particular importance, as it allows revealing the basic laws of individual development, as well as determining the functional capabilities of the body of children of primary school age.

According to the theoretical study in chapter I, the problem of recovering obese primary school students is not fully resolved and requires the development of new models to be applied in physical education lessons.

Chapter 2 presents the methods used in the work, the reason for selecting the tests in order to obtain a truthful situation regarding the health status and physical development of the selected students. Also, all the stages of the pedagogical study are outlined.

### Research methods used in the study

In order to objectify the research process and control the condition of the subjects included in the research, the following research methods were used:

1. Theoretical analysis and generalization of specialized scientific and methodological literature;
2. Analysis of the documents that ensure the training process;
3. Pedagogical observation;
4. Investigation (questionnaires);
5. Evaluation tests;
6. Pedagogical experiment (finding and training);
7. Statistical-mathematical methods;
8. Graphical and tabular method.

The study presented in this work was carried out in the period 2016-2020.

**The first stage** of the study took place between 2016 and 2017 and was based on the study and analysis of specialized literature published at the national and international level regarding the subject of the research and the current situation in the field of epidemiology, treatment and prevention of obesity in children.

**In the second stage** (2017 – 2018) I carried out the confirmatory study at the beginning of the 2017 – 2018 school year. To assess the proportion of excess body mass based on BMI, 695 children aged 7 – 10 years were examined. The children included in the research were selected from three public institutions of the city. Chisinau: Theoretical High School "Minerva", Moldovan-French Theoretical High School "Gh. Asachi" and the Theoretical High School "Pro Succes".

To assess the nutritional level, the body weight and height of the students were evaluated. The collection of these data was done with the consent of the institutional committee and anonymized in order not to allow the identification of the people included in the study.

Depending on BMI, the children were divided into 3 groups: I – normal weight (between the 5th and 85th percentile for age and sex), group II – overweight (between the 85th and 95th percentile) and obese children (greater than the 95th percentile)

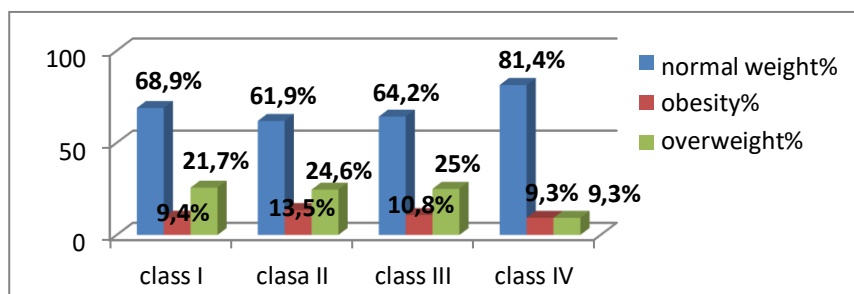
As a result of this study, we found that of the total number (N = 695) of children included in the study, 482 (69.4%) are normal weight children, 139 (20%) – overweight and 74 (10.6%) – obese, of which 39 (10.9%) – boys and respectively 35 (10.4%) – girls. In the first grade of 212 children, 68.9% are normal weight, 21.7% are overweight and 9.4% are obese (of which 8.4% - girls and 10.2% - boys). The results are displayed in the table below (Table 2.1.)

**Table 2.1 BMI variation in children aged from 7 to 10 years (n= 695)**

Class	Gender	Normal weight n (%)	Overweight n (%)	Obese n (%)
I-a	F (n = 95)	73 (76,9)	14 (14,7)	8 (8,4)
	B (n = 117)	73 (62,4)	32 (27,4)	12 (10,2)
	Total (n = 212)	146 (68,9)	46 (21,7)	20 (9,4)
II-a	F (n = 90)	59 (65,6)	20 (22,2)	11 (12,2)
	B (n = 73)	42 (57,5)	20 (27,4)	11 (15,1)
	Total (n=163)	101 (61,9)	40 (24,6)	22 (13,5)
III-a	F (n = 69)	40 (58)	19 (27,5)	10 (14,5)
	B n= (79)	55 (69,6)	18 (22,8)	6 (7,6)
	Total (n= 148)	95 (64,2)	37 (25)	16 (10,8)
IV-a	F (n= 83)	68 (81,9)	9 (10,9)	6 (7,2)
	B (n=89)	72 (80,9)	7 (7,9)	10 (11,2)
	Total (n=172)	140 (81,4)	16 (9,3)	16 (9,3)
Total	F (n=337)	240 (71,2)	62 (18,4)	35 (10,4)

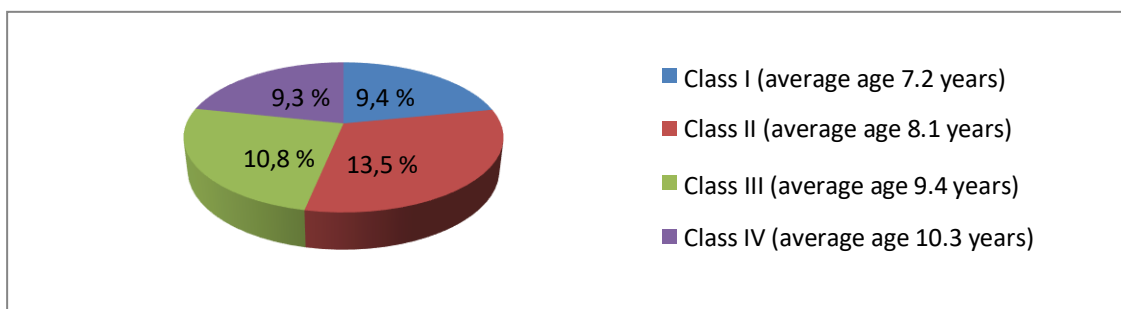
	B (n=358)	242 (67,6)	77 (21,5)	39 (10,9)
	Total (n=695)	482 (69,4)	139 (20)	74 (10,6)

Note \*n – the number of children; F – girls; B – boys



**Fig. 2.1. Incidence of overweight and obesity in students of the 1st - 4th grades**

The incidence of obesity among children aged 7-10 years varies from 9.3% to 13.5% depending on the age and gender of the children (Figure 2.1). Comparing the obtained results, we notice that the incidence of obesity prevails among second grade students, with 13.5%, and the lowest incidence of obesity was found to be among fourth grade students and is 9.3% (Figure 2.2).



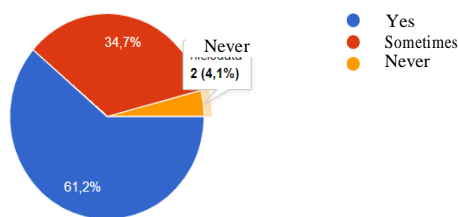
**Fig. 2.2. The prevalence of obesity depending on children's age and school class**

**Stage III** during the 2018-2019 academic year included the actual scientific-didactic experiment, which lasted from September to May. In our study, 50 obese children were selected (n=25 children in the experimental group - GE and n=25 children in the GM control group). Thus, the indices of physical development and psychomotor skills of the children included in the study were evaluated and analyzed in comparison. 2 questionnaires were developed to assess the eating behavior and physical activity of the children included in the study, the results of which are presented below.

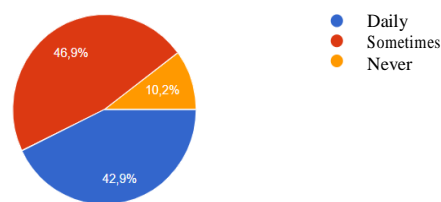
**The results of the food and physical activity survey of the students included in the study.** As specified in chapter 1, both diet and physical activity are key elements in the development of obesity in children, and their monitoring is of particular importance in the early prevention of obesity in children. Next, we will present the most conclusive answers.

To the question: Do you usually have breakfast at home?

The results demonstrate the following fact: 30 (61.2%) respondents state that they have breakfast at home; 17 (34.7%) respondents answered that they sometimes have breakfast at home and 2 (4.1%) answered that they never have breakfast at home (Figure 2.3).



**Fig. 2.3. Eating habits at breakfast**



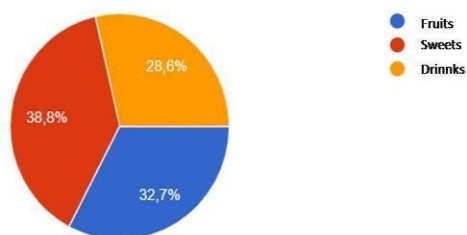
**Fig. 2.4. Food in the educational institution**

Question 2. How fervently do you eat in the school canteen? The results demonstrate the following fact: 21 (42.9%) respondents state that they eat at the school canteen; 23 (46.9%) respondents answered - sometimes and 5 (10.2%) answered that they never eat at the school canteen (fig. 2.4).

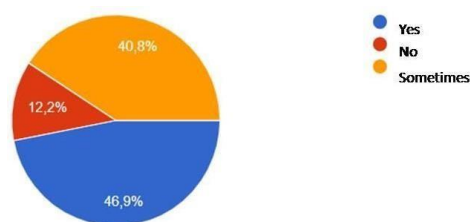
Question 3. What do you usually eat for lunch? The results demonstrate the following fact: 21 (42.9%) respondents state that they usually eat soups with vegetables for lunch; 17 (34.7%) respondents answered - salad and meat and 11 respondents (22.4%) answered that they prefer fast food products for lunch.

Question 4. Do you usually have snacks between the main meals of the day? For this question in the questionnaire, the results demonstrate as follows: 22 (44.9%) respondents state that they usually eat meat and meat derivatives at dinner; 13 (26.5%) respondents answered that they usually eat fast food; 8 (16.3%) respondents answered that they eat fruits and vegetables for dinner and 6 (10.2%) answered that they prefer milk and milk derivatives for dinner (Figure 2.5).

Question 5. Do you follow the daily regime? For question 8 of the questionnaire regarding the observance of the daily regime, we found the following results: 23 (46.9%) respondents state that they respect the daily regime; 20 (40.8%) respondents answered sometimes and 7 (12.2%) answered that they do not respect the daily regime (Figure 2.6).

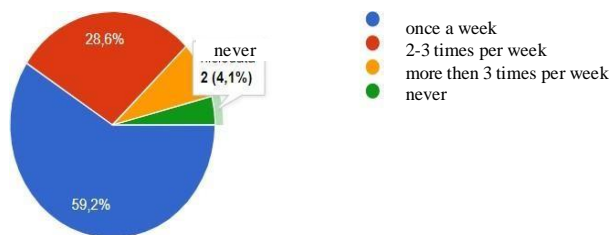


**Fig. 2.5. The favorite foods of the children included in the study for snacks**

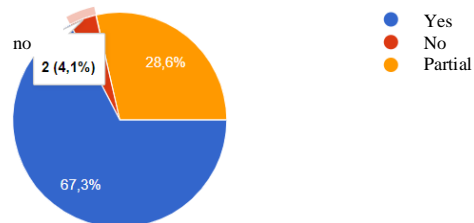


**Fig. 2.6. Observance of the daily routine by the students included in the study**

Question 6. How often do you eat in public places (cafes, pizzerias, etc.) The results of the answers to question 9 of the food questionnaire demonstrate the following fact: 29 (59.2%) of the respondents say that they usually eat in public places at least once a week; 14 (28.6%) of the respondents state that they usually go to fast food places 2-3 times a week; 4 (8.2%) respondents answered that they used to eat fast food in public places more than 3 times a week and 2 (4.1%) of the respondents answered that they never (Figure 2.7).



**Fig. 2.7. The ratio of the students included in the study who eat in places that offer fast food**



**Fig. 2.8. The ratio of students who know the types of "healthy" and "unhealthy" foods**

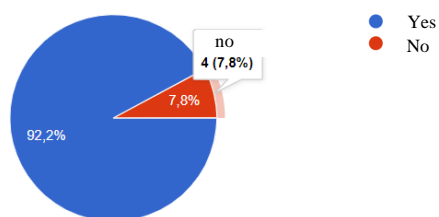
Question 7. Do you know what are "healthy" and "unhealthy" products The results obtained for question number 10 of the food questionnaire demonstrate the following fact: 33 (67.3%) of the respondent's state that they know the difference between "healthy" and "unhealthy" foods "; 14 (28.6%) respondents answered that they partially know, and 2 (4.1%) respondents answered that they do not know (Figure 2.8)

#### **Physical activity questionnaire results**

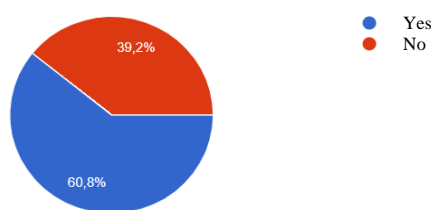
The result of the respondents' answers regarding the question:

**1. Do you have participants during the year in physical education lessons?** The results obtained for answer number 1 of the physical activity questionnaire showed that: 47 (92.2%) of the respondents answered that they regularly participate in physical education classes, while 4 (7.8%) answered that they do not participate regularly in physical education lessons (Figure 2.9).

**2. Do you practice physical activity in your spare time?** The results obtained in the physical activity questionnaire regarding the practice of physical activity in free time demonstrated that: 31 (60.8%) of the respondents state that they perform physical activity in free time, and 20 (39.2%) of the respondents state with no physical activity during free time (Figure 2.10).



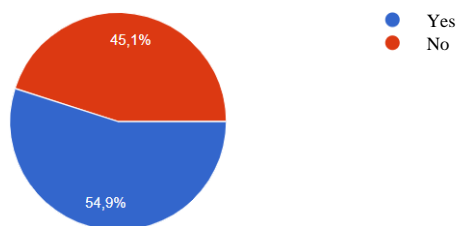
**Fig. 2.9. The percentage of students who participate in physical education during the school year**



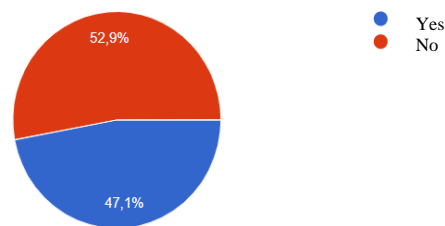
**Fig. 2.10. The percentage of students practicing physical activity in their free time**

**3. Did you practice physical activities regularly (2-3 times a week), attending the sports sections organized within the school?** The results obtained for answer number 3 of the physical activity questionnaire showed that: 28 (54.9%) of the respondents answered that they participate in physical activities regularly (2-3 times a week) attending the departments of the educational institution, but 23 (45.1%) of the respondents answered that they do not regularly participate in physical activities (Figure 2.11).

**4. Practice physical activities regularly (2-3 times a week), attending sports sections in the city.** The results obtained for answer number 4 of the physical activity questionnaire showed that: 24 (47.1%) of the respondents answered that they regularly participate in physical activities at the sports sections in the locality, while 27 (52.9%) of the respondents confirmed that they do not attend the sports sections in the locality (Figure 2.12).

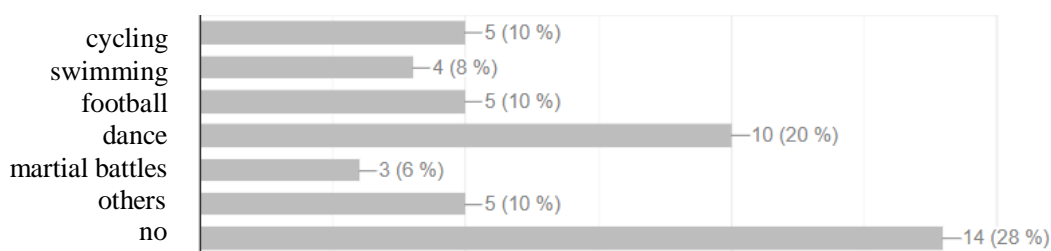


**Fig. 2.11. The percentage of children who do physical activities regularly in the sports sections organized within the school**



**Fig. 2.12. The percentage of students who do physical activities regularly (2-3 times a week) attending sports sections in the city**

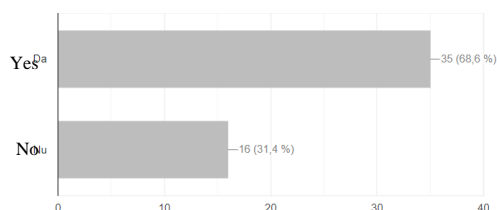
**5. Do you have a favorite type of sport that you regularly practice at least 3 times a week?** The results obtained for answer number 5 of the physical activity questionnaire showed that: 14 (28%) of the respondents answered that they do not participate in practicing sport regularly at least 3 times a week. While 36 (72%) respondents confirmed that they do regular sports of which: 5 (10%) practice cycling, 4 (8%) practice swimming, 5 (10%) practice football, 5 (10%) practice other sports that were not mentioned in the respective questionnaire (Figure 2.13).



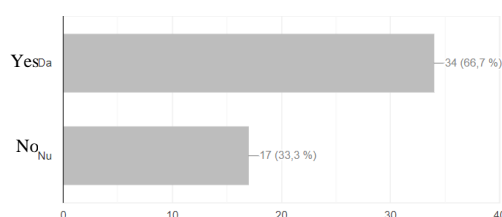
**Fig. 2.13 Percentage of sports practiced regularly (3 times a week) of the students included in the study**

**6. Do you do moderate or vigorous physical activity, but not regularly?** The results obtained for answer number 6 of the physical activity questionnaire showed that: 35 (68.6%) of the respondents answered that they regularly participate in vigorous physical activities but not regularly, while 16 (31.4%) answered that they do not participate regularly during physical activities but occasionally (fig. 2.14).

**7. Do you intend to practice moderate or vigorous physical activities in the next 6 months?** The results obtained for answer number 7 of the physical activity questionnaire showed that: 34 (66.7%) of the respondents answered that they intend to practice moderate or vigorous physical activities in the next 6 months, while 17 (33.3%) have answer that they do not intend to practice physical activities in the near future (Figure 2.15).



**Fig. 2.14. The percentage of students involved in the study who practice moderate or**



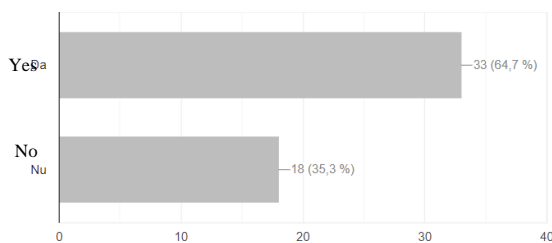
**Fig. 2.15. The percentage of students involved in the study who intend to engage in**

**vigorous physical activities, but not regularly**

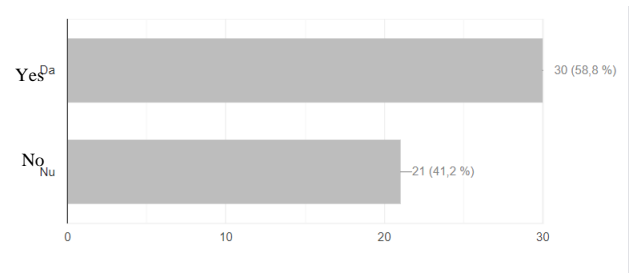
**moderate or vigorous physical activities in the next 6 months**

**8. Did you practice moderate physical activity for 30 minutes a day, 5 days a week in the last 1 - 6 months?** The results obtained for answer number 8 showed that: 33 (64.7%) of the respondents answered that they practiced moderate activity for 30 min./day, 5 days a week during half a year, while 18 (35.3 %) answered that they do not practice physical activity 5 days a week for 30 minutes (Figure 2.16).

**9. Did you do vigorous physical activity 3 or more times a week for 1-6 months?** The results obtained for answer number 9 showed that: 30 (58.8%) of the students who completed the questionnaire did intense physical activity 3 times a week in the last half year, while 21 (41.2%) answered that he does not practice vigorous physical activity for 1-6 consecutive lines (Figure 2.17).



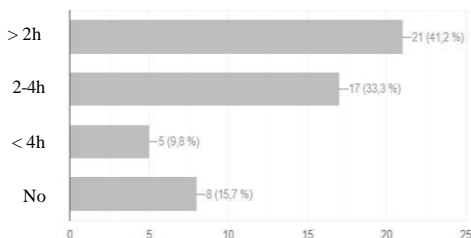
**Fig. 2.16 The percentage of students involved in the study who performed moderate physical activity for 30 min a day, 5 days a week in the last 1 - 6 months**



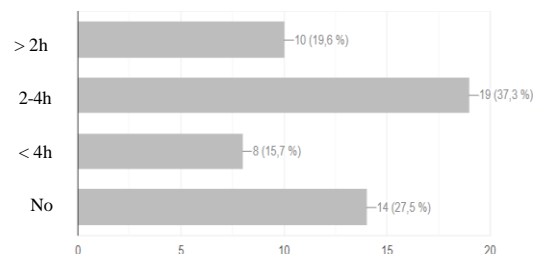
**Fig. 2.17. The percentage of students involved in the study who perform intense physical activity 3 times a week for 1-6 months**

**10. Do you watch TV in your daily free time?** For question number 10 of the questionnaire, we received the following results: in their free time, 8 (15.7%) of the students involved in the study do not watch TV, but 5 (9.8%) watch TV more than 4 hours/day, 17 (33.3%) watch TV approximately 2-4 hours/day, and 21 (41.2%) of the respondents answered that they watch TV less than 2 hours/day, being restricted by their parents (Figure 2.18).

**11. Do you play video games on your computer or phone in your spare time?** The results obtained for question number 11 are as follows: only 14 (27.5%) of the respondents do not play video games in their free time, more than 4 hours/day 8 (15.7%) of the respondents play video games, approximately 2 – 3 hours/day 19 (37.3%) of the respondents and less than 2 hours/day 10 (19.6%) of the respondents answered that they play computer or mobile games (Figure 2.19).



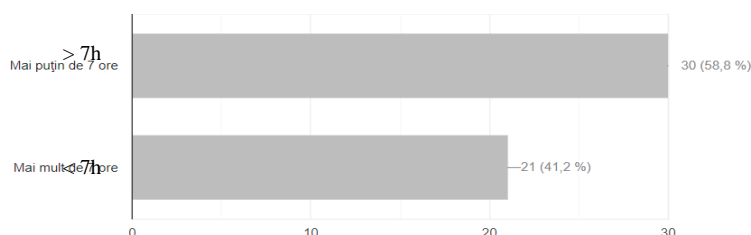
**Fig. 2.18. The time spent daily by the students involved in the study watching television**



**Fig. 2.19. The time spent daily by the students involved in studying video games on the computer or phone**



**12. Duration of physical activity during free time per week?** We received the following results: 30 (58.8%) of the respondents practice physical activities less than 7 hours a week in their free time, while 20 (40 %) practice sports activities more than 7 hours in their free time (Fig. 2.20).



**Fig. 2.20. The time given by the students involved in studying to physical activities during their free time**

The results obtained from the investigation allowed us to appreciate the eating behavior and the level of physical activity of the group of children included in the pedagogical study. Also, we had the opportunity to identify the number of hours required for the child's physical activity, to select the specific means used to develop the experimental model.

In the context of the above, the experimental model for physical education adapted for the recovery of obese second-grade students with the use of physical therapy (MEDEFRO) was structured as follows:

- formulation of tasks;
- the total number of lessons per week, per month, per year and their structure;
- the thematic distribution of the program material by periods;
- the content-model of the special physical exercises and the method of application (in the complex).

### **The experimental model in physical education for the rehabilitation of students with obesity from the 2nd grades with the use of physical therapy means**

#### **Objectives:**

1. Strengthening the health of second grade students from the primary cycle through all means of physical education.
2. Educating the spirit of discipline and conscious attitude towards maintaining a correct position (postures) of the body.
3. Formation of a constant habit for practicing physical exercises.
4. Timely development of motor skills in second grade children.

#### **The structure and continuity of the lesson.**

According to our recommendation, the physical education lesson for children with obesity in the 2nd grade lasts 45 minutes.

According to the structure, each lesson consists of:

- **the preparatory part** (5 – 7 minutes) – organizational which includes exercises that capture the students' attention, creating favorable conditions for further activation of the neuromuscular apparatus, as well as preparing the students' body for the next part of the lesson;
- **the basic part** (30 – 33 minutes), is directed towards the solution of two basic tasks: 1. Improving the functions of the cardio-respiratory system with the simultaneous increase of general resistance and 2. Activating and normalizing the metabolism, which also involves weight normalization;
- **the final part** (3-5 minutes) is aimed at ensuring a gradual transition to the usual school activity.

According to the national curriculum for primary grades, 2 physical education lessons are expected for second grade students in the weekly schedule, and a total of 68 hours/year are allocated. The distribution of hours according to the type of activities, were distributed as follows:

- 16 hours of learning lessons;
- 40 hours of material consolidation lessons;

- 12 hours of motor skills improvement lessons.

Total 68 hours

The types of lessons are divided into 3 quarters:

I. September - November;

II. December – February;

III. March – May.

**Table 2.2 Quarterly distribution of hours in the discipline "Physical Education" for students in the 2nd grade of the primary cycle**

<i>The content of the program material</i>	<i>Quarters and number of lessons</i>		
	I	II	III
1. Complex of specialized exercises for the preparatory part of the lesson:	1 – 22	23 – 46	47 – 68
1.1. Formations and motor activities: aligning in a column, respecting the distance of an outstretched arm from each other; turning on the spot and jumping: to the right and to the left.	1 – 22	23 – 46	47 – 68
Walking exercises, jumping and running in a circle, one in a row: - normal walking; - walking with the knees high; - walk with pedestrians after the signal with the change of direction of movement (right - left); - jumps: on both legs, in one leg with a change at the teacher's signal; - Running at a slow pace (1 – 2 min)	1 – 22	23 – 46	47 – 68
<b>1.2.</b> Explaining and learning the correct exercises for posture deficiencies in the supine position (dorsal, ventral, quadrupedal) using these initial positions for the following exercises: a) Initial position (PI) supine position (DD) - trunk flexion and return to the initial position; flexion - extension, abduction - adduction (alternative and simultaneous) of the lower limbs - toning of the abdominal muscles; b) P.I. from the ventral decubitus (DV) - hands parallel to the shoulders: extension of the head and trunk with bringing the arms forward - up, then to the side and returning to the initial position - to tone the back muscles; c) P.I. quadruped - extension of the trunk with the simultaneous lifting of the right arm and the left leg with a return to the initial position; the same is repeated with the opposite member.	1 – 22	23 – 46	47 – 68
<b>1.4.</b> Exercises from the basic standing position (PB). Explanation of the correct position in orthostatism, using this position as a starting point for the following exercises: a) arms forward, from the side - up with a palm on the head, at the same time by jumping with the feet shoulder-width apart, returning by jumping to the initial position, perform the movements in tact with the breath: during the execution - exhale when returning - inspired; b) arms forward, arms up simultaneously with the extension of the trunk - we inhale into the abdomen and take the right leg back to the top (inhale), return to PI (exhale). Repeat with the opposite leg; c) arms forward with lunge to the left (expire),	1 – 22	23 – 46	47 – 68

return to PI. (inhale), the lunge to the right is repeated, we coordinate with the breath;			
<b>1.5. Breathing exercises</b> a) taking the arms to the side, flexing the trunk simultaneously with twisting to the right - with the left hand we touch the right leg (exhale) and return to the initial position. We repeat the same on the opposite side; b) bringing the arms through the side - up (inspiration), arms down with swings of free arms (exhalation); c) diaphragmatic breathing exercise with hand control (right on the chest and left on the abdomen) - when we inhale we inflate the abdomen, when we exhale we suck the abdomen;	1 – 22	23 – 46	47 – 68
<b>2. Specialized exercises for the basic part of the lesson</b>	I	II	III
<b>2.1. Development of motor skills:</b> - going up and down on the gymnastic bench; - crawling on the gymnastic bench with the help of the arms; - jumping rope	1 – 22 15 – 22 25 – 22	23 – 46 30 – 40 36 – 46	
<b>2.2. Dynamic games with a specialized character for the basic part of the lesson (complex formation of coordination abilities through games with a predominant effort for large muscle groups):</b> - the game "hunters and ducks"; - "Whoever is called catches the ball" - the "go through the tunnel" game - "The Belt"	I 8 – 20 10 – 22 12 – 22	II 23 – 44 26 – 46 30 – 46	III 47 – 68 50 – 60 48 – 68
<b>2.3. Control lessons</b>	22	46	68
<b>3. The complex of actions and specialized exercises for the concluding part of the lesson:</b>			
<b>3.1. Bringing the body into a state of calm:</b> - exercises in motion and on the spot, correlated with breathing, quiet tempo; - lesson totals; - homework assignment;		in all lessons in all lessons in all lessons	
1. Complex of therapeutic exercises no. 1.		1 – 22	
2. Complex of therapeutic exercises no.		23 – 68	

### 3. ARGUMENTATION OF THE EFFICIENCY OF THE EXPERIMENTAL MODEL IN PHYSICAL EDUCATION, ADAPTED FOR THE RECOVERY OF OBESE CHILDREN IN PRIMARY CLASSES USING SPECIFIC MEANS

(summary of the third chapter)

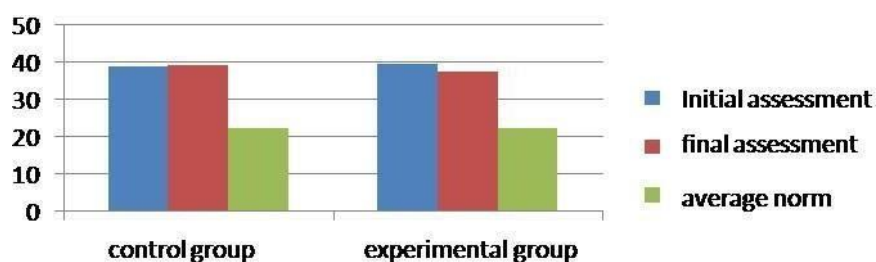
#### Analysis of the initial indices of the level of physical development, psychomotor and functional training of the students of small school age included in the pedagogical study

In order to argue the effectiveness of the "Experimental model for physical education, adapted for the recovery of obese children from primary classes, with the use of physical therapy" the somatic, functional and physical training indices of the participants included in the study group were evaluated and compared - between the study group - GE (who followed the experimental model during the school year, within the physical education lesson) and the control group - GM (who followed the school program in the discipline of physical education) at the beginning of the study - EI and at the end of the study - EF.

Based on the analysis of the anthropometric indices obtained during the school year, we can report the following:

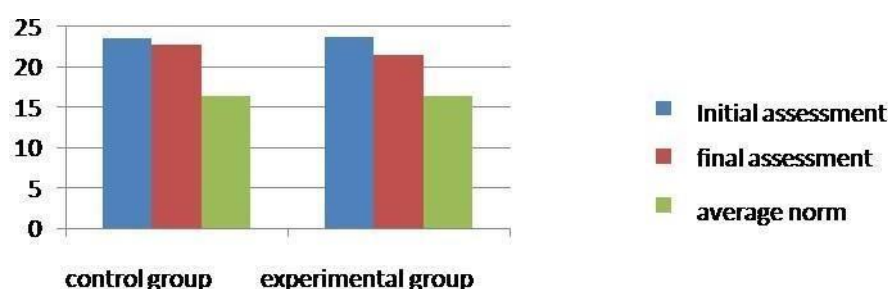
The results of the waist assessment (cm) of students in GM and GE, during the school year, highlight ( $\bar{X} \pm m$ ) in GE increases by 3.73 cm, and GM increases by 4.27 cm in the final test (TF).

If we refer to the results of the assessment of body weight (kg) in the GE at EI and EF, it increased in the GM by 0.58 kg, and in the GE students it decreased by 1.25 kg during the academic year. Looking at the differences in the average weight indices between GE and GM, a not so significant, but important decrease can be seen in the experimental group (Figure 3.1).



**Fig. 3.1. Variations in body weight between the initial and final assessment of the study group**

The results obtained, within the EI and EF, demonstrate that the BMI during the study year, in the boys from GM, decreases insignificantly, from  $23.60 \pm 0.55$  at EI and up to  $22.70 \pm 0.50$  with  $p > 0,05$ . And in GE, BMI values decrease from  $23.80 \pm 0.53$  to  $21.50 \pm 0.54$ . Thus, over the course of the year, the body weight of students from GE decreases, approaching the average limits for age and sex, compared to the BMI index of those from GM (Figure 3.2).



**Fig. 3.2. Variations of the BMI index at the initial and final evaluation of the study group**

**Table 3.1. Comparative analysis of anthropometric indicators of 8-9 year old boys from the study group (n = 25) and the control group (n = 25) (Total = 50)**

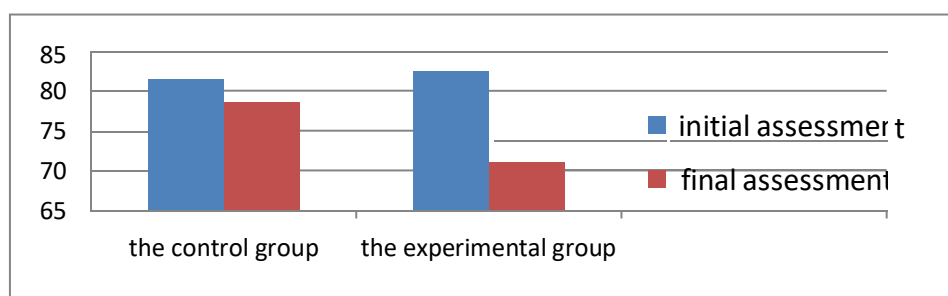
Nr. ord	Anthropometric indices	Groups and statistics	Initial assessment $\bar{X} \pm m$	Final evaluation $\bar{X} \pm m$	t	P
1.	Waist (cm)	M	127,00±3,53	131.27±3,50	1,13	> 0,05
		S	128,50±3,57	132,23±3,47	0,99	> 0,05
		t	0,30	1,03	—	—
		P	> 0,05	> 0,05	—	—
2.	Weight (kg)	M	38,80±0,78	39,38±0,78	1,60	> 0,05
		S	40,75±0,80	39,50±0,82	1,44	> 0,05
		t	1,22	1,28	—	—
		P	> 0,05	> 0,05	—	—
3.	BMI	M	23,60±0,55	22,70±0,50	4,38	< 0,001
		S	23,80±0,53	21,50±0,54	3,75	< 0,001

		t	5,89	0,39	—	—
		P	< 0,001	> 0,05	—	—
4.	CA (cm)	M	81,40±2,26	78,60±2,22	1,16	> 0,05
		S	82,50±2,20	71,00±2,00	5,00	< 0,001
		t	0,35	2,54	—	—
		P	> 0,05	< 0,05	—	—
5.	PT (cm)	M	60,00±1,74	63,20±1,76	1,70	> 0,05
		S	63,30±1,70	62,00±1,78	0,69	> 0,05
		t	1,36	0,48	—	—
		P	> 0,05	> 0,05	—	—
6.	Fold thickness (mm.)	M	23,90±0,66	24,20±0,64	0,43	> 0,05
		S	23,70±0,67	20,50±0,61	4,64	< 0,001
		t	4,20	0,21	—	—
		P	< 0,001	> 0,05	—	—

Note: PT - chest circumference; CA - abdominal circumference; BMI - body mass index.

n <sub>K</sub> -25; n <sub>3</sub> -25;	P	-	0,05	0,01	0,001	
f=24	t	-	2,004	2,797	3,745	r= 0,423
f=48	t	-	2,010	2,680	3,508	

The most obvious changes proved to be in the evaluation of the circumference of the abdomen (PA). Thus, in GM at TF the abdominal perimeter decreases by 2.7 cm compared to TI, while in the GE assessment this decrease is much more obvious and is equal to 11.5 cm (Fig. 3.3).



**Fig. 3.3. The variations of abdominal circumference indices at the initial and final evaluation of the group included in the study**

#### **Analysis of the manifestation of the level of psychomotor training of the students investigated in the pedagogical study**

According to the curriculum for the discipline "physical education", 5 tests were selected to evaluate the motor skills of primary school students, and the results obtained from the evaluation of the study participants are displayed in the table below (table 3.2.)

**Table 3.2. Comparative analysis of the indicators of physical training of children aged 8-9, the experimental groups (no. = 25) and the control group (no. = 25) (total no. = 50)**

Nr. or.	Control tests	Groups and statistically	indicator initial $\bar{X} \pm m$	indicator final $\bar{X} \pm m$	t	P
1.	Running 30 m (sec.)	M	9,85±0,49	8,87±0,47	1,88	> 0,05
		E	10,10±0,47	7,00±0,45	3,10	< 0,01
		t	0,37	2,88	—	—

		P	> 0,05	< 0,01	—	—
2.	Lifting the trunk from the lying position (30 sec.)	M	15,00±0,42	14,44±0,40	1,27	> 0,05
		E	14,28±0,40	16,00±0,37	4,19	< 0,001
		t	0,91	2,88	—	—
		P	> 0,05	< 0,01	—	—
3.	Trunk bending (cm.)	M	5,35±0,15	5,58±0,14		> 0,05
		E	5,14±0,14	6,00±0,11		< 0,01
		t	1,05	2,33	—	—
		P	> 0,05	< 0,05	—	—
4.	Push-ups (number of repetitions)	M	5,13±0,14	5,26±0,14	0,93	> 0,05
		E	5,15±0,15	6,00±0,10	6,07	< 0,001
		t	0,10	4,62	—	—
		P	> 0,05	< 0,001	—	—
5.	Standing long jump (cm)	M	98,00±2,72	100,00±2,70	0,68	> 0,05
		E	99,00±2,64	109,63±2,13	4,09	< 0,001
		t	0,26	2,80	—	—
		P	> 0,05	< 0,01	—	—

Note:  $n_k=25$ ;  $n_g=25$ ; P - 0,05 0,01 0,001  
 $f=24$  t - 2,004 2,797 3,745  $r=0,423$   
 $f=48$  t - 2,010 2,680 3,50

As we can see, at the beginning of the pedagogical study, there was no statistically significant difference in the preparation of students from GM and GE ( $p > 0.05$ ). However, compared to the appropriate indicative indicators of the same students, a greater number of children with low indicators were identified.

Thus, the results of the boys from GE and GM at the initial testing - "speed run test 30 m (s)" corresponded to  $9.85 \pm 0.49$  and  $10.10 \pm 0.47$  (s), respectively, compared to 7, 6 for the satisfactory qualification for students of that age. At TF, children demonstrated much better results compared to IT: GM –  $8.87 \pm 0.47$  and children from GE -  $7.00 \pm 0.45$ .

The results of the evaluation of the strength of the muscles of the abdominal press assessed by the test "Lifting the trunk from the lying position" (no. of repetitions) in GM and GE, during the study year, highlight ( $X \pm m$ ) an increase of 0.56 repetitions in GM and of 1.72 repetitions for students from GE to TF.

The results of the assessment of the strength of the scapular girdle muscles "The push-up test from supine support, hands on the gym bench" (no. of repetitions) of the GM and GE students during the school year, show ( $X \pm m$ ) an insignificant increase in GM and GE of 0.13 and 0.85 repetitions respectively at TF compared to TI and on average performs 5-6 push-ups which corresponds to the qualification "satisfactory".

With regard to the results of the "Standing long jump" test, students from GM at TI demonstrated values of  $98.00 \pm 2.72$ , while students from GE demonstrated values of  $99.00 \pm 2.64$ , respectively during the year school evaluated, thus at TF they demonstrated an increase of 2 cm at GM and respectively at GE the increase is more significant than 109.63 cm at the final testing ( $P > 0.05$ ).

Analyzing the level of performance of the students from the control group and those from the experimental group, we can see that the results obtained by using the tests from the school curriculum, although the students from GE had a level of development similar to the level of those from GM to TI, GE to TF have managed to demonstrate a higher level of physical development in all tests of the school program.

In practice, physical performance is determined using functional tests. The most studied factor of physical condition is cardio-respiratory endurance, using measurable parameters such as: Heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP). All these parameters are appreciated and used in the assessment of the body's functional indices [24].

Blood pressure is one of the most important indicators of the functioning of the body.

The results obtained from the assessment of HR in students from GM and GE, demonstrate that HR was within the normal limits according to the age of 9 years, highlight ( $\bar{X} \pm m$ ) in GM the truth values from  $88.00 \pm 2.44$  b/min to TI as well as TF with values of  $87.00 \pm 2.42$  b/min with a difference of 1 b/min at ( $P > 0.05$ ). In GE students, HR values at TI were  $89.00 \pm 2.48$  b/min and at TF the recorded values of HR decreased by 3 b/min respectively  $86.00 \pm 2.18$  at ( $P > 0.05$ ) which attests that they fall within the limits of the FC norm at the age of 10.

The results obtained in the assessment of TAS values at EI demonstrated increased values compared to physiological norms according to age, both at GM and GE and were between  $112.63 \pm 3.13$  and  $113.25 \pm 3.15$  mm/Hg respectively with differences insignificant ( $P > 0.05$ ). But at EF to GE the SBP values decreased from  $113.25 \pm 3.15$  to  $105.00 \pm 2.90$  mm/Hg ( $P < 0.05$ ), falling within the upper limits of normal according to age.

The results obtained during the evaluation of TSD within the EI at GM and GE values were between  $67.00 \pm 1.80$  and respectively  $70.00 \pm 1.75$  mm/Hg with  $P > 0.05$ . In the EF, the TAD values recorded show an insignificant decrease in GM with  $P > 0.05$ , and in GE the TAD values decrease to  $66.00 \pm 1.83$  mm/HG, approaching the limits of normal values according to age.

**Table 3.3. Comparative analysis of the functional indicators obtained during testing of boys aged 8-9 years, the experimental group (n= 25) and the control group (n= 25) (Total n = 50)**

Nr. ord	Test	Groups and statistics	Initial clues $\bar{X} \pm m$	Final clues $\bar{X} \pm m$	t	P
1.	FC (b/min)	M	$88,00 \pm 2,44$	$87,00 \pm 2,42$	0,38	$> 0,05$
		S	$89,00 \pm 2,48$	$86,00 \pm 2,18$	1,19	$> 0,05$
		t	0,29	0,31	—	—
		P	$> 0,05$	$> 0,05$	—	—
2.	TAS (mm Hg)	M	$112,63 \pm 3,13$	$110,00 \pm 3,10$	0,78	$> 0,05$
		S	$113,25 \pm 3,15$	$105,00 \pm 2,90$	2,54	$< 0,05$
		t	0,14	1,18	—	—
		P	$> 0,05$	$> 0,05$	—	—
3.	TAD (mm Hg)	M	$67,00 \pm 1,80$	$65,00 \pm 1,80$	1,04	$> 0,05$
		S	$70,00 \pm 1,75$	$66,00 \pm 1,83$	2,06	$< 0,05$
		t	1,19	0,39	—	—
		P	$> 0,05$	$> 0,05$	—	—
4	PWC 150 (kg/min)	M	$360,00 \pm 10,10$	$370,40 \pm 10,29$	0,95	$> 0,05$
		S	$305,00 \pm 10,00$	$386,01 \pm 10,72$	7,27	$< 0,001$
		t	3,87	1,05	—	—
		P	$< 0,001$	$> 0,05$	—	—
5	The Stanghe test (sec.)	M	$25,73 \pm 0,71$	$28,00 \pm 0,70$	3,03	$< 0,01$
		S	$26,00 \pm 0,68$	$30,00 \pm 0,63$	5,71	$< 0,001$
		t	0,29	2,13	—	—
		P	$> 0,05$	$< 0,05$	—	—

Note:  $n_k=25$ ;  $n_s=25$ ; P - 0,05 0,01 0,001

f=24 t - 2,004 2,797 3,745

f=48 t - 2,010 2,680 3,508

r= 0,423

The results of the PWC150 test, used to evaluate the physical performance of the children involved in the respective study, demonstrated that at the initial test the students from GM demonstrated values of  $360.00 \pm 10.10$ , which were significantly higher than the values obtained by GE which fell within the mean of  $305.00 \pm 10.00$  ( $P < 0.001$ ). But at the final evaluation, GE demonstrates significantly higher values of  $386.01 \pm 10.72$  kg/min compared to EI with  $P < 0.001$ .

The results obtained in the assessment of the Ștanghe sample demonstrated that the students from GM at the initial and final testing varied the indices between  $25.73 \pm 0.71$  sec. at TI and  $28.00 \pm 0.70$  sec. at TF with ( $p < 0.01$ ). In the students of GE, the values of the indices at TF increased by 4 sec. compared to TI with ( $p < 0.001$ ).

Thus, according to the results obtained, we can mention the following: The control group (GM) - obese students aged 8-9 years - who were involved in the scheme of education lessons carried out according to the school program, showed lower results in physical training compared to the experimental group (GE) - obese students of the same age, who were involved in physical education lessons based on the kinetotherapeutic program developed by us.



## GENERAL CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis and synthesis of specialized literature, we can conclude the following:

1. The study of the specialized literature, as well as the research results from our work on the incidence of obesity among children of small school age, demonstrate that their number is maintained at increased values both at the global level up to 40%, and at the national level where an incidence of 10.6% of the evaluated children is found. At the end of the primary cycle, obesity takes the first place among metabolic diseases, mainly being found in boys. This condition also conditions negative effects on other systems of the body such as: cardiovascular, respiratory, locomotor, etc., causing disturbances both in the physical and psychomotor development of children. Based on the ascertainment study, we highlight the incidence of obesity among primary school children in the Republic of Moldova is quite high. Of the total number of 695 children, 20% are overweight and 10.6% are obese, of which 10.9% are boys and 10.4% are girls. This fact states that childhood obesity in the Republic of Moldova is progressing, affecting a large number of children, which endangers their health and quality of life.
2. The analysis of statistical data and the pedagogical observation highlighted the fact that the incidence of obesity among children of small school age in the municipality of Chisinau constitutes on average 10.6% of the total number of students at this level, with an increasing trend. The highest incidence was found to be in second grade children with 13.5%, with a preponderance in boys with 15.1% compared to 12.2% in girls. As demonstrated by the results obtained in the pedagogical study, complex changes associated with cardiovascular and respiratory diseases are observed in obese primary school students that limit psychomotor development and adaptation to physical exertion.
3. Violation of the diet and adaptation to a sedentary lifestyle are the triggering factors that favor the development of obesity in primary school students. Thus, following the analysis of the results of the food and physical activity questionnaire, we can state the following: although the included students are sufficiently active during the week, they still spend their free time from 2 to 4 hours a day in front of the screens. At the same time, their daily diet includes fast food products, sweets and sweetened drinks at the main meals of the day and at snacks. We believe that adopting these behaviors during the day maintain excess weight and favor the development of obesity.
4. Kinetotherapy in the recovery of obese students requires the use of specific means of physical education in combination with therapeutic exercises to correct physical deficiencies and respiratory exercises, which allow the normalization of cardio-respiratory functions in order to strengthen health and normalize body weight. The physical education lesson must be organized and systematized based on didactic rules and principles grouped in an experimental model for physical education, which includes a minimum of 68 hours in a year of studies. And the weekly program includes 2 hours of 45 minutes each.
5. The results obtained in the evaluation of the physical training of the students involved in the study, based on the tests of the school program, demonstrated that the students from GE, although they had a level of development similar to GM at the initial testing where  $P > 0.05$ , however at EF students from GE managed to demonstrate a higher level of physical development in all tests in the school program, proving statistically true results where  $P < 0.001$ .
6. The comparative analysis of the results obtained in the assessment of physical development demonstrated that at EI the body weight of the boys included in the study group was between  $38.80 \pm 0.78$  (GM) and  $40.75 \pm 0.80$  (GE), and the BMI varied between the values of 23.80 (GE) and 22.70 (GM), which proved obesity of degree I and II. And in TF, the body mass of students from GM increased by an average of 0.58 kg, and among students from GE decreased on average by 1.25 kg during the academic year. These results demonstrate the effectiveness of the experimental model developed and implemented in the physical education lessons organized with the students in the experimental group.
7. The directed influence of the specialized means of physical education, included in the experimental model, allowed the considerable improvement of the physical and psychomotor

development of the investigated children compared to the traditional organization, favoring the reduction of excess weight.

### PROPOSALS AND RECOMMENDATIONS

- For the early detection of obesity, it is necessary to monitor the BMI of students annually by the responsible persons in the educational institution;
- To pay special attention to the daily diet of the children in the school, by the administration and the medical staff of the institution;
- Primary school students must be encouraged to practice moderate to vigorous physical activities systematically 2-3 times a week, as part of extra-curricular activities to achieve the desired result;
- Sports such as: swimming, cycling, dancing, tennis, athletics, etc., are welcome to reduce excess weight in obese children.

**Proposals for the educational institution** to improve the health status of obese students:

- There is a need to organize various sports sections within the educational institution, which will be conducted by physical education teachers. This is dictated by the fact that children are not independent enough, and many parents do not have the opportunity to drive their children to the sports sections organized in the city.
- The physical education rooms must be equipped with the necessary inventory for conducting the physical education lesson with both the basic group and the medical group.
- It is necessary to organize remedial gymnastics sessions with students with different ailments. Since these do not fall within the competence of the physical education teacher, there is a need to employ a qualified physiotherapist. Physiotherapists having the necessary knowledge in the field of recovery of various diseases have the ability to develop kinetotherapeutic programs, are able to organize treatment and prophylaxis sessions with different contingents of people, taking into account their age and physical development.

These results from the need to improve the health of the growing generation and to prevent the installation of various diseases associated with obesity in children.

There is another argument in favor of the above, an important problem has arisen at the level of all general education institutions related to the inclusion of children with special needs (CES). These children have different degrees of disability, physical or mental deficiencies, which require kinetotherapeutic approaches.

Thus, being a physiotherapist employed in the school, being provided with a space equipped with everything necessary, additional expenses will be required from the institution, in return one of the most important objectives will be favorably resolved - organizing the educational process of the children and ensuring the improvement the health of the students in the given institution.

### **Recommendations for parents:**

- Given the fact that the parent decides what foods to feed his child, it is important to ensure the obese child a balanced diet with a reduction in the volume of foods rich in fat and sugar (fast food products, pastries and sweetened drinks), being replaced fresh fruits and vegetables daily.
- It is necessary to monitor the child's health, including his body weight. Because excess weight not only negatively influences the physical and mental development of the child but is also an important factor in the installation of serious chronic conditions that persist into adulthood, affecting health and quality of life.
- During the primary school cycle, the child's physical activity level drops drastically. Thus, there is a need to schedule the day's regime in such a way that the child has the opportunity to do moderate physical activity for 60 minutes daily. This can include walking to school, cycling, outdoor games.
- If greater safety is desired to ensure the child's minimum physical activity, they can be enrolled in a sports section within the school or organized in the locality.
- When the overweight child complains of pain in the musculoskeletal system, it should not be neglected. Because orthopedic deficiencies from childhood often progress into degenerative conditions, which seriously affect the locomotor system and can lead to disabling conditions.

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## ADNOTARE

**Corman Mariana. *Kinetoterapia în obezitate la elevii din clasele primare*: teză de doctor în științe ale educației, Chișinău, 2022.**

**Structura tezei:** Lucrarea cuprinde adnotări în limbile română, rusă și engleză, lista tabelelor, figurilor și abrevierilor, introducere, 3 capitole, concluzii generale și recomandări, bibliografie (268 surse), 9 anexe, 123 pagini text de bază, 29 figuri, 16 tabele. Rezultatele obținute au fost publicate în 9 lucrări științifice.

**Cuvinte-cheie:** obezitate, elevi ai claselor primare, educație fizică, kinetoterapie, Model experimental.

**Scopul lucrării:** Fundamentarea metodologiei de creștere a eficacității lecției de educație fizică și perfecționarea procesului de recuperare a elevilor obezi din ciclul primar.

**Obiectivele cercetării:** Studiarea prevalenței obezității în rândul copiilor de vârstă școlară mică, pe baza rezultatelor propriului studiu epidemiologic și compararea acestor date cu datele statisticilor oficiale din țară și de peste hotare; Studiarea problemei corectării excesului de greutate la copii de vârstă școlară mică și analiza abordări teoretice și metodologice pentru soluționarea acesteia; Evaluarea nivelului de dezvoltare fizică și a pregătirii motrice al elevilor obezi din ciclul primar; Elaborarea, implementarea și argumentarea eficacității Modelului experimental, adaptat pentru recuperarea elevilor cu obezitate.

**Noutatea și originalitatea științifică:** pentru prima dată în Republica Moldova, a fost elaborat și aplicat un model de educație fizică, adaptat pentru recuperarea copiilor cu obezitate din clasele primare. În cadrul acestui model au fost utilizate exerciții de dezvoltare generală (prescrise de programa școlară), exerciții de corectare a posturii în combinație cu exerciții de respirație (prescrise în programul kinetoterapeutic, ținând cont de specificul obezității la copii), care au contribuit la întărirea sănătății și normalizarea greutății corporale a acestora.

**Rezultatele obținute care contribuie la soluționarea unei probleme științifice importante:** Rezultatele obținute în teză, demonstrează din punct de vedere științific și metodologic necesitatea și eficacitatea utilizării mijloacelor kinetoterapiei în cadrul lecției de educație fizică cu elevii obezi din clasele primare. Aplicarea modelului experimental propus, a făcut posibilă normalizarea funcției sistemului cardio-respirator, optimizarea abilităților motorii generale și îmbunătățirea stării de sănătate a copiilor incluși în studiul.

**Semnificația teoretică al lucrării:** extinderea arealului de cunoaștere a concepțiilor teoretico-metodice, privind organizarea și desfășurarea lecțiilor de educație fizică în clasele primare cu elevii obezi în vederea fortificării și păstrării sănătății populației în creștere.

**Valoarea aplicativă:** constă în posibilitatea utilizării rezultatelor studiului cu scopul optimizării motricității generale și funcționalității organismului elevilor obezi în cadrul lecțiilor de educație fizică. Reperele metodologice pot fi folosite în procesul elaborării proiectelor didactice pentru lecția de educație fizică din învățământul primar de către profesorii de educație fizică și la elaborarea programelor kinetoterapeutice în recuperarea obezității la copii.

**Implementarea rezultatelor științifice.** Conținutul modelului experimental a fost aplicat, având scopul de a fortifica starea de sănătate și normalizarea indicelui masei corporale (IMC) la elevii obezi de vârstă școlară mică în cadrul lecțiilor de educație fizică din Instituțiile Publice: Liceul Teoretic „Minerva” și „Pro Succes” din municipiul Chișinău, fapt care este confirmat prin adeverințe de implementare.

## АННОТАЦИЯ

**Корман Мариана. Кинетотерапия при ожирении у школьников начальных классов:**  
диссертация на соискание ученой степени доктора педагогических наук, Кишинев, 2022.

**Структура диссертации:** Диссертация состоит из аннотации на трех языках, списка сокращений, введения, трех глав, общих выводов и рекомендаций, библиографии (268 наименований), 9 приложений, 123 страниц основного текста, 29 рисунков, 16 таблиц. Результаты исследования опубликованы в 9 научных работах.

**Ключевые слова:** ожирение, младшие школьники, физическое воспитание, лечебная физкультура, экспериментальная модель.

**Цель работы:** Обоснование методики повышения эффективности урока физической культуры и совершенствования восстановительного процесса у учащихся начальных классов с ожирением.

**Задачи исследования:** Изучение распространенности ожирения среди детей школьного возраста на основе результатов собственного эпидемиологического исследования и сопоставление этих данных с данными официальной статистики в стране и за рубежом; Изучение проблемы коррекции избыточного веса у детей младшего школьного возраста и анализ теоретико-методических подходов к ее решению; Оценка уровня физического развития и двигательной подготовки учащихся начальных классов с ожирением; Разработка, внедрение и аргументация эффективности Экспериментальной Модели, адаптированной для оздоровления учащихся с ожирением.

**Научная новизна и оригинальность:** впервые в Республике Молдова была разработана и применена экспериментальная модель физического воспитания адаптированная для оздоровления детей младшего школьного возраста с ожирением. В данной модели были использованы общеразвивающие упражнения (предусмотренные школьной программой), упражнения для коррекции осанки в сочетании с дыхательными упражнениями (которые предписаны в кинетотерапевтической программе с учетом специфики ожирения у детей), что способствовало укреплению их здоровья и нормализации массы тела.

**Полученные результаты способствуют решению важной научной проблемы:** в диссертации продемонстрирована, с научно-методической точки зрения, необходимость и эффективность использования средств кинетотерапии на уроке физической культуры с учащимися начальных классов с ожирением. Применение предложенной экспериментальной модели позволило нормализовать функцию кардио-респираторной системы, оптимизировать общую моторику и укрепить состояние здоровья детей младшего школьного возраста с ожирением.

**Теоретическая значимость работы** заключается в расширении области знаний теоретико-методических представлений о методике организации и проведения уроков физической культуры в начальных классах с учащимися с ожирением в целях воспитания здорового образа жизни освещении роли физической культуры, улучшении и поддержания здоровья населения.

**Практическая значимость:** заключаются в возможности использования результатов исследования с целью оптимизации общей моторики и функциональных возможностей организма детей младшего школьного возраста с ожирением на уроках физической культуры. Методические ориентиры могут быть использованы в процессе разработки дидактических проектов для уроков физической культуры в начальных классах учителями физической культуры и при разработке кинетотерапевтических программ при лечении ожирения у детей.

**Внедрение научных результатов.** Содержание экспериментальной модели применено с целью укрепления здоровья и нормализации индекса массы тела (ИМТ) у школьников с ожирением на уроках физической культуры в Государственных учреждениях: Теоретический лицей «Минерва» и «Pro Succes» города Кишинев, что подтверждается сертификатами внедрения.



## ANNOTATION

**Corman Mariana *Physiotherapy in obesity of young school-age students*:** PhD thesis in educational sciences, Chisinau, 2022.

**Thesis structure:** The paper includes annotations in Romanian, Russian and English, the list of abbreviations, introduction, three chapters, conclusions and recommendations, bibliography (268 sources), 9 annexes, 123 pages of basic text, 29 figures, 16 tables. The results are published in 9 scientific papers.

**Keywords:** obesity, primary school students, physical education, physical therapy, experimental model.

**The purpose of the paper:** Foundation of the methodology for increasing the effectiveness of the physical education lesson and improving the recovery process of obese primary school students.

**Research objectives:** Studying the prevalence of obesity among school-age children, based on the results of their own epidemiological study and comparing these data with the data of official statistics in the country and abroad; Studying the problem of correcting excess weight in children of small school age and analyzing theoretical and methodological approaches for its solution; Evaluation of the level of physical development and motor training of obese primary school students; Elaboration, implementation and argumentation of the effectiveness of the experimental model, adapted for the recovery of students with obesity.

**The novelty and the scientific originality:** for the first time in the Republic of Moldova, an experimental model of physical education was developed and applied, adapted for the rehabilitation of children of primary school age with obesity. In this model, general developmental exercises (provided by the school curriculum), exercises for posture correction in combination with breathing exercises (which are prescribed in the kinetotherapy program, taking into account the specifics of obesity in children) were used, which contributed to strengthening their health and normalizing body weight.

**The obtained results that contribute to the solution of an important scientific problem:** The results obtained in the thesis demonstrate, from a scientific and methodological point of view, the necessity and effectiveness of using the means of physical therapy in the physical education lesson with obese primary school students. The application of the proposed experimental model made it possible to normalize the function of the cardio-respiratory system, optimize general motor skills and improve the health of the children included in the study.

**Theoretical significance:** expanding the area of knowledge of theoretical-methodical concepts, regarding the organization and conduct of physical education lessons in primary classes with obese students in order to strengthen and preserve the health of the growing population.

**The applicative value:** consists in the possibility of using the results of the study with the aim of optimizing the general motor skills and body functionality of obese students in physical education lessons. The methodological benchmarks can be used in the process of developing didactic projects for the physical education lesson in primary education by physical education teachers and in the development of physical therapy programs in the recovery of obesity in children.

**Implementation of the scientific results:** The experimental content of the research program was applied in order to strengthen health and normalize body mass index (BMI) in obese students of young school age and was implemented in physical education lessons in Public Institutions: the Theoretical High School “Minerva” and “Pro Succes” in Chisinau, which is confirmed by the implementation certificates.

**CORMAN MARIANA**

**KINETOTHERAPY IN OBESITY IN PRIMARY CLASS STUDENTS**

**Specialty: 533.04. Physical education, sport, kinetotherapy and recreation**

**SUMMARY**

**of Doctor of Philosophy thesis in educational sciences**

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