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# Way of Life as Emphasizing Factors in the Progression of Idiopathic Scoliosis in Adolescence Era

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## ORIGINAL PAPER

### ABSTRACT

**Introduction:** Idiopathic scoliosis is a significant health problem which occurs in 2%–4% school kids in adolescent age. Reasons of occurrence are not quite clear, there are many theories, but probably it is multifactor disease. Among the theories that are mentioned some of them included environmental and behavioral factors. **Aim:** Research the impact of some environmental and behavioral factor on development and progression of idiopathic scoliosis in school kids. **Methodology:** Research was conducted on 421 pupil in adolescent age, where 120 pupils was from urban schools and 301 pupil from rural schools. Environmental factors and habits like the bigger osteomuscular structure mobility at kids from rural schools, longer outdoor time spending, different nutrition, alcoholism and smoking, different obligations, etc. factors which can be cause of scoliosis development. **Results:** In this research we assumed that different environmental and behavioral factors of school kids, which exist in rural and urban areas, can develop to different expression of scoliosis in these areas. In our research we proved that the scoliosis occurrence is more often in urban areas than in rural (Fisher's exact test  $P < 0.001$ ). **Conclusion:** It is necessary to research all factors of lifestyle individually, which are different between the urban and rural kids.

**Key words:** adolescent idiopathic scoliosis, rural, urban, school kid's.

## 1. INTRODUCTION

Idiopathic scoliosis is the most common form of scoliosis and its incidence in the total number of scoliosis is from 67% to 90% depending on types of research and the observed age groups. (1, 2, 3). It is present in 2 – 4% of children aged from 10 to 16 years of age (4), but more than 50% at persons older than 60 years (3). The causes of its origin still are not clear, and probably they are many. More frequent occurrence in some families are leading to genetic factors (5), gender distribution also wasn't clearly defined. In infantile period both sexes are equally affected, while in the juvenile and adolescent period girls have bigger tendencies for illness, and at the age of 10 years that ratio is 6:1 (3). During etiology research of idiopathic scoliosis disorder of connective tissues, abnormal biomechanical forces as well as neuophysiological predisposition was determined. (6). Some research are blaming sudden dynamic development of adolescents and asymmetrical tensions that are there created within



Figure 1. Normal spine position and scoliosis.

the musculo-skeletal system (7), or a problematic posture as a factor in enhancing the period of rapid development of the body (8). (Figure 1).

Idiopathic scoliosis is rare in early childhoods and its prevalence is growing in the school age from 2% to 4% as the child getting older. (4). From that reason and because of the risk in specific development stages idiopathic scoliosis can be classified into three groups. Scoliosis occurred in early childhood (infantile) before the age of three, scoliosis occurring in juvenile child age (from 3 to 9 years) and scoliosis that occurs in adolescent age (from 9 to 18 years) (1). Adolescent idiopathic scoliosis (AIS) is not a disease primarily caused due to poor posture, but poor posture may potentiate the deterioration of the existing scoliosis. This is very important in the period of rapid growth because epidemiological studies suggest that AIS is a leading orthopedic problem of children in school period. Due to the ill micro-environment, environmental factors can be potentiate factor in AIS developing. Changes in intervertebral discs and other parts of vertebra's indicate to the ineffective synthetic response to a pathological environment (9). (Figure 2,3).

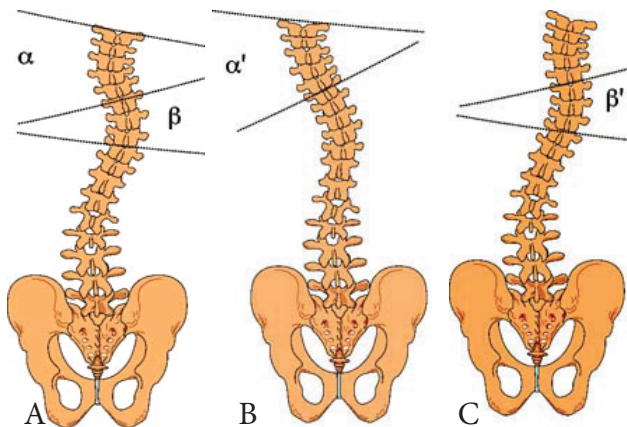


Figure 2. A: thoracic scoliosis. B: Bending the upper curvature to determine the reduction. C: bending the principal curvatures b clinically satisfactory result if  $b \leq 17^\circ$

If we considered all these emphasizing factors, we set the goal of this study to determine the impact of behavioral and environmental factors on developing and progression of AIS in children at school age. These factors are the one that make difference in living in rural or urban area. In example it is a bigger mobility of osteomuscular structure at children in rural area, longer stay outside, a different diet, alcoholism, smoking, other commitments, habits and interests, etc. (10, 11, 12).

## 2. SAMPLE AND METHODS

This is an epidemiological - analytical cross section study. Adolescent students from two different elementary school's from urban area in Žepče are the research sample and two elementary school's in rural area in Gradačac. They were selected from bigger research sample which included all age groups in elementary school from 6 to 15 years old (adolescent age). The cases with scoliosis as a result of congenital disorder or neuromuscular disease are did not take in consideration. Scoliosis is defined as a lateral curvature of spine from 10 and more degrees with vertebral rotation.

Scoliosis was diagnosed by experienced doctors. In addition to the notice of presence or absence of scoliosis, body height, weight were measured, also BMI (body mass index) and the relationships between this values and occurrence of AIS were calculate.

## 3. RESULTS

Results are presented on table 1, table 2 and chart 1. Total examined sample was consisted of 618 pupils. From total sample, research sample is separated of 421 or 68,1% pupils of adolescent age. Analysing the gender distribution with  $X^2$  test we established that there is no statistical significant difference in research sample by gender in rural and urban school. ( $X^2_{(1)}=0.085$ ;  $P=0.77$ ).

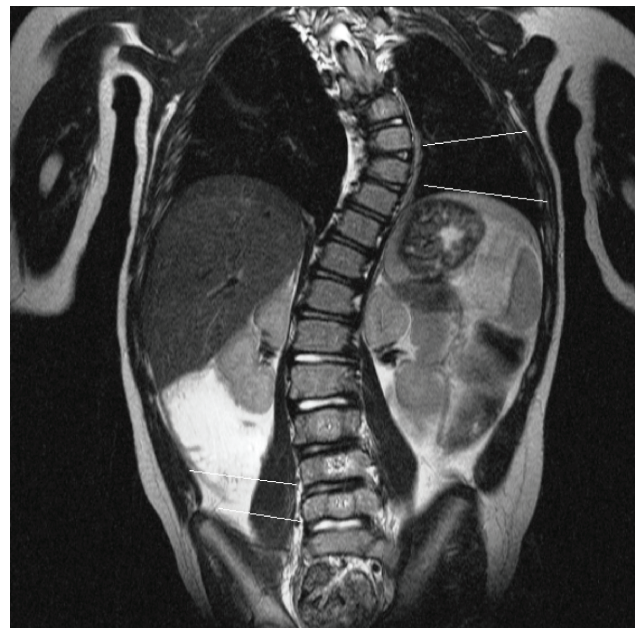


Figure 3. MRI – Patient with idiopathic scoliosis.

	Area		Total
	Urban	Rural	
Male	60 (50.0%)	144 (47.8%)	204 (48.5%)
Female	60 (50.0%)	157 (52.2%)	217 (51.5%)
Total	120 (100.0%)	301 (100.0%)	421 (100.0%)

Table 1. Subject distribution by gender and area

Since in this sample there is a statistically significant difference in the average age of subjects ( $t_{(410)}=23.511$ ;  $p<0.001$ ), we have selected cohort of pupils of 14 years old which was consist of 184 students both sexes, where is no statistically significant difference in gender distribution by area of living. ( $X^2_{(1)}=0.62$ ;  $p=0.80$ ).

In a cohort made of fourteen years old kids there is no statistically significant differences in average body weight among subjects classified by place of residence ( $t_{(99)}=-1.834$ ;  $p=0.07$ ), but there is statistically significant difference in average BMI ( $t_{(87)}=-5.203$ ;  $p<0.001$ ). Higher BMI had the students of schools in rural area. Analyzing data on the presence of the scoliosis in relation to place of residence we found a statistically significant difference (Fisher's exact test  $p<0.001$ ). Scoliosis is more common in urban school

students.

	Area		Total
	Urban	Rural	
Scoliosis YES	40 (33.3%)	4 (6.3%)	44 (23.9%)
Scoliosis NO	80 (66.7%)	60 (93.8%)	140 (76.1%)
Total	120	64	184

Table 2. Scoliosis distribution by the place of residence

Analyzing the results of the research sample (cohort of adolescents) we found that scoliosis is much more common among urban school children. While testing this difference we found that it was statistically significant ( $X^2_{(1)}=32.127$ ;  $P<0.001$ ).

Analyzing the correlation between the appearance of scoliosis with the size BMI in the research sample, the Pearson correlation coefficient shows a significant positive correlation ( $P. \text{corr} = 0.176$ ;  $p<0.001$ ).

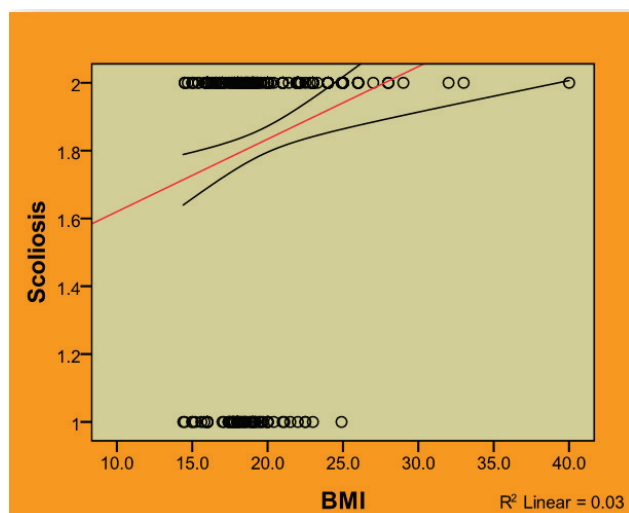


Chart 1. Correlation of scoliosis with BMI

Analyzing the difference between the scoliosis appearance by gender in research sample we found a statistically significant difference. Scoliosis is two time more often at girls than boys ( $X^2_{(1)}=4.863$ ;  $p=0.027$ ).

#### 4. DISCUSSION

The intention of this study is to show the impact of environment and lifestyle as a potential factors in expression of AIS. As we mentioned above idiopathic adolescent scoliosis is not a habit disease, it is not caused by carrying heavy school bags on one shoulder, or bad posture and neither the lack of calcium (13). Many research are agree in one that the rapid pubertal growth can be connected with asymmetric growth of the spine and the occurrence of this type of scoliosis (14, 15, 16). We assumed that such, vulnerable conditions some secondary factor can exist which can potentiate and have impact on expression and progression of AIS. Therefore, we look for this factors in diversity of environmental factors and habits in different living environments, urban and rural.

Many research are showing that osteomuscular mobility, and especially mobility of spine and the dominant body posture body can cause many changes which can potentiate scoliosis development. Shultz (1984) was talking about poor postural control of spine with AIS as biomechanical

factor of her progression, neuromuscular mechanism's are the most important (17). Tinazci (2009) is pointing to the environmental effects on physical activity at children in urban and rural area (18). Reyes (2003) is showing differences in development at school children of rural and urban area, school children in urban area are in average more taller and heavier than the children in rural area (19).

In our research we didn't measured specific parameters of the physical activity of children, we haven't conduct any survey about diet and other habits, but we assumed there are significant differences between the children in urban and rural area, on a tradition base, earlier research and the usual habits of life. School children in rural area have more physical activity, they are more actively involved in activities helping their parents, and less time they are spending in front of the television and game console, in total children in rural area have healthier profile (20, 21). There are differences in osteomuscular development of children in urban and rural area what is shown in our research. In our research children from rural area have higher BMI, and smaller average high than the kids from urban elementary schools. It is established that the appearance of scoliosis is more often in school children from urban area, two times more often in girls and it is more often at children with higher BMI.


#### 5. CONCLUSION

There are numerous theories about the AIS etiopathogenesis, from those that assume genetic heritage, abnormalities of nervous system, abnormal bone growth, hormonal and metabolic disorders to the biomechanical, and environmental factors that are result of lifestyle habits (22). Our research has shown that incidence of scoliosis at school children is more often in urban area, as it brings need for further research of the factors which are different in living in urban and rural area and which can be cause or reason of scoliosis expression.


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