Baltic Journal of Health and Physical Activity

Volume 11 | Issue 2 Article 7

2019

Characteristics of the correlations between body posture and postural stability in boys aged 10-12 years

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Recommended Citation

Bieniek K, Wilczynski J. Characteristics of the correlations between body posture and postural stability in boys aged 10-12 years. Balt J Health Phys Act. 2019;11(2):65-74. doi: 10.29359/BJHPA.11.2.07

Baltic Journal of Health and Physical Activity 2019; 11 (2): 65-74
Journal of Gdansk University of Physical Education and Sport
e-ISSN 2080-9999

ORIGINAL

doi: 10.29359/BJHPA.11.2.07

Characteristics of the correlations between body posture and postural stability in boys aged 10-12 years

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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abstract

Background: The aim of the study was to analyse the correlations between body posture parameters and postural stability in boys aged 10-12 years.

Material and methods: The study involved a group of 159 boys aged 10-12 years from the Świętokrzyskie Voivodeship. Body posture was evaluated using the Diers formetric III 4D optoelectronic method, which allows photogrammetric registration of the back surface using the raster stereography process. Postural stability of the examined boys was evaluated using the Biodex Balance System balance platform.

Results: Spearman's rank correlation showed a directly proportional relationship be-tween selected postural stability parameters and the inflection point ILS (mm) as well as surface rotation (rms) (°). However, on inversely proportional relationships were found be-tween length of the trunk VP-DM (mm), length of the trunk VP-SP (mm) and the pelvic in-clination (symmetry line) (°).

Conclusions: The results showed that the poorer the postural stability of the subjects, the worse the quality of body posture.

Key words: body posture, scoliotic posture, scoliosis, central stabilization, Diers Formetric III 4D method.

article details

Article statistics: **Word count:** 2,688; **Tables:** 7; **Figures:** 0; **References:** 31
Received: April 2018; **Accepted:** March 2019; **Published:** June 2019

Full-text PDF: http://www.balticsportscience.com

Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, De Gruyter - IBR (International Bibliography of Reviews of Scholarly Literature in the Humanities and Social Sciences), De Gruyter - IBZ (International Bibliography of Periodical Literature in the Humanities and Social Sciences), DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interests: Authors have declared that no competing interest exists.

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INTRODUCTION

In postural re-education, both morphological and neurophysiological factors are important. Publications on the influence of stability disorders on the quality of posture are rare. There is enough evidence that despite the considerable strength and endurance of postural muscles, body posture is often incorrectly assumed, and corrective action does not bring the expected results [1,2,3,4]. Both in prophylaxis and in the correction of postural defects, one should gradually move away from one-sided, usually one-system therapeutic interaction. Body posture is conditioned by many factors, including central regulation, the quality of which is related to the postural system that gradually develops during ontogenesis. A well-functioning postural system contains components that are dependent on one another, i.e. correct postural muscle tension, reciprocal innervation as well as postural and motor patterns. In the case of reduced tension of postural muscles, the postural system does not develop properly, and children compensate for its shortages by positioning individual body sections in a way that facilitates functioning under gravity. Hypotony, which disturbs the functioning of other antigravity system components, is the basic postural problem. According to Wilczyński [5], postural defects are greatly a consequence of spontaneous compensation of postural hypotony. Meanwhile, in both the diagnosis and correction of postural defects, mainly bone-joint and musculo-ligamental bases are considered. The neurophysiological sphere is neglected, playing a fundamental role in somatognosia and postural re-education [5].

Postural regulation is automatic. It is based on a large group of postural reactions, the arches of which run through various floors of the central nervous system. Some of these reactions are important only during the development of posture, while others play a significant role throughout one's whole life.

The aim of the study was to answer the question what relationships exist between the body posture and postural stability in boys aged 10–12.

MATERIAL AND METHODS

The study covered a group of 159 boys aged 10–12 years attending three different primary schools in Kielce. The research was carried out in January and February 2016 at the Posturology Laboratory at noon. The most numerous group comprised of 67 10-year-old boys; the next group totaled 60 boys aged 11, and the least numerous group was formed by 12-year-olds – 32 individuals. The subjects' body height was determined by means of a centimeter tape with an accuracy of 0.001 cm, while the Tanita body composition analyzer was used to assess body mass. The mean height of the examined boys at the age of 10 was 144.567 cm; the mean body weight reached 38.146 kg, and the mean BMI was 18.128. In the group of 11-year-old boys, the mean body height was 154.933 cm; the mean body weight of the subjects was 46.913 kg, and the BMI reached the mean value of 19.372. Among boys aged 12, the mean body height was 158.344 cm; the mean body weight was 48.256 kg, while the BMI index reached the mean value of 19.113. In order to select children for the study group, an online Randomizer was used, which allows organizing list elements in a random order. Prior to the research, its purpose, course and duration were determined. Then, the parents/legal guardians of the children gave written consent for their children's participation in the study. All research procedures were carried out in accordance with the Declaration of Helsinki from 1964 and with the consent of the University Bioethics Committee for Research at Jan Kochanowski University in Kielce (Resolution No. 5/2015).

Examination of the body posture

Body posture was assessed using the Diers formetric III 4D optoelectronic method, which allows photogrammetric video registration of the back's surface using raster stereography [6,7,8]. Body posture measurements were carried out via the DiCAM programme using the average measurement. This consisted in taking a sequence of twelve photographs, which by creating an average value reduce the variance of posture and thus, improve the clinical value of the study [9]. Based on the received data, a precise, three-dimensional model of the back surface was created [10]. The essence of the device is analysis of the back form. Considering anatomical and biomechanical assumptions of the model, it was possible to calculate permanent anatomic points, spinal curvatures and spatial forms of the trunk [11, 12]. The following parameters were used to describe the body posture:

- trunk length VP-DM (mm), the distance measured from the C7 vertebra to the midpoint between the lumbar dimples,
- trunk length VP-SP (mm), the length measured from the C7 vertebra to the beginning of the glottal fissure,
- pelvic tilt DL-DR (mm), this variable refers to the difference in the height of the lumbar dimples in relation to the horizontal plane (cross section); a positive value means that the right dimple is higher than the left one; a negative value occurs when the right dimple is located below the left one,
- pelvic torsion DL-DR (°), calculated from the mutual torsion of the lumbar dimples (vertical component); with a positive difference the right one (DR) is directed further and more upwards than the left one (DL),
- inflection point ICT (mm), the cervico-thoracic point of inflection, i.e. the point of the highest inclination of the area within the cervical segment (above the kyphosis apex),
- inflection point ITL (mm), the thoracic-lumbar inflection point, the point of the highest negative inclination in the area between the kyphosis apex and the lordotic apex,
- inflection point ILS (mm), the lumbar-sacral point of inflection, i.e. the highest positive inclination point of the surface between the lordosis apex and sacral kyphosis,
- kyphotic angle ICT-ITL (max) (°), the maximal kyphotic angle measured between the tangents to the surface of the upper inflection point ICT near VP and thoracic-lumbar inflexion ITL,
- lordotic angle ICT-ITL (max) (°), the maximal angle of lordosis, measured between the tangents to the surface of thoracic lumbar inflexion ITL and the lower lumbar-sacral point of inflection ILS,
- pelvic inclination (symmetry line) (°), pelvic inclination (°) (dimples), calculated as mean inclination of the pelvic plane at the DL and DR points,
- surface rotation (rms) (°), the parameter regards the mean value of surface rotation (root mean square) of so-called surface rotation on the symmetry line [13].

Postural stability assessment

Postural stability of the examined boys was assessed using the Biodex Balance System balance platform. The Postural Stability Test was performed with both feet placed on a stable surface and with open eyes. The duration of the test included three samples lasting 20 seconds separated by a 10-second interval. During the examination, the subject focused on the monitor screen where a characteristic dot appeared (COP). This was a symbolic representation of the center of mass (COM). The subject's task was to balance his body so that the dot (COP) was in the middle of a circle visible on the monitor and at the intersection point of the coordinate axes [14].

The analyzed parameters were:
- Overall Stability Index (SI), reflecting the variability of the platform's position from the horizontal plane regarding all movements performed in the test expressed in degrees over time. Its high value indicates a large number of movements performed during the test;
- Anterior/Posterior Stability Index (A/P), reflecting the variability of the platform position for sagittal movements expressed in degrees;
- Medial/Lateral Stability Index (M/L), reflecting the variability of the platform position for movements in the frontal plane expressed in degrees [15].

The independent variables were related to postural stability parameters, while the parameters of the body posture were considered dependent variables. People with postural disorders mostly show higher values of all the mentioned parameters. The correlation of scale-type features was investigated using Spearman's r test. The level of significance was $p < 0.05$.

RESULTS

In the group of boys aged 10–12, the results of the study showed that along with an increase in the overall stability index, the value of inflection point ILS (R = 0.24; p = 0.002) as well as the value of surface rotation also increase (rms) (R = 0.16; p = 0.044). Inversely proportional correlations between the discussed postural stability parameter and the length of the trunk VP-DM (R=-0.23; p = 0.003), the length of the trunk VP-SP (R = -0.22; p = 0.006) and pelvic inclination (symmetry line) (R = -0.18; p = 0.022) (Tab. 1) were also observed. The same relationships appeared in the case deviation of the body in the anterior/posterior plane (A/P). Direct proportional correlations regarded: inflection point ILS (R = 0.24; p = 0.002) and surface rotation (rms) (R = 0.20; p = 0.010), while inversely proportional correlations concerned: trunk length VP-DM (R = -0.23; p = 0.004), trunk length VP-SP (R = -0.21; p = 0.007) and pelvic inclination (line of symmetry) (R = -0.18; p = 0.027) (Tab. 2).

In the case of body deflection in the medial-lateral plane (M/L), a lower M/L index value showed higher trunk length VP-DM (R = -0.18; p = 0.022), trunk length VP-SP (R = -0.18; p = 0.027) and pelvic inclination (symmetry line) (R = -0.20; p=0.014). The direct proportional correlation concerned the inflection point ILS (mm) (R = 0.18; p = 0.020) (Tab. 3).

Among boys aged 10 years there was a direct proportional correlation between pelvic tilt DL-DR: overall stability index (R = 0.26; p = 0.032) and the anterior/posterior plane (A/P) (R = 0.29; p = 0.016) (Tab. 4 and 5).

In the group of 11-year-old boys, positive correlations related to the overall stability index and pelvic tilt DL-DR (R = 0.30; p = 0.021). The same relationships appeared in the case deviation of the body in the anterior/posterior plane (A/P) (R = 0.30; p = 0.021). In addition, the parameter positively correlated with surface rotation (rms) (R = 0.30; p = 0.018) and kyphotic angle ICT-ITL (max) (R = 0.26; p = 0.043) (Tab. 6 and 7). The analysis of the results in the oldest group of boys did not show statistically significant relationships.

Table 1. Correlations between the Overall Stability Index and body posture parameters in the group of studied boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Overall Stability Index (°) / Trunk length VP-DM (mm)	159	-0.23	-2.990	**0.003**
Overall Stability Index (°) / Trunk length VP-SP (mm)	159	-0.22	-2.804	**0.006**
Overall Stability Index (°) / Pelvic tilt DL-DR (mm)	159	0.5	0.663	0.508
Overall Stability Index (°) / Pelvic torsion DL-DR (°)	159	0.11	1.439	0.152
Overall Stability Index (°) / Inflection point ICT (mm)	159	-0.03	-0.410	0.682
Overall Stability Index (°) / Inflection point ITL (mm)	159	0.07	0.813	0.417
Overall Stability Index (°) / Inflection point ILS (mm)	159	0.24	3.140	**0.002**
Overall Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	159	0.02	0.197	0.844
Overall Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	159	-0.09	-1.079	0.282
Overall Stability Index (°) / Pelvic inclination (symmetry line) (°)	159	-0.18	-2.318	**0.022**
Overall Stability Index (°) / Surface rotation (rms) (°)	159	0.16	2.035	**0.044**

Table 2. Correlations between Stability Index in the anterior-posterior plane (A/P) and body posture parameters in the group of studied boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Anterior-Posterior Stability Index (°) / Trunk length VP-DM (mm)	159	-0.23	-2.906	**0.004**
Anterior-Posterior Stability Index (°) / Trunk length VP-SP (mm)	159	-0.21	-2.738	**0.007**
Anterior-Posterior Stability Index (°) / Pelvic tilt DL-DR (mm)	159	0.03	0.325	0.746
Anterior-Posterior Stability Index (°) / Pelvic torsion DL-DR (°)	159	0.08	1.008	0.315
Anterior-Posterior Stability Index (°) / Inflection point ICT (mm)	159	-0.06	-0.738	0.461
Anterior-Posterior Stability Index (°) / Inflection point ITL (mm)	159	0.06	0.801	0.424
Anterior-Posterior Stability Index (°) / Inflection point ILS (mm)	159	0.24	3.139	**0.002**
Anterior-Posterior Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	159	0.03	0.370	0.712
Anterior-Posterior Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	159	-0.06	-0.769	0.443
Anterior-Posterior Stability Index (°) / Pelvic inclination (symmetry line) (°)	159	-0.18	-2.234	**0.027**
Anterior-Posterior Stability Index (°) / Surface rotation (rms) (°)	159	0.20	2.610	**0.010**

Table 3. Correlations between the Stability Index in the medial-lateral (M/L) plane and body posture parameters in the studied group of boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Anterior-Posterior Stability Index (°) / Trunk length VP-DM (mm)	159	-0.23	-2.906	**0.004**
Anterior-Posterior Stability Index (°) / Trunk length VP-SP (mm)	159	-0.21	-2.738	**0.007**
Anterior-Posterior Stability Index (°) / Pelvic tilt DL-DR (mm)	159	0.03	0.325	0.746
Anterior-Posterior Stability Index (°) / Pelvic torsion DL-DR (°)	159	0.08	1.008	0.315
Anterior-Posterior Stability Index (°) / Inflection point ICT (mm)	159	-0.06	-0.738	0.461
Anterior-Posterior Stability Index (°) / Inflection point ITL (mm)	159	0.06	0.801	0.424
Anterior-Posterior Stability Index (°) / Inflection point ILS (mm)	159	0.24	3.139	**0.002**
Anterior-Posterior Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	159	0.03	0.370	0.712
Anterior-Posterior Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	159	-0.06	-0.769	0.443
Anterior-Posterior Stability Index (°) / Pelvic inclination (symmetry line) (°)	159	-0.18	-2.234	**0.027**
Anterior-Posterior Stability Index (°) / Surface rotation (rms) (°)	159	0.20	2.610	**0.010**

Table 4. Correlations between the Overall Stability Index and body posture parameters in the group of studied 10-year-old boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Overall Stability Index (°) / Trunk length VP-DM (mm)	67	0.05	0.371	0.712
Overall Stability Index (°) / Trunk length VP-SP (mm)	67	0.03	0.211	0.834
Overall Stability Index (°) / Pelvic tilt DL-DR (mm)	67	0.26	2.188	**0.032**
Overall Stability Index (°) / Pelvic torsion DL-DR (°)	67	-0.04	-0.281	0.779
Overall Stability Index (°) / Inflection point ICT (mm)	67	-0.01	-0.111	0.912
Overall Stability Index (°) / Inflection point ITL (mm)	67	-0.07	-0.599	0.551
Overall Stability Index (°) / Inflection point ILS (mm)	67	0.04	0.346	0.730
Overall Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	67	-0.15	-1.214	0.229
Overall Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	67	-0.08	-0.683	0.497
Overall Stability Index (°) / Pelvic inclination (symmetry line) (°)	67	-0.20	-1.678	0.098
Overall Stability Index (°) / Surface rotation (rms) (°)	67	-0.19	-1.554	0.125

Table 5. Correlations between the Stability Index in the anterior-posterior plane (A/P) and body posture parameters in the group of studied 10-year-old boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Anterior-Posterior Stability Index (°) / Trunk length VP-DM (mm)	67	0.07	0.523	0.603
Anterior-Posterior Stability Index (°) / Trunk length VP-SP (mm)	67	0.04	0.304	0.762
Anterior-Posterior Stability Index (°) / Pelvic tilt DL-DR (mm)	67	0.29	2.478	**0.016**
Anterior-Posterior Stability Index (°) / Pelvic torsion DL-DR (°)	67	-0.13	-1.076	0.286
Anterior-Posterior Stability Index (°) / Inflection point ICT (mm)	67	-0.06	-0.485	0.630
Anterior-Posterior Stability Index (°) / Inflection point ITL (mm)	67	-0.09	-0.753	0.454
Anterior-Posterior Stability Index (°) / Inflection point ILS (mm)	67	0.05	0.388	0.699
Anterior-Posterior Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	67	-0.15	-1.218	0.228
Anterior-Posterior Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	67	-0.21	-1.707	0.093
Anterior-Posterior Stability Index (°) / Pelvic inclination (symmetry line) (°)	67	-0.17	-1.406	0.164
Anterior-Posterior Stability Index (°) / Surface rotation (rms) (°)	67	0.10	0.842	0.403

Table 6. Correlations between the Overall Stability Index and body posture parameters in the group of studied 11-year-old boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Overall Stability Index (°) / Trunk length VP-DM (mm)	60	-0.19	-1.472	0.146
Overall Stability Index (°) / Trunk length VP-SP (mm)	60	-0.12	-0.931	0.356
Overall Stability Index (°) / Pelvic tilt DL-DR (mm)	60	-0.07	-0.550	0.584
Overall Stability Index (°) / Pelvic torsion DL-DR (°)	60	0.30	2.364	**0.021**
Overall Stability Index (°) / Inflection point ICT (mm)	60	-0.06	-0.453	0.653
Overall Stability Index (°) / Inflection point ITL (mm)	60	0.09	0.658	0.513
Overall Stability Index (°) / Inflection point ILS (mm)	60	0.07	0.542	0.590
Overall Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	60	0.21	1.665	0.101
Overall Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	60	0.09	0.649	0.519
Overall Stability Index (°) / Pelvic inclination (symmetry line) (°)	60	-0.05	-0.362	0.718
Overall Stability Index (°) / Surface rotation (rms) (°)	60	0.15	1.162	0.250

Table 7. Correlations between the Stability Index in the anterior-posterior plane (A/P) and body posture parameters in the group of studied 11-year-old boys

Correlated parameters	N	Spearman R	t (N-2)	P level
Anterior-Posterior Stability Index (°) / Trunk length VP-DM (mm)	60	-0.19	-1.472	0.146
Anterior-Posterior Stability Index (°) / Trunk length VP-SP (mm)	60	-0.12	-0.931	0.356
Anterior-Posterior Stability Index (°) / Pelvic tilt DL-DR (mm)	60	-0.07	-0.550	0.584
Anterior-Posterior Stability Index (°) / Pelvic torsion DL-DR (°)	60	0.30	2.364	**0.021**
Anterior-Posterior Stability Index (°) / Inflection point ICT (mm)	60	-0.06	-0.453	0.652
Anterior-Posterior Stability Index (°) / Inflection point ITL (mm)	60	0.09	0.658	0.513
Anterior-Posterior Stability Index (°) / Inflection point ILS (mm)	60	0.11	0.832	0.409
Anterior-Posterior Stability Index (°) / Kyphotic angle ICT-ITL (max) (°)	60	0.26	2.065	**0.043**
Anterior-Posterior Stability Index (°) / Lordotic angle ICT-ITL (max) (°)	60	0.17	1.279	0.206
Anterior-Posterior Stability Index (°) / Pelvic inclination (symmetry line) (°)	60	0.00	0.005	0.100
Anterior-Posterior Stability Index (°) / Surface rotation (rms) (°)	60	0.30	2.432	**0.018**

DISCUSSION

Postural development is the effect of gradual integration of muscle tone during development of the postural system [16, 17]. The postural system receives stimuli from the environment via receptors in the vestibular organ, the organ of sight and hearing, proprioceptors and skin mechanoreceptors. The obtained information is processed by the central nervous system and then transmitted to the periphery of the effector organs [18, 19]. Signals from sensory inputs are a source of information about body orientation and its orientation in relation to reference systems. According to Nowotny and Saulicz [20], if incorrect information is provided to the body posture control system, based on this data, a postural and locomotion control system is created that will prevent performing its function properly. This means that children who do not have sufficient postural tension in lower positions are unable to achieve higher positions without activating the compensation system [21, 22]. This is exemplified in studies by Klavina and Galei [23], which assessed the relationship between body posture and static balance among children aged 7–12 years with sensorimotor deficits. The study involved 34 subjects (8 with hearing disorders, 8 with eyesight disorders, 6 with cerebral palsy and 12 with mild intellectual disabilities). To assess body balance, the BTS P-6000 platform was used on a stable surface with open and closed eyes. Body posture was assessed in the sagittal and frontal planes using a Nikon D-5000 digital camera. The results showed that in children with cerebral palsy who do not have appropriate central tension, most abnormalities occur in both the sagittal and frontal plane in comparison with the other groups. The concept of central stabilization is associated with activation of deep trunk muscles, which affect the control of the spine, pelvis and limbs. In addition, central stabilization protects joints from overloads, ensuring their axial load. It helps in maintaining correct spinal curvature, which is great protection against the occurrence of postural defects.

Own research has shown that with an increase in postural stability variables, the values of the body postural variables are increasing, which means that the worse the subjects' postural stability, the worse the quality of their posture. Inverse proportional correlations can be explained by the strategy of the hip joint, which causes the torso to tilt forward with the flexion of the hip joints. In addition, a large obstacle in comparing the results of this study with the outcomes of other authors is often related to the different methodology of conducted research, as well as the use of different measures and boundaries between a postural defect and the correct posture. However, proving the existing relationships between body posture and postural stability indicates the need to consider a dysfunction of the central nervous system as the basic problem in the lack of muscle integration [24] . Many studies indicate the desirability of using postural re-education exercises to improve balance with a use of biofeedback on balance platforms. Information on the relationship between the posture of school-children and the use of exercises on balance platforms can be found in the paper by Jankowicz-Szymańska and Mikołajczyk [25]. It has been proven that regular exercises on an unstable surface and the use of sensory devices improve symmetry of the body in the frontal plane and are an effective preventive method in the formation of postural defects. A study by Le Berre et al. [26], regarding the assessment of body posture and equivalent responses, enrolling 114 people with scoliosis (mean age 14.5 ±1.9 years, Cobb angle 35.7 ±15.3 °) and 81 healthy individuals (mean age 14.1 ±1.9 years), showed that there was no difference between persons with idiopathic scoliosis and the control group in the assessment of static balance. However, significant discrepancies in the assessment of dynamic balance have been noticed, which shows that dynamic proprioception is associated with body posture parameters.

The current research results on the development of children and adolescents with hearing impairments are not conclusive and indicate a possible dissimilarity with respect to the peer group. Comparison of the results is not easy due to the selected research groups, different in terms of age, sex, size, hearing loss or applied tests [27–29]. Majlesi et al. [30] analyzed the impact of a 12-session balance exercise program based on proprioception training in a static position and during gait among 10 deaf children constituting the experimental group. The control group consisted of 10 healthy children. Comparison of the control and experimental groups revealed that the intervention program did not significantly increase gait speed in the affected patients, but it significantly reduced their swaying. Therefore, it was concluded that the exercise program applied to strengthen somatosensory capacity could improve balance in deaf children. The research by Walicka-Cupryś et al. [31] involving 228 children, including 65 deaf persons (DCH) and 163 people without hearing loss (CON) in the control group showed significant differences in the parameter range of the total path length recorded in the test with open eyes and the whole range of registered parameters when the subjects had closed eyes. The test results showed better static values of balance parameters in deaf children compared to peers without hearing impairments. The differences were particularly evident in the test with closed eyes. The results suggest significantly better processing of sensory stimuli in postural responses especially as a result of proprioception, and, to a lesser extent, due the vision system observed in the studied groups compared to peers from the control group.

The influence of postural stability on the quality of body posture is very important in the diagnosis of postural defects. In literature on the subject, most research concerns the links between body posture and postural stability among children with hearing and eyesight disturbances or cerebral palsy. However, there are no data on the connections between these parameters among the population of healthy children. Due to the vast number of factors, interactions between variables and the cross-sectional nature of the empirical material, it is not possible to clearly indicate specific types of posture which depend on the parameters of postural stability. On the other hand, the author’s research indicates parameters in the field of body posture and postural stability which are closely correlated with each other. Thanks to this, it seems necessary to include exercises in the field of central stabilization in postural re-education programs, which is the basis for a coordinated and ergonomic body system.

CONCLUSIONS

The conducted study showed correlations between posture parameters and postural stability among boys aged 10–12. Worse postural stability resulted in poorer postural quality of the subjects, which indicates the need to include the posture of central stabilization exercises into the correction of defects. Exercises shaping the correct body posture in conjunction with adjusting and equivalent reactions should be applied in the correction of posture defects.

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Cite this article as:

Bieniek K, Wilczyński J.
Characteristics of the correlations between body posture and postural stability in boys aged 10-12 years
Balt J Health Phys Act. 2019;11(2):65-74
doi: 10.29359/BJHPA.11.2.07