



# Formation of strength endurance of the abdomen and back muscles in girls with degree I scoliosis using fitball-gymnastics

UDC 612.76

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Received by the editorial office on 03.25.2023

## Abstract

**Objective of the study** was to assess the effect of fitball gymnastics on the indicators of static and dynamic strength endurance of the abdominal and back muscles in girls with grade I scoliosis.

**Methods and structure of the study.** The scientific work involved 62 female students of a special medical health group at the age of  $18.4 \pm 0.6$  years with scoliosis of the 1st degree, who were divided into two subgroups depending on the organization of their training process at the university. The strength endurance of the abdominal and back muscles was assessed based on the results of exercises to hold the body and the number of lifts in various initial positions.

**Results and conclusions.** It has been established that in the groups engaged in the framework of the author's and standard methods of organizing physical culture lessons, there is a significant ( $p \leq 0.05$ ) increase in results for all proposed tests. However, in the group that used fitball exercises, the increase in strength endurance is more pronounced. The author's method of doing fitball gymnastics has a significant beneficial effect on the level of endurance of the abdominal and back muscles in girls with first-degree scoliosis.

**Keywords:** fitball-gymnastics, girls, scoliosis of the 1st degree, static and dynamic strength endurance.

**Introduction.** Scoliosis is one of the most common musculoskeletal disorders among school graduates and students, which may be due to the significant prevalence of physical inactivity among the younger generation, ergonomic violations of workplaces and excessive use of electronic devices [3, 8, 9].

Scoliosis can lead not only to aesthetic problems, disrupting the symmetry of the body, but also to limit the movement of the chest during breathing. As a result, over time, disturbances in the functioning of the respiratory system may develop, back pain may appear, which will negatively affect not only the quality of life of the schoolchild and student, but may also affect academic performance due to a poor psycho-emotional background. Organizing physical education classes for people with scoliosis as part of the educational process at a university requires a special ap-

proach. Traditional physical therapy methods for treating scoliosis include postural exercises, stretching, breathing training, and exercises to correct muscle strength imbalances [1, 2, 10, 11].

However, there are a number of works that consider other methods of organizing corrective measures using swimming, kinesiotherapy and even karate [4, 5, 6, 7, 12, 13]. Corrective measures can also be applied through exercises to strengthen the abdominal and back muscles using fitball gymnastics [1, 2, 10, 11, 12].

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**Methods and structure of the study.** The scientific work involved 62 female students with grade I scoliosis from a special medical health group (average age



18.4±0.6 years), who were divided into 2 subgroups depending on the organization of their training process at the university. The experimental group (EG) consisted of girls involved in fitball-gymnastics using the author's method (n=31), the control group (CG) (n=31) included girls involved in the regular university program.

To assess the strength endurance of the abdominal and back muscles, the subjects were offered the following exercises: holding the torso in the initial positions (i.p.) lying on the stomach (s), on the left side (s), on the right side (s), while holding the legs under angle of 45° (c), lifting the body in the i.p. lying on the stomach (one time), on the back (one time), legs on a fitball (one time).

To process the obtained data, the statistical software package SPSS 27.0 and Excel was used. To assess the significance of differences in mean values, Student's t-test was used; the critical level of significance was accepted at  $p \leq 0.05$ .

Results of the study and discussion. As a result of the analysis of the data obtained, it was established that in the EG and in the CG there was a significant increase in results for all proposed tests for assessing the static strength endurance of the abdominal and back muscles. Thus, in the EG, girls demonstrated an increase in the time of holding the body in the initial position lying on the stomach by 49% ( $p < 0.001$ ), in the initial position lying on the left and on the right side by 20% and 21% ( $p < 0.01$ ;  $p < 0.01$ , respectively), and when holding the legs at an angle of 45° - by 35% ( $p < 0.001$ ), relative to the initial indicators. In turn, in the CG the female students performed 26% ( $p < 0.001$ ) better on the task of holding the body in the i.p. lying on the stomach, the indicators of holding the torso in i.p. improved by 10% and 21% lying on the left and right sides ( $p < 0.05$ ;  $p < 0.01$ , respectively), and by 11% when keeping the legs at an angle of 45° ( $p < 0.05$ ) (Figure 1).

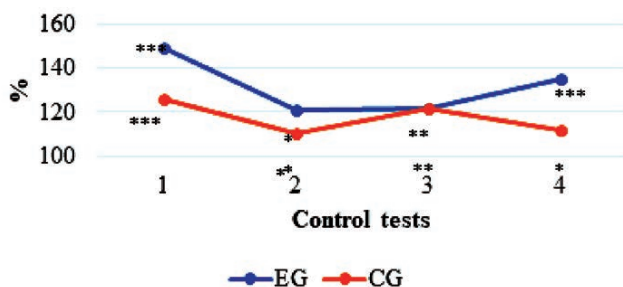


Figure 1. Indicators of static strength endurance of the abdominal and back muscles in girls, %

Note: 1 – holding the body while lying on the stomach; 2 – holding the body while lying on the right side; 3 – holding the body while lying on the left side; 4 – keep your legs at an angle of 45°.

When analyzing the results of dynamic strength endurance of the abdominal and back muscles in the EG and CG, a significant increase in results for all proposed tests was also noted. Thus, EG girls were able to increase the number of body lifts in the initial position lying on the stomach and on the back by 50% and 27% ( $p < 0.001$ ;  $p < 0.01$ , respectively), in the initial position of the leg on a fitball - by 17%. Among female students from the CG, the studied indicators increased by 21, 14 and 11% ( $p < 0.01$ ;  $p < 0.05$ ;  $p < 0.05$ , respectively) (Figure 2).

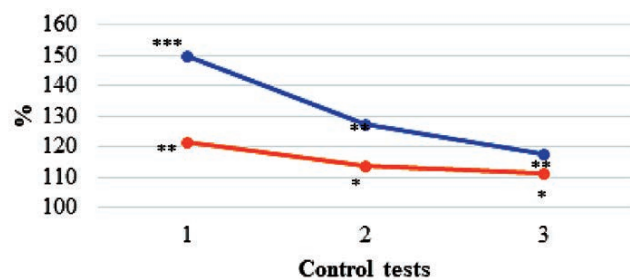


Figure 2. Indicators of dynamic strength endurance of abdominal and back muscles in girls, %

Note: 1 – lifting the body while lying on the stomach; 2 – lifting the body while lying on your back; 3 – lifting the torso, legs on a fitball.

Non-surgical methods for correcting scoliosis today include all kinds of adapted physical exercises, means of therapeutic physical education, various types of gymnastics with and without objects. All these methods are aimed at strengthening the muscle corset and increasing motor activity [1, 10, 11].

Fitballs, as one of the means for correcting scoliosis, help to increase the stability and flexibility of the spine, as well as strengthen the abdominal and back muscles, both during direct physical exercise and at rest [1, 10, 11, 12]. It is important to remember that when practicing fitball gymnastics, you should follow all the principles of building a sports training, pay special attention not only to strengthening the muscles, but also to proper breathing, avoid overwork, as well as alternating muscle tension and relaxation.



As a result of the study, a positive effect of fitball gymnastics on the endurance of the abdominal and back muscles was established. Timely initiation of physical exercises aimed at correcting scoliosis will help maintain correct posture and speed up recovery [5, 10, 13].

**Conclusions.** The author's method of fitball gymnastics has a significant beneficial effect on the level of static and dynamic endurance of the abdominal and back muscles in girls with first-degree scoliosis.

### References

1. Anoshina T.V., Mishchenko I.V., Shiryayeva T.P. Fitbol-gimnastika kak sredstvo razvitiya ravnovesiya i koordinatsii pri skolioze I stepeni [Fitball-gymnastics as a means of developing balance and coordination in scoliosis of the 1st degree]. *Sportivnaya meditsina i reabilitatsiya: traditsii, opyt i innovatsii* [Sports medicine and rehabilitation: traditions, experience and innovations]. Proceedings national scientific-practical conference. Krasnodar. 2022. pp. 110-113.
2. Anoshina T.V., Pushkina V.N., Zelyanina A.N. Formirovaniye motivatsii k zanyatiyam fizicheskoy kulturoy u studentok s I stepenyu skolioza [Formation of motivation for physical culture among female students with the 1st degree of scoliosis]. *Sovremennyye problemy nauki i obrazovaniya*. 2014. No. 3. p. 189.
3. Buzinov R.V., Averina E.A., Unguryanu T.N. Vliyaniye usloviy obrazovatelnoy sredy na sostoyaniye zdorovya detey doshkolnogo i shkolnogo vozrasta na territorii Arkhangel'skoy oblasti [Influence of conditions of the educational environment on the state of health of children of preschool and school age in the territory of the Arkhangel'sk region]. *Analiz riska zdorovyu*. 2015. No. 3. pp. 27-32.
4. Korzakov V.N. Napravlennoye vozdeystviye na razvitiye myshechnogo korseta v protsesse zanyatiy karate kekusinkay u podrostkov 12-15 let so skoliozom pervoy stepeni [Directed influence on the development of the muscular corset in the process of karate kyokushin training in adolescents 12-15 years old with scoliosis of the first degree]. *Uchenye zapiski universiteta im. P.F. Lesgafta*. 2013. No. 9 (103). pp. 75-79.
5. Makina L.R., Busheneva I.S., Zlobina D.A. Korrektsiya skolioza u devushek 18-20 let zanimayushchikhsya v spetsialnykh meditsinskikh gruppakh [Correction of scoliosis in girls 18-20 years old involved in special medical groups]. *Mir nauki, kul'tury, obrazovaniya*. 2018. No. 5 (72). pp. 181-183.
6. Morozova O.V., Mayorova E.B., Abakumova E.N. et al. Opyt primeneniya fitbola na zanyatiyakh fizicheskoy kulturoy so studentami spetsialnoy meditsinskoy gruppy «A» v meditsinskom universitete [Experience in the use of fitball in physical education classes with students of the special medical group "A" at the Medical University]. *Uchenye zapiski universiteta im. P.F. Lesgafta*. 2019. No. 11 (177). pp. 298-303.
7. Mukina E.Yu. Metodika kineziterapii pri narusheniyakh osanki i skoliozakh detey mladshogo shkol'nogo vozrasta spetsialnykh meditsinskikh grupp [Methods of kinesitherapy for violations of posture and scoliosis of children of primary school age of special medical groups]. *Vestnik Tambovskogo universiteta. Seriya: Gumanitarnyye nauki*. 2013. No. 8 (124). pp. 167-173.
8. Skoblina N.A., Milushkina O.Yu., Tatarinchik A.A. Gigiyenicheskiye problemy ispolzovaniya informatsionno-kommunikatsionnykh tekhnologiy shkolnikami i studentami [Hygienic problems of using information and communication technologies by schoolchildren and students]. *Zdorovye naseleniya i sreda obitaniya, ZNiSO*. 2017. No. 9 (294). pp. 52-55.
9. Skoblina N.A., Milushkina O.Yu., Popov V.I. et al. Fizicheskoye razvitiye detey: metodicheskiye aspekty [Physical development of children: methodological aspects]. Moscow: Nauchnaya kniga publ., 2020. 178 p.
10. Cynthia St. Arnaud Liggett. The Swiss Ball: An Overview of Applications in Sports. *Medicine Journal of Manual & Manipulative Therapy*. 1999. No. 7 (4). pp. 190-196.
11. Escamilla R.F., Bell D., Bramblet G., Daffron J. et al. Core Muscle Activation During Swiss Ball and Traditional Abdominal Exercises. *Journal of Orthopaedic & Sports Physical Therapy*. 2010. No. 40 (5). pp. 265-276.
12. Kim J.J., Song G.B., Park E.C. Effects of Swiss ball exercise and resistance exercise on respiratory function and trunk control ability in patients with scoliosis. *J Phys Ther Sci*. 2015. No. 27 (6). pp. 1775-8.
13. Li X., Shen J., Liang J., et al. Effect of core-based exercise in people with scoliosis: A systematic review and meta-analysis. *Clinical Rehabilitation*. 2021;35(5):669-680.