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FUNCTIONAL STATE OF THE MUSCULOSKELETAL SYSTEM OF THE MIDDLE SCHOOL AGE CHILDREN WITH HEARING LOSS

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Abstracts

The topicality of the research. The human musculoskeletal system plays an important role in the formation and harmonious development of it. The functional state of the musculoskeletal system is a unique indicator of health. The analysis of literary resources testify that children with hearing loss have the indicators of the musculoskeletal system functional state differ from those in healthy children. **The aim of the research** is to determine and analyze the age-related changes in the indicators of the functional state of the musculoskeletal system for the children of middle school age with hearing loss. In the process of research we used the following methods: analysis of literary resources, videometry (Torso Program) for determining the angles of the torso and head inclination, pedagogical testing for the definition of the static endurance of the front torso and legs muscles and the back torso and legs muscles also methods of mathematical statistics. **The results of the work.** The results of the work. In the research it was found that in the age of 11-14 years, boys and girls research indicators are growing, also this process is ambiguous. So in the research period, the indicator of static endurance of the front part of the torso and legs is statistically significantly ($p < 0,05$) in creases for boys to 9,2s, for girls only to 5,2 s; the indicator of static endurance of the back part of the torso and legs is statistically significant ($p < 0,05$) increases for boys to 9,2 s, for girls to 6,2 s. The angle of inclination of the head (\square_1) in the period of 11-14 years as boys as girls is statistically significant ($p < 0,05$) in creasing to 0,6 degree. The angle of inclination of the torso (\square_1) is statistically significant ($p < 0,05$) in creases for boys 0.18 degrees and for girls – 0,2 degrees. Growth of the research indicators is different for boys and girls. **Conclusions.** The obtained results indicate that boys and girls have statistically significant ($p < 0,05$) growth of the research parameters in the age aspect. In this case, the boys and girls have rather low indicators of static endurance of front part of the torso and legs, somewhat better, but still low indicators of static endurance of the back of the torso and legs. Indicators of the angles of inclination of the head and torso are also lower than the standard ones.

Key words: musculoskeletal system, the middle school age children with hearing loss, angle of inclination of the head, angle of inclination of the torso, static endurance.

Роман Іваніцький, Алла Альошина. Функціональний стан опорно-рухового апарату дітей середнього шкільного віку з вадами слуху. Актуальність. Опорно-руховий апарат людини відіграє важливу роль у формуванні й гармонійному її розвитку. Функціональний стан опорно-рухового апарату людини є своєрідним індикатором здоров'я. Аналіз літературних джерел засвідчує, що в дітей із вадами слуху показники функціонального стану опорно-рухового апарату відрізняються від аналогічних даних у здорових дітей. **Мета дослідження** – визначити та проаналізувати вікові зміни показників функціонального стану опорно-рухового апарату дітей середнього шкільного віку з вадами слуху. У процесі дослідження ми використовували **такі методи:** аналіз літературних джерел, відеометрія (програма «Torso») для визначення кутів нахилу тулуба й голови, педагогічне тестування для визначення статичної витривалості м'язів передньої частини тулуба та ніг і м'язів задньої частини тулуба й ніг, методи математичної статистики. **Результати дослідження.** У процесі досліджень встановлено, що в період із 11 до 14 років у хлопчиків та дівчаток відбувається зростання досліджуваних показників та здійснюється цей процес неоднозначно. Так, у досліджуваний період показник статичної витривалості передньої частини тулуба й ніг статистично достовірно ($p < 0,05$) зростає в хлопчиків на 9,2 с, у дівчаток – лише на 5,2 с; показник статичної витривалості задньої частини тулуба й ніг статистично достовірно ($p < 0,05$) зростає, у хлопчиків – на 9,2 с, у дівчаток – на 6,2 с. Кут нахилу голови (\square_6) у період 11–14 років у хлопців і дівчат статистично достовірно ($p < 0,05$) зростає на 0,6 град. Кут нахилу тулуба (\square_1) статистично достовірно ($p < 0,05$) зростає в хлопців 0,18 град., у дівчат – 0,2 с. Приріст досліджуваних показників різний у хлопців і дівчат. **Висновки.** Отримані результати засвідчують, що в хлопців і дівчат відбувається статистично достовірно ($p < 0,05$) зростання досліджуваних показників у віковому аспекті. При цьому у хлопців та дівчат досить низькі показники статичної витривалості передньої частини тулуба й ніг, дещо кращі, але все ж низькі показники статичної витривалості задньої частини тулуба та ніг. Показники кутів нахилу голови й тулуба також нижчі від нормативних.

Ключові слова: опорно-руховий апарат, діти середнього шкільного віку з вадами слуху, кут нахилу голови, кут нахилу тулуба, статична витривалість м'язів.

Роман Іваницький, Алла Алєшина. Функциональное состояние опорно-двигательного аппарата детей среднего школьного возраста с нарушениями слуха. Актуальность. Опорно-двигательный аппарат человека играет важную роль в формировании и гармоничном его развитии. Функциональное состояние опорно-двигательного аппарата человека является своеобразным индикатором здоровья. Анализ литературных источников свидетельствует, что у детей нарушениями слуха показатели функционального состояния опорно-двигательного аппарата отличаются от аналогичных показателей у здоровых детей. **Цель исследования** – определить и проанализировать возрастные изменения показателей функционального состояния опорно-двигательного аппарата детей среднего школьного возраста с нарушениями слуха. В процессе исследования мы использовали такие **методы:** анализ литературных источников, видеометрия (программа «Torso») для определения углов наклона туловища и головы, педагогическое тестирование для определения статичной выносливости мышц передней части туловища и ног, и мышц задней части туловища и ног, методы математической статистики. **Результаты исследования.** В процессе исследований установлено, что в период с 11 до 14 лет у мальчиков и девочек происходит рост исследуемых показателей, но происходит этот процесс неоднозначно. Так, в исследуемый период показатель статической выносливости передней части туловища и ног статистически достоверно ($p < 0,05$) растет у мальчиков на 9,2 с, у девочек – только на 5,2 с; показатель статической выносливости задней части туловища и ног статистически достоверно ($p < 0,05$) растет у мальчиков на 9,2 с, у девочек – на 6,2 с. Угол наклона головы (α_6) в период 11–14 лет у мальчиков и девочек статистически достоверно ($p < 0,05$) растет на 0,6 град. Угол наклона туловища (α_1) статистически достоверно ($p < 0,05$) растет у мальчиков на 0,18 град., у девочек – на 0,2 с. Прирост исследуемых показателей разный у мальчиков и девочек. **Выводы.** Полученные результаты свидетельствуют, что у мальчиков и девочек происходит статистически достоверно ($p < 0,05$) рост исследуемых показателей в возрастном аспекте. При этом у мальчиков и девочек достаточно низкие показатели статической выносливости передней части туловища и ног, несколько лучшие, но все же низкие показатели статической выносливости задней части туловища и ног. Показатели углов наклона головы и туловища также ниже от нормативных.

Ключевые слова: опорно-двигательный аппарат, дети среднего школьного возраста с изъятиями слуха, угол наклона председателя, угол наклона туловища, статичная выносливость мышц.

Introduction. Analysis of literary sources [2; 3; 6] shows that the musculoskeletal system performs several major functions. It protects the internal organs, supports and gives shape to the body and allows for movement. Functional disorders of the musculoskeletal system might hinder or retard normal physical development of human being and can lead to health diseases [3; 6; 7].

Numerous studies have examined and proved the close connection between the musculoskeletal system and health condition [1; 3; 4].

Standard assessment findings of the musculoskeletal system include determination of the spine, foot support-spring properties, body's muscle corset, and also the basic physical qualities (flexibility, speed, strength, agility, speed-strength qualities) related to the physical development. [2; 5; 7].

Therefore, it is worth using the technology of computer diagnostics "Torso" to assess the posture of schoolchildren, which was developed by V.O. Kashuba [5,6]. He proposes to evaluate posture based on the linear and angular characteristics of spinal column structures in the sagittal profile.

Analysis of literary sources [4; 6; 7] shows low-strength development of rectus abdominis and abdominal internal oblique muscles, muscles that used to straighten the back is noticeable in most of the deaf children of the junior school age. All this can lead to further serious posture problems.

Everything mentioned above suggests that middle school age children also have certain features of the musculoskeletal system's primary functions. The study of these features will influence the child's body by means of physical education. This is necessary for the harmonious development of the child in the future.

Communication with the Scientific Programs, Plans, Themes. Work is done by according to the Consolidated Plan of the research work in the field of physical culture and sports for 2011–2015 3.7 «Improvement of biomechanical technology in physical education and rehabilitation to an individual motor skills man», the state registration number 0111U001734.

The goal of the article is to determine and analyze the age-related changes in the indicators of the functional state of the musculoskeletal system for the children of middle school age with hearing loss.

In the process of research we used the following methods: analysis of literary resources, videometry (Torso Program) for determining the angles of the torso and head inclination, pedagogical testing for the

definition of the static endurance of the front torso and legs muscles and the back torso and legs muscles also methods of mathematical statistics.

The results of the work. The human musculoskeletal system's results of the study and their analysis [3; 5; 6] shows that on the results of videometry among the characteristics of the sagittal profile posture, which reflect the features of its type, the most informative is the angle α_1 – formed by a vertical line that connects a spinous process of the seventh cervical vertebrae C7 and head's center of mass. Spinous process of C7 has a large spinous process that protrudes posteriorly toward the skin on the border of cervical vertebra and thoracic vertebra, head's center of mass in the sagittal profile projected onto the area of the ear. The angle α_6 – formed by a vertical line that connects a spinous process of the seventh cervical vertebrae C7 - protrudes posteriorly toward the skin on the border of cervical vertebra and thoracic vertebra and the spinous process of the fifth lumbar vertebra (L₅) – lordosis peak location (center of the somatic nervous system coordinates). We used videometry to determine these angles («Torso» Program). The obtained results were processed by methods of mathematical statistics and presented in the table 1.

Table 1

Angular characteristics of the sagittal profile of posture in for the children of middle school age with hearing loss. (n=58)

№	Age / Number of persons	The angle of the body (α_1) X±S (degree)	The coefficient of variation V (%)	The angle of head inclination (α_6) X±S (degree)	The coefficient of variation V (%)
Girls (n=28)					
1	11 (n=8)	3,30±0,01	0,31	24,8±0,10	0,42
2	12 (n=8)	3,35±0,01	0,23	25,0±0,10	0,40
3	13 (n=6)	3,45±0,03	0,89	25,2±0,05	0,21
4	14 (n=6)	3,50±0,01	0,35	25,4±0,15	0,59
Boys (n=30)					
1	11 (n=8)	3,42±0,02	0,46	25,2±0,08	0,33
2	12 (n=8)	3,47±0,02	0,43	25,4±0,13	0,52
3	13 (n=8)	3,53±0,01	0,36	25,6±0,08	0,33
4	14 (n=6)	3,60±0,02	0,42	25,8±0,14	0,54

According to the results, boys and girls have the angle α_1 formed by a vertical line and a line connecting a spinous process of the seventh cervical vertebra C₇ and head's center of mass. Spinous process of C7 has a large spinous process that protrudes posteriorly toward the skin on the border of cervical vertebra and thoracic vertebra, head's center of mass in the sagittal profile projected onto the area of the ear. With increasing age a spinous process statistically significant increases ($p<0,05$). Boys have higher indicator than girls.

If we look at Table 1, we will see that the angle of the cluster of the torso (α_1) for girls from 11 to 14 years increases 0.2 degrees, but this process is uneven and wavy. Growth of the research indicators in the period from 11 to 12 years – 1.5%, from 12 to 13 years - 2.9%, from 13 to 14 years only 1.4%. Growth of the research for boys is completely different. The angle of the cluster of the torso (α_1) for boys from 11 to 14 years increases 0.18 degrees. Growth of the research indicators are progressive and straight: from 11 to 12 years – 1.5%, from 12 to 13 years – 1.7%, from 13 to 14 years – 2.0%.

Children of middle school age with hearing loss the angle α_6 a large spinous process that protrudes posteriorly toward the skin on the border of cervical vertebra and thoracic vertebra and the spinous process of the fifth lumbar vertebra (L₅) – lordosis peak location. With increasing age a spinous process statistically significant increases ($p<0,05$). Boys have higher indicator than girls.

The angle of inclination of the head (α_6) in the period of 11-14 years in boys and girls is statistically significant ($p < 0,05$) increasing to 0,6 degree. It is interesting that growth of the research indicators is 0.8 % in every age, both in boys and girls.

In order to analyze the static muscle endurance of trunk and legs, we used the tests proposed by V.O. Kashuba [6] which provide information about posture. The obtained results were processed by methods of mathematical statistics and presented in the table 2.

Table 2

The indicators of static endurance of the back of the torso and legs in for the children of middle school age with hearing loss. (n=58)

№	Age / Number of persons	Static endurance of the back of front part of the torso and legs X±S (c)	The coefficient of variation V (%)	Static endurance of the back of the torso and legs X±S (c)	The coefficient of variation V (%)
Girls (n=28)					
1	11 (n=8)	122,5±0,93	0,76	123,8±0,71	0,57
2	12 (n=8)	124,8±1,04	0,83	126,6±1,06	0,84
3	13 (n=6)	125,7±1,21	0,96	128,2±1,47	1,15
4	14 (n=6)	127,7±1,03	0,81	130,0±1,41	1,09
Boys (n=30)					
1	11 (n=8)	134,5±0,93	0,69	137,8±1,04	0,75
2	12 (n=8)	138,8±1,28	0,92	141,9±1,25	0,88
3	13 (n=8)	141,6±1,30	0,92	144,9±1,36	0,94
4	14 (n=6)	143,7±1,03	0,72	147,0±1,10	0,75

Indicators of static endurance of front part of the torso and legs statistically significant increases ($p < 0,05$) both in boys and girls. Boys have higher indicator than girls. The growth rate at different ages: boys - 9.2 s, girls - 5.2 s. Growth of the research indicators are different in boys and girls. Growth of the research indicators for girls are uneven and wavy. In the period from 11 to 12 years – 1.5%, from 12 to 13 years – 0.7%, from 13 to 14 years – 1.6%. Growth of the research indicators for boys decreases with age: in the period from 11 to 12 years the maximum increment is 3.1%, from 12 to 13 years – 2.0 %, from 13 to 14 years only 1.5%.

The obtained results indicate that static endurance of the back of the torso and legs statistically significant ($p < 0,05$) growth of the research parameters in the age aspect. Boys have higher indicator than girls, what is worth to notice. Growth of the research indicators statistically significant increases by 9.2 s for boys and 6.2 s for girls in the period from 11 to 14 years. Growth of the research indicators for boys: in the period from 11 to 12 years – 2,9 %, from 12 to 13 years – 2.1%, from 13 to 14 years only 1.4%. Growth of the research indicators for girls are different. In the period from 11 to 12 years – 2,2 %, from 12 to 13 years – 1.3%, from 13 to 14 years – 1.4%.

It is worth to mention that indicators of static endurance of the back of the torso and legs are higher than indicators of back part of the torso and legs both boys and girls.

Conclusions. The obtained results indicate that boys and girls have statistically significant ($p < 0,05$) growth of the research parameters in the age aspect. In this case, the boys and girls have rather low indicators of static endurance of front part of the torso and legs, somewhat better, but still low indicators of static endurance of the back of the torso and legs. Indicators of the angles of inclination of the head and torso are also lower than the standard ones.

Prospects for further research. Investigating the tone of the muscles that hold the human body upright and development of physical exercises which ones will contribute the formation of the correct posture and harmonious development of children.

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