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Exercise programme for schoolgirl with poor posture

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Abstract

The pilot study explains how important it is to include the intervention exercise programme in the syllabi of physical and sport education, especially in terms of primary prevention and improvement of dynamic postural stereotype of pupils. The experimental group consisted of nine female pupils who attended one elementary school in the town of Liptovský Mikuláš and whose age was 13.6 years. We obtained data using the standardized method based on pedagogical and medical practice connected with evaluation of body posture. We used the Wilcoxon signed-rank test to process the obtained qualitative and quantitative data within individual groups. The Wilcoxon-Mann–Whitney test was used to assess the effect of exercise programmes between the two groups (M_{WWtest} $p < 0.01$; $p < 0.05$). The test results proved the

positive impact of the applied exercise programme on overall posture as well as its individual components. *The partial output is part of the: VEGA 1/0376/14.*

Key words: motion program, posture, health, schoolgirl

Introduction

Contemporary sedentary lifestyle of children and adolescents (Bendíková, 2014; Novotná, Slováková, 2016) leads to an increasing number of lifestyle diseases, which undoubtedly include also functional disorders of the musculoskeletal system, poor posture and muscle imbalance. Functional disorders of the musculoskeletal system in children and adolescents are the subject of studies conducted not only by Slovak authors (Adamčák et al., 2011; Kanásová et al., 2015), but also by foreign scientists (Chen et al., 1998; Kopecký, 2004; Kabátová et al., 2012; Lemos et al., 2012; Łubkowska, Tarnowski, 2012; Yoo, 2013; Żukowska et al., 2014). At present, the high occurrence of poor posture among school population is largely caused by lack of physical activity (Bendíková, Kostencka, 2013). In addition to other important functions, good posture is a condition of optimal work of internal organ systems (especially the respiratory and cardiovascular ones).

Coordination between postural and phasic muscles results in body posture that presents a relatively proper arrangement of individual body segments in a sitting and standing position, while walking or doing other movements that these segments participate in (Čermák et al., 2005):

- ✓ head posture,
- ✓ spine (axial body organ),
- ✓ position of pelvis and posture of lower limbs,
- ✓ posture of foot arch and information inputs.

One of the most important movement mechanisms is anti-gravity – postural mechanism, e. i. keeping the upright position. In this regard, it is necessary to point to the optimal spine mobility, which is considered to be one of the basic conditions of good body posture.

The spine needs to be perceived as a compact organ that performs several functions:

- ✓ it is a support that enables upright posture,
- ✓ it participates in creation of movement,
- ✓ it protects an important part of the nervous system (spinal cord and spinal nerve roots).

In addition, the spine participates in provision and keeping of balance and provides horizontal position of eyes and head. Nowadays, spine diseases are deemed to be lifestyle diseases. These

disorders are more common also in young age due to insufficient support of the spine. Their symptoms in the first phase are functional postural disorders and poor (improper) posture is, in fact, a disorder of the system postural function, which results in changes in body shape caused by shortening or weakening of some muscle groups and unphysiological curvature of the spine (Vojtaššák, 2000).

Symptoms of functional disorders of the musculoskeletal system affect three interconnected systems (Kolář, 2001):

a) in the area of muscle functions it is muscle imbalance,

b) in the area of central regulation they are disorders of movement stereotypes,

c) in joints the symptoms are limited joint mobility or hypermobility.

The most common symptom of the spine functional disorder is pain (Łubkowska et al., 2016). It is a subjective feeling ranging from mild discomfort to strong unpleasant sensation (Hart et al, 1995; Thurzová, 2003). Therefore, intensity of experience of pain does not always correspond with how serious the spine disorder is (Buran, 2002). Buran (2002), Véle (2006) and other authors consider muscle imbalance as the main reason of chronic pains in the musculoskeletal system and the spine disorders. Muscle imbalance has a negative impact on posture, movement stereotypes and muscle coordination. What is more, it increases susceptibility to injuries and changes or limits joint mobility.

Muscle imbalance and the spine disorders lead to changes in mobility and function of the musculoskeletal system as well as static and dynamic disorders. They also result in unphysiological loading of individual parts of joints that changes their functions and can subsequently lead to premature degenerative changes. Insufficient primary prevention leads to vertebrogenic diseases in adulthood, which (Buran, 2002):

- ✓ are the main cause of sickness absence among people after the age of 45 years,
- ✓ are the fifth or the sixth most common reason for hospitalization,
- ✓ 60 - 90 % of the population suffered or suffer from vertebrogenic diseases and problems,
- ✓ 70 % of the Slovak patients in rehabilitation facilities have problems with their spine, which is a serious economic problem.

Aim

The study aims to broaden the knowledge on how exercise programmes applied in physical and sport education classes can affect the postural stereotype of pupils.

Materials and methods

The study group comprised 9 female pupils from the experimental group (EG), the average age of whom was 13.6 years, and 9 female pupils from the control group (CG), the

average age of whom was 13.3 years. The pupils attend one elementary school in the town of Liptovský Mikuláš (Table 1).

Table 1 Characteristics EG (n = 9) and CG (n = 9)

Group	n	Decimal age	Body height (cm)	Body weight (kg)	BMI
A Group (EG)	9	±13.6	163.9	45.1	21.9
B Group (CG)	9	±13.3	163.6	46.6	22.1

Legend: BMI – Body mass index, EG – experimental group, CG - control group

The study was conducted in the school year 2014/2015 in 3 stages. In September 2014, the pupils underwent an initial medical examination the purpose of which was medical diagnosis focused on selected determinants of the musculoskeletal system. The examination was based on the standardized method for physical education practice developed by Thomas – Klein and modified by Mayer (Labudová, Vajcziková, 2009). The above-mentioned method uses the following classification of body posture: I. Perfect, II. Good, III. Poor and IV. Bad. Each posture quality level has 5 postural components and is given marks from 1 to 4.

I. Head and neck posture

II. Chest (shape)

III. Abdomen and pelvic tilt

IV. Spine curvature

V. Front posture (assessment of posture of shoulders – shoulder girdle)

Classification of postures:

I. Perfect posture .....5 points

II. Good (almost perfect) posture .....6 – 10 points

III. Poor posture .....11 – 15 points

IV. Bad posture .....16 – 20 points

Posture of lower limbs was assessed on the basis of the distance between inner sides of knee joints (varus deformities) and the distance between inner sides of ankles in a standing position (valgus deformities).

The EG members participated in the exercise programmes three times per week during their physical and sport education classes. These programmes took 20 minutes of the 45-minute lesson. Their purpose was to improve the pupils' musculoskeletal system and they were focused on good posture. Continuous evaluation of the monitored factors was conducted in December 2014 and final measurements were performed in May 2015.

The qualitative and quantitative traits were processed by means of the clinical case study (Vojtaššák, 2000), including application of the logical analysis and synthesis theoretical methods, induction and deduction, comparison and generalization as well as arithmetic mean (x), extent of variation ($R_{max - min}$), standard deviation (s) and median (m). The statistical significance of the difference in monitored indicators (posture and individual segments) between initial and continuous and initial and final assessments was determined by means of the nonparametric test for dependent monitoring, Wilcoxon signed-rank test (W_{test} $p < 0.01$; $p < 0.05$). We used the Wilcoxon-Mann–Whitney test (M_{WWtest} $p < 0.01$; $p < 0.05$) to verify the agreement of the level of two independent groups.

Research results and discussion

Following the partial aim and assignments, we present the part of results that require further and more exact monitoring and processing. The presented results cannot be generalized. They need to be perceived as orientation and source data that can be used to organise the syllabi for physical and sport education with regard to health status of pupils and aims of this school subject.

The initial classification of the pupils' posture (Table 2) in both experimental and control groups significantly ($p < 0.01$) showed that the highest percentage of the pupils (55.6 % in both groups) belong to the quality level III., which means poor posture. 18.9 % of the pupils in both groups belonged to the second quality level, which is characterized by good posture. 11.1 % of the pupils in both groups belonged to the first quality level, which means perfect posture and the same percentage of the pupils in both groups belonged to the fourth quality level. We would like to point out that good posture is associated with aesthetic and also energetic and economic requirements and it reflects the internal and external environment – homeostasis of the function of individual systems. Our findings correspond with the findings made by other authors (Medeková, Bekö, 2009; Adamčák, Bartík, Kozaňáková, 2011), who also point to an increasing occurrence of bad posture among pupils in elementary schools and students in secondary schools.

Table 2 Classification of posture in the EG members EG (n = 9) and CG members (n = 9)

Evaluation/ sex Initial	I. Perfect posture up to 5 points	II. Good posture 6 – 10 points	III. Poor posture 11 – 15 points	IV. Bad posture 16 – 20 points
EG	11.1 % (n=1)	22.2 % (n=2)	55.6 % ** (n=5)	11.1 % (n=1)
CG	11.1 % (n=1)	22.2 % (n=2)	55.6 % (n=5)	11.1 % (n=1)

Legend: ** p < 0.01, ES – experimental group, CG – control group

Continuous evaluation showed that the exercise programme had a positive impact on overall posture, including individual segments, in all members of the experimental group (Table 3).

Table 3. Overall posture in EG (n = 9)

Factors/EG	1.	2.	3.	4.	5.	6.	7.	8.	9.
Initial	12	11	13	12	14	12	13	6	16
Continuous	6	6	7	7	8	6	7	5	13
Final	5	5	5	5	7	5	6	5	11

W_{test} = (p < 0.01)

Posture		
n = 9	**Initial**	**Final**
mean	12.1	6
min	6	5
max	16	11
extent of variation	10	6
standard deviation	1.3	1.2

There were no significant (W_{test} =p >0.05) changes between the initial, continuous and final assessment of overall posture and its individual segments in the control group. The members of this group attended physical education classes, which were organised in accordance with the education programme (Table 4).

Table 4 Overall posture in CG (n = 9)

Factors/CG	1.	2.	3.	4.	5.	6.	7.	8.	9.
Initial	12	12	13	14	15	10	5	10	16
Continuous	12	11	13	14	14	10	5	9	15
Final	12	12	13	13	15	10	5	10	16

W_{test} = ($p < 0,01$)

Posture		
n = 9	**Initial**	**Final**
mean	11.8	11.7
min	5	5
max	16	16
extent of variation	10	9
standard deviation	1.4	1.3

There were significant (M_{WWtest} $p < 0.01$) changes in posture and its individual segments in both groups between the initial and final assessment. We also measured significant (M_{WWtest} $p < 0.01$) changes in both groups between the initial and continuous evaluation of overall body posture.

The assessment results of individual postural segments were as follows.

The final evaluation of the head and neck posture (I.) in the EG showed that there was a significant difference (W_{test} = $p < 0.01$) between the initial evaluation, when only one pupil was given mark 1, and the final assessment, when seven pupils were given mark 1.

The initial assessment of the chest region (II.) in the EG showed that only one girl, who had a symmetrical and well arched chest and used the intercostal region for breathing, was given mark 1 while most of the pupils belonged to the third quality level. The positive thing was that none of the pupils belonged to the fourth quality level (IV.). There was a significant difference (W_{test} = $p < 0.01$) between the initial and final evaluation, concerning especially mark 2, which had the highest percentage and significance ($p < 0.01$). The doctor gave mark 3 to only pupil. However, even this girl underwent noticeable subjective and consciously controlled changes. Tisovský et al. (2004) also points to prevalence of asymmetric trunk in children aged 8 – 14. It is necessary to emphasize that posture of chest plays an important role in breathing and position of individual internal organs in a rib cage, which protects them.

Another area of evaluation was the abdomen and pelvic tilt (III.). There were significant ($W_{test} = p < 0.01$) changes between the initial and final assessment. There was an improvement ($W_{test} = p < 0.05$) after the final evaluation in all the pupils. What is more, the improvement was significant ($W_{test} = p < 0.05$) also after the continuous evaluation. In this regard, it is necessary to point out that good posture depends also on proper curve of the spine and appropriate pelvic tilt. Improper posture and extension of pelvic tilt results in weakening of rectus abdominis muscles and shortening of the iliopsoas muscle, which can lead to other functional disorders affecting individual postural segments.

Physiological and natural curve of the spine in sagittal and lateral plane is important in health, economic and aesthetic terms. The initial evaluation of the spine curve (IV.) showed that all the pupils had apparently rounded back and forward head posture as compensation. Even the continuous evaluation proved a positive impact of the exercise programme, where changes were significant ($W_{test} = p < 0.05$). There was also a significant difference ($W_{test} = p < 0.01$) between the initial and final assessment of the whole EG.

As regards the front posture (V.), we saw the highest percentage and significance ($W_{test} = p < 0.01$) in marks 1 and 2 after the final evaluation.

The initial assessment showed that 8 pupils had prominent shoulder blades and shoulders that were pulled forward, which are typical symptoms of the rounded back (Labudová, Vajciková, 2009). It is necessary to point out that initially such symptoms are connected with only a functional disorder that can later develop into a structural disorder. Therefore, it is important to align and strengthen the spine by active muscle activity before it matures (approximately up to 12 or 13 years of age). This muscle activity includes preventive exercises focused on individual segments that contribute to good posture. The main reason of prominent shoulder blades is weakening of the shoulder blade and rhomboid muscles, which are drawn by relatively stronger pectoral muscles (Bendíková, Stacho, 2010). After the final evaluation of forward posture we found out symmetry and relaxed shoulders that were at the same height. Furthermore, the results showed that 6 pupils did not have prominent shoulder and 3 girls had only slight deviations.

There were no significant changes between the initial and final evaluation of lower limbs because the pupils did not have valgus or varus deformities of lower limbs. What is more, they did not have any deformities of their soles, which were properly curved.

The above-mentioned findings are the subject of further and more exact monitoring.

Conclusion

The presented empirical study helps to broaden the knowledge of applying the exercise programme in physical and sport education, with focus on monitored determinants of the musculoskeletal system. The study proved the positive effect of the programme ($p<0.01$), with the significant difference ($p<0.01$) between the experimental group and the control group. Our results show that adequate physical activities can influence the factors influencing the body posture and support proper development and growth in pupils. *The partial output is part of the: VEGA 1/0376/14.*

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