**Research Article**

# THE FREQUENCY OF SPINAL DEFORMITIES OF STUDENTS IN LOWER ELEMENTARY SCHOOL GRADES WITH REGARD TO GENDER

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## Abstract

The aim of this research is to determine the frequency and structure of spinal deformities, as well as their combinations with students in lower elementary school grades with regard to gender. The research was conducted on a sample of 1105 students, of which 563 boys and 542 girls, aged 5-12 years. The research program includes students from 1st to 5th grade in eleven elementary schools in Sarajevo. To assess the deformity of the spine, the method of measuring the curves of the spine according to the criteria of Napoleon Wolanski from 1975 was used. D-5 Spine Posture (ODK) - Spine Posture Assessment. The analysis of spinal deformities of students in lower elementary school grades was done with the help of descriptive statistics of the Chi-square. A significant value of statistical significance was investigated at the level of p <0.01. By analyzing the spinal deformity variables of the investigated sample with the help of descriptive statistics of the Hi-square, it was found that the postural status of the spinal column is very neglected in a large number of subjects of both genders. In the initial measurement, there is a higher number of male subjects without spinal deformities compared to female subjects. Female subjects have a higher prevalence of grade II spinal deformities, and the prevalence of grade I spinal deformities is the same in both male and female subjects in the initial measurement and this difference is statistically significant at less than 1%, as indicated by a significant Chi-square (Chi-square = 9.389 ip = 0.009). In the final measurement, there was a higher number of male subjects without spinal deformities, and a higher prevalence of first-degree spinal deformities in female subjects, while the prevalence of second-degree spinal deformities is not present in both female and male subjects and this time the difference is not statistically significant (Chi-square = 1,866 ip = 0,172). Male subjects have more cases of kyphosis and scoliosis than female subjects, and fewer cases of lordosis. Combinations of spinal deformities were common in both male and female subjects. Kyphosis-Scoliosis and Kyphosis-Lordosis are more common in male subjects, and Scoliosis-Lordosis and Kyphosis-Scoliosis-Lordosis in female subjects. In the final measurement, there was a significant reduction in the proportion of cases with all four combinations of deformities. It has been shown that the frequency of postural disorders can be significantly reduced through a planned and continuous corrective procedure. It is necessary to develop awareness of a healthy lifestyle that includes appropriate corrective exercises, which have a preventive and corrective effect on the posture of young people. It is necessary to understand the importance of exercise for the health and needs in the life of each individual.

**Keywords:** Frequency, Spinal deformities, Combinations of deformities, Gender, Students.

## INTRODUCTION

Active body forces (muscles) and passive forces (ligaments), joints and bone parts participate in maintaining an upright posture. In the case of spinal deformities, it is necessary to establish the following: In which plane is the curve (frontal or sagittal), because all curves in the frontal plane belong to the type of scoliotic curves, and those in the sagittal plane belong to kyphotic and lordotic curves; What is the degree of curvature (measurement is done with a vise), in centimeters of distance from the vise; What is the position of the spine when standing, sitting and squatting. In different postures, the spine can show different positions. Postures are also selected according to the progress of the correction. Are there structural changes in the spine, which indicate a poor prognosis with less chances of successful correction. Is it a congenital or acquired deformity of the spine. Congenital deformities are more complicated and worsen faster. Acquired deformations can also be with a bad prognosis, but they can also be with a good prognosis (Nikšić *et al.,* 2019a). Spinal deformities are present to a large extent, because the characteristics of the environment affect the way of life, as well as the spinal column. The consequence is today's way of life, ie daily activities with too little exercise and with excessive and inappropriate diet.

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This leads to an unhealthy lifestyle, which indicates the need for intervention to change behavior and lead a healthy lifestyle in order to protect and promote health, which is based on a healthy diet, drink and exercise. It is predicted that the number of these children will increase if the importance of play is not recognized, as well as physical exercise in school, which has a great impact on children's health. It is necessary to understand the importance of play and exercise for the health and needs in the life of each individual. It has been shown that the frequency of postural disorders can be significantly reduced through a planned and continuous corrective procedure. It is necessary to develop awareness of a healthy lifestyle that includes appropriate corrective exercises, which have a preventive and corrective effect on the posture of young people (Nikšić *et al.,* 2019b). The spine is a firm and elastic support for the upper body. Corrective exercises are aggregate physical exercises dosed by intensity, type and duration, used either for prevention purposes in children with predisposition for some of the postural deformities, or for therapeutic purposes in case deformities are already present (Karačić *et al.,* 2018). Statistics show that about 4% of people have a spinal deformity at any level, and the reason for this is bad posture that is not removed in time. Malfunctions caused by improper posture must first reflect on the spinal column, and later to the other parts of the locomotors apparatus. The spine is the primary factor of upright posture and a weight

carrier of all the upper body. That is why it is often exposed to numerous strains that can affect the entire spinal column or just parts. Proper development of the spinal cord depends on several factors, namely: effects of muscle force, strengthening the ligament apparatus, the skeleton of the spine (structure and its proper shape), outsourcing and other factors (lifestyle, diet, disease, apparel, furniture, physical activity, early burden etc.). The main role in preventing and suppressing these deformities is played by the teacher of physical education and health, who must work on the corrective work of postural disorders (Nikšić *et al.,* 2015). Active forces of the body (muscles) and passive force (ligaments), attachments and bone parts are involved in keeping an upright posture. The backbone of the blade is on three sides, and thus we see three types of distortion of the spine: kyphosis, scoliosis and lordosis (Nikšić and Rašidagić, 2014). In their research work, the authors analyze the postural status of preschool children in the territory of Novi Sad. The sample consisted of 423 respondents of both genders, aged six and seven years. Based on the obtained data, it can be seen that the identified deviations from the correct postural status of the spinal column in the frontal and sagittal planes are represented in a high percentage (about 70%). The deviation from the normal postural status of the spinal column, which was identified in the sagittal plane for the lumbar segment, is the most represented percentage. Poor lordotic posture in preschoolers is represented by about 40%, which indicates that daily inactivity (immobility) is increasingly present in this population, which can be caused by prolonged and irregular sitting, which implies the appearance of weakening of the abdominal muscles and shortening of the back muscles. Boys are more active in this period of life, in terms of greater participation in games in which physical activity dominates more. Poor lordotic posture is equally prevalent in both boys and girls (Romanov *et al.,* 2014). Proper posture should be at the very top, because it is a basic prerequisite for good health, normal growth and development and a beautiful appearance of every student. It is a movement habit that is formed and changed throughout a person's lifetime. Teachers should recognize improper posture, so that they can adequately fight against it. Also, based on the research, a high percentage of abnormal posture in school children was found, as well as the occurrence of postural disorders on the spine (scoliosis and kyphosis) and deviations in the longitudinal arch of the foot (Beganović and Bešović, 2012). Automation and computerization in all spheres of life leads to hypokinesia, which is one of the primary preconditions for the development of poor posture. In addition, bad habits, improper posture, improper sitting, inadequacy of school desks, school chairs, as well as excessive weight of the school bag affect the appearance of various forms and an increasing number of postural disorders. In the period of growth and development, ie. between the ages of 6 and 18, children are exposed to a variety of health problems including the problem of proper posture (Bogdanović and Milenković, 2008). It has been determined that pain in the lumbar spine in school children occurs from 20% to 51% of the total school population of children. Also, back pain is associated with prolonged sitting, weakness of certain muscle groups, poor posture, etc. (Lafond, 2007).

## MATERIALS AND METHODS

### Participants

The research was conducted on a sample of 1105 students, of which 563 boys and 542 girls, aged 5 - 12 years, i.e. students

from I to V grade, in eleven elementary schools in Sarajevo: "Kovačići", "Behaudin Selmanović", "Sokolje", "Dobroševići", "Safet-beg Bašagić", "Zahid Baručija", "Fatima Gunić", "Aleksa Šantić", "Avdo Smailović", "Mehmedalija Mak Dizdar" "and " Hamdija Kreševljaković ". The research was conducted in accordance with the recommendations of the Declaration of Helsinki and participation was voluntary.

### Research Design

The following variable was used to determine the status of the spine: the method of measuring the curves of the spine according to the criteria of Napoleon Wolanski from (1975). D-5 Spine Posture (ODK) - Spinal Posture Assessment. To determine the status of the spine, it was necessary for the subject whose spine status was taken to turn his back to the examiner with his feet slightly apart but parallel in his usual position. All respondents were in shorts in rooms whose temperature ranged from 20-23 degrees.

Description of measuring instruments - Spinal posture assessment (ODK)

0 - Physiological curvature normal in both sagittal and frontal planes.
1 - First-degree deviation: kyphosis, scoliosis, or lordosis.
2 - A combination of deviations or individually, but at the level of a second degree.

### Statistical Analysis

The analysis of spinal deformities of students in lower elementary school grades was done with the help of descriptive statistics of the Chi-square. A significant value of statistical significance was investigated at the level of $p < 0.01$. Using descriptive statistics, the minimum and maximum values, arithmetic mean, standard deviation and median for cervical and lumbar curvature, numerical and percentage frequency of spinal deformities, as well as their combinations were determined, and are presented in tabular form.

### Work program

The work program that was realized in this research lasted one school year. At the beginning of the school year in September, an initial posture measurement was performed according to the criteria of Napoleon Wolanski (1975). D-5 Spine Posture (ODK) - Spinal posture assessment, with the help of a physical education and health professor. The examinees practiced according to the program of elementary games intended for the prevention and correction of incorrect posture and the stated deformities of the spine, which were made after the initial measurement. The concept of the elementary games program is made so that it is implemented through the forms of applied activities in the physical and health culture of students in the lower grades of elementary school. Each exercise started with the preparation of the organism, both physiological and emotional. The cardiovascular introduction of the load functions yet to follow was the initial physiological load. The emotional introduction to this type of special program was extremely important. Each exercise was performed from easier to harder. In order to get the best possible effect, special attention was paid to the following: a concrete demonstration of exercises (elementary games), because these were strictly defined movements. So after the demonstration and the

teacher's explanation, the students tried to do a certain task. The explanations were short and related to the way of performing and the goal of individual games with respect to age. The content of the program was not static, because elementary games were applied in order to correct and prevent spinal deformities, they changed and adapted to given situations, supplemented, depending on student motivation, because over time individual games if repeated daily, students become monotonous and this reduces attention to proper movement. After the initial measurement, a 6-month (31-week) program was implemented. The program was implemented in the months of October, November, December, February, March, April, with which teachers / classroom teachers worked. Number of training units: physical education classes twice a week, where elementary games were applied in the function of prevention and correction of spinal deformities. The duration of one lesson was 45 minutes. At the end of the school year in May, a final posture measurement was performed according to the criteria of Napoleon Wolanski (1975). D-5 Spine Posture (ODK) - Spinal posture assessment, with the assistance of a physical education and health professor. The 6-month program did not include testing and measurements, and they were performed before and after the application of the program. After the initial and final testing and measurement, an evaluation of the obtained results was made.

## RESULTS

In this chapter, the obtained data on the frequency and size of postural disorders of the spinal column, as well as their combinations in lower primary school students in relation to gender, are presented and analyzed.

Spinal posture assessment - ODK (0 - Physiological curve normal in both sagittal and frontal planes; 1 - Deviation of the first degree: kyphosis, scoliosis or lordosis; 2 - Combination of deviations or individually, but at the level of the second degree).

**Table 1. Presentation of the frequency distribution of individual spinal posture scores in the initial and final measurements, and by gender**

| Body part | Gender | Body posture measurement | | | | |
|---|---|---|---|---|---|---|
| | | Grade (number of points) | Initial | | Final | |
| | | | F | % | F | % |
| Spine | Male | 0 | 262 | 46,5 | 357 | 63,4 |
| | | 1 | 211 | 37,5 | 206 | 36,6 |
| | | 2 | 90 | 16,0 | 0 | 0,00 |
| | | Total | 563 | 100,0 | 563 | 100,0 |
| | Female | 0 | 211 | 38,9 | 322 | 59,4 |
| | | 1 | 211 | 38,9 | 220 | 40,6 |
| | | 2 | 120 | 22,1 | 0 | 0,00 |
| | | Total | 542 | 100,0 | 542 | 100,0 |

Based on the results presented in Table 1, it can be concluded that in the initial measurement, there was a larger number of male subjects without spinal deformities compared to female subjects. Female subjects have a higher prevalence of grade II spinal deformities, and the prevalence of grade I spinal deformities is the same in both male and female subjects in the initial measurement and this difference is statistically significant at less than 1%, as indicated by a significant Chi-square from previous analyzes (Chi-square = 9.389 ip = 0.009). And in the final measurement, and as can be seen from the table, there was a higher number of male subjects without spinal deformities, and a higher prevalence of spinal deformities of I degree in female subjects, while the prevalence of spinal deformities of II degree is not present in both females and males respondents and this time the difference is not statistically significant (Chi-square = 1,866 and p = 0,172).

**Table 2. Average values and measures of deviation related to the measurement of neck curvature, and by gender**

| Gender | Measurement | N | Lowest value | Highest value | Arithmetic mean | Std. deviation | Median |
|---|---|---|---|---|---|---|---|
| Male | IM | 563 | 1,00 | 6,50 | 3,3897 | 0,74399 | 3,5 |
| | FM | 563 | 1,50 | 5,20 | 3,0325 | 0,50794 | 3,0 |
| Female | IM | 542 | 1,50 | 5,50 | 3,3218 | 0,73571 | 3,5 |
| | FM | 542 | 1,50 | 4,50 | 3,0166 | 0,46981 | 3,0 |

Legend: N (sample of examinees), IM (initial measurement), FM (final measurement)

From the above table, we can conclude that the average value of the neck curve is lower in female subjects in both the initial and final measurement compared to male subjects.

**Table 3. Average values and measures of deviation related to the measurement of lumbar curvature, and by gender**

| Gender | Measurement | N | Lowest value | Highest value | Arithmetic mean | Std. deviation | Median |
|---|---|---|---|---|---|---|---|
| Male | IM | 563 | 0,50 | 7,50 | 3,4536 | 1,24304 | 3,5 |
| | FM | 563 | 0,60 | 5,60 | 3,4572 | 0,91669 | 3,6 |
| Female | IM | 542 | 0,50 | 8,50 | 4,0435 | 1,32624 | 4,0 |
| | FM | 542 | 0,60 | 6,00 | 3,7197 | 0,97438 | 3,8 |

Legend: N (sample of examinees), IM (initial measurement), FM (final measurement)

From the above table, we can conclude that the average value of lumbar curvature is lower in male subjects in both the initial and final measurement compared to female subjects.

**Table 4. Representation of the frequency distribution of the presence of spinal deformities (kyphosis, scoliosis, lordosis) in the initial and final measurement, and according to gender**

| | | **Body posture measurement** | | | |
| | | **Initial** | | **Final** | |
| **Gender** | **Spinal deformity** | **F** | **%** | **F** | **%** |
|---|---|---|---|---|---|
| **Male** | Kyphosis | 116 | 20,6 | 72 | 12,8 |
| | Not present | 447 | 79,4 | 491 | 87,2 |
| | Total | 563 | 100,0 | 563 | 100,0 |
| **Female** | Kyphosis | 60 | 11,1 | 42 | 7,7 |
| | Not present | 482 | 88,9 | 500 | 92,3 |
| | Total | 542 | 100,0 | 542 | 100,0 |
| **Male** | Scoliosis | 123 | 21,8 | 89 | 15,8 |
| | Not present | 440 | 78,2 | 474 | 84,2 |
| | Total | 563 | 100,0 | 563 | 100,0 |
| **Female** | Scoliosis | 105 | 19,4 | 71 | 13,1 |
| | Not present | 437 | 80,6 | 471 | 86,9 |
| | Total | 542 | 100,0 | 542 | 100,0 |
| **Male** | Lordosis | 150 | 26,7 | 76 | 13,5 |
| | Not present | 413 | 73,4 | 487 | 86,5 |
| | Total | 563 | 100,0 | 563 | 100,0 |
| **Female** | Lordosis | 238 | 43,9 | 138 | 25,5 |
| | Not present | 304 | 56,1 | 404 | 74,5 |
| | Total | 542 | 100,0 | 542 | 100,0 |

**Table 5. Representation of the frequency distribution of combinations of individual spinal deformities in the initial and final measurement, and according to gender**

| | | | **Body posture measurement** | | | |
| | | | **Initial** | | **Final** | |
| **Gender** | **Deformity** | **Combination of deformities** | **F** | **%** | **F** | **%** |
|---|---|---|---|---|---|---|
| **Male** | **Kyphosis-Scoliosis** | Not present | 532 | 94,5 | 552 | 98,0 |
| | | Present | 31 | 5,5 | 11 | 2,0 |
| | | Total | 563 | 100,0 | 563 | 100,0 |
| | **Kyphosis-Lordosis** | Not present | 544 | 96,6 | 556 | 98,8 |
| | | Present | 19 | 3,4 | 7 | 1,2 |
| | | Total | 563 | 100,0 | 563 | 100,0 |
| | **Scoliosis-Lordosis** | Not present | 530 | 94,1 | 551 | 97,9 |
| | | Present | 33 | 5,9 | 12 | 2,1 |
| | | Total | 563 | 100,0 | 563 | 100,0 |
| | **Kyphosis-Scoliosis-Lordosis** | Not present | 560 | 99,5 | 562 | 99,8 |
| | | Present | 3 | 0,5 | 1 | 0,2 |
| | | Total | 563 | 100,0 | 563 | 100,0 |
| **Female** | **Kyphosis-Scoliosis** | Not present | 539 | 99,4 | 541 | 99,8 |
| | | Present | 3 | 0,6 | 1 | 0,2 |
| | | Total | 542 | 100,0 | 542 | 100,0 |
| | **Kyphosis-Lordosis** | Not present | 524 | 96,7 | 534 | 98,5 |
| | | Present | 18 | 3,3 | 8 | 1,5 |
| | | Total | 542 | 100,0 | 542 | 100,0 |
| | **Scoliosis-Lordosis** | Not present | 500 | 92,3 | 520 | 95,9 |
| | | Present | 42 | 7,7 | 22 | 4,1 |
| | | Total | 542 | 100,0 | 542 | 100,0 |
| | **Kyphosis-Scoliosis-Lordosis** | Not present | 537 | 99,1 | 542 | 100,0 |
| | | Present | 5 | 0,9 | 0 | 0,00 |
| | | Total | 542 | 100,0 | 542 | 100,0 |



**Figure 1. Kyphosis-Lordosis**



**Figure 2. Scoliosis**



**Figure 3. Lordosis**

Based on the results presented in Table 4, it can be concluded that in the initial and final measurement in male subjects compared to female subjects there are more cases with kyphosis and scoliosis, and fewer cases with lordosis. In the context of the results presented at the descriptive level, it can be concluded that in the final measurement there was a significant decrease in the proportion of cases with all four combinations of deformities. In the final measurement, both male and female subjects had a significantly lower number of cases with Kyphosis –Scoliosis type deformities.. In male subjects (11 vs. 31 cases), and in female subjects (1 vs. 3 cases). In the final measurement, both male and female subjects had a significantly lower number of cases with a combination of Kyphosis-Lordosis deformities compared to the initial measurement. In male subjects (7 versus 19 cases), and in female subjects (8 versus 18 cases). In the final measurement, both male and female subjects had a significantly lower number of cases with a combination of Scoliosis-Lordosis type deformities compared to the initial measurement. In male subjects (12 versus 33 cases), and in female subjects (22 versus 42 cases). In the final measurement in male subjects there is a significantly lower number of cases with a combination of deformities of the Kyphosis-Scoliosis-Lordosis type compared to the initial measurement (1 vs. 3 cases), and in female subjects in the final measurement this combination of deformities is not present.

## DISCUSSION

Table 1 clearly shows the deviations, which are classified according to their size and are evaluated by so-called negative points, where: 0 points - means no deviation, 1 point - indicates a slight deviation, 2 points - indicates a significant deviation. By assessing the posture of the spine of male students, data were obtained which show that in the initial measurement in 262 (46.5%) students the physiological curve was normal in both the sagittal and frontal planes, which indicates proper posture. In 211 (37.5%) students there is a deviation of the first degree: kyphosis, scoliosis or lordosis, and in 90 (16.0%) students a combination of deviations or individually, but at the level of the second degree. In 211 (38.9%) female students, the physiological curve is normal in both the sagittal and frontal planes, which indicates proper posture, while in 211 (38.9%) female students there is a deviation of the first degree: kyphosis, scoliosis or lordosis, and in 120 (22.1%) students a combination of deviations or individually, but at the level of the second degree. In the final measurement in 357 (63.4%) male students, the physiological curve was normal in both the sagittal and frontal planes, indicating proper posture. In 206 (36.6%) students there is a deviation of the first degree: kyphosis, scoliosis or lordosis, while a significant deviation, a combination of deviations or individually, but at the level of the second degree, was not present in the final measurement in male students. In 322 (59.4%) female students, the physiological curve is normal in both the sagittal and frontal planes, which indicates proper posture, while in 220 (40.6%) female students there is a deviation of the first degree: kyphosis, scoliosis or lordosis, while marked deviation, a combination of deviations or individually, but at the level of the second degree, was not present in the final measurement even in female students. The obtained research results lead to the conclusion that the postural status of the spinal column is very disturbed in a large number of primary school students, both sexes. Numerous authors have obtained similar results in their research. The percentage of postural disorders varies considerably with different authors, and it depends on the specifics of the sample, age, environment, applied methodology. In a study conducted on a sample of a total of 581 subjects (290 male and 291 female subjects), IV, V and VI grades of elementary school, spinal deformity (kyphosis) was represented. In terms of the percentage of this deformity in female respondents, 49 students or 17% of the examined sample had the first degree of deformity, 8 students or 3% of the examined sample had the second degree, while no deformities were recorded in the third degree. In terms of the percentage of this deformity in male respondents, the first degree of deformity had 68 students or 23% of the examined sample, the second degree 20 students or 7% of the examined sample and the third degree 3 students or 1% of the examined sample (Aščić *et al.,* 2015). Spinal deformities are present in students of older grades of elementary school to a large extent. The highest percentage of spinal deformities in the frontal plane - scoliosis (38%) and spinal deformities in the sagittal plane - kyphosis (28%), and in a slightly lower percentage than the previous two deformities is present lordotic posture (19%). Out of a total of 204 subjects of both sexes, scoliotic posture was found in 78 (38%) subjects, of which 66 (32%) had a smaller deviation and 12 (6%) with a larger deviation from normal posture. These data indicate that scoliotic posture is present in almost one third of the examined sample. Kyphotic posture was found in 56 (28%) subjects, of whom 50 (25%) had a smaller deviation and 6 (3%) had a larger deviation from normal posture. Lordotic posture was found in 38 (19%) subjects, of whom 34 (17%) had a minor deviation and 4 (2%) had a greater deviation from normal posture. This state of frequency of poor posture (scoliotic, kyphotic and lordotic posture in elementry school students) indicates a condition that warns of the need for systematic examinations in schools in order to take preventive measures and develop corrective exercise programs (Bajrić *et al.,* 2012). Researches on the population of school children, students from I-VIII grades of elementary schools, confirm our research, that a large number of students of both sexes have postural disorders of the spine in the sagittal plane and deviations in the longitudinal arch of the foot. Out of the total number of respondents, 1309, 1060 students have postural disorders, which is 80.9%, while the other 249 respondents or 19.1% do not have researched postural disorders. Among students from I to IV grade, out of the total number of examinees of 435, 365 are with postural disorders (83.8%), and only 70 (16.1%) examinees are without postural disorders. Among students from 5th to 8th grade, out of the total number of examinees of 874, 695 are with postural disorders (79.5%), and only 179 (20.5%) examinees are without postural disorders. In grade I, it was noted that there were no differences in postural disorders between boys and girls. In the second grade, the percentage of deformities is higher in boys, and in the 3rd and 4th grade, there is a higher percentage of these changes in girls. The obtained data indicate a high percentage of deviations in the investigated postural disorders (Živković *et al.,* 2011). The results of the research showed that in the population of 320 students from I to VIII grade, there is no deviation in the assessment of spinal posture of 30 students or 9%, the physiological curve is normal in both sagittal and frontal planes, which indicates proper posture of the spine. 231 students or 72% have a slight deviation, there is a deviation of the first degree: kyphosis, scoliosis or lordosis, while 59 students or 19% have a significant deviation, there is a combination of deviations or individually, but at the level of the second degree (Beganović and Bešović, 2012 ).

In Table 4, by measuring the curvature of the spine of male students, and according to the type of deformity, data were obtained which show that out of 1105 examined in the initial measurement, 447 (79.4%) students have symmetrical shoulders, even shoulders and a straight line of the spine, which means they have good posture. 116 (20.6%) students have the following characteristics: head bent forward, shoulders bent forward, increased stooping, chest retracted, shoulders prominent, abdomen limply convex, knees slightly bent and moved forward, indicating a deformity called kyphosis. 482 (88.9%) female students have good posture. 60 (11.1%) students have a spinal deformity, kyphosis. In the final measurement, 491 (87.2%) male students have good posture. 72 (12.8%) students have spinal deformity, kyphosis. 500 (92.3%) female students have good posture. 42 (7.7%) students have a spinal deformity, kyphosis. In the initial measurement, 440 (78.2%) students have symmetrical shoulders, even shoulders and a straight line of the spine, which means they have good posture. 123 (21.8%) students have an irregular shoulder position, different levels of the shoulder blades, which shows a curvature of the spine in the lateral plane, which is known as scoliosis. 437 (80.6%) female students have good posture. 105 (19.4%) students have spinal deformity, scoliosis. In the final measurement, 474 (84.2%) male students have good posture. 89 (15.8%) students have spinal deformity, scoliosis. 471 (86.9%) female students have good posture. 71 (13.1%) students have spinal deformity, scoliosis. In the initial measurement, 413 (73.4%) students had symmetrical shoulders, even shoulders and a straight line of the spine, meaning they had good posture.

In 150 (26.7%) students, the head is slightly away from the vertical line, the chest is straight or convex, and slightly lowered, the pelvis as a whole is moved forward and down, the abdomen is convex and soft, the hips are slightly moved forward, indicating a deformity that is called lordosis. 304 (56.1%) female students have good posture. 238 (43.9%) students have a spinal deformity, lordosis. In the final measurement, 487 (86.5%) male students have good posture. 76 (13.5%) students have spinal deformity, lordosis. 404 (74.5%) female students have good posture. 138 (25.5%) students have a spinal deformity, lordosis. After a study conducted on a sample of 778 respondents (382 girls and 396 boys), II and III grade of primary school, it was proved that spinal deformities (kyphosis and lordosis) are more common in girls, compared to boys. The frequency of kyphosis in boys of II and III grade of the experimental and control groups in the initial measurement was 53 (13.38%), and in girls 70 (18.32%). The frequency of lordosis in boys of II and III grade of the experimental and control groups in the initial measurement was 54 (13.63%), and in girls 63 (16.49%). In the final measurement, there is a tendency to decrease the reduction of spinal deformities (kyphosis and lordosis). The postural status of the spinal column can be improved by applying special programs (Fulurija and Gojković, 2012). When measuring postural disorders of the spine, it was determined that out of the total number of respondents, 320 students of both genders, 146 students (46%) have a deformity of the spine (kyphosis), ie. the point falls into the anterior silhouette of the neck, indicating that children have shoulders bent forward, increased stooping, chest retracted, shoulders prominent, abdomen flaccidly convex, knees slightly bent, indicating kyphosis. 97 students (30%) have spinal deformity (lordosis). The head is slightly away from the vertical line, the thorax straight or bulging, and slightly lowered, the pelvis as a

whole moved forward and down, the abdomen bulged and soft, the hips slightly moved forward, indicating lordosis. 47 students (15%) have an irregular shoulder position, different level of the shoulder blades, which indicates a curvature of the spine in the lateral plane, which indicates scoliosis (Beganović and Bešović, 2012). The results of the research showed that in students of III, V and VII grades of elementary schools the frequency of spinal deformities of scoliosis was present in 12 (8.39%) female subjects, and in 3 (1.66%) male subjects. (Gojković and Milinković, 2013). The results of the research showed that in students from 1st to 4th grade of elementary schools, the frequency of spinal deformities of kyphosis was present in 246 (56.5%) students of both genders. Lordosis was present in 9 (2.0%) students of both genders (Živković *et al.,* 2011). Of the 299 respondents, 136 (45.48%) were male and 163 (54.52%) were female. Kyphotic poor posture, in male subjects, is significantly more present (62.02%) than in female subjects (37.98%). Regarding the indicators of good posture, there is a far higher percentage (67.06%) of respondents in the female population than in the case of men (32.94%) (Marković, 2011). It was determined that out of 258 examined boys, 142 or 55% of them, and out of girls 111 or 43.8%, had increased thoracic curves (kyphosis) on the spinal column.

The distribution of kyphosis, depending on the stage of development, showed certain characteristics, which are related, first of all, to the gender of the examinees. Functional disorders have been shown to be by far the most prevalent in both genders. 25.4% of boys and 100% of girls had incompletely fixed disorders. The most difficult form, or so-called fixed kyphosis had only one boy (0,04%). According to the obtained results, lordotic disorders are somewhat more represented than kyphotic disorders. Increased lordotic deviations were recorded in 146 boys (56.6%) and 125 girls (49.4%), who, including kyphosis, showed slightly better spinal posture than boys. By far the largest number of lordotic deviations refers to functional disorders or, so-called, poor posture. In boys, their relative frequency is 78%, and in girls 77%. Incompletely fixed disorders account for 19.1% of cases in boys and 23% in girls. Thus, reducible lordotic disorders account for 97.1% of cases in boys and 100% in girls. The most difficult form, ie. fixed lordosis was reported in four boys, accounting for 2.9%, of the total number of disorders. From these results, it can be concluded that boys had a slightly higher overall percentage of functional disorders, that is, they showed somewhat poorer posture compared to girls (Jovović, 2010). Such results may be the result of more intense growth of boys in this period. As a consequence of the intensive growth of the skeletal system on the one hand and the ossification process that has not yet been completed, on the other hand.

In Table 5, by measuring the curvature of the spine of male students, and according to the type of deformity, data were obtained which show that out of 1105 examined in the initial measurement, 532 (94.5%) students did not have a combination of Kyphosis-Scoliosis deformity, while 31 (5.5%) students present a combination of Kyphosis-Scoliosis deformity. 539 (99.4%) female students do not have a combination of Kyphosis-Scoliosis deformities, while 3 (0.6%) female students have a combination of Kyphosis-Scoliosis deformities. In the final measurement, 552 (98.0%) male students did not have a combination of Kyphosis-Scoliosis deformities, while 11 (2.0%) students had a combination of Kyphosis-Scoliosis deformities. 541 (99.8%) female students do not have a combination of Kyphosis-Scoliosis deformities,

while 1 (0.2%) female students have a combination of Kyphosis-Scoliosis deformities. In the initial measurement, 544 (96.6%) students did not have a combination of Kyphosis-Lordosis deformities, while 19 (3.4%) students had a combination of Kyphosis-Lordosis deformities. 524 (96.7%) female students do not have a combination of Kyphosis-Lordosis deformity, while 18 (3.3%) female students have a combination of Kyphosis-Lordosis deformity. In the final measurement, 556 (98.8%) male students did not have a combination of Kyphosis-Lordosis deformity, while 7 (1.2%) students had a combination of Kyphosis-Lordosis deformity. 534 (98.5%) female students do not have a combination of Kyphosis-Lordosis deformity, while 8 (1.5%) female students have a combination of Kyphosis-Lordosis deformity. In the initial measurement, 530 (94.1%) students did not have a combination of Scoliosis-Lordosis deformities, while 33 (5.9%) students did not have a combination of Scoliosis-Lordosis deformities. 500 (92.3%) female students do not have a combination of Scoliosis-Lordosis deformities, while 42 (7.7%) female students have a combination of Scoliosis-Lordosis deformities. In the final measurement, 551 (97.9%) male students did not have a combination of Kyphosis-Lordosis deformities, while 12 (2.1%) students had a combination of Scoliosis-Lordosis deformities. 520 (95.9%) female students do not have a combination of Scoliosis-Lordosis deformities, while 22 (4.1%) female students have a combination of Scoliosis-Lordosis deformities.

In the initial measurement, 560 (99.5%) students did not have a combination of Kyphosis-Scoliosis-Lordosis deformities, while 3 (0.5%) students had a combination of Kyphosis-Scoliosis-Lordosis deformities. 537 (99.1%) female students do not have a combination of Kyphosis-Scoliosis-Lordosis deformity, while 5 (0.9%) female students have a combination of Kyphosis-Scoliosis-Lordosis deformity. In the final measurement, 562 (99.8%) male students did not have a combination of Kyphosis-Scoliosis-Lordosis deformities, while 1 (0.2%) student had a combination of Kyphosis-Scoliosis-Lordosis deformities. 542 (100.0%) female students do not have a combination of Kyphosis-Scoliosis-Lordosis deformity, which means that the combination of Kyphosis-Scoliosis-Lordosis deformity is not present in female students in the final measurement. Spinal deformities are present to a large extent in children, as well as their combinations. In a sample of 120 students aged 6 to 7, both genders, it was found that female subjects have more common spinal deformities compared to male subjects (kyphosis, lordosis and kypho-lordosis). 22 female subjects had deformity kyphosis, 33 lordosis and 11 kypho-lordosis. 19 male subjects had deformity kyphosis, 25 lordosis and 6 kypho-lordosis. Scoliosis deformity was present in 83 subjects of both genders (Vukićević *et al.,* 2018a). In a sample of 61 elementary school first graders, 33 boys and 28 girls, it was determined that the subjects had impaired postural status. 3 female subjects had deformity kyphosis, 13 lordosis, 2 kypho-lordosis, 2 flat backs and 20 scoliosis. 7 male subjects had deformity kyphosis, 20 lordosis, 5 kypho-lordosis, 1 flat back and 21 scoliosis (Vukićević *et al.,* 2018b).

## Conclusion

By analyzing the variables of spinal deformities of the investigated sample with the help of descriptive statistics of Chi-squares, it was found that spinal deformities are a very common occurrence in a large number of subjects of both genders. Male subjects have more cases of kyphosis and scoliosis than female subjects, and fewer cases of lordosis. Combinations of spinal deformities were common in both male and female subjects. Kyphosis-Scoliosis and Kyphosis-Lordosis are more common in male subjects, and Scoliosis-Lordosis and Kyphosis-Scoliosis-Lordosis in female subjects. In the final measurement, there was a significant reduction in the proportion of cases with all four combinations of deformities. Such a high level of deformity can be explained by the lack of sports, the negative impact of the environment and improper diet. The consequence is today's sedentary lifestyle, with too little physical activity and too much consuming unhealthy diet. It is predicted that the number of these children will increase if the importance of physical exercise in school, which has a great impact on children's health, is not recognized. Sport at school is of great importance, because in addition to maintaining health, preventing improper posture, it provides support and assistance in natural growth and development, and creates a habit of daily use of the value of physical activities. Prevention of postural disorders is a very important element in preserving the health of children, because spinal disorders themselves can later lead to complete deformity, the consequences of which are far more severe. The research also monitored the effects of the work program on the postural status of the spine in lower primary school students. The program used in this study had significant effects on the prevention of postural disorders of the spine, as indicated by the results of the final measurement.

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