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The role and importance of the physiotherapists in educational institutions

Dan Alexandru SZABO[1], Carmen PÂRVU[2], George Danut MOCANU[3], Neculai HARABAGIU[2], Ioan Sabin SOPA[4], Gabriela TRUŞCĂ[1], Andi STOICA[1]

[1] Department M2, Faculty of Medicine, George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, 38 Gheorghe Marinescu Street, Târgu Mureș 540139, Romania.
[2] Department of Sports Games and Physical Education, Faculty of Physical Education and Sports, Dunărea de Jos University, 63–65 Gării Street, Galați 800003, Romania.
[3] Department of Individual Sports and Physiotherapy, Faculty of Physical Education and Sports, Dunărea de Jos University, 63–65 Gării Street, Galați 800003, Romania.
[4] Department of Environmental Science, Physics, Physical Education and Sport, Faculty of Science, Lucian Blaga University of Sibiu, 5-7 Ion Rațiu Street, Sibiu 550012, Romania.

***Correspondence:** Dan Alexandru SZABO; e-mail: alexandru.szabo@umfst.ro

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Abstract: This research aimed to introduce at least one physiotherapist in the interdisciplinary team of the schools, including teachers, doctors, dentists, psychologists, psychotherapists, and auxiliary staff, for the assessment and, if necessary, the periodic postural treatment of the students. The study included 25 students aged between 16 and 18, of which 12 were female and 13 were male. The subjects were divided as follows: 13 students represented the experimental group, and the other 12 constituted the control group. Individuals from the first group followed an individualized kinetic program, and those from the second group followed Physical Education classes within the educational unit. The final results of the research confirmed the hypothesis of our study, namely, the subjects in the experimental group who followed a personalized rehabilitation program developed by a pediatric physical therapist, which contains specific exercises to correct postural deformities for whole body prophylaxis, obtained significantly better results in terms of posture compared to the subjects in the control group who followed the Physical Education class in the school curriculum. Following the initial assessment at the beginning of the study, we concluded that students show multiple postural variations that could be prevented in educational establishments in the presence of at least one pediatric physiotherapist.

Keywords: physiotherapy, physical activity, educational units, physical activity, kinetic prophylaxis

Introduction

Movement represents a physiological category that designates the totality of movements and changes made by living and non-living matter in the universe. Human movement is a reflex, automatic or voluntary act, which consists of changing the whole body's position or a part. It is performed due to concentric or eccentric and dynamic muscle contractions. The production of positive mechanical work accompanies concentric dynamic contractions; the negative one is present during eccentric dynamic contractions.

Pediatrics represents the medical science that has been the field of study of the human body from birth to adolescence from the point of view of development and the pathologies that may appear during this period.

Prophylaxis represents all the means implemented to avoid, expand or worsen certain diseases. A medical-sanitary ensemble is used to prevent certain diseases. Prophylactic treatment measures are used in modern medicine because the chance of success increases considerably, and it is not less expensive from a financial point of view compared to curative treatment (Mârză-Dănilă, 2012).

The purpose of kinetic prophylaxis is to strengthen the state of health, increase the body's natural resistance to pathogens of the external environment, determine a normal psycho-physical balance between the body and the environment, and for children, ensure the conditions for harmonious and normal growth and development of the body, preventing the appearance of physical deficiencies and contact with pathogens that could affect their normal development (Roşulescu et al., 2007; Chang, 2022).

Physiotherapists are specialized medical staff trained to identify and correct the body's biomechanical and anthropometric deficiencies (Szabo et al., 2023). Pediatric physiotherapists work with children from birth to adulthood. They know the stages of development, the evolution of movements concerning advancing age and possible deviations from them (Chang, 2022).

Adolescence is generally considered a healthy period; many of the non-communicable diseases that manifest later are, in part, the result of modifiable risk behaviors established during this period, such as smoking, unhealthy eating patterns, and low levels of physical activity (Balint, 2010; van Sluijs et al., 2021).

Physical inactivity is often associated with later non-communicable diseases. This is recognized as a global pandemic (Kohl et al., 2012), with most evidence coming from studies of adults when the effects of NCDs become apparent (Gore et al., 2011). The World Health Organization recommends that adolescents and children up to 18 years of age do, on average, 60 minutes a day of moderate to vigorous physical activity. People over 18 should perform between 150-300 minutes of moderate or 75-150 minutes of intense physical activity (Bull et al., 2020).

Regular physical activity at any age improves the formation and expansion of new blood vessels in the brain and the increase of neurotrophic factors that support neuronal birth and proliferation (Sleiman et al., 2016; Miranda et al., 2019). Specifically, levels of brain-derived neurotrophic factor (BDNF), a protein associated with changes in learning, memory, mood, and anxiety, were found to increase in response to exercise due to increased production of component molecules that comprise the BDNF protein.

Given rapid growth and myelination during adolescence, neural mechanisms strengthened by physical activity may support fine-tuning cognitive functions that promote learning and memory processes. Physical activity also has immediate direct effects on the adolescent brain, including increased mean cerebral blood flow and increased plasma levels of key neurotransmitters linked to increased arousal, all of which may support improved cognitive functioning (McAuley et al., 2004; Querido & Sheel, 2007).

Beyond neurocognitive benefits, physical activity also profoundly benefits psycho-emotional outcomes among preschoolers, children, and adolescents (Rodriguez-Ayllon et al., 2019). Focusing on teenagers, those who engage in more physical activity than their peers report experiencing less anxiety, depression, and other mood disorders; they also stated that self-esteem and self-concept are higher compared to colleagues who did not perform physical activity (Spruit et al., 2016; Chen et al., 2017; Mandolesi et al., 2018; Belcher et al., 2021).

Endogenous and exogenous factors act with a specific rhythm that induces a certain rhythm of growth and development, presenting a characteristic speed of the process with periods of acceleration and deceleration. These processes of influencing development and growth agents are carried out by defining energy consumption for each process, moment, stage or phase.

Heredity is the transmission of certain traits and characteristics from ancestors to ancestors. The characteristics that can be transmitted through heredity and can be of a constitutional nature: height, body mass, hair texture, eye color; of a psycho-behavioral nature: intelligence, creativity, personality; of a sanogenic or pathogenic nature: diabetes, obesity, cardiovascular diseases: arterial hypertension; or they may be related to motor skills that are influenced by neuro-hormonal processes and the body's metabolism (Balasundaram & Avulakunta, 2023).

Endocrine factors are represented by hormonal processes that have variable influence during development.

Secreted by the thyroid gland, thyroid hormones ensure the normal functioning of the body by regulating the body's metabolism and internal organ functions. Through the bloodstream, they traverse the body and support cells to convert calories and oxygen into energy, which essentially influences every cell, tissue, and internal organ of the human body (Benyi & Sävendahl, 2017).

Somatotropic hormones control the growth of the body until the age of 10 years. After this period, the anterior pituitary gland determines, through these hormones, protein synthesis, body weight, and growth in bone length and thickness. Pituitary gigantism and dwarfism represent two pathologies determined by pituitary somatotropic hyperfunction and hypofunction, respectively (Kato et al., 2002).

Gonadotrophins or sex hormones have a predominant influence during puberty, and this is divided into two distinct stages, namely the general stimulation of growth and physical development phenomena; respectively, the second stage is represented by the stopping of the growth process by strengthening the epiphyses and ossification of growth cartilages located in the border area between diaphyses and epiphyses (Graber et al., 2021).

Metabolic and nutritional factors are the internal factors necessary for developing all metabolic and nutritional processes in the human body. They ensure caloric, protein, lipid, carbohydrate, vitamin and mineral intake. Various morphological or functional dysfunctions can occur due to the lack of nutrients. They can represent the involution of growth and development processes (Balasundaram & Avulakunta, 2023).

The family environment exerts a marked influence on the child's perception of the outside world. It helps build the self-concept and trains it for actions in society. The child learns through interaction with parents and other family members in this

environment. In the first years of development, the family environment modulates the individual's behaviors. Normal development occurs in a supportive, harmonious and warm environment; in the case of a stressful environment, broken families or careless parents, children can develop as maladjusted persons (Horton & Wedding, 2008).

Human posture is generally understood as the relationship between the parts of the human body in an upright position. Certain parts of the body, such as the head and neck, the trunk, and the upper and lower limbs, are involved in the final posture of the body. A good body posture is considered ergonomically advantageous during standing, mechanically efficient during locomotion, and supportive of the normal functioning of internal organs (Czaprowski et al., 2018).

Body posture is described and considered in three reference planes: sagittal, coronal and transverse. Good posture is a state of muscular and skeletal balance that protects the body's supporting structures against injury or progressive deformation, regardless of the posture in which these structures work or rest. In such conditions, the muscles will work most efficiently, and the optimal positions are provided for the thoracic and abdominal organs (Kendall et al., 2005).

The most common deformations of the posture in the sagittal plane in both children and adults are lumbar hyperlordosis, thoracic kyphosis, flat back, where the physiological curves of the spine are missing, and forward projection of the pelvis (Sahrmann, 2002; Janssen et al., 2011; Comerford & Mottram, 2012).

To fulfill the objective of this work, we needed therapeutic tools such as mattresses, gym benches, balls, cones, and hoops. The primary method used in the study is therapeutic physical exercise. Stretching exercises, passive, passive-active, and active mobilizations, taping, therapeutic massage, and trigger point therapy are other methods used in the study. Therapeutic exercise involves prescribed movements to correct impairments, restore muscle and skeletal function, and/or maintain a state of well-being (Bielecki & Tadi, 2022).

Stretching is a therapeutic method by which the stretching of soft tissues is achieved beyond the limit point of the active range of motion and maintaining or not this stretching over a certain period. With its help, the undulations of the collagen fibers are stretched. We mean soft tissue, muscle tissue, contractile, fibrous skeleton, non-contractile, and other non-contractile structures, such as the joint capsule, tendons, ligaments, and skin.

The benefits of stretching are reducing stress and physical relaxation, increasing flexibility and muscle strength, improving posture, preventing injuries, cramps and muscle pain, and improving physical performance (Matthews, 2016). The types of stretching are as follows: passive stretching (Nelson & Kokkonen, 2021), isometric stretching (Ullman et al., 2021), dynamic stretching (Lin et al., 2020), ballistic stretching (Nelson & Kokkonen, 2021) and sports stretching (Matthews, 2016).

Kinesio taping is a treatment modality based on the body's natural healing process. This technique manifests its effectiveness by activating the neurological and circulatory systems. Kinesio taping comes from the science of kinesiology, which recognizes the importance of body movement and its segments in rehabilitation.

Excluding the role of muscles in the movement of body segments and the whole body and in maintaining posture, they also control the circulation of venous and lymphatic flows and maintain body temperature (Kase, 2010).

Massage is a complex of manual maneuvers systematically and methodically applied to body parts to obtain physiological, prophylactic, and therapeutic effects (Diaconu, 2015). This research aimed to introduce at least one physiotherapist in the interdisciplinary team of the schools, including teachers, doctors, dentists, psychologists, psychotherapists, and auxiliary staff, for the assessment and, if necessary, the periodic postural treatment of the students. The main objective of this research is to achieve wellness by applying prophylactic or recuperative programs within an educational institution, thus increasing the quality of life of the people who have benefited from them. Acting at a pediatric level will have positive repercussions on the adults of "tomorrow", reducing the pressure on the medical sector for recovery among adults. The paper is the first study on this topic and presents many novel elements. The study touches on key points such as postural imbalances among students and their correction in educational institutions. Another topic in this paper is how to prevent these static changes through kinetic programs to ton the back, chest and abdominal muscles.

Materials and methods

In the present research, we started from the hypothesis that following the program elaborated by us, one with a therapeutic and prophylactic purpose, the experimental group subjects will obtain better results from the postural point of view and the Harvard test compared to the subjects from the control group.

The type of study is longitudinal and is carried out to investigate a possible causal relationship between a risk factor and the occurrence of a disease, in our case, the relationship between physical therapy and postural deficiencies of students.

The research was carried out for 2 months, April 1 - June 1, 2023. The place of research was Theoretical High School "Constantin Noica" Sibiu.

The study included 25 students aged between 16 and 18, of which 12 were female and 13 were male. The group of subjects was divided as follows: 13 students represented the experimental group, and the other 12 constituted the control group. Individuals from the first group followed an individualized kinetic program, and those from the second group followed Physical Education classes within the educational unit.

The inclusion criteria were as follows: the subjects participating in the research had to be 11th-grade students of the Theoretical High School "Constantin Noica" Sibiu; it was mandatory that the subjects had parental consent and had no contraindications concerning the effort made during physical education and sports classes, given by the family doctor.

Exclusion criteria: subjects who did not receive a certificate from their family doctor that they could perform physical activity and those from whom parental consent was not obtained were excluded from the study.

The 25 subjects underwent a questionnaire on daily habits and periodic assessments: initial, intermediate and final. The experimental group, consisting of 13 randomly chosen subjects, followed a personalized rehabilitation plan after the first

assessment results. Along with their evolution, the program changed according to the subjects' needs and the intermediate evaluation results. At the same time, the control group followed the school curriculum for physical education classes.

The multidisciplinary team consisted of a doctor, a nurse from the school office, teachers, and a physiotherapist. The study's conduct, objectives and purpose were explained to all participants in advance. All 25 subjects who participated in the present study, both passively and actively, have the consent of their parents/legal guardians.

The management of the Theoretical High School "Constantin Noica" Sibiu agreed with the conduct of our research, and the collaboration was bilaterally excellent.

The study was carried out with the approval of the ethics committee of the University of Medicine, Pharmacy, Sciences and Technology "George Emil Palade" Târgu Mureș (Decision of the Ethics Committee of Scientific Research, No. 2256 of 06.04.2023) and all procedures were carried out in compliance with the requirements of the World Medical Association's Declaration of Helsinki and good clinical trial practice.

Tests used

The Harvard Maximal Effort test

It is used to measure the aerobic capacity of individuals, being a predictive test of VO_2max. The cardiovascular system is tested, thus reflecting the body's general ability to react to increased physical work and its ability to recover from exertion (https://www.physio-pedia.com/Harvard_Step_Test).

Equipment used: timer, metronome, exercise ladder/gym bench.

Conducting the test: The individual is prepared for the test; the assessor explains the procedure and asks for the testee's consent. Once his consent is obtained, the evaluator records his pulse. Begin the test by going up and down the exercise ladder at a rate of 30 ascents/descends per minute for 5 minutes. If the assessed individual can no longer perform the effort to the metronome's rhythm, the test is suspended, and the time of the effort performed is noted. Immediately after the effort, the pulse is determined in 3 periods: P1 the first 30 seconds after the effort, P2 the first 30 seconds of the 2nd minute and P3 in the 3rd minute, the first 30 seconds.

Anthropometric assessment

A. Height measurement

B. Chest circumference measurement

C. Measurement of abdominal circumference

Questionnaire on habitual habits

This questionnaire was used to observe whether there is a connection between the results obtained during the initial evaluation and the habits of the subjects.

The subjects answered questions regarding using personal belongings and transport objects, the consumption and amount of fast food, tobacco, alcohol, and caffeinated beverages, and the practice of physical exertion and frequency.

Results

Questionnaire about usual activities and habits

The questionnaire consisted of 25 questions aimed at discovering the activities of each individual participating in the study.

Respondents were asked to respond if they use a bag or backpack; the answers were: 19 respondents (76% of the total) use backpacks and 6 persons (24% of the total) use a backpack, 16 of them (84%) on both shoulders and 3 of them (16%) on one shoulder.

Respondents were asked if they eat fast food, and the answers were: 23 persons yes (92%) and 2 persons no (8%), 1-2 times a week 18 persons (78%) and 3-5 times 5 persons (22%).

Also, they were asked if they smoke, and the answers were: no – 10 persons, occasional – 6 persons and yes – 9 persons (89%), half a pack of cigarettes – 8 persons, one pack of cigarettes 1 person (11%).

Regarding the use of alcohol, the respondents answered: don't drink at all – 6 persons, drink occasionally – 17 persons, drink often – 2 persons; 1-2 glasses – 16 persons (84%), 3-5 glasses – 3 persons (16%).

Statistical processing

Descriptive and inferential statistics (median, mean and standard deviation) were included in the statistical analysis. The Kolmogorov-Smirnov normality test was applied to see to what extent our data follow a particular distribution. The Grubbs test was used to determine the outliers and the T-student test for unpaired data was applied to compare means. The Mann-Whitney test was utilized to correlate medians for unpaired data. Finally, the Anderson-Darling test was used to obtain descriptive statistics of the Harvard Test results. Minitab was applied for statistical analysis (Minitab 20.3, LLC, 2021).

Thirteen subjects were included in the study in the experimental group (16.92 ± 0.49 years old), and the control group was composed of 12 subjects (17 ± 0.42 years old). Following the Kolmogorov-Smirnov normality test (Table 1) applied to the two samples included in the research, we obtained statistical significance in both groups, with a p-value <0.05.

Table 1. Kolmogorov-Smirnov normality test results

	Experimental Group	Control Group
Mean	16.92	17
St Dev	0.4935	0.4264
KS	0.408	0.417
P value	<0.05	<0.05

*KS= Kolmogorov-Smirnov normality test

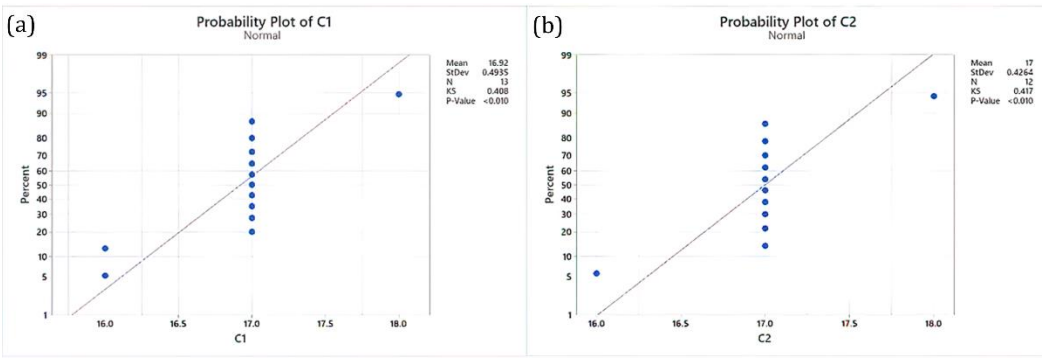

Figure 1. The results for EG (a) and for CG (b)

The p-value<0.05, thus resulting in a statistically significant difference (Table 1 and Figures 1a and b).

Table 2. Grubbs test results

	Experimental Group	Control Group
No.	13	12
Mean	16.923	17.000
ST.Dev	0.494	0.426
Min	16	16
Max	18	18
G	2.18	2.35
p-value	0.195	0.073

*G= Grubbs test

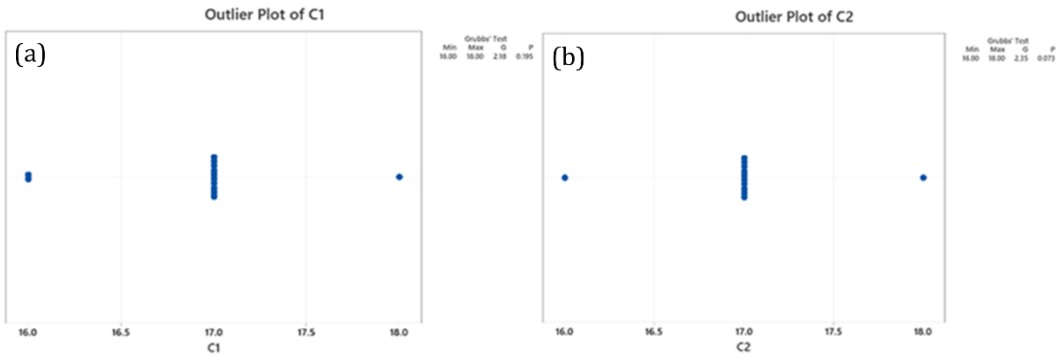

Figure 2. Grubbs test results for EG (a) and for CG (b)

The p-value > 0.05 resulted in the test not showing a statistically significant difference in the difference reported for each group (Table 2 and Figures 2a and b).

Table 3. Height results

	Experimental Group		Control Group
No.	13		12
Mean	96.92		95.7
ST Dev	6.85		16.7
t value T-test		0.24	
p-value T-test		0.812	

w value M-W	163.50
p-value M-W	0.348

*Mann-Whitney test; Equal variances are not assumed for this analysis.

The p-value > 0.05 means the test does not show a statistically significant height difference between the two groups (Table 3).

Table 4. Chest perimeter results

	Experimental Group		Control Group
No.	13		12
Mean	88,85		90,7
ST Dev	8,69		12,3
t value T-test		-0,42	
p-value T-test		p<0.05	

Equal variances are not assumed for this analysis.

The p-value < 0.05, thus resulting in the test showing a statistically significant difference in the difference in chest perimeters of the two groups (Table 4).

Table 5. Abdominal Perimeter results

	Experimental Group		Control Group
No.	13		12
Mean	72,69		76,1
ST Dev	8,53		16,9
t value T-test		-0,63	
p-value T-test		0,54	

Equal variances are not assumed for this analysis.

The p-value > 0.05 resulted in the test not showing a statistically significant difference between the abdominal perimeters of the two groups (Table 5).

Table 6. Waist perimeter results

	Experimental Group		Control Group
No.	13		12
Mean	96.92		95.7
ST Dev	6.85		16.7
t value T-test		0.24	
p-value T-test		0.812	

Equal variances are not assumed for this analysis.

The p-value > 0.05 resulted in the test not showing a statistically significant difference between the pool perimeters of the two groups (Table 6).

Table 7. Scapulo-humeral symmetry results

	Initial Evaluation		Final Evaluation	
	EG	CG	EG	CG
No.	0.715	0.533	0.583	0.583
Mean	0.524	0.311	0.446	0.359
ST Dev	1.07		-0.28	
t value T-test	p<0.05		0.784	

Equal variances are not assumed for this analysis.

The p-value<0.05 thus resulting in a statistically significant difference (Table 7).

Table 8. Waist symmetry results

	Initial Evaluation		Final Evaluation	
	EG	CG	EG	CG
No.	0.346	0.433	0.246	0.467
Mean	0.506	0.421	0.380	0.464
ST Dev	-0.47		-1.29	
t value T- test	0.643		p<0,05	

Equal variances are not assumed for this analysis.

The p-value<0.05 thus resulting in a statistically significant difference (Table 8).

Table 9. Harvard Test- Summary Report results

	Experiment Group	Control Group
Mean	98.043	99.014
Minimum	81.967	79.787
Median	98.039	99.014
Maximum	114.504	121.951

Equal variances are not assumed for this analysis.

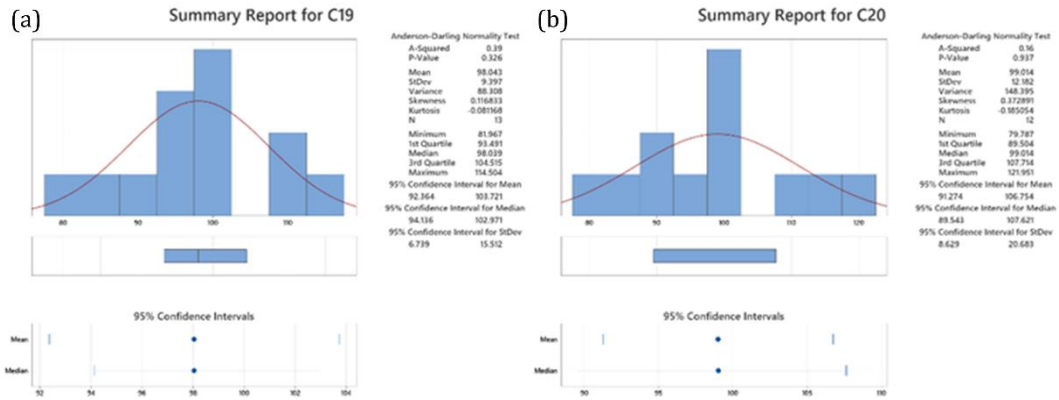

Figure 3. Summary Report results for EG (a) and for CG (b)

Table 10. Harvard Test results

	Experiment Group		Control Group
No.	13		12
Mean	98.04		99.0
ST Dev	9.40		12.2
t value T-test		-0.22	
p-value T-test		p<0.05	

Equal variances are not assumed for this analysis.

The p-value<0.05, thus resulting in a statistically significant difference (Table 10).

Discussion

The final results of the research confirmed the main objective of our study, namely, to achieve wellness by applying for prophylactic or recuperative programs

within an educational institution and increasing the quality of life of the people who have benefited from them.

Achieving the state of wellness by applying prophylactic or remedial programs in an educational institution was the main objective of our study. Using the final results of our research and the feedback provided by the subjects who participated in the study, we can say that we have met the main objective of this work.

As a result of the study we conducted, we found out that the presence of physiotherapists in an educational establishment is essential for the harmonious development of children.

This topic addressed in our study is new, as there are no previous studies to which we can refer in terms of results.

According to the World Health Organization, a child or adolescent should get at least 60 minutes of moderate to vigorous physical activity daily. The results of our study showed that about half of the students who participated in our research use walking as their only physical activity.

The consumption of caffeine-containing beverages (48% of students consume daily and 32% occasionally) and alcohol (8% regularly consume alcohol and 68% occasionally consume) among students is increasing, which is evident from the questionnaire responses in our study. These results should raise some alarm bells among adults, being substances that can bring imbalances in the body: anxiety, depression, fatigue and stress (Rodak & Kratz, 2021).

The correct use of backpacks plays an important role in students' posture. 24% of the students use a bag, and 76% use a backpack. Subjects were asked to show how they position their backpack. All individuals misused it, leading to kyphosis and hyperlordosis, by hanging the backpack because the straps were too wide. Explaining the correct use of such an object, the positive results of proper wearing, and the negative results of incorrect use can prevent postural deviations.

Conclusions

The hypothesis of our study was confirmed; the subjects in the experimental group who followed a personalized rehabilitation program developed by a pediatric physical therapist, which contains specific exercises to correct postural deformities for whole body prophylaxis, obtained significantly better results in terms of posture compared to the subjects in the control group who followed the Physical Education class in the school curriculum.

Following the initial assessment at the beginning of the study, we concluded that students show multiple postural variations that could be prevented in educational establishments in the presence of at least one pediatric physiotherapist.

Explaining the importance of maintaining an appropriate posture and how to prevent it from deviating from normal led to body and postural awareness of each individual. We propose introducing a pediatric physiotherapist to the school's multidisciplinary team to correct and prevent postural deviations. Regular assessment of pupils for postural deviations should be carried out at least twice a year to keep track of the developmental stages of each individual. Another proposal is to repeat the study on a larger scale to validate the results.

Limitations of the study

The first major limitation of the study was that the research sample consisted of only 25 subjects. A second limitation was that the sample size calculation could not be applied due to the small number of subjects, as it was not relevant. Furthermore, the last limitation was the absence of the statistical power calculation, which was not included for the same reasons stated above.

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