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Original Article

The effectiveness of health exercises in children during physical education classes in the first level of primary schools

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Abstract
Problem Statement: It is well-known that low back pain (LBP) prevalence is high among school-age children. We are talking about ten percent who are diagnosed with scoliosis, posture disorders, or other various deformities by the early age of 7. The Modules are a project whose goal is to provide physical education lessons with innovative content which are aimed at students in the 2nd, 3rd, and 4th years of primary school. **Approach:** The data collection was carried out in the months of October and November 2022. The study included 32 girls and 36 boys aged 7-11 years with a mean age of 8.4, the mean height of 138.1 cm, mean weight of 33.5 kg, and mean BMI of 17.65. To evaluate the effectiveness of the exercise, we chose Schober's and Thomayer's tests. The children were examined before the exercise and then after the completion of the block of 6 lessons (45 minutes of group exercise, once a week). The data were processed in the statistical program SPSS using one sample t-test to compare the collected values to physiological values of Schober´s and Thomayer´s tests in children. **Purpose:** The purpose of this paper was to evaluate the effectiveness of the exercise on the range of motion of the spine.
Results: Thomayer's and Schober's test results showed significantly lower differences from the physiological values of these tests after the exercise than at the initial examination (the p-value before the exercise of Thomayer's test > 0.05, after < 0.001, Schober's test > 0.05, after < 0.05). A negative correlation was found between Thomayer´s test and age. The difference was found lower after finishing the „Modules“ (before: r = -0.23, after: r = -0.05). **Conclusions:** After 6 weeks of correctly adjusted group health exercises in physical education classes, the range of motion of the spine with Schober´s test increased and the average deviation from the norm in the Thomayer´s test decreased. The higher the average age, the lower the range of motion of Thomayer´s test. Using health exercises in physical education classes is an effective form of prevention of back pain for children.
Keywords: physiotherapy, exercises, children, health

Introduction

Low back pain is a frequent complaint in the child-adolescent age group. The causes of low back pain are as diverse as adults in this age group (Illeez et al., 2020). Spinal pain in children and adolescents is common. Incorrect body posture is recognized as a risk factor for the future development of pathological, functional, and morphological painful conditions of the spine (Kutiš et al. 2017). Non-specific low back pain in children and adolescents has increased in recent years (García-Moreno et al. 2022; Latalski et al., 2013; Permoda-Białozorczyk et al. 2022). Research in the last decades has shown that spinal pain starts early in life and that prevalence rates increase rapidly during adolescence, reaching adult levels around the age of 18 (Jeffries et al. 2007). 34% of children between the age of 8 to 9 years show a postural insufficiency which is evenly distributed between postural impairment and postural decline for both genders (Mahlknecht et al. 2007). Kolarová et al. observed statistically significant postural disorders in children. Health status of the children's locomotor system, especially postural system is poor.

High prevalence of postural disorders in children requires preventive programs such as introducing corrective exercises into physical education and engaging children in sports (Kolarova et al., 2019). Good fundamentals of posture and balance are essential for the efficient performance of both simple daily tasks and more complex movement patterns (Saggini et al., 2021).

The benefits of childhood physical activity include fitness, weight control, and exercise habits that may carry over into adulthood. School physical education is the primary program responsible for training the nation′s youth to be physically active and national objectives call for students to be engaged in moderate-to-vigorous physical activity at least 50% of the class time (Simonsmorton et al. 1994). In recent years, many interventional studies have focused on the promotion of PA opportunities for children and have adopted time-efficient activity breaks to be implemented in non-curricular school time showing positive results (Howe, et al., 2012; Casolo, et al. 2019; Wilczyński et al. 2020; Michaleff et al., 2014). Physical activity among children and adolescents is associated with lower adiposity, improved cardio-metabolic health, and improved fitness. Worldwide, fewer than 30% of children and adolescents meet global physical activity recommendations of at least 60 minutes of

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moderate to vigorous physical activity per day (Neil-Sztramko et al., 2021). Six PE lessons at school can reduce children's cardiovascular disease risk in school children aged 6-13 years (Klakk et al., 2014). Regular physical education classes can reduce aggression and stress levels, and improve sociality and physical fitness levels already after 8 weeks (Park et al., 2017). Modules are a project of the Ministry of Education, Science, Research and Sport of the Slovak Republic, which aims to **improve the quality of physical and sport education classes** through innovative content and interesting educational methods.

The project coordinates the interconnection of a school environment with the environment of sports associations, clubs, and organizations. The primary goal is children, and the intention is to positively and playfully stimulate their desire to exercise, to build a positive relationship with exercise equipment, and to focus on the comprehensive strengthening of their spine. Low back stability and hamstrings flexibility have being demonstrated to be associated with low back pain occurrence in population. Considering that, exercise training programs that focus on low back stability and mobility through strength and stretching exercises would be a possible intervention strategy for preventing low back pain in schoolchildren However, it is necessary to evaluate if exercise training is efficient in promoting muscle endurance and flexibility improvements (Moreira et al., 2012). Our goal was to evaluate the effect of the exercises in these lessons focused on the spine´s range of motion.

Materials and Methods

Informed consent was obtained from the institution (Elementary school, East Street Trenčín, Slovakia) that with the parents´ consent volunteered to take part in the project „Modules“. One module represents a coherent thematic set of **6 lessons** and was held once a week in the months from october to november 2022. Lessons were taught by a physiotherapist directly during the physical education classes together with the class teacher. One lesson with the physiotherapist lasted 45 minutes and contained the following steps: verbal introduction and instructions for the current class, 2 minutes of moderate-intensity running, 30 minutes of health group exercise concentrated on the spine and 10 minutes of exercise focused on balance and stability training. Each exercise was performed by a physiotherapist first and with direct instructions for the children. The children were corrected during their exercise. The first two lessons were concentrated on right body posture during sitting and standing, increasing the range of motion, and increasing trunk muscle strength.

The second two lessons were concentrated on exercises with the thera-bands in opened and closed kinetic chain exercises. The last two lessons included exercises using fit balls. The main reason for regularly changing exercise aids was to maintain maximum motivation during the class. The children were examined before the first module and then after 6 weeks of exercise. We collected the data in the months of October and November 2022.

The study included 68 participants (32 girls and 36 boys) aged 7-11 years (Table 1). To evaluate the effectiveness of the exercise on the range of motion of the spine, we chose Schober's and Thomayer's tests. The Schober´s test was carried out in a standing position and in maximum forward trunk flexion, keeping the knees extended. With the participant in the orthostatic position, a mark is placed at the level of the fifth lumbar vertebra and the second mark is placed 10 cm above the first mark.

The test was considered physiological when there was variation of at least 5 cm between the measures in orthostatic position and trunk flection (Macedo et al., 2015). A < 5cm increase between the superior and inferior points indicates a positive examination and indicates decreased flexion range of motion of the lumbar vertebral bodies. The Thomayer´s test was carried out in a standing position with a participant deeply bending forward towards the floor. Standard: patients touch the floor with their fingertips. We measured the distance between the fingertips and the floor.

Statistical analysis

The data were processed in the statistical program SPSS. For sample characteristics (n = 68) we calculated the mean and standard deviations. To calculate the differences between the physiological values and measured values of each test we used the one sample Student´s t-test. One sample Student´s t-test is primarily used for comparing sample results with a known and specified value (Skaik, 2015). For Thomayer´s test was the normal/physiological value set to 0 cm. With Schober´s test to 5 cm. We calculated the mean values, SD (standard deviation) and *p*-value of each test before and after the therapy (Table 2). We tested at the level of significance $p < 0.05$.

Table 1 The characteristics of the research sample (n = 68)

	Mean	**SD**
Age (years)	8.4	1.0
Height (cm)	138.1	8.5
Weight (kg)	33.5	8.7
BMI	17.65	4.7

Results

Table 2 shows the means and SD of each test and the results of Student´s one sample t-test as p-value. The differences from physiological values before the therapy with each test were not statistically significant ($p > 0.05$). A statistically significant difference was found with Thomayer´s test and Schober´s tests after the therapy. To show the differences between our variables we used the Pearson coefficient, or Pearson's *r,* which measures the strength and direction of a linear relationship between two variables. We did not find any statistically significant differences between Schober´s test and age or height. Neither between Thomayer´s test and BMI or weight. However, a positive correlation was found with BMI, weight, and Schober´s test. The plot in Figure 1 top: shows the positive correlation between BMI and Schober´s test before the therapy ($r = 0.325$, $p < 0.05$), bottom: show´s the positive correlation between BMI and Schober´s test after the therapy ($r = 0.232$, $p > 0.05$). The correlation between weight and Schober´s test was found positive, statistically significant before the therapy ($p < 0.05$), but statistically insignificant after the therapy ($p > 0.05$) (table 2).

Table 2 Evaluation of Thomayer´s and Schober´s test before and after completing the „Modules“ (n = 68)

	Mean	**SD**	***p*-value**
Thomayer, bef	-6.10	7.96	> 0.05
Thomayer, aft	-2.79	4.99	< 0.001
Schober, bef	5.74	1.11	> 0.05
Schober, aft	6.57	0.99	< 0.05

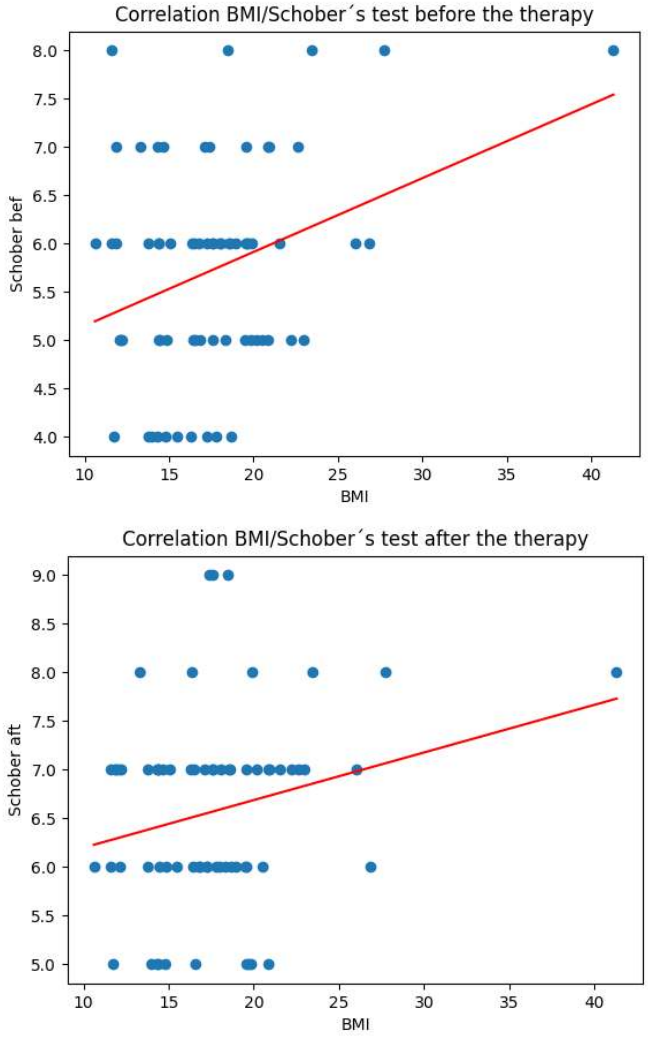

Figure 1 Correlation coefficient between BMI a Schober´s test in centimeters (top: before the therapy, bottom: after the therapy)

A negative correlation was found between age and Thomayer´s test. The higher the average age, the lower values of Thomayer´s test (The higher distance between the fingers and the floor) (figure 2, top: before the therapy, bottom: after the therapy). The difference was found lower after finishing the „Modules“ (before: r = -

0.23, after: r = -0.05). With increasing age decreses the spine´s range of motion or muscle length of the hamstrings. The statistically significant difference ($p < 0.05$) was found in the correlation between sex and Schober´s test results after the therapy (using **Point-biserial correlation). The range of motion after the therapy increased more significantly in boys than in girls.**

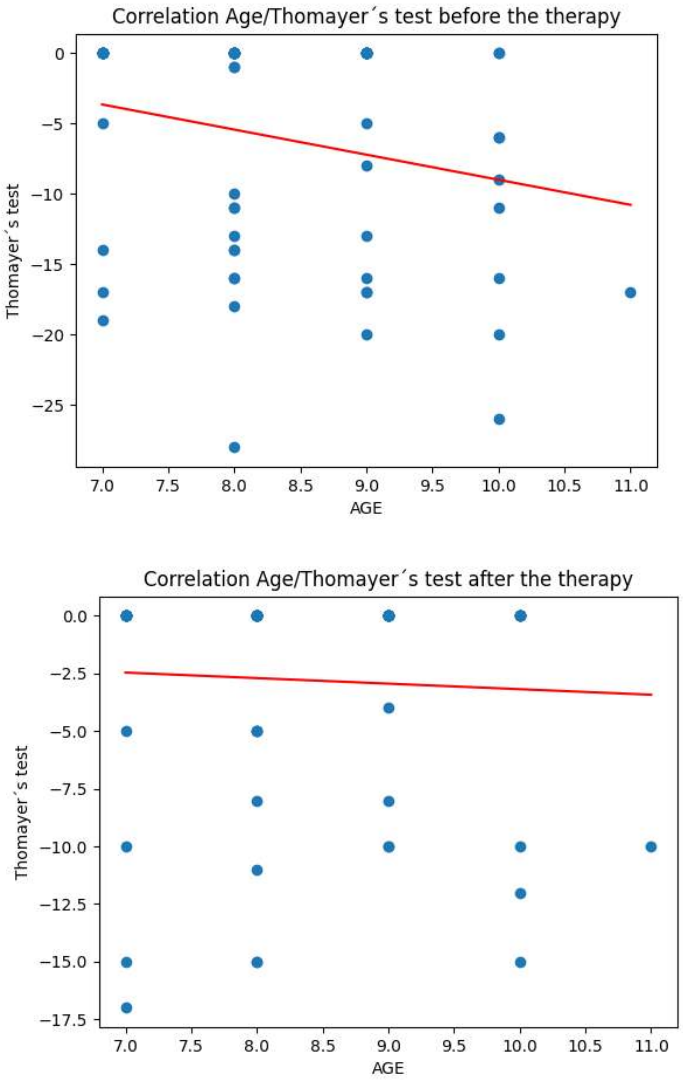

Figure 2 Correlation coefficient between the age a Thomayer´s test in centimeters (top: before the therapy, bottom: after the therapy)

Conclusions

The health exercises in primary schools have a positive effect on the spine´s range of motion using Thomayer´s and Schober´s tests. The higher the age is, the lower the range of motion using Thomayer´s test. The higher the BMI, the higher range of motion using Schober´s test. The range of motion was more significantly increased in boys after the therapy with Schober´s test. The health exercises performed by physiotherapist in physical education classes are an effective form of exercise for primary school children.

Discussion

Our results showed that there exists a correlation between sex and Schober´s test examination. The statistically significant difference was found only after finishing the therapy. According to Woolston et al. 2012, sex is not associated with Schober´s measurement. Although the age and height were statistically significant. The differences can be also because of different sized research sample and also to examine the data they using R^2, we used the correlation R. Physical activity, including physiotherapy exercises in physical education classes is a tool that can increase the range of motion of the spine and therefore decrease the occurrence of musculoskeletal disorders. García-Moreno et al. (2022) suggest, that interventions involving physical exercise, postural hygiene,

and physical activity should be preferred. According to our results we suggest that healthy physical activity is an important tool for the prevention of back pain in children. Blanco-Morales et al. (2020) found that the presence of a physiotherapist in the school context facilitates the acquisition of healthy postural habits. All the adolescents perceived a decrease in back pain after undergoing the program. Screening school-aged children is of major importance in detecting and correcting physical deficiencies. According to Vitman et al. (2022), lower-frequency individual physiotherapy treatment for 12 weeks proved as beneficial as the same program with an additional higher-frequency group physiotherapy in improving thorax curve angle and LBP. However, the higher-frequency group physiotherapy in addition to the lower-frequency individual treatment was significantly more effective in improving postural behavior and adherence to treatment.

Conflicts of interests

The authors have no conflicts of interests to declare.

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References

Bendíková E, Palaščáková I, Tomková Š, Vagner J. Effects of an Exercise Programme on Dynamic Function of the Spine in Secondary-School Female Students. Journal of Physical Education and Sport ® (JPES), 2018; 18;1(74):517 - 525, online ISSN: 2247 - 806X

Blanco-Morales M , Abuín-Porras V, Romero-Morales C , Cueva-Reguera M , De-La-Cruz-Torres B, Rodríguez-Costa I. Implementation of a Classroom Program of Physiotherapy among Spanish Adolescents with Back Pain: A Collaborative Study. Int. J. Environ. Res. Public Health. 2020 July;17(4086);doi:10.3390/ijerph17134806

Cosolo A, Sagelv EH, Bianco M, Casolo F, Galvani CH. Effects of a structured recess intervention on physical activity levels, cardiorespiratory fitness, and anthropometric characteristics in primary school children. Journal of Physical Education and Sport ® (JPES), 2019; 19;5(264): 2247-8051, online ISSN: 2247 - 806X

García-Moreno JM, Calvo-Muñoz I, Gómez-Conesa A, López-López JA. Effectiveness of physiotherapy interventions for back care and the prevention of non-specific low back pain in children and adolescents: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2022 Apr 2;23(1):314. doi: 10.1186/s12891-022-05270-4. PMID: 35366847; PMCID: PMC8976404.

Howe, Freedson, P., Alhassan, S., Feldman, H., & Osganian, S. A recess intervention to promote moderate-to-vigorous physical activity. Pediatric Obesity. 2012 7(1), 82–88. https://doi.org/10.1111/j.2047-6310.2011.00007.x

Illeez OG, Akpinar P, Bahadir Ulger FE, Ozkan FU, Aktas I. Low back pain in children and adolescents: Real life experience of 106 patients. North Clin Istanb. 2020 Nov 17;7(6):603-608. doi: 10.14744/nci.2020.93824. PMID: 33381701; PMCID: PMC7754872.

Jeffries LJ, Milanese SF, Grimmer-Somers KA: Epidemiology of adolescent spinal pain: a systematic overview of the research literature. Spine. 2007, 32 (23): 2630-2637. 10.1097/BRS.0b013e318158d70b

Klakk H, Andersen LB, Heidemann M, Møller NC, Wedderkopp N. Six physical education lessons a week can reduce cardiovascular risk in school children aged 6-13 years: a longitudinal study. Scand J Public Health. 2014 Mar;42(2):128-36. doi: 10.1177/1403494813505726. Epub 2013 Sep 20. PMID: 24055828.

Kolarova M, Kutiš P, Rusnak R, Hrčková Z, Hudáková Z, Lysá Ľ, Luliak M, Babeľa R. Analysis of body segments and postural state in school children. Neuro Endocrinol Lett. 2019 Oct 8;40(Suppl1):17-23. Epub ahead of print. PMID: 31785222.

Kutis P, Kolarova M, Hudakova Z. Assesment of the posture with the students of the first grade of primary schools. Int. J. Educ. 2017 Jan 2017;3(1)457-464. doi: 10.17060/ijodaep.2017.n1.v3.1015

Latalski M, Bylina J, Fatyga M, Repko M, Filipovic M, Jarosz MJ, Borowicz KB, Matuszewski Ł, Trzpis T. Risk factors of postural defects in children at school age. Ann Agric Environ Med. 2013;20(3):583-7. PMID: 24069870

Leboeuf-Yde C, Kyvik KO: At what age does low back pain become a common problem? A study of 29,424 individuals aged 12–41 years. Spine. 1998, 23 (2): 228-234. 10.1097/00007632-199801150-00015

Macedo, Rosangela B. et al. Quality of life, school backpack weight, and nonspecific low back pain in children and adolescents . *J. Pediatr. (Rio J.)* [online]. 2015, vol.91, n.3 [cited 2023-02-15], pp.263-269. Available from: <http://old.scielo.br/scielo.php?script=sci_arttext&pid=S0021-75572015000300263&lng=en&nrm=iso>. ISSN 0021-7557. https://doi.org/10.1016/j.jped.2014.08.011

Mahlknecht JF. The prevalence of postural disorders in children and adolescents: a cross sectional study [in German] Z Orthop Unfall. 2007 May-Jun;145(3):338-42. German. doi: 10.1055/s-2007-965256. Erratum in: Z Orthop Unfall. 2007 Jul-Aug;145(4):440. PMID: 17607634

Michaleff ZA, Kamper SJ, Maher CG, Evans R, Broderick C, Henschke N. Low back pain in children and adolescents: a systematic review and meta-analysis evaluating the effectiveness of conservative

interventions. Eur Spine J. 2014 Oct;23(10):2046-58. doi: 10.1007/s00586-014-3461-1. Epub 2014 Jul 29. PMID: 25070788

Moreira RF, Akagi FH, Wun PY, Moriguchi CS, Sato TO. Effects of a school based exercise program on children's resistance and flexibility. Work. 2012;41 Suppl 1:922-8. doi: 10.3233/WOR-2012-0264-922. PMID: 22316839.

Neil-Sztramko SE, Caldwell H, Dobbins M. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. Cochrane Database Syst Rev. 2021 Sep 23;9(9):CD007651. doi: 10.1002/14651858.CD007651.pub3. PMID: 34555181; PMCID: PMC8459921

Park JW, Park SH, Koo CM, Eun D, Kim KH, Lee CB, Ham JH, Jang JH, Jee YS. Regular physical education class enhances sociality and physical fitness while reducing psychological problems in children of multicultural families. J Exerc Rehabil. 2017 Apr 30;13(2):168-178. doi: 10.12965/jer.1734948.474. PMID: 28503529; PMCID: PMC5412490

Permoda-Białozorczyk A, Olszewska-Karaban M, Permoda A, Zajt J, Wiecheć M, Żurawski A. Evaluation of the Functional Status of the Posture Control System in Children with Detected Disorders in Body Posture. Int J Environ Res Public Health. 2022 Nov 5;19(21):14529. doi: 10.3390/ijerph192114529. PMID: 36361407; PMCID: PMC9654118

Saggini R, et al. Consensus paper on postural dysfunction: recommendations for prevention, diagnosis and therapy. J Biol Regul Homeost Agents. 2021 Mar-Apr;35(2):441-456. doi: 10.23812/20-743-A. PMID: 33940790.

Simonsmorton BG, Taylor WC, Snider SA, Huang IW, Fulton JE; Observed Levels of Elementary and Middle School Children′s Physical Activity during Physical Education Classes, Preventive Medicine. 1994. 23(4):437-441, ISSN 0091-7435

Skaik Y. The bread and butter of statistical analysis "t-test": Uses and misuses. Pak J Med Sci. 2015 Nov-Dec;31(6):1558-9. doi: 10.12669/pjms.316.8984. PMID: 26870136; PMCID: PMC4744321

Vitman N, Hellerstein D, Zeev A, Gilo Y, Nakdimon O, Peretz A, Eilat-Adar S. A Comparison between Different Types and Frequency of Physiotherapy Treatment for Children and Adolescents with Postural Problems and Low Back Pain. Phys Occup Ther Pediatr. 2022;42(2):215-226. doi: 10.1080/01942638.2021.1977759. Epub 2021 Sep 29. PMID: 34587853

Wilczyński J, Lipińska-Stańczak M, Wilczyński I. Body Posture Defects and Body Composition in School-Age Children. Children (Basel). 2020 Oct 29;7(11):204. doi: 10.3390/children7110204. PMID: 33138013; PMCID: PMC7694094.

Woolston SL, Beukelman T, Sherry DD. Back mobility and interincisor distance ranges in racially diverse North American healthy children and relationship to generalized hypermobility. Pediatr Rheumatol Online J. 2012 Jun 20;10(1):17. doi: 10.1186/1546-0096-10-17. PMID: 22716216; PMCID: PMC3424979.