Chapter

Spinal Deformities with Students in Classroom Teaching in Urban and Rural Areas

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Abstract

The goal of this research is to determine the differences between spinal deformities of students in urban and rural areas with regard to the initial and final measurements. This research was conducted on a sample of 1105 students. This research program includes students from the first to the fifth grade in the following 11 elementary schools in Sarajevo. Method of measuring the curvature of the spine based on Napoleon Wolanski's criteria from 1975 entitled D-5 spine posture (ESP). The analysis of spinal deformity of students in urban and rural classrooms was done by using the descriptive chi-square statistics. It has been determined that in the initial measurement, a greater number of examinees with no spinal deformity came from the rural schools. The examinees from the urban schools displayed first- and second-degree spinal deformity. In the final measurement, a greater number of examinees without spinal deformity came from rural schools, 28 (2%) to be precise. There was also a greater representation of first-degree spinal deformity in the examinees from urban schools, 49 (8%) to be precise. However, the representation of second-degree spinal deformity was not present in either of the examinees from rural or urban schools.

Keywords: students, spinal deformities, urban-rural area

1. Introduction

Statistical data show that about 4% of people in Sarajevo have spinal deformities to some degree [1]. This is due to the so-called incorrect body posture that has not been corrected on time. Functional disturbances, which have been caused by incorrect posture, are first noticed on the spine and later also on the chest, legs, and feet. The spine is the main contributor to the upright posture and carries all of a person's upper body weight. That is why the spine is often exposed to many deformities, which can seize the entire spine or just some parts of it. The spine can be contorted in three different ways [1]. The types of spinal distortion include kyphosis, scoliosis, and lordosis. One of the key persons in the prevention and suppression of these deformities is the physical and health education teacher, who has to work on correcting postural disorders [1]. He has to apply the appropriate exercises in order to prevent the incorrect body posture. The exercises should contribute to strengthening all the major muscle groups, which are important in preserving the upright

posture and preventing worsening of the deformity. Many authors have dealt with the problem of evaluating body posture, as well as spinal deformities and the reliability of these results [2–5]. The analysis of their work included the postural status of the children in the city of Novi Sad. It was a sample of 242 examinees, who were 6 years old. The evaluation of the postural status of the examinees was conducted with the analysis of certain segments of the body based on the method of Napoleon Wolanski [6]. The analysis of the results showed that the boys had good stomach and spine posture, while the posture of other segments was incorrect. The girls had incorrect stomach and spine posture, while the posture of the other segments was good [6]. At the end, the authors concluded that the postural status of the 6-year olds in Novi Sad was disconcerting, and, in the future, it would require taking appropriate measures in order to prevent and realign those postures to their original state [6]. Using the method of Napoleon Wolanski, an evaluation of the body posture of students in the fifth and seventh grade of an elementary school in Sarajevo was conducted. The results have shown that the students in the seventh grade have significantly worse body posture than the students in the fifth grade. It was concluded that the students in the seventh grade had more poor body posture more often located in the areas of the shoulders and neck [7]. This states that 53% of the examinees have incorrect body posture. In conjugation with this statistic, some authors point out that even more than 70% of the school children have some sort of body disorders and certain difficulties that are a consequence of a lack of body movement [8, 9]. The percentages of the presence of postural disorders in young people substantially vary with different authors, and it depends on the specificity of the sample, age, life area, and the applied methodology in detecting the disorders, etc. Winged blades and concave feet are significantly more present in both the boys and the girls from rural areas than those in urban settings. On the other hand, there is a greater presence of a flat foot deformity in both genders from urban areas. Also, we have noticed that the greatest number of disorders refer to the functional shape, which is at the same time the mildest. It is obvious that the presence of incompletely fixated and structural disorders is significantly smaller. It must be noted, however, that it is a significant percentage in the frequency of the more severe forms of body deviations. It is known that children from rural areas are thinner than the city children for several reasons. Not only are they more physically active, but also they are healthier and receive better nutrition. Considering the fact that the winged blades are a lot easily recognized in thinner examinees than those who have larger amounts of subcutaneous fat, this result is not a surprise. As for the status of the foot arch, the obtained results are only a confirmation that the children from urban areas are less mobile and are not prone to be a part of physical activities, especially those forms that are intended to strengthen the foot and lower leg muscles. The fact is that the greatest percentages of the postural disorders refer to the functional form. However, with an adequate program of corrective physical therapy, we can stop the further progression of the physical deviation into a worse stage and largely correct the postural disorder(s) and align the body to its normal position. Obviously, there is a significantly smaller presence of incompletely fixated and structural deformities [10]. A lot of research has been done on proper body posture [6, 8, 11–13]. In comparison to the urban children, the everyday lifestyle of the children in rural schools requires more physical activity outside during the day and includes a healthier diet. In contrast, the urban children often eat unhealthy food from the school kitchen, such as pizza, croissants, pies, various pastries, etc. The students are still not aware enough to choose vegetables and eat less sweet. Foods with artificial flavors are easily within reach, and, once they taste it, everything else tastes bad. Fast food is a modern convenience and can lead to obesity. This has contributed to improper body posture and deformities in an increasing number of children. It can

also produce a series of other health difficulties later on in life. Another reason for these disorders is that urban children have difficulties making new friends. They do not go outside but increasingly use the computer and socialize on Facebook. The research conducted, which compared the problems in children from urban and rural areas, has definitely confirmed that the rural children have less postural disorders of any kind [12]. Today, a variety of programs for physical activity are more available to the school children, which can enhance their quality of life. There are many sports clubs, such as collective and individual sports. While urban areas also have natural resources and water sports as well as extreme sports, the research in this area points to the fact that "a great percentage of elementary school children are not included in sports activities, and that is the reason for a greater presence of incorrect body posture."

2. Working method

2.1 Examinee sample

This research includes N = 1105 school age children, of which 528 students were from urban areas (261 girl and 267 boys) and 577 students from rural areas (281 girl and 296 boys). They attended 11 elementary schools in the Sarajevo Canton and the surrounding area, and their average age was M = 82.864. Students who were from first to fifth grade were tested in every school. The breakdown of students included:

- First grade: 221 students (113 boys, 108 girls)
- Second grade: 214 students (109 boys, 105 girls)
- Third grade: 218 students (107 boys, 111 girl)
- Fourth grade: 237 students (121 boys, 116 girls)
- Fifth grade: 215 students (113 boys, 102 girls)

2.2 Variable sample

In order to determine the spinal status, the following variable was used: the method of measuring the curvature of the spine based on Napoleon Wolanski's criteria from 1975, *D-5 spine posture (ESP)—Evaluation of spine posture*. To determine the spinal status, it was necessary for the examinee to turn his back to the examiner with slightly separated but parallel feet in his normal posture. All of the examinees were in their underwear in rooms where the temperature was from 20 to 23°C.

The description of the measuring instrument—evaluation of spinal posture:
0—Physiological curve: normal and within the sagittal and frontal plane.
1—First-degree deviation: kyphosis, scoliosis, and lordosis.
2—Deviation of some kind: a specific deformity or combination of deformities but on a second-degree level

2.3 Data-processing methods

The analysis of spinal deformities of students in school was done by using the descriptive chi-square statistics. Applying the descriptive statistics, the researchers could determine the numerical and percentage frequency of the spinal deformity. These are displayed in tables and graphs.

2.4 Research trial

The research trial lasted one school year. The trial consisted of the following:

- At the beginning of the school year in September, an initial measurement of the body posture was performed based on the criteria of Napoleon Wolanski (1975), *D-5 Spine Posture (ESP)—Evaluation of Spine Posture*, with the help of a physical and health education professor.

- The examinees exercised according to the corrective exercise program used to prevent and correct incorrect body posture and the mentioned postural disorders (spinal deformities) that were made after the initial measuring (**Table 1**). The corrective exercise program was designed to be conducted through various forms of applied activities within the realms of physical and health education with students as a part of classroom instruction.

Every exercise would start by preparing the body, both physiologically and emotionally. The cardiovascular introduction of the load functions that occurred represented the initial physiological element. The addition of an emotional component into this unique program had an enormous significance on the results. Every exercise which was performed gradually increased in intensity from the easiest to the most difficult. To achieve the best result, the teachers focused on concrete exercise demonstration because it was about strictly defined movements. This is why, after the demonstration and the teacher's explanation, the students tried to do a certain task. The short explanations presented the goal of certain exercises and showed how to perform them according to the age of the child. The content of the program was not static, because various corrective exercises were applied in order to correct and prevent specific spinal deformities (**Figures 1–9**).

The exercises need to be changed and adapted to certain situations depending on students' motivation because certain exercises, if they were repeated daily, became monotonous to the students, and thus they would not pay enough attention to perform the moves correctly.

- After the initial measuring, a program was completed during a 6-month period (which finished at week 31). The program was held during the school year from October to April, when the educators were in the classroom.

- The number of training units consisted of physical and health education two times a week, where corrective exercises were performed in order to prevent and correct the spinal deformities.

- The duration of one class is 45 min.

- At the end of the school year in May, final body posture measurements were conducted according to the criteria of Napoleon Wolanski, 1975 [14], *D-5 Spine Posture (ESP)—Evaluation of Spine Posture*, with the help of a physical and health education professor.

- During the 6-month program, there was no testing and measuring. These were conducted before and after the applied program.

- After the initial and final testing when the measurements were taken, an evaluation was made based on the results.

	Beginning position	**Exercise description**
Remedial shaping excercises for correcting kyphosis	Beginning position: lying on the stomach	**1.** From the beginning position (hands next to the body), lift the shoulders the shoulder muscles while moving the shoulder blades towards the spinal column. At the same time, lift the head from the ground.
		2. From the beginning position, as in exercise 1, lift the hands, place the palms faced down to the ground and the head faced to the ground.
		3. From the beginning position, the fingers are interlocked resting on the back with the palms backwards. Lift the arms and the shoulder muscles while moving the shoulder blades towards the spinal column.
		4. From the beginning position, the arms are faced downwards as are the palms of the hands. Lift the arms (up the side of the body) and shoulders muscles while moving the shoulder blades towards the spinal column. The head remains in line with the spinal column.
		5. From the beginning position, the arms are on the floor, bent at the elbows, so that lower and upper arms make a 90° angle. The elbows are at the height of the shoulder muscles. Lift the head, the pectoral part of the spine and the arms bringing the shoulder blades closer to the spinal column.
		6. From the beginning position, the arms need to be bent at the elbows with the fingers interlocked resting on the nape of the neck. Lift the elbows as high as possible above the ground, as well as the head and the pectoral part of the spine.
		7. From the beginning position, the arms need to be bent at the elbows, but the hands are on the ground next to the shoulders (a resting support for the arms). At the same time lift the shoulder muscles and the arms and yet twist the hands with the palms facing upwards. This head movement is the same as in exercise 4.
		8. From the beginning position, lift the head as high as possible. The face needs to be looking towards the ground. Interlock the fingers, place the hands on the nape of neck, and use them to create strong resistance.
		9. From the beginning position (with the arms stretched out on the ground in front of the head), lift the arms at the same time turning the palms upwards and moving the shoulder blades in towards the spine.
		10. The beginning position is the same as in exercise 9 where the arms are stretched out in front of the head and on the ground, the fingers interlocked, and the palms turned forward. Lift both arms at the same time. The head, turned toward the ground, follows the movement with the face.

	Beginning position		Exercise description
		11.	From the beginning position as in exercise 10, the arms are stretched and raised from the ground. Bend them at the elbows and rest the palms of the hands on the nape of the neck. Then, stretch them out and bring them back down into the beginning position.
		12.	From the beginning position, positions the arms next to the body, turning the palms so that they face the ground. Lifting the arms, with the elbows slightly bent, bring them above the head. The whole movement takes place above the shoulders muscles, as one lifts the pectoral part of the spine and head. Do the same thing in reverse to get back to the beginning position.
		13.	From the beginning position, the arms are lifted above the head. Lifting the pectoral part of the spine and head, bend the arms at the elbows, like in exercise 5, stretch them out and then bring them back into the beginning position.
		14.	From the beginning position, firmly tighten the stomach and buttocks muscles. Interlock the fingers and place the hands on the nape of the neck using them to create resistance as the head is lifted.
	Beginning position		**Exercise description**
Remedial shaping excercises for correcting kyphosis	Beginning position: while sitting with stretched knees	**1.**	From the beginning position, with the arms placed on the pelvis, stretch the spinal column supporting and producing resistance with the hands. The head remains extended, upright in relation to the spine, but the shoulder muscles need to be pulled downwards.
		2.	In the beginning position, the arms are behind the body and the fingers are interlocked. Stretch the arms pulling them upwards and back as far as possible while turning the palms backward and bringing the shoulder blades in towards the spine.
		3.	In the beginning position, the arms are stretch and turn outwards. While pulling the upper arm upward, bend the elbows.
		4.	In the beginning position, the arms are raised to the level of the shoulders (up the sides of the body) The upper and lower arm form a 90° angle and are in horisontal position. The palms are pointing towards the ground. In that position pull the arms backwards using only the shoulder joints. Be careful that the elbows do not drop lower than the level of the shoulders.
		5.	From the beginning position the arms are bent the arms and the elbows are at shoulder level. Upper and lower arm need to form a 90° angle. While stretching the pectoral part of the spinal column pull the lower arm as far back as possible.

	Beginning position		Exercise description
		6.	In the beginning position the arms are bent at the elbows, the fingers interlocked, and the palms on the nape of the neck. Pull the elbows back as much as possible not separating the palms from the nape of the neck and the chest needs to protrude forward.
		7.	In the beginning position, the arms are being supported by the palms which are resting on the nape of the neck. The elbows are pulled back. Stretch the arms outwards behind the body, palms turned up and forward.
		8.	In the beginning position, the arms are bent, and the fingers are interlocked with the palms on the nape of the neck. Stretch the arms above the head, turning the palms upwards. Do not unfold the fingers and pull the arms as far back as much as possible.
		9.	In the beginning position, the arms are spread with palms turned forward. Pull the arms backwards, bringing the blades in toward the spine. While performing this move, make sure that the arms do not go below the level of the shoulders.
	Beginning position		**Exercise description**
Remedial shaping excercises for correcting kyphosis	Beginning position: Quadrupedal	**1.**	From the beginning position, supported by the forearms, lift the pectoral part of the spine to the horizontal position while facing the ground. Extend the arms backwards and lift them up, with the palms turned to the ground.
		2.	From the beginning position (like in exercise 1) Lift the pectoral part of the spine until it is in the horizontal position, interlock the fingers on the nape of the neck with the elbows above the level of the shoulder muscles.
		3.	From the beginning position (like in exercise 1), Lift the pectoral part of the spine until it is in the horizontal position. Once the arms are extended up through the elbows, lift them up and to the side. With the arms stretched in this position, turn the palms upwards.
		4.	From the beginning position (like in exercise 1), lifting the pectoral part of the spine to the horizontal position, the completely extended arms (even through the elbows) need to extend forward and up. The exercise is very difficult so it should only be done a few times in the beginning until the examinee builds up his strength.
		5.	The exercises will be even more difficult in this position if they are done with the help of another student. In the beginning position with the hips above the knees, the body should rest on the elbows as the fingers interlocked on the nape of the neck. Lift the pectoral part of the spine to the horizontal position pulling the elbows above the level of the shoulder muscles.

	Beginning position		**Exercise description**
	Beginning position: Standing	**1.**	In the beginning position the arms are behind the body, the fingers are interlocked, and the palms turned backwards. Bending the elbows, pull the upper part of the hands across the back as high as possible. The abdominal muscles need to be kept firmly tightened during the whole movement.
		2.	In the beginning position, the arms are behind the body, the fingers are intertwined, and the palms turned backwards. Pull the stretched arms back as much as possible and up moving the shoulders blades in towards the spine. Pull the stomach in.
		3.	In the beginning position the arms are next to the body. While stretching the spinal column, extend the arms. Perform this movement behind the body as much as possible. With the arms stretched out, turn the palms so that they are going up. In the same way, bring the arms back to the beginning position.
		4.	From the beginning position, raise the arms to a stretched position, bending them at the elbows. At the level of the shoulder muscle, pull the elbow backwards with a pronounced withdrawal of the forearm. Firmly tighten the abdominal muscles and keep the spinal column vertical.
		5.	From the beginning position, lift the arms above the head. With the arms stretched out above, firmly tighten abdominal muscles, draw the stretched arms back as much as possible.
		6.	In the beginning position, bend the upper part of the body to the horisontal position with the face faced down. Pull the arms behind the back with palms facing towards the ground.
		7.	In the beginning position, the hands are on the nape of the neck. Then, bend the upper part of the body up into the horisontal position. At the same time, pull the elbows back as much as possible.
	Beginning position		**Exercise description**
Remedial shaping excercises for correcting lordosis	Beginning position: lying on the back with legs bent at the knees	**1.**	From the beginning position, pull one knee and then the other one up as close to the chest as possible (alternating them in sequence). Later, in the exercise, do this with both legs at the same time.
		2.	From the beginning position, lift up the head with the face towards the chest without the support of the hands.
		3.	From beginning position, lift and extend both arms toward the knees, lifting both the head and the shoulder muscles. The feet need to remain on the ground.

	Beginning position	**Exercise description**
		4. From the beginning position, pull the feet up off of the ground. Then, with the knees together, move them from one side to the other side toward the floor.
		5. From the beginning position, stretch the left leg upwards, pulling it as close as possible to the body core. At the same time, lift only the right shoulder and the head and with your right hand reach for the foot of the extended leg. Then do this process again with the left leg and right hand.
		6. From beginning position, the hands are interlocked on the nape of the neck. Lift the head and then the shoulder muscles, pulling up the shoulder blades from the ground.
		7. From the beginning position, bend the legs at the knees and stretch the lower legs.
		8. From the beginning position, pull the tights towards the chest, then lift the pelvis, so that the knees are above the chin. The arms need to be in an extended position next to the body.
		9. In the beginning position fingers are interlocked on the nape of the neck, with elbows in the back. Lift the head and the shoulder muscles and rotate them from one side to the other.
	Beginning position sitting with stretched legs	**1.** From the beginning position lift the legs one by one with the knee extended.
		2. From the beginning position lift both legs at the same time with the knee extended.
		3. From the beginning the extended legs are being crossed the left leg over the right and the right leg over the left legs (alternating the legs).
		4. From the beginning position separate the extended legs, pull them back together, and then bring them back to the beginning position.
		5. From the beginning position lift the extended legs. At the same time pull chest forward and touch the feet with your hands.
		6. From the beginning position bring the extended upper body backwards. Be careful not to create an increase the curvature in the lumbar.
	Starting position: lying on the back with the legs stretched	**1.** In the starting position, tighten the abdominal muscles and lower the lumbar part of the spine to the ground. In the beginning allow for some knee bending, but later have the examinee do the exercise to their maximum leg extension.
		2. From the starting position, lift the right arm, right shoulder and head and touch the left hand that is on the ground on the left side of the body. Alternate the arms with this same action having them come cross over the body.

	Beginning position	**Exercise description**
		3. From the starting position, (to bend the legs at the knees), pull the up feet along the ground until they're fully bent at the knees. At the same time lift the head until you touch your chest with your chin.
		4. From the beginning position, lift both legs off of the ground at the same time, crossing them, the left across the right and vice versa.
		5. In the starting position, the hands are interlocked on the nape of the neck. Lift the upper part of the body to a 45 ° angle.
		6. From the starting position with the hands interlocked on the nape of the neck, lift the head and the shoulder muscles off of the ground.
Remedial shaping excercises for correcting scoliosis (Right thoracic scoliosis)	Starting position lying on the stomach	**1.** In the starting position place the arms on the pelvis. While facing the ground, stretch the spine with some intensity, bring the shoulder muscles down.
		2. In the starting position the left arm is above the head, and the right arm is next to the body. Lift the head and the shoulder muscles together along with the arms along with stretching spine with as much intensity as possible.
		3. From the starting position the left arm is stretched above the head, the right arm bent at the elbow next to the body. Lift the head and left arm and apply pressure with the forearm on the ground. Later, it can be combined with a deflection to the right side, that should be prevented with the pressure of the right forearm.
		4. From the starting position do the same as in the exercise 1, with a deflection in the pectoral part of the spine.
		5. From the starting position the left arm is extended, the right arm is bent at the elbow and that hand rest on the cheek. Lifting the head from the ground, move it toward the right side, which should completely prevent it because of the pressure from the right hand. At the same time, while slightly bending the left arm at the elbow, pull down the hand.
		6. From the starting position, the left arm is next to the body, with the palm facing down. Another student gives an appropriate amount of resistance on the forearm while the other student tries to lift and bring his stretched arm back.
	Quadrupedal starting position	**1.** From the starting position, lower the thighs on to the lower legs and have the left extended. The right arm is resting on the forearm on the ground and the elbow a distance from the body. Lift the pectoral part of the spine with left arm extended. The right arm stays on the ground. Repeat this exercise alternating positions of the arms.

	Beginning position	Exercise description
		2. From the starting position like in exercise 1. Lift the pectoral part of the spine, with arms as they are in the starting position.
		3. In the starting position lean on the forehead, interlock the fingers and place them on the nape of the neck. Stretching the pectoral part of the spine into the horizontal position, use the hands to produce resistance.
		4. From starting position, pull the hips back, interlock the hands on the nape of the neck. Produce a deflection in the pectoral part of the spine to the right while at the same time create resistance with the right arm to the movement.
		5. Sitting with the knees extended could also be used with functional scoliosis localized in the pectoral part of the spine. With a couple of examples, it is possible to choose arm stances given in the previous positions.
Remedial shaping excercises for correcting scoliosis (Left thoracic scoliosis)	Starting position: lying on the stomach	**1.** From a starting position make a deflection with the whole upper part of the body to the left. With the left hand touch the left knee.
		2. In the starting position pull the upper part of the body and the extended leg to the left. The deflection should be in the area of the belt (or waistline). The right leg stays on the ground.
		3. In the starting position bend both legs at the knees. The thighs and lower legs need to create a 90° angle. Lift both thighs from the ground, not changing the angular relation of thighs and lower legs.
		4. In the starting position lift both extended legs from the ground. If the scoliosis is not corrected, separate the left leg slightly.
		5. In the starting position lift the head, and the shoulder muscles from the ground, while the face is facing the ground. Lift the left leg bent at the knee from the ground, and then stretch it out. Lowering the upper part of the body, lower the stretched leg to the starting position.
		6. From the starting position lift both legs slightly from the ground and pull them to the left.
	Quadrupedal starting position	**1.** From the starting position pull the left leg bent towards the chest. The foot should not touch the ground.
		2. From the beginning position lift the hips until the knee is completely extended and with the ground as a support for the feet. From that position, lift the left leg to the side.
		3. In the starting position the left knee is in front of the right knee. Extend the right leg completely (including the knee) and lift it to the horisontal position.

Table 1.
Exercise program for preventing and correcting the postural disorders of the spine.

Figure 1.
(a–i) Some of the exercises for the removal of kyphosis.

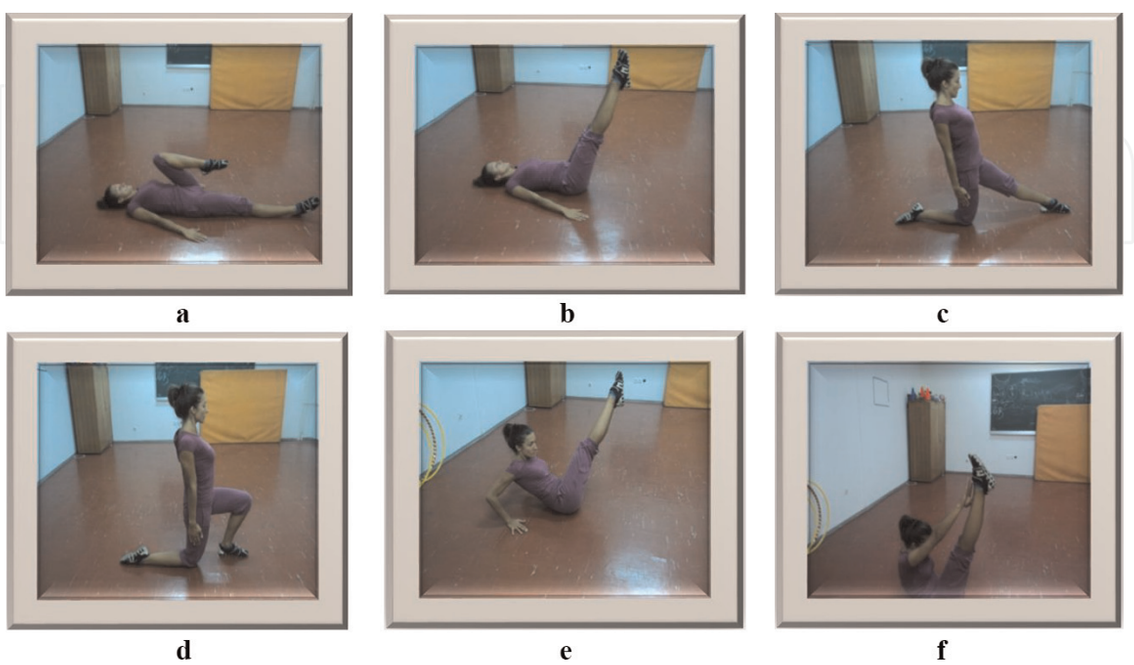

Figure 2.
(a–f) Some of the exercises for the removal of lordosis.

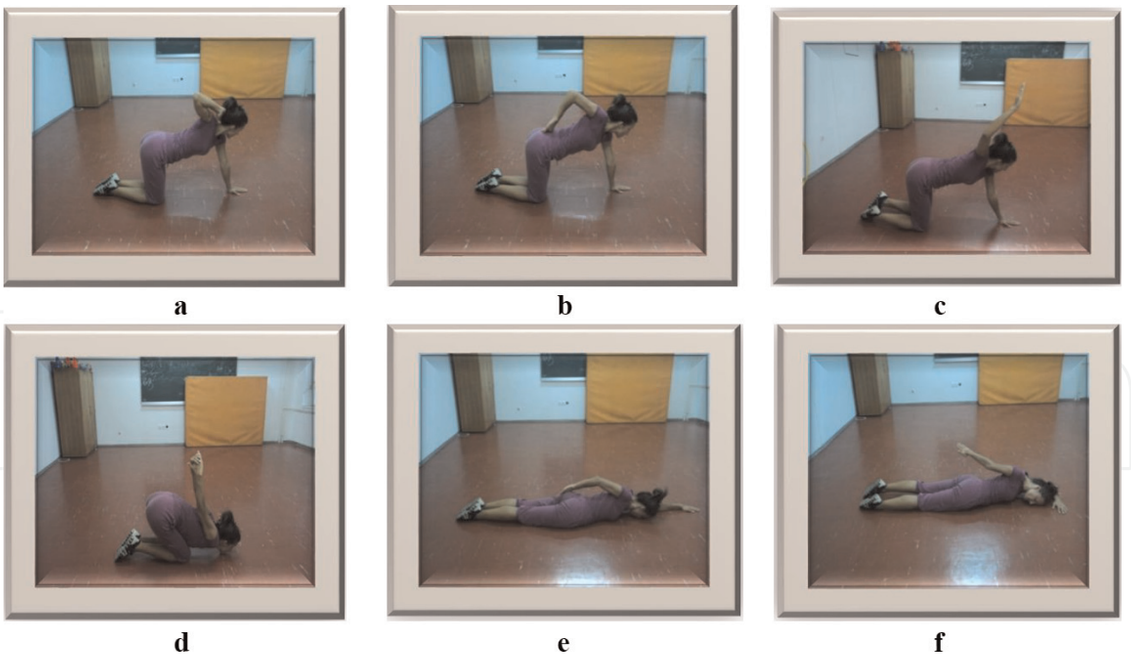

Figure 3.
(a–f) Some of the exercises for the removal of scoliosis.

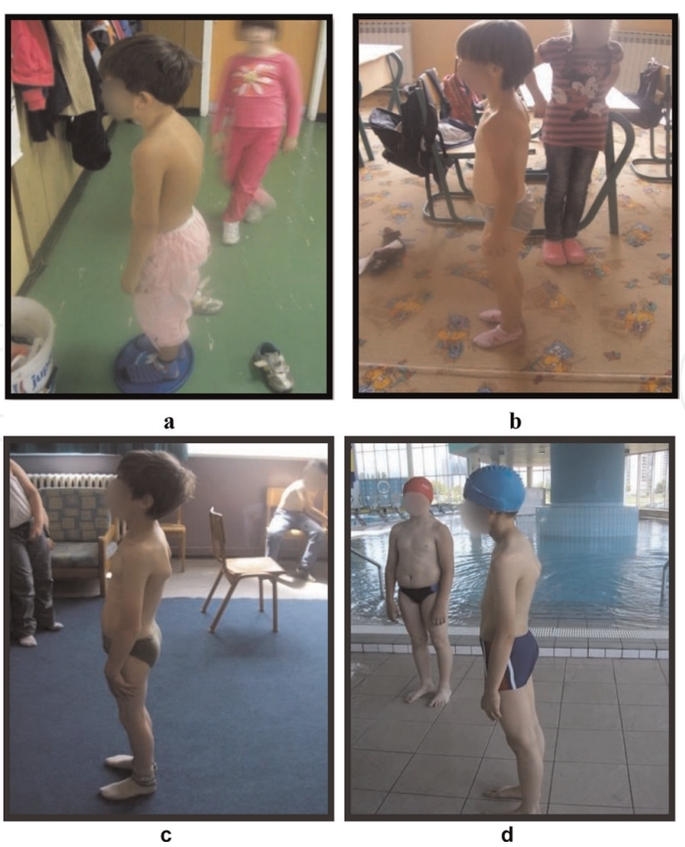

Figure 4.
(a, b) Kyphosis with girls. (c, d) Kyphosis with boys.

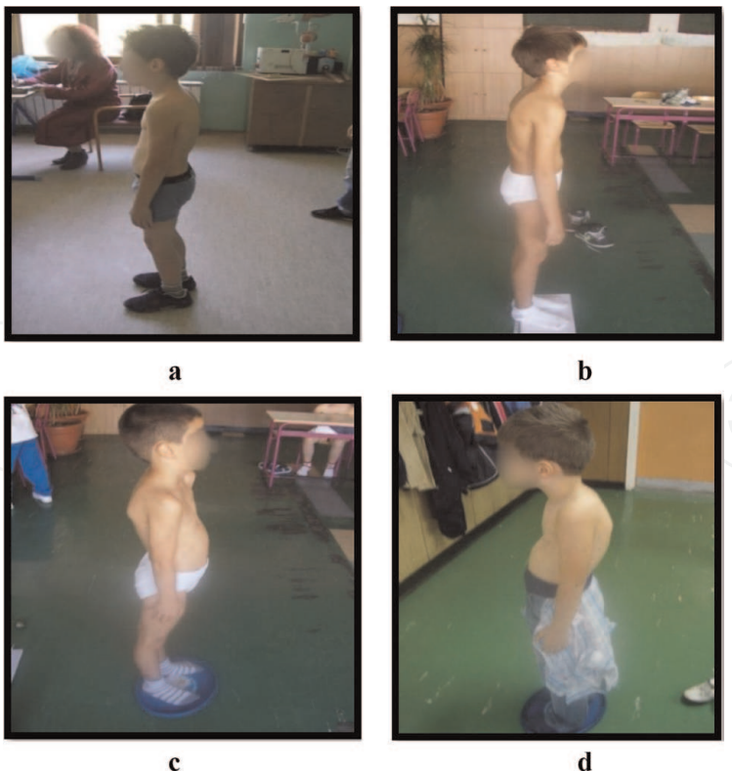

Figure 5.
(a–d) Kyphosis with boys.

Figure 6.
(a–f) Scoliosis with girls.

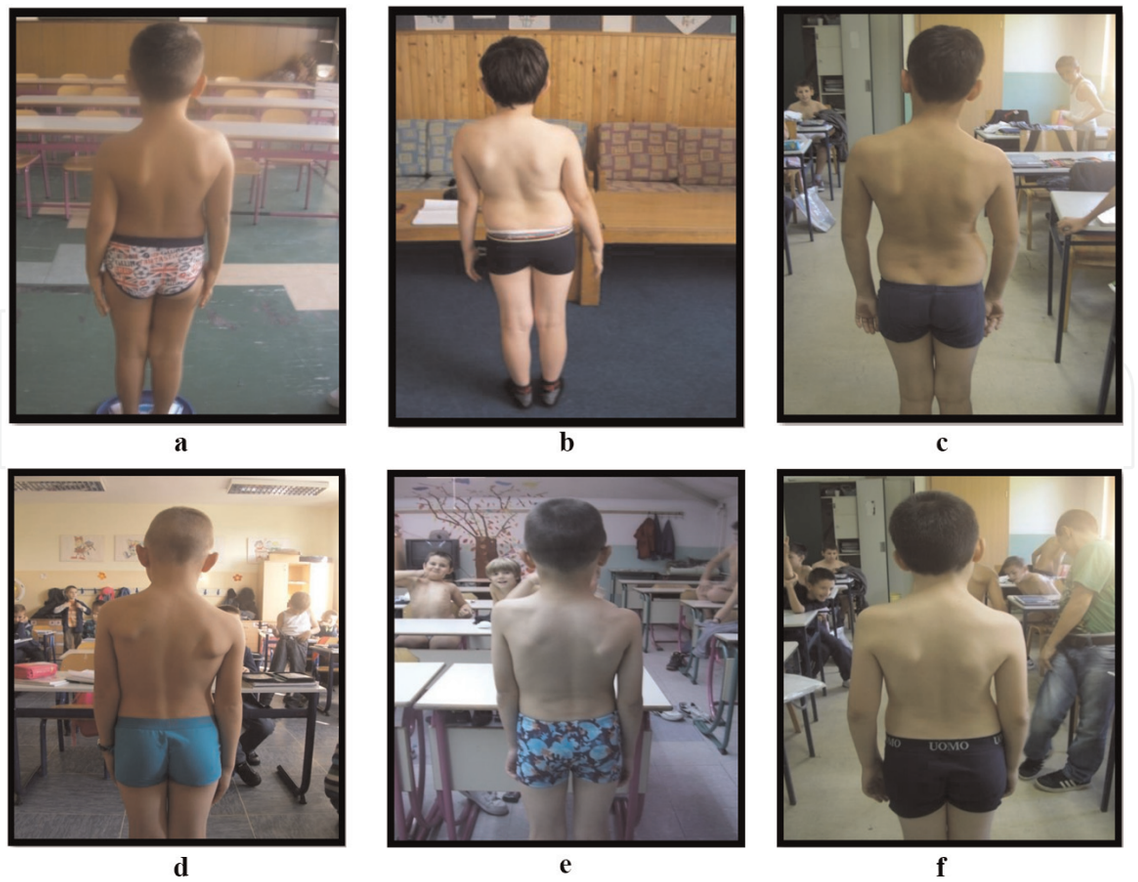

Figure 7.
(a–f) Scoliosis with boys.

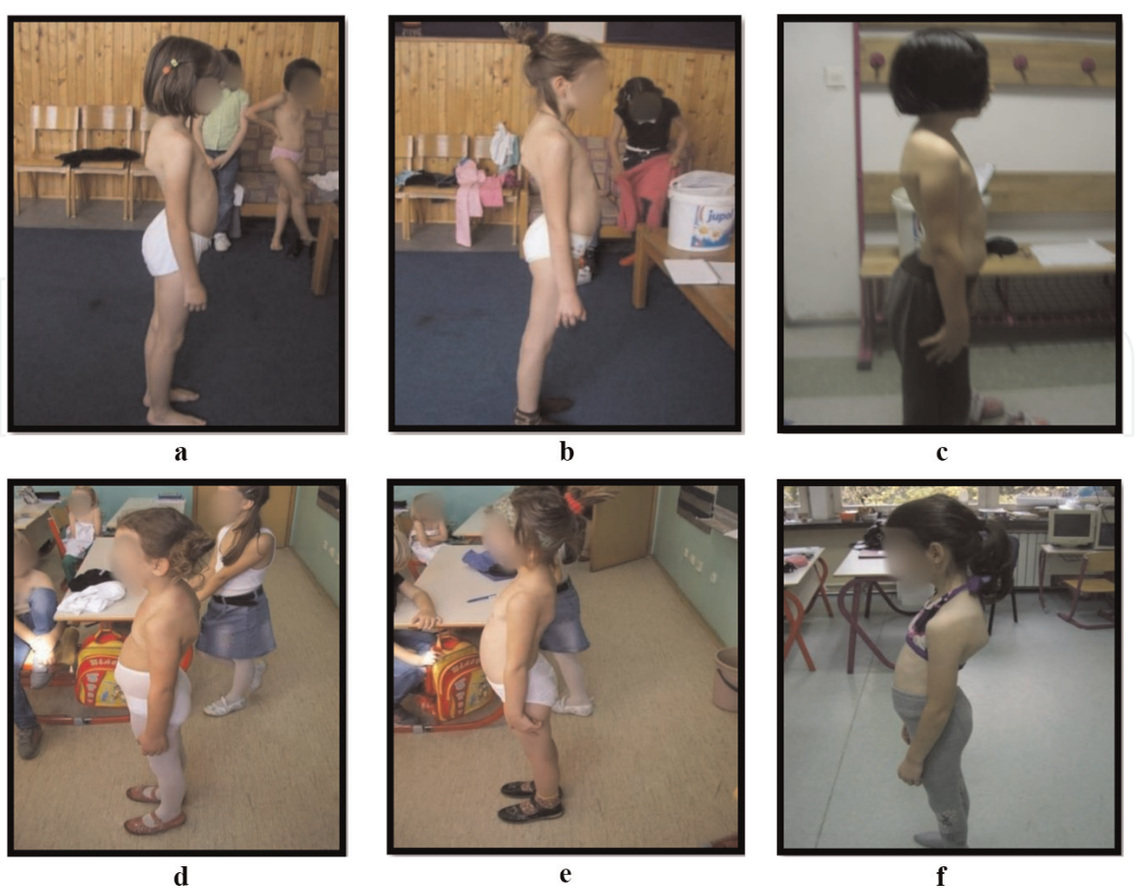

Figure 8.
(a–f) Lordosis with girls.

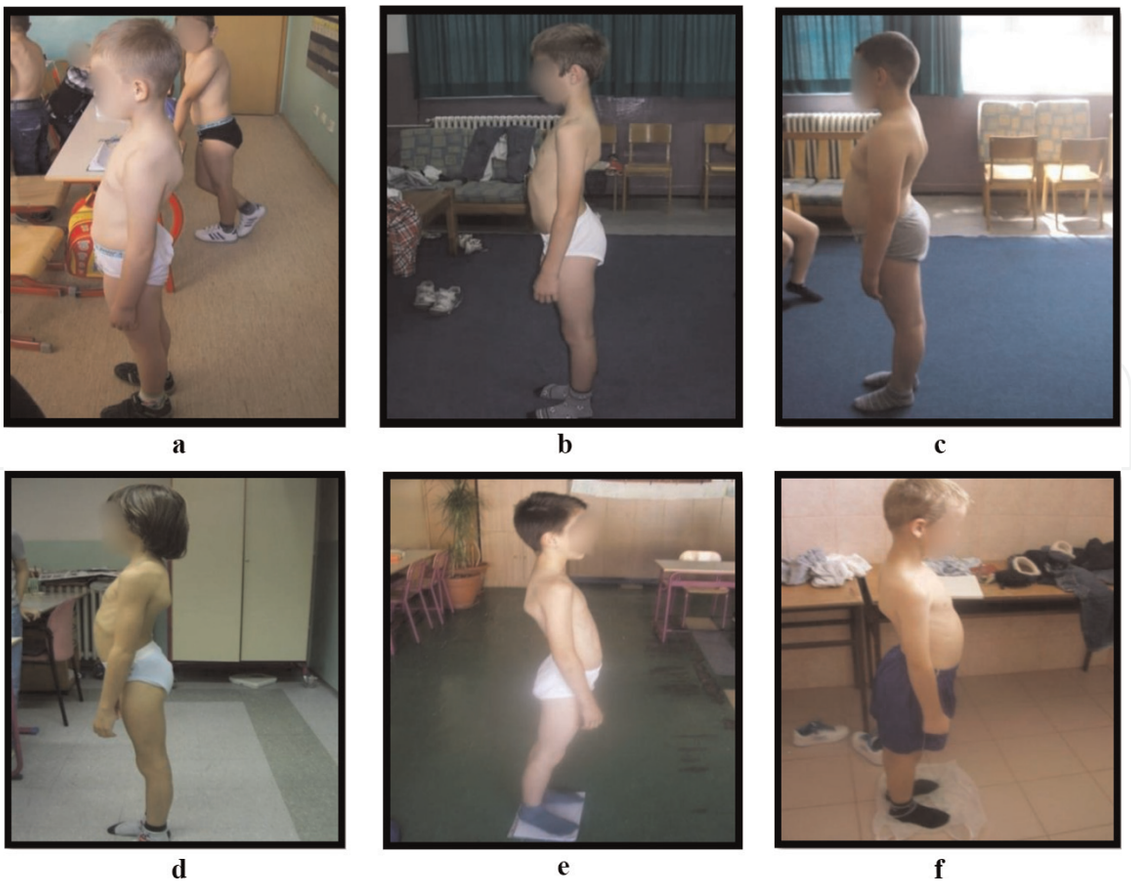

Figure 9.
(a–f) Lordosis with boys.

3. Results and analysis

In this chapter, the data obtained about the frequency and size of spinal deformities of students in classroom are presented and analyzed. The evaluation of spine posture (ESP) is as follows: 0, physiological curve (normal and within the sagittal and frontal plane); 1, first-degree deviation (kyphosis, scoliosis, and lordosis); and 2, deviation of some kind (a specific deformity or combination of deformities but on a second-degree level).

In **Table 2**, we can see that in the initial and the final measurements, there are statistically significant differences between the two genders in urban and rural school settings in the presence and degree of spinal deformities which was on a level lower than 1% (chi-squares are statistically significant).

In **Table 3**, we can see that, in the initial measurement, a greater number of examinees from rural schools had no spinal deformity in comparison to the examinees from urban schools. The examinees from urban schools had a bigger

Body part	Initially			Finally		
	Chi-square	Liberty degree	Level of significance	Chi-square	Liberty degree	Level of significance
Spine	35.750	2	0.000**	54.104	1	0.000**

***Chi-square is statistically significant at a level lower than 1%.*

Table 2.
The values and levels of chi-square significance in examining the differences between urban and rural schools in the degree of spinal posture in the initial and final measurements.

Body part	School	Body posture measuring				
		Grade (number of points)	Initial		Final	
			F	%	F	%
Spine	Rural	0	296	51.3	414	71.8
		1	190	32.9	163	28.2
		2	91	15.8	0	0.00
		Total	577	100.0	577	100.0
	Urban	0	177	33.5	265	50.2
		1	232	43.9	263	49.8
		2	119	22.5	0	0.00
		Total	528	100.0	528	100.0

Table 3.
The distribution of certain grades of spinal posture at initial and final measurements, according the location of the school.

percentage of spinal deformities of the first and second degree. This difference is statistically significant and measures at a level lower than 1%, which is shown by the chi-square from the previous analysis (chi-square = 35.750 and p = 0.000). In the final measurements from **Table 3**, there is a greater number of examinees from rural schools without a spinal deformity, and there is a greater presence of spinal deformity of the first degree in the examinees from urban schools. However, the presence of second-degree spinal deformity is not present in either examinees from rural or from urban schools, and the difference is statistically significant at a level lower than 1% (chi-square = 54.104 and p = 0.000).

In **Table 4** based on the F-ratio values which are significant to the factors of the exercise program, we can conclude that, in the final measurement, there were statistically significant changes in the values of the cervical and lumbar curves. On the other side, both in the initial and in the final measurements, a significant difference was noted in the range of the cervical and lumbar curves given the fact that the difference in size is slight in the final comparison to the initial measuring,

Source of variability	Measure	Sum of squares	Liberty degree	Variance	F-ratio	p
Measurement	Cervical curve	61.595	1	61.595	433,492	0.000 **
	Lumbar curve	13.964	1	13.964	48,869	0.000 **
School	Cervical curve	5.972	1	5.972	9342	0.002 **
	Lumbar curve	19.094	1	19.094	8146	0.004 **
School interaction × Measuring	Cervical curve	1.820	1	1.820	12,806	0.000 **
	Lumbar curve	1.264	1	1.264	4422	0.036 *
Degree of Error	Cervical curve	705.135	1103	0.639		
	Lumbar curve	2585.443	1103	2.344		

**F-ratio is statistically significant on a level lower than 5%.*
***F-ratio is statistically significant on a level lower than 1%.*

Table 4.
The analysis results of the variation in examining the differences between the students in urban and rural schools in the initial and final measurements of cervical and lumbar curves.

which is indicative of the significant interaction from the school and the exercise program.

In **Table 5**, we can see noticeable differences according to the location of the school in the value of the cervical curve in both the initial and the final measurements. Those differences are statistically significant, which is indicated by the value and significance of the obtained F-range (F = 9342 and p = 0.002). Also, there are noticeable differences between the measurements where the values of the cervical curve are smaller than in the final measurement in comparison to the initial measuring. These differences are statistically significant, and they are indicated by the value of F-range from the previous analysis (F = 433,492 and p = 0.000). Additionally, the level of interaction from specific schools involved in the exercise program was determined. So, in the final measurements of the cervical curve, differences based on school location are significantly greater than the initial measuring.

In **Table 6**, we can see that there are differences between the measurements as well as differences regarding the school area in the values of the lumbar curve. The change in the value of the lumbar curve at the final measuring in comparison to the initial measuring is significant for both the examinees from rural and urban schools. This is indicated by a significant F-range (F = 48,869 and p = 0.000). Also, there are noticeable differences regarding the school's location in the initial and final measurements, which is indicated by the significant F-range that takes into consideration the school factor (F = 8146 and p = 0.004). On average, the examinees from rural schools have smaller values for the lumbar curve both in the initial and final measuring. Additionally, the significance of the school's interaction through the exercise program was determined. So, in the final measurements, differences according to gender with regard to the measures of lumbar curve are significantly larger than the initial measurements.

In **Table 7**, we can see that in the initial measurements, there are statistically significant differences between the examinees from urban and rural schools with regard to the presence and degree of the spinal deformity (scoliosis and lordosis).

School	Measuring	N	Smallest value	Biggest value	Arithmetic mean	Standard deviation	Median
Rural	IM	577	1.50	5.00	32.792	0.65634	3.5
	FM	577	1.50	4.10	30.024	0.44999	3.0
Urban	IM	528	1.00	6.50	34.407	0.81478	3.5
	FM	528	1.50	5.20	30.491	0.52858	3.0

Table 5.
The average values and measurements of the deviations in regard to the measurements of the cervical curve at the initial and final measuring, in relation to the school location.

School	Measuring	N	Smallest value	Biggest value	Arithmetic mean	Standard deviation	Median
Rural	IM	577	0.50	8.50	36.312	1.30201	3.5
	FM	577	0.60	5.70	35.199	0.91960	3.7
Urban	IM	528	0.60	8.00	38.652	1.32449	3.5
	FM	528	0.90	6.00	36.581	0.98621	3.7

Table 6.
The average values and measurements of the deviation regarding the measures of the lumbar curve in initial and final measuring, regarding the school area.

Deformity	Initial			Final		
	Chi-square	Liberty degree	Level of significance	Chi-square	Liberty degree	Level of significance
Kyphosis	10.649	2	0.005	16.519	1	0.000**
Scoliosis	18.176	2	0.000**	27.332	1	0.000**
Lordosis	23.042	2	0.000**	16.614	1	0.000**

***Chi-square is statistically significant on a level lower than 1%.*

Table 7.
The values and levels of the chi-square significance in examining the differences between urban and rural schools in regard to the presence of certain kinds of spinal deformities in initial and final measuring.

The chi-square is statistically significant at a level lower than 1%, but there are no statistically significant differences in the presence and degree of spinal deformity (kyphosis). In the final measurement, significant differences are seen between the examinees from urban and rural schools in the degree and presence of the spinal deformity (kyphosis, scoliosis, and lordosis). The chi-square is statistically significant at a lever lower than 1%.

In **Table 8**, it is visible that in the initial measurement of the examinees from rural schools and from urban schools, there are fewer cases of kyphosis, and first- and second-degree kyphosis among those from rural schools. Also, in the final measuring, as seen in **Table 8**, there are a larger number of examinees from rural schools without kyphosis and a larger number of examinees from urban schools with first-degree kyphosis. In addition, second-degree kyphosis was not present in the examinees either from rural or from urban schools.

In **Table 9**, we can see that there are more cases without scoliosis in the initial measurements of examinees from rural schools than the examinees from urban schools. There are also fewer cases of first- and second-degree scoliosis. Also, in the final measurements, as seen in **Table 9**, there are a large number of examinees from rural schools without scoliosis and examinees from urban schools without first-degree scoliosis, while second-degree scoliosis was not present in the examinees either from rural or urban schools.

Spine deformity	School	Body posture measuring				
		Deformity	Initial		Final	
			F	%	F	%
Kyphosis	Rural	Not present	504	87.3	538	93.2
		I degree	56	9.7	39	6.8
		II degree	17	2.9	0	0.00
		Total	577	100.0	577	100.0
	Urban	Not present	425	80.5	453	85.8
		I degree	72	13.6	75	14.2
		II degree	31	5.9	0	0.00
		Total	528	100.0	528	100.0

Table 8.
Display of the frequency distribution of the presence of spine deformity in the initial and final measurements, according to the school location—kyphosis.

Spine deformity	School	Body posture measuring				
		Deformity	Initial		Final	
			F	%	F	%
Scoliosis	Rural	Not present	480	83.2	524	90.8
		I degree	94	16.3	53	9.2
		II degree	3	0.5	0	0.00
		Total	577	100.0	577	100.0
	Urban	Not present	397	75.2	421	79.7
		I degree	113	21.4	107	20.3
		II degree	18	3.4	0	0.00
		Total	528	100.0	528	100.0

Table 9.
Display of the frequency distribution of spinal deformity in the initial and final measuring, according to the school location—scoliosis.

Spine deformity	School	Body posture measuring				
		Deformity	Initial		Final	
			F	%	F	%
Lordosis	Rural	Not present	412	71.4	492	85.3
		I degree	90	15.6	85	14.7
		II degree	75	13.0	0	0.00
		Total	577	100.0	577	100.0
	Urban	Not present	305	57.8	399	75.6
		I degree	130	24.6	129	24.4
		II degree	93	17.6	0	0.00
		Total	528	100.0	528	100.0

Table 10.
Display of the frequency distribution of spinal deformities in the initial and final measuring, according to school location—lordosis.

In **Table 10**, we can see that in the initial measurements, fewer examinees from rural schools have lordosis than the examinees from urban schools, and there are fewer cases of first- and second-degree lordosis. In the final measuring, seen in **Table 10**, there are a greater number of examinees from rural schools without lordosis and fewer examinees from urban schools with first-degree lordosis, while second-degree lordosis was not present in the students either from rural or urban schools.

3.1 Discussion

3.1.1 Table 3

As we were evaluating the spinal posture of the students from rural schools, we came across some data that shows that, in the initial measuring of 296 (5.3%) students, the physiological curvature was normal in both the sagittal and frontal

planes, which indicates correct body posture. In 190 (32.9%) students, the deviation of a first-degree deformity was present as kyphosis, scoliosis, or lordosis. In 91 (15.8%) students, there was a singular deviation or a combination of them but on a second-degree level. In 177 (33.5%) students from urban schools, the physiological curvature was normal and within both the sagittal and frontal planes, which indicates correct body posture, while in 232 (43.9%) students, there was a first-degree deviation of kyphosis, scoliosis, or lordosis. In 119 (22.5%) students, there was a singular deviation or combination but on a second-degree level. In the final measuring of 414 (71.8%) students from rural schools, the physiological curvature was normal in both the sagittal and frontal planes, which indicated correct body posture. In 163 (28.2%) students, there was a first-degree deviation of kyphosis, scoliosis, or lordosis, while an expressed deviation, a singular deviation or combination on a second-degree level, was not present in the final measuring of students from rural schools. In 265 (50.2%) students from urban schools, the physiological curvature was normal in both the sagittal and frontal planes, which indicates correct body posture, while in 263 (49.8%) of the students, there was a first-degree deviation of kyphosis, scoliosis, or lordosis, while an expressed deviation, a singular deviation or combination on a second-degree level, was not present in the final measuring in the students from urban schools. Because of this and the tiredness that occurs after sitting too long, children most often take incorrect positions that later grow into bad habits, and in time these become physical disorders of a milder or more severe form. In addition, a child's means to get back and forth to school has changed a lot over the years. This is due mostly to the increase in number of cars. Unlike the previous generations of students who went mostly on foot to school, to practice, to their relatives, etc., children in the twenty-first century are not walking enough. Driving from one place to another exclusively takes place in cars, busses, van, etc. This kind of lifestyle, along with many other conveniences, has certain consequences that have negatively affected the motor capabilities and posture as well as the esthetic look and the quality of life of young people.

3.1.2 Table 8

After measuring the spine curvature of the students from rural schools, the data obtained showed that out of 1105 examinees examined in initial measuring, 504 (87.3%) students had symmetrical shoulders and shoulder blades and a straight spine, which means that they had good body posture. Fifty-six (9.7%) students had the following characteristics: a head bent in the forward position; shoulders bent in the forward position; a pronounced stoop; a recessed chest; protruding shoulder blades; a bulging, flabby stomach; and knees which were slightly bent and shifted forward. This indicates a first-degree kyphosis deformity. Seventeen (2.9%) students with more pronounced symptoms were classified to have a second-degree kyphosis deformity. Four hundred and twenty-five (80.5%) students from urban schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Seventy-two (13.6%) students had the following characteristics: a head bent in the forward position; shoulders bent in the forward position; a pronounced stoop; a recessed chest; protruding shoulder blades; a bulging, flabby stomach; and knees which were slightly bent and shifted forward. This indicates a first-degree kyphosis deformity. Thirty (5.9%) students with more pronounced symptoms were classified to have second-degree kyphosis. In the final measuring, 538 (93.2%) students from rural schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Thirty-nine (6.8%) students had the following characteristics: a head bent in the forward position; shoulders bent in the forward position; a pronounced stoop; a

recessed chest; protruding shoulder blades; a bulging, flabby stomach; and knees which were slightly bent and shifted forward. This indicates a first-degree kyphosis deformity. However, the extreme deviation, first-degree kyphosis, was not present in the students from the rural schools in the final measuring. Four hundred and fifty-three (85.8%) students from rural schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Seventy-five (14.2%) students had the following characteristics: a head bent in the forward position; shoulders bent in the forward position; a pronounced stoop; a recessed chest; protruding shoulder blades; a bulging, flabby stomach; and knees which were slightly bent and shifted forward. This indicates a first-degree kyphosis deformity. However, the extreme deviation, first-degree kyphosis, was not present in the students from urban schools in the final measuring.

3.1.3 Table 9

After measuring the spinal curvature of the students from rural schools, the data obtained showed that, out of 1105 examined students in the initial measuring, 480 (83.2%) students had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Ninety-four (16.3%) students had asymmetrical shoulders and shoulder blades, which indicated a spinal distortion which curved from side to side, known as first-degree scoliosis. Three (0.5%) students had more pronounced symptoms which indicated second-degree scoliosis. Three hundred and ninety-seven (75.2%) students from urban schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had a good body posture. One hundred and thirteen (21.4%) students had asymmetrical shoulders and shoulder blades, which indicated a spinal distortion which curved from side to side, known as first-degree scoliosis. Eighteen (3.4%) students had more pronounced symptoms which indicated second-degree scoliosis. In the final measuring, 524 (90.8%) students from rural schools have symmetrical shoulders and shoulders blades and a straight spine, which means they had good body posture. Fifty-three (9.2%) students had asymmetrical shoulders and shoulder blades, which indicated a spinal distortion which curved from side to side, known as first-degree scoliosis. However, the extreme deviations or second-degree scoliosis was not present with the students from rural schools in the final measuring. Four hundred and twenty-one (79.7%) students from urban schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. One hundred and seven (20.3%) students had asymmetrical shoulders and shoulder blades, which indicated a spinal distortion which curved from side to side, known as first-degree scoliosis. However, the extreme deviations or second-degree scoliosis was not present in the students from the urban schools in the final measuring.

3.1.4 Table 10

After measuring the spine curvature of the students from rural schools, the data obtained showed that, out of 1105 students in the initial measuring, 412 (71.4%) students had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Ninety (15.6%) students had heads which protruded backward; a flat or bulging chest; a pelvis which was completely shifted forward and down, a bulging, untoned stomach; and hips which shifted forward. All of these symptoms indicated a deformity called first-degree lordosis. Seventy-five (13.0%) students had more pronounced symptoms which indicated second-degree lordosis. Three hundred and five (57.8%) students from urban schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good

body posture. One hundred and thirty (24.6%) students had heads which protruded backward; a flat or bulging chest; a pelvis which was completely shifted forward and down; a bulging, untoned stomach; and hips which shifted forward. All of these symptoms indicated a deformity called first-degree lordosis. Ninety-three (17.6%) students had second-degree lordosis. In the final measuring, 492 (85.3%) students from rural schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. Eighty-five (14.7%) students had heads which protruded backward; a flat or bulging chest; a pelvis which was completely shifted forward and down; a bulging, untoned stomach; and hips which are shifted forward. This indicated the deformity, first-degree lordosis. However, the extreme deviation, second-degree lordosis, was not present in the students from the rural schools in the final measuring. Three hundred and ninety-nine (75.6%) students from the urban schools had symmetrical shoulders and shoulder blades and a straight spine, which means they had good body posture. One hundred and twenty-nine (24.4%) students had heads which protruded backward; a flat or bulging chest; a pelvis which was completely shifted forward and down; a bulging, untoned stomach; and hips which shifted forward. This indicated the deformity, first-degree lordosis. However, the extreme deviations, second-degree lordosis, were not present in the students from the rural schools in the final measuring.

4. Citing sources

A decrease in physical activity, due to an urban lifestyle, inadequate exercises during physical education classes, and lack of participation in sports activities, leads to a weakening of the whole muscular system including the muscles within the spine. This leads to specific disorders connected to improper posture and the appearance of physical deformities [15].

Based on current research and statistics, deformities in children's posture appear mostly because of muscle weaknesses in the back area, chest, or abdomen. Thus, a weakness in the pelvic muscles and lower extremities could lead to a secondary disorder in the upper body. Initial changes usually appear first in the muscles and then in the ligaments and skeletal system [16].

Reducing physical activity also reduces the resistance of the locomotor apparatus on the effect of the external factors which enables the appearance and development of many postural disorders [17].

Today, the lifestyle of young people is characterized by a lack of movement, that is, it has become more sedentary. Almost one-third of all children spend more than 4 h a day sitting in front of the TV. This does not account for the time spent sitting in the school or being on the computer and playing video games. All of these tell us that the number of sitting hours, whether at home or in school, with children and youth is growing [18].

All of this is confirmed by research which shows that the percentage of school children and youth with postural disorders is well over 60%. The biggest percentage of these disorders is due to spinal deformities [19, 20]. Unfortunately, the number of children with problems due to body posture is increasing every year [18].

Today, a lot of attention is given to researching the factors that are affecting the appearance of spinal deformity. In some European countries, the law states that the weight of a school backpack must not exceed 10% of the weight of that child [21, 22]. Research conducted worldwide shows that the average weight of a backpack exceeds the permitted amount and ranges from 10 to 14% [21].

Recent researches in some Dalmatian elementary schools, with students from all grade levels, have shown that the average weight of a school bag, with regard to the

weight of a student, ranges from 12.5 to 13.8%. A specified, heavier load in a backpack affects the growth and development of the child because the child's locomotor system is not fully developed. In research by different authors around the world and in Croatia, they mention this problem of overly heavy school bags as one of the common factors that are responsible for the development of incorrect physical posture and spinal deformity [23].

Besides the backpack, scientists also mention that school furniture is not being adapted to the growth and development of the children in classroom. This stated that lordosis is a curvature of the spine whose convexity is facing forward. This curvature is present in the cervical and lumbar parts of the spine and has a strong connection with kyphosis [24].

Kyphosis is more present in male students from urban areas, and lordosis is more present in female students than the students from rural areas. A rise in kyphotic diagnoses indicates a sudden growth and development of the skeleton, a lack of strength in the back muscles, an absence of physical hygiene, insufficient physical activity, as well as a lack of the preventive-corrective exercising models [15, 25].

The results of the research have shown that there was a difference in the students from the first to the fourth grade in elementary schools who had presented symptoms related to kyphosis. Two hundred and forty-six (56.5%) students from urban areas, compared to students from rural areas [26].

Out of 299 examinees, 136 (45.48%) examinees were male, and 163 (54.52%) examinees were female. Kyphosis in the male examinees from urban areas was significantly more present (62.02%) than in the case of female examinees (37.98%) [27].

It was determined that, out of 258 examined boys, 142 or 55%, and 111 girls or 43.8% from urban areas, there was an increased thoracic curve (kyphosis) on the spine compared to students from rural areas. The kyphosis chart, depending on the degree of development, focuses on certain characteristics which include mainly the gender of the examinees as well as the type of living environment. It was proven that, in all of the students, the functional disorders were the most present. With the boys, the value is Rf = 73.9 and with the girls Rf = 81.1. Incomplete fixated disorders made up 25.4% of the cases in the boys and 100% of the cases in the girls. The most difficult form or the so-called fixated kyphosis included only one boy (0.4%) [28].

In measuring the postural disorders of the spine, the researchers determined that out of the total number of 320 examinees, 146 students (46%) had the spinal deformity (kyphosis), that is, where the silhouette is hunched forward. This indicates that the children have shoulders which are bent forward, an enhanced stoop, a recessed chest, protruding shoulder blades, a bulged and flabby stomach, and knees which are slightly bent and shifted forward. This indicates the deformity, kyphosis [29].

While measuring the postural disorders of the spine, it was determined that out of the total number of 320 students, 47 students (15%) had asymmetrical shoulders and shoulder blades. This indicates a distortion of the spine which is a sideway curvature, better known as scoliosis [29].

While measuring spine deformities with preschool children, it was proven that the girls from urban areas had the highest deformity percentages: scoliosis (31.25%), lordosis (18.75%), and kyphosis (9.37%). The boys from urban areas had the biggest percentage of deformities: kyphosis (13.33%), scoliosis (31.25%), and lordosis (2.22%) [30].

The results of this research have shown that in the students from the first to the fourth grade of elementary schools, the frequency of the spinal deformity, lordosis, was present in 9 (2.0%) students from urban areas, compared to the students from rural areas [26].

According to the obtained results, lordotic disorders are more present than the kyphotic disorders in the students from urban areas, compared to the students from rural areas. This coincides with this researcher's results. Increased lordotic deviations were recorded in 146 boys (56.6%). One hundred twenty-five girls (49.4%), with even their number of kyphosis, have shown to have slightly better spinal posture than the boys. The greatest number of lordotic deviations refers to the functional disorders or the so-called bad body posture. With the boys from urban areas, their relative frequency is 78% and with girls 77%. With incomplete fixated disorders, it has been found to be in 19.1% of the cases in boys and 23% of the cases in girls. So, with the reducible lordotic disorders, it has been found in 97.1% of the cases in boys from urban areas and 100% in the cases of girls compared to the students from rural areas. The heaviest case, that is, fixated lordosis, was found in four boys from the urban areas, which makes up 2.9% of the total number of disorders. We can conclude from these results that the boys from the urban areas had a slightly larger total percentage of functional disorders. Thus, they showed worse body posture than the girls from rural areas [28].

In measuring the postural disorders of the spine, it was determined that, out of the total number of 320 examinees, 97 students (30%) had the spinal deformity, lordosis. This diagnosis is indicated by a head which protrudes backward; a flat or bulging chest which is a bit lowered; a pelvis which is completely shifted forward and down; a bulged, untoned stomach; and untoned hips which are shifted forward [29].

5. Conclusion

Based on the obtained results of the spinal measurements, that is, before and after the realization of the program, it can be concluded that all of the spinal deformities were more present in the children from urban area than in the children from rural areas. Compared to urban children, everyday responsibilities of the village children included physical activity outside during the day as well as a balanced diet. On the other hand, urban children often ate unhealthy food from the school kitchen, such as pizza, croissants, pies, various pastries, etc.

The students are still not aware enough of their need to choose fruits and vegetables and eat less sweet food. Food with artificial flavors is easily within reach, and once they have tasted it, everything else tastes bad. This, then, negatively affects body posture and is causing deformities in an increasing number of children. It is also known that there are also other health difficulties which can arise because of bad nutrition and lifestyle. Another contributing factor to these disorders is also the fact that urban children have a harder time making new friends. They do not go outside but socialize on Facebook and are on the computer more than ever before.

The research, which compared children from the city to children from the village schools, definitely confirmed that village children have a significantly smaller percent of postural disorders of any kind [12]. Today, school children can have various means which could enhance their quality of life. There are many sport clubs, such as collective and individual sports.

While in urban surroundings there are natural resources and developed and water sports, such as some extreme sports, research in this area shows us that a large percentage of children from elementary schools do not participate in sports activities. Thus, this is the reason for the increased number of children with incorrect posture.

Spinal deformities are present to a great extent because of the way regional landscapes affect a child's spine and the child's way of life. This can be observed in

everyday activities that are centered on very little body movement, overeating, and overall inappropriate nutrition. It leads to an unhealthy lifestyle. Thus, there is a need for intervention in order to change the child's behavior and help him to live out a healthier lifestyle. The goal would be to protect and enhance his health through a healthy diet and physical activity.

It is predicted that the number of these children will keep increasing if the significance of the physical activity is not taken seriously enough. Physical education in school can have a great influence on the health of the children. It needs to be understood how great the significance of the games and exercising for the health is and that it is needed by every individual. It has been proven that the frequency of the postural disorders could be significantly decreased with a well-planned corrective procedure which is carried out in the long term. It is necessary to develop an awareness that points to the need for a healthy lifestyle, which includes proper corrective exercises that work to prevent and correct one's posture. Otherwise, the consequences could be devastating not only esthetically but also in a poorer life quality which affects motor capabilities and can endanger one's overall health. That is why there is a need to have a solid, long-lasting program in conjugation with health institutions, which starts from preschool and goes up through high school and focuses on early discovery, prevention, and correction of physical disorders in children and youth. Besides the regular physical education program and sports and dance as electives, a special significance should be placed on the need to organize corrective gymnastics classes. It is very important to point out that only the early detection of the deviations from the correct physical posture is the key to success. Incorrect body postures developed because of weakened postural muscles in the earlier stages of development could be corrected with additional physical exercising programs especially if they are detected earlier on. Early diagnosis is the most important key to a successful treatment of these disorders of the musculoskeletal system. The teachers in physical and health education need to head this off by creating a plan for early detection. The program that was applied in this research had significant effects on the prevention of the postural disorders of the spine.

The applied program has easily fit into the curriculum of the school institutions. We can say that this program and many others, along with certain modifications, could be incorporated into the regular physical education program in order to decrease the number of children with these disorders. When one considers the severity and consequences of these disorders, it can be said that there is still not enough awareness among parents, teachers, and children about the necessity to take certain measures in order to prevent and correct these disorders. However, only an educated teaching staff can contribute to correcting hygiene and exercise which will accomplish the goal of correct body posture. In addition to participating in regular physical and health education classes, students should regularly exercise at home in order to positively affect their growth and development.

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