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The Intervention Program effect on the Quality of Children's Body Posture at Elementary Education Level

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Abstract

The goal of this research was to determine the impact of an intervention program containing music-accompanied sport and dance activities on the quality of pupils' body posture at the elementary level of education in physical and sports education classes. The research sample comprised Σ 102 pupils at the primary level of education, 53 of whom were boys with a decimal age of 8.83±0.69 and 49 were girls with a decimal age of 8.77±0.68. They were subjected to testing according to the Klein and Thomas method modified by Mayer. The output results of the posture diagnostics confirmed the significant effect of targeted exercises on the overall posture of boys with a substantial effect ($Z=-6.131$, $p<0.05$, $r=0.60$ – substantial effect). The greatest influence in the boys' group was confirmed in the general spine curvature in the sagittal plane ($Z=-5.209$, $p<0.05$, $r=0.51$ – substantial effect). In the girls' group, the targeted movement program was confirmed to have a substantial effect on overall body posture ($Z=-5.793$, $p<0.05$, $r=0.59$). In all other segments, it was significantly manifested with a medium effect. It was concluded that none of the participants had flawless posture. After the application of the intervention program, good posture was demonstrated by 62.2% of boys and 61.1% of girls. In the output test, the posture of 37.7% of boys and 38.8% of girls was incorrect. None of the pupils was diagnosed with very bad posture after the application of the intervention program. The relationship between BMI and posture assessment of the respondents was assessed. The results of the correlation of BMI values ($r=0.007$, $p>0.05$) and overall body posture did not show statistical dependence in both sexes. The intervention program including music-movement and dance elements had a significant effect on improving the posture quality of both boys and girls. The program supported by a musical piece was perceived positively by the pupils for its variety and emotionality. The program should be applied in the physical education classes at a frequency of minimum 2 times a week.

Keywords: *physical education, music-movement and dance program, body posture, younger school age*

Introduction

Sedentary lifestyle, physical inactivity, deteriorating physical fitness of children and its negative effects were pointed out by several studies even before the Covid-19 pandemic (HBSC-Slovakia, 2011; Israel & Holdoš, 2020). The global pandemic and the distance learning related to it put the children again in front of computers, isolating them and limiting their possibilities for organized physical activities and sports in schools. This significant decrease in physical activity due to the pandemic had an adverse effect on children's health, including the quality of their posture (Galmes-Panades & Vidal-Conti, 2022; Rozim, Daubnerová, Slováková & Bendíková, 2022). Proper posture is a concomitant phenomenon of physical and mental health maintained by the activity of muscles and nerves. It is defined by an upright posture, symmetrical development of muscles, and natural curvature of the spine in the form of cervical and lumbar lordosis, thoracic kyphosis, and adequate muscle tension. Such posture, however, is not only a mechanical assembly of individual parts of the human body, but also an expression of behaviour and attitude towards life (Hnízdil et al., 2005).

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When children start school, there is a change in their locomotor system, affected by straining the organism by sitting. Out of the total number of hours of the daily routine, children spend one third of their time at school in a static position. This fact starts to manifest itself as soon as children enter school by weakening the supporting locomotion system (Zukowska et al., 2014). Already in the first primary education stage (6-10 years), children have incorrect posture habits, which, if not compensated, can later lead to degenerative changes in their spine, often accompanied by pain and limited opportunities to assert themselves in life (Halmová, 2000). There is an increasing tendency of incorrect body posture and incorrect bendability of the spine, which can also be seen in the results of the study of Kratěnova et al. (2005), evaluating 3520 children from the Czech Republic aged 7, 11 and 15. In this study, they ascertained that while 33.1% of 7-year-olds had poor posture, it increased to 40.6% with 11-year-olds, and 40.9% with 15-year-olds. As the children grow older, the percentages get higher and higher. A whole range of factors contribute to incorrect posture (visual impairment, hearing defects, blocked airways, delayed mental development); external factors mainly include incorrect sitting, prolonged standing, and inappropriate movement habits. The majority of posture faults can be ascribed to muscle balance disorders or to muscle imbalance. According to the National Report on Youth Policy in the Slovak Republic for the Council of Europe, in the category of 0-18-year-old children and adolescents there is currently an increase in chronic health disorders that require intensive preventive care (Sobihardová et al., 2005). Factors determining body posture can be positively influenced by properly chosen physical activity and thus support appropriate development. However, more important than the correction of detected faulty posture is early and effective diagnosis, as a result of primary prevention. (Malá et al., 2023). Physical education at school plays a fundamental role in the development of physical literacy of children. The concept of physical and sports education aims to link it with health care, with a healthy lifestyle and to increase its attractiveness; it places greater emphasis on freedom for schools and teachers in choosing the content of lessons (Antala & Labudová, 2008). In order to achieve the aforementioned goal of physical education, it is necessary to offer pupils attractive and varied content with the possibility to experience success, which creates a basic precondition for a quest for another activity. Studies (Kouli, Rokka, Mavridis, & Derri, 2009; Owen, Smith, Lubans, Ng, & Lonsdale, 2014) point to the fact that fun and enjoyment in physical education classes can influence the development of positive attitudes towards physical activity. In connection with the above stated, it is important to note, the only activity of pupils based on their interest in a varied exercise program can lead to spontaneous involvement in the offered activities, which also leads to the development of movement skills or physical fitness. In an effort to exert a preventive effect and at the same time make exercise activities more attractive in the physical and sports education classes, intervention exercise programs are being created with a focus on health-oriented exercises and at the same time on increasing the level of movement skills. Health-oriented exercises are mostly aimed at strengthening the internal stabilization system, improvement of coordination, flexibility, balance and physical condition. The effect of compensatory exercises can significantly influence the level of mobility of the spine and alleviate the manifestations of muscle imbalance (Kanásová & Broďáni, 2007). It is believed that such programs for pupils should also include a program containing music and dance activities or aerobics.

The positive effect of an aerobic dance program on physical fitness and intrinsic motivation of primary school students is described in a study by Koli et al. (2009). Pantelić et al. (2019) confirmed the effect of an experimental dance program on children's motor coordination skills. Fong et al. (2018) studied the available literature on the effectiveness of dance interventions. They examined dance interventions lasting >4 weeks that included physical health outcomes and had a comparison group with a movement program. They compared different dance genres and structured movement interventions in a sample of 1,276 participants. Meta-analyses showed that the dance interventions significantly improved body composition, blood biomarkers, musculoskeletal function, and cardiovascular function. There are no programs specifically examining the impact of dance programs on body posture. Similary, Mishenko et al. (2023) draws attention to the insufficient number of studies in the given area.

The benefit of the study is the expansion of potential means in school physical education affecting the quality of children's posture through attractive music-movement programs.

The objective of this study was to determine the impact of an intervention program containing musical movement and dance tools on the quality of elementary school students' posture.

Methods

Subjects

The research group consisted of 102 primary school pupils, of which 53 were boys with a decimal age of 8.83±0.69 and 49 girls with a decimal age of 8.77±0.68. They were pupils of the third and fourth grades of elementary school. The average weight of the boys was 35.92±4.79 kg, average height 136±4.19 and BMI 19.36±1.99 kg/m2. The average weight of the girls was 32.62±4.22 kg, average height 134.39±4.44 cm and BMI 18.04±2.04 kg/m2.

Pupils participated voluntarily with written parental consent. Ethical approval was obtained from the ethical committee at the Matej Bel University under project number 1522/2022. Measurements were carried out in accordance with the ethical standards of the Declaration of Helsinki.

Measurement organization

The research took place in the school year 2021/2022 at an elementary school in Banská Bystrica. After a well-thought-out organization of the research with the aim of achieving the goal, in February initial diagnosis was carried out (V1), of somatometric indicators and a diagnosis of body posture were evaluated by a standardized test routinely used in schools. To evaluate and classify body posture, the Klein and Thomas method, modified by Mayer (in Hošková, & Matoušová, 2005; Bartík, 2005) was used, in which 5 body segments were evaluated visually: head and neck posture, chest shape, abdominal shape and pelvic tilt, overall curvature of the spine, shoulder height, and posture of shoulder blades (Table 1). Each dimension in the range of 1-4 points was graded. For the final typology, the probands were classified into 4 qualitative categories and the corresponding degrees of body posture. This method was employed in recent studies (Bendíková et al., 2020; Rozim et al., 2022). Participants were assessed by two trained persons (physiotherapists) and a consensus was reached in case of disagreement in the assessment.

Table 1. Evaluation of body postures

Evaluation of body postures		
I.	Correct body posture	5 points
II.	Goo d (almost correct) body posture	6 – 10 points
III.	Bad body posture	11 – 15 points
IV.	Incorrect body posture	16 – 20 points

Experimental Program

Subsequently, a movement program aimed at promoting health, perceived through the pupils' correct body posture, was included in the compulsory physical and sports education curriculum (supported by studies: Gao, Zhang & Stodden, 2013; May et al., 2019; Mischenko et al., 2020; Andrieieva et al., 2021; Kashuba et al., 2021) twice a week for 45 minutes, for 18 weeks, a total of 36 lessons. Each lesson of the exercise program included music-movement and dance-based activities (Table 2), and contained 10 minutes of warm-up, 25 minutes of main part and 5 minute Cool-Down. The music was played at a soft rhythm at 20-128 beats per minute (bpm). The main part included 30 minutes of continuous movement and dance activities accompanied with music, such as aerobic, dances, dance games, exercise on the wall bars, exercise on the Overball and Stability ball, skipping rope games. The intensity of the main program was 60% -75% of the maximum heart rate with a rhythm of 130-135 bpm in the first six weeks. After six weeks, from week seven to week eleven, the intensity was increased to 75%-85% of the maximum heart rate (music at 140-150 bpm). In the following seven weeks, the intensity of the program was variable, every subsequent lesson was reduced to 60%-70% of the maximum heart rate, and remaining weeks increased to 75-85% of the maximum heart rate. In the last part of the lessons, the participants were given a 5-minute cool down. Educational process was managed by a qualified teacher with years of experience. Subsequently, output testing (V2) of the same indicators was performed.

Table 2. Movement program plan for 1 month (sample)

Lesson	Warm-up (10min.)	Main Part (30 min.)		Cool down (5min.)
		A part	B part	
1	Warm-up	Stability ball	Dance games	stretching
2	Warm-up	Low Aerobic	Dance- modern	stretching
3	Warm-up	Stability ball	Dance- folk	stretching
4	Warm-up	Dance Aerobik	Dance - modern	stretching
5	Warm-up	Over ball	Rope Skipping	stretching
6	Warm-up	Exercise on the wall bars	Dance games	stretching
7	Warm-up	Skipping Rope games	Dance- folk	stretching
8	Warm-up	Low Aerobic	Dance Aerobik	stretching
Σ	80min.	240 min/month		40 min.

Statistics

The paired Wilcoxon signed-rank test was used to determine the significance of the differences between the input (pre-test) and output (post-test) measurements in the studied posture indicators. The coefficient r (Corder - Foreman, 2009) was used to calculate the effect size, which was interpreted according to the minimum threshold values as follows: r=0.10 - small effect, r=0.30 - medium effect, r=0.50 - large effect (Cohen, 1988). The relationship between the total point score of posture in the sets of girls and boys was determined by Spearman's correlation coefficient r, which was interpreted according to the minimum threshold values as follows: r=0.10 - small (weak) relationship, r=0.30 - moderate (medium strong) relationship, r=0.50 – large (strong) relationship (Cohen, 1988). In the study, we worked with ordinal types of data, therefore it was not necessary to verify the normality of their distribution and non-parametric statistical tests were used. The probability of a type I error was set to α=0.05 in all statistical analyses. Statistical analysis procedures were carried out in accordance with the recommendations of the publication Pivovarniček (2021) using IBM® SPSS® Statistics v28 and Microsoft® Office Excel 2016 software.

Results

Boys

In the evaluation of the overall boys' posture, which is the sum of the marks for the assessed elements, the respondents achieved an average value of (12.23±1.8) points at the beginning of the research. These values correspond to incorrect posture. The best average score for boys (2.04) was achieved in the head and neck area (Table 3) both at the initial and final assessment (1.66). The most serious postural disorders in boys' set (68%) were recorded in the physiological curvature of the spine in the sagittal plane and in assessment of the abdomen and pelvic tilt. Hyperlordosis of the fourth qualitative degree was registered in the case of three boys.

The individual values varied from 8 to 16 points at the initial diagnosis. Perfect posture (below/up to 5 points) was not recorded in case of any pupil. Good (almost perfect) posture (from 6-10 points) was recorded in 13.2% of boys and faulty posture in up to 84.9% of boys (Table 4). Very bad posture was present in the case of one pupil (16 points).

After the application of the intervention program, there has been noted a statistically significant improvement in body posture in boys ($p<0.05$) in all investigated segments of the

spine (Table 5). The exercise program had the greatest impact on improvement in spinal curvature in the sagittal plane (r=0.51 large effect size) as well as in overall body posture (r=0.60 large effect size). After the application of the intervention program, 62.2% of the pupils showed good posture.

One of the causes of incorrect body posture is overweight or obesity. 28.3% of the boys in the research group were overweight. Two boys had proven obesity exceeding the 97 percentile. Therefore, also the relationship between BMI and body posture assessment in the respondents was evaluated. However, the results of the correlation between BMI values (r=0.007, p>0.05) and overall body posture did not point to statistical dependence (Table 6).

Girls

In the evaluation of the overall girls' posture, which is the sum of the marks for the assessed particular elements, the girl respondents achieved an average value of 11.73±2.04. Such values already belong to the third qualitative level, i.e. faulty posture (Table 3). The variance of individual values at the initial assessment ranged between 8-17 points. Perfect posture (up to 5 points) was not recorded in any pupil. Good (almost perfect) posture (between 6-10 points) was recorded in 28.6% of girls and faulty posture in 69.4% of girls (Table 4). Very bad posture was present in the case of one pupil (17 points). As in the case of boys, we recorded the best point score (1.96 points) in the evaluation of the position of the head and neck both during the initial and final assessment (Table 3). During the initial assessment of girls' body posture, the area of the abdomen and pelvis was most involved in incorrect posture. Up to 65.3% of female pupils had the slightly or significantly protruding abdomen. In one case of proband, a sunken chest was diagnosed. In the case of three probands, a very bad curvature of the lumbar area, a hyperlordosis ranging up to the fourth qualitative level of body posture was found.

After the application of the intervention target program focused on the primary education pupils' health, a statistically significant difference has been noted (Z=-5.793 p<0.05, r=-0.59 - large effect) with a large effect on overall body posture, in individual segments of the spine with a medium effect size (Table 5). In the output (post-test) testing, 61.2% of female pu-

Table 3. Average score of body posture in individual segments of the spine

	Boys (n=53)		Girls (n=49)	
	X_1±SD	X_2±SD	X_1± SD	X_2±SD
Overall body posture	12.23±1.8	9.79±1.72	11.73±2.04	9.49±1.8
Head and neck posture	2.04±0.48	1.66±0.59	1.96±0.54	1.59±0.54
Chest shape	2.43±0.69	1.98±0.50	2.35±0.52	1.88±0.53
Abdomen and pelvic inclination	2.74±0.59	2.26±0.56	2.71±0.65	2.24±0.60
Total Spine curvature	2.75±0.59	2.21±0.57	2.59±0.64	2.08±0.49
Shoulder blades/ scapulae	2.25±0.43	1.68±0.55	2.12±0.48	1.69±0.51

x - arithmetical mean; SD- standard deviation; n- sample size

Table 4. Assessment of body posture according to Klein and Thomas modified by Mayer

	Boys (n=53)		Girls (n=49)	
Body posture	V_1	V_2	V_1	V_2
Ideal body posture	(n=0) 0 %	(n=0) 0 %	(n=0) 0 %	(n=0) 0 %
Good body posture	(n=7) 13.2%	(n=33) 62.2%	(n=14) 28.6%	(n=30) 61.2%
Poor body posture	(n=45) 84.9 %	(n=20) 37.7 %	(n=34) 69.4 %	(n=19) 38.8 %
Incorrect body posture	(n=1) 1.9%	(n=0) 0 %	(n=1) 2%	(n=0) 0%

V_1 – input, V_2 – output

Table 5. Statistical significance of differences after the application of the body posture intervention program

Boys (n=52)	Head and neck posture	Chest shape	Abdomen and pelvic inclination	Total Spine curvature	Shoulder blades/ scapulae	Overall body posture
Z-value	-4.472	-4.347	-4.642	-5.209	-4.973	-6.131
p-value	0.000	0.000	0.000	0.000	0.000	0.000
r (effect size)	-0.43	-0.42	-0.45	-0.51	-0.48	-0.60
	medium effect	medium effect	medium effect	large effect	medium effect	large effect
Girls(n=49)	**Head and neck posture**	**Chest shape**	**Abdomen and pelvic inclination**	**Total Spine curvature**	**Shoulder blades/ scapulae**	**Overall body posture**
Z-value	-4.025	-4.261	-4.600	-4.811	-4.379	-5.793
p-value	0.000	0.000	0.000	0.000	0.000	0.000
r (effect size)	-0.41	-0.43	-0.46	-0.49	-0.44	-0.59
	medium effect	medium effect	medium effect	medium effect	medium effect	large effect

Table 6. Relationship between BMI and overall body posture (in output measurements)

Correlations			boys		girls	
			Overal body posture	BMI	Overal body posture	BMI
Spearman's rho	Overall body posture	Correlation Coefficient	1.000	0.007	1.000	0.046
		p		0.959		0.751
		N	53	53	49	49
	BMI	Correlation Coefficient	0.007	1.000	-0.046	1.000
		p	0.959		0.751	
		N	53	53	49	49

BMI - Body mass index, kg/ m^2-kilogram per square meter

pils demonstrated good posture.

Average BMI values for girls were (18.05±2.04), which means normal weight at the 75 percentile level. 6.1% of female pupils were overweight and 6.1% of female pupils were obese. The remaining pupils (n=37) had a normal weight in the range of 25-75 percentile. The relationship between BMI and overall posture of female students was investigated (Table 6). Similar to boys, a statistically significant relationship between increased or reduced BMI and overall body posture among female pupils (r=-0.046, p>0.05) was not recorded.

Discussion

The research proves an increasing tendency in the occurrence of deviations from correct body posture of children at the primary level. The study results confirmed the occurrence of wrong body posture in 86.8% of boys and 71.4% of girls at the primary level of elementary school as part of the entrance diagnostic. Similar results in the incidence of postural disorders were also ascertained by Medeková (2009), wrong posture among students of The International Standard Classification of Education, level 1 occurred in up to 78% of boys and 70% of girls, muscle imbalance even among up to 90% of boys and girls. Kanásová and Broďáni (2007) pointed out the wrong posture among children at the primary level in 100% of the probands. The most risky dimension with the highest representation of students was the height of the shoulders and the position of the shoulder blades (58% of the students) and the overall curvature of the spine in 55% of the students.

Lafond et al. (2007) assessed the posture of children in Canada. They evaluated postural deviations in the sagittal plane and their results show that children aged 4-12 years are characterized by postural disorders in the sagittal plane, especially forward head, shoulders and pelvis posture, and knee deformities. The incidence of postural disorders is also reported by Penha, João, Casarotto, Amino and Penteado (2005), who studied 136 girls aged 7–10 years. The main postural deviations found were knock-knee, medial rotation of the hip, antepulsion, pelvic anteversion, knee hyperextension, lumbar hyperlordosis, valgus ankle, imbalanced shoulders, lateral pelvic inclination, scoliosis, trunk rotation, thoracic hyperkyphosis, winged scapula, shoulder protraction, abducted scapula, medial rotation of shoulders, and head tilt.

In his study, Wojtków, Szkoda-Poliszuk and Szotek (2018) points out the occurrence of abnormal posture in 42 percent of examined younger school age children who were diagnosed by using a photogrammetric method. In the research by Sedres et al., (2015) the prevalence of postural changes was 79.7% (n=47), of which 47.5% (n=28) showed frontal plane changes and 61% (n=36) sagittal plane changes. A significant association was found between the presence of thoracic kyphosis and female gender, practice of physical exercises only once or twice a week.

Černický, Ratulovská, Pavlíkova, Vomela and Klein, (2018) considers it appropriate that the elements of the back school methodology implementation should be included in the subject of physical education. Within the author's study, it was found that up to 80 out of 260 school-aged children had faulty or bad posture. Authors recommend, when creating habits of correct posture, to practice physical activity in a playful way with the use of suitable motivational means such as words, music, colourful and appealing aids. The incorporation of posture correction activities into the teaching process was also followed by Kashuba et al. (2020), 139 students aged 6 to 10 with hearing impairment were involved in the testing. Children with postural deviation were included in a transformative experiment, in which the implementation technology was proposed for them, taking into account the indicators of the body posture biometric profile. The entire block consisted of preventive modules (education of postural preventive exercises, yoga breathing exercises, exercises according to Gitman Pilates, exercises on the fit ball). The effect of the intervention program turned out to improve the biogeometric profile index of the respondents at the statistical level of p<0.05.

In our study an intervention program with music-movement and dance elements into the content of school physical education was also applied, two times per week. The results of our research confirmed the significant impact of targeted exercises on overall body posture among both boys (Z=-6.131, p<0.05, r=0.60 - large effect) and girls (Z=-5.793, p<0.05, r=0.59) with great effect. After the application of the intervention program, good body posture was demonstrated by 62.2% of boys and 61.1% of girls.

Similar results were observed in the research of authors Mischenko et al., (2020), who investigated the method of correcting posture disorders using health-improving story rhythmic gymnastics, which was included in the curriculum of physical education for 8 to 10 year old girls for a period of 15 to 20 minutes. It showed that 78.5% of the girls in the experimental group showed a stabilization of the spine curvature angle value in the frontal plane. In the control group, stabilization was recorded in only 28.5% of the girls. In the experimental group, only two (14.2%) girls had slight deviation in posture. The authors recommend the health-improving story rhythmic gymnastics method for wide use in the correction of posture. Grygus, Nesterchuk, Hrytseniuk, Rabcheniuk, & Zukow, (2020) conducted an experiment on a sample of 169

elementary school students with the objective of validating a dance program included in education with an effort to correct body posture. The effectiveness of the program for correction of posture disorders was confirmed ($p>0.05$).

The results of our study are consistent with the opinions of experts (Gao et al., 2013; May et al., 2019; Andrieieva et al., 2021; Kashuba et al., 2021), that dance and choreographic exercises can be one of the most effective means of child's body development, correct posture formation and posture disorders prevention. Hojker, Vaishnav, Staparski, and Dobravec (2023) examined the impact of an intervention preventive program on posture and back pain in primary education students. 179 fourth graders of four elementary schools were included in the study. The main age of participants was 9.2±0.5 years. Half of the classes were part of the posture hygiene program throughout the school year, the other half served as a control group. The class consisted of nine exercises: five activation exercises to strengthen the muscles of the chest, shoulder, girdle, back, abdomen and pelvis; two exercises to stretch the thoracic and lumbar fascia; one to stretch the deep anterior fascia and one meditation exercise. The exercise lasted 10 minutes. The study results showed a significant improvement in sitting and standing posture in the tested group, where 72% of the children had ideal posture. In contrast, only 16% of the students in the control group had ideal posture. Despite the important impact of posture on spine health and, in addition, the increasing incidence of back pain in young people, similar to our study, the authors point to the lack of specific studies on the impact of preventive programs on posture, which brings up a great need for research and practical work in this area.

Some authors also investigated the dependence of body posture and BMI index on movement activity. Brzek et al. (2016) report that obese children more frequently suffer postural disorders in the sagittal plane than children with a normal weight, which results in the development of postural disorders and various health problems at such an early age. Maciałczyk-Paprocka et al. (2017) found that, in a group of pupils aged 7–12 years, the probability of occurrence of wrong body posture was significantly higher among the obese than among the pupils with a normal body weight, namely among boys ($p=0.042$) and also among girls ($p=0.007$). In their study, Zanovitová, Zanovit and Bendíková (2011) found that almost 60% of girls and 55% of boys have incorrect posture. In addition, the authors reported a difference in posture between the children who play sports in their free time and those who do not. The results evidenced significantly in favour of physically active children. In our study, no significant relationship between the BMI index of the observed group of boys and girls on body posture was confirmed.

The strength of the study is the fact that the results obtained are unique, as there are few studies presenting the use of music-movement means in relation to posture quality at the primary school level of physical education. Another advantage is easy implementation into the teaching process at low costs.

Limitations of the study are body posture was assessed using a visual method, and the use of the posture assessment method is influenced by the subjective assessment of the researcher. Also, the absence of a control group to determine the effect of the program and to generalise the conclusions. Future studies use of objective non-invasive diagnostic devices with a high degree of validity and reliability.

Conclusion

The prevalence of postural disorders among children is high (Albertsen et al., 2018). It is precisely for this reason that it is necessary to exert a preventive effect on children's correct body posture even within the framework of school physical and sports education. As part of our study, a targeted compensatory program with dance elements was created, to be included in the lessons twice a week, aimed at promoting health from the viewpoint of proper pupils' body posture. The results of the output (post-test) assessment of posture confirmed the significant effect of targeted exercises on the overall posture of boys with a large effect ($Z=-6.131$, $p<0.05$, $r=0.60$ - large effect). The greatest effect among boys was confirmed in the area of the total anteroposterior curvature of the spine ($Z=-5.209$, $p<0.05$, $r=0.51$ - large effect). In the girls' set, a large effect of the targeted movement program on overall body posture was confirmed ($Z=-5.793$, $p<0.05$, $r=0.59$). In all other segments, it was significantly manifested with a medium effect. In conclusion, not that not a single student had flawless posture. After the application of the intervention program, 62.2% of boys and 61.1% of girls demonstrated good posture. In the output test, 37.7% of boys and 38.8% of girls had incorrect posture. Not a single student was diagnosed with very bad posture after the application of the intervention program.

The relationship between BMI and posture assessment of the respondents was evaluated. The results of the correlation of BMI values ($r=0.007$, $p>0.05$) and overall body posture did not indicate any statistical dependence among male or female individuals.

Based on the results found at younger school age, the necessity of active prevention and enhancement of pupils' movement aspect of pupils within school physical education is emphasized, as well as the frequency of movement activities of pupils within the daily regime. Appropriately determined and implemented movement activity in childhood is the best prerequisite for maintaining proper posture and eliminating the occurrence of subsequent functional disorders of the locomotor system in adulthood.

The intervention program including music-movement and dance elements had a significant effect on improving the posture quality of both boys and girls. The program supported by a musical piece was perceived positively by the pupils for its variety and emotionality. Based on the results, the program should be applied in physical education classes at least 2 times a week.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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