

# PREVALENCE OF ADOLESCENT IDIOPATHIC SCOLIOSIS IN SELECTED URBAN AND COUNTRYSIDE SCHOOLS IN EGYPT

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## **Abstract:**

**Background:** Scoliosis is a lateral curvature of the spine when the Cobb angle is more than 10° on the frontal plane. Curve detection before skeletal maturation gives a good opportunity for early treatment or prevention of curve progression. Purpose of this study to compare between the prevalence of adolescent idiopathic scoliosis in selected urban and countryside areas in Egypt.

**Methods:** This study was conducted on 840 Egyptian male student between ages 10 to 15 years old from 4 schools according to exclusion and inclusion criteria. Students were divided into two groups, group A which represented urban schools students and group B which represented the countryside schools students. Screening was conducted on both groups by using Adam's forward bend test (FBT), students with rib cage hump (positive test) and students with no hump (negative test). Then students were screened using the Scoliometer HD application with reading 7 degrees or more ( $\geq 20$  degrees Cobb angle) were referred to the medical assurance and their parents were informed about the findings.

**Results:** The forward bending test (FBT) group A showed a higher positive results (41.43%) than group B (17.14%). The scoliometer HD application readings which (7 or more) showed a significance difference between two groups as group A was (12.61%) and group B was (5%).

**Conclusion:** Urban males school students have a higher prevalence of adolescent idiopathic scoliosis than that in countryside schools.

**Keywords:** Scoliosis; Scoliometer HD; School screening; Forward bending.

- **Introduction:**

Scoliosis is defined as a lateral curvature of the spine greater than  $10^\circ$  which is quantified using the Cobb angle on posteroanterior (PA) radiographs [1]. Adolescent idiopathic scoliosis is a common disease with an overall prevalence of 0.47–5.2 % in the current literature. It develops at the age of 11–18 years and accounts for approximately 90 % of cases of idiopathic scoliosis in children [2].

The prevalence of adolescent idiopathic scoliosis in the world ranges from 1 to 13% in different contexts [3]. The rate in school children was 1% to 2% and in adults aged 25 and older, it raised above 8%. Cases with progressive scoliosis (Juvenile, adolescent and adult) often require long and complicated treatment. Over 80% of cases of infantile scoliosis correct itself with no need for treatment [4]

Scoliosis may have an impact on the Egyptian society as children between 10-15 years old represent 9.5 % of the population which is the third large category. So without the early detection of adolescent idiopathic scoliosis for that age group bad impacts will be implemented for Egyptian society by causing disabilities and psychological problems for these children [5].

In Norway 1994 school screening programs were firstly done to detect scoliosis then stopped for its high cost and lack of evidence that the programs improved outcome. With the absence of a scoliosis screening programs, fewer patients were being braced, and more patients were having surgery. So the school screening program was found to be effective in decreasing the rate of surgical correction in adolescent idiopathic scoliosis [6].

School screening study which was conducted to detect the prevalence of adolescent idiopathic scoliosis in 4000 Norwegian children aged 12 years found that the point prevalence of adolescent idiopathic scoliosis (AIS) in 12-year- old children was 0.40% in girls and 0.15% in boys [7].

Screening of Lithuanian school children aged 16-19 years of secondary schools, comparing between city residences and people who lives in small cities and villages. The researchers found that low physical activity in city residences led to higher posture disorders in city residences when compared to small cities and villages [8].

So early detection of scoliosis and determination of which areas are more affected urban or countryside will help in early management. Also this will guide the government and the community for early intervention to decrease the factors that leads to this postural abnormality. This also will guide another clinician to search for caused of these posture deformities and to concentrate screening for special areas with special cultures.

- **Material and methods:**

***Study design:***

This study is a cross-sectional study.

***Participants:***

In this study 840 male student between ages 10 to 15 years old were screened after the agreement of the school directors and parent consent. The participants were chosen randomly from 4 schools (2 urban schools and 2 countryside schools). They were divided into two groups, group A (n= 420): urban school students and group B (n= 420): countryside schools students. The participants were interviewed before the screening and the procedures and the purpose of this screening were told to them. Participants how not willing in participation and how's parents refused there participation were excluded. This study was approved by the Research Ethical Committee of the Faculty of Physical Therapy, Cairo University, in September 2018 (No: P.T.REC/012/002051).

***The inclusion and exclusion criteria:***

The participants were healthy and from selected urban and countryside schools with the following inclusion criteria; age range from 10 to 15 year, males (parents refused the screening of their girls and girls refused to take of their clothes to be screened because of the cultural differences) and students who have structural scoliosis. On the other side

the exclusion criteria were congenital deformities, recent fracture and there is fixation in the upper or the lower extremities, neuromuscular disorder (Cerebral palsy and spinal muscle atrophy) and syndromic disorders (Muscular dystrophy, Osteogenesis imperfect and spinabifida).

***Measurement procedures:***

Each school's director was interviewed, the approval of the Director of Education Department at Al Wasta city was showed to them, the purpose of the study and procedures was explained to them. Parent agreement and written consent was used. A place was allocated for the assessment taking in consideration that the place was warm, closed and secured from any risk.

Then during the school morning broadcasting 10 minutes were taken to increase the students and the staff awareness about scoliosis causes, symptoms, progression and how to avoid it and detailed procedures were discussed to them.

**1- Adam's forward bend test (FBT):**

The student was asked to stand erect, knees straight, feet at the same level and hands freely hang as in figure (1, a) and then was observed from the back for shoulders level pelvic level and knees level. Student was asked to bend forward with his knees straight, feet together and hands freely and loosely hanged as in figure ( 1, b). So if there was scoliosis the rib cage rotated and a hump appeared. Positive test indicated the presence of a rib hump and negative if there was any hump appeared [9].

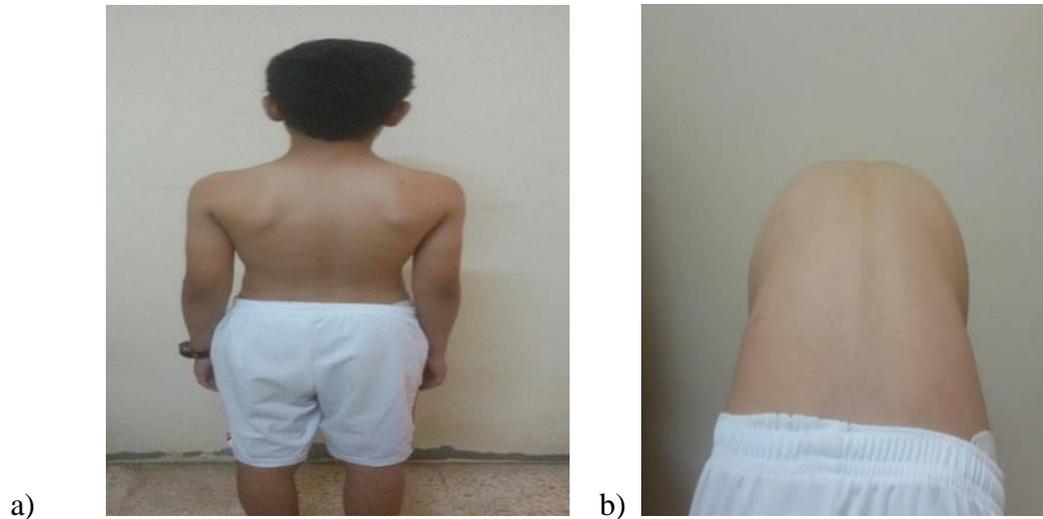


Figure (1).a); shows a student standing in an erect position with knees straight and feet at the same level with hands hanged beside him. b): the student was asked to bend forward with his feet together and his hands freely hanged to observe the presence of the rib hump.

## **2- Measurement of angle of trunk rotation (ATR) by using scoliometer HD application:**

Then Students were screened using the Scoliometer HD Application [10]. The student was asked to bend over, arms dangling and palms pressed together. The smart phone (Scoliometer HD) was placed on the student back with the central dark area in the application placed on the spinous processes of the lumbar and thoracic regions to measure the angle of trunk rotation as shown in figure (2). Also those with a scoliometer HD reading  $>7$  degrees ( $\geq 20^\circ$  Cobb angle) were referred and their parents were be informed about the findings of the screening by the school manager and the school social worker.

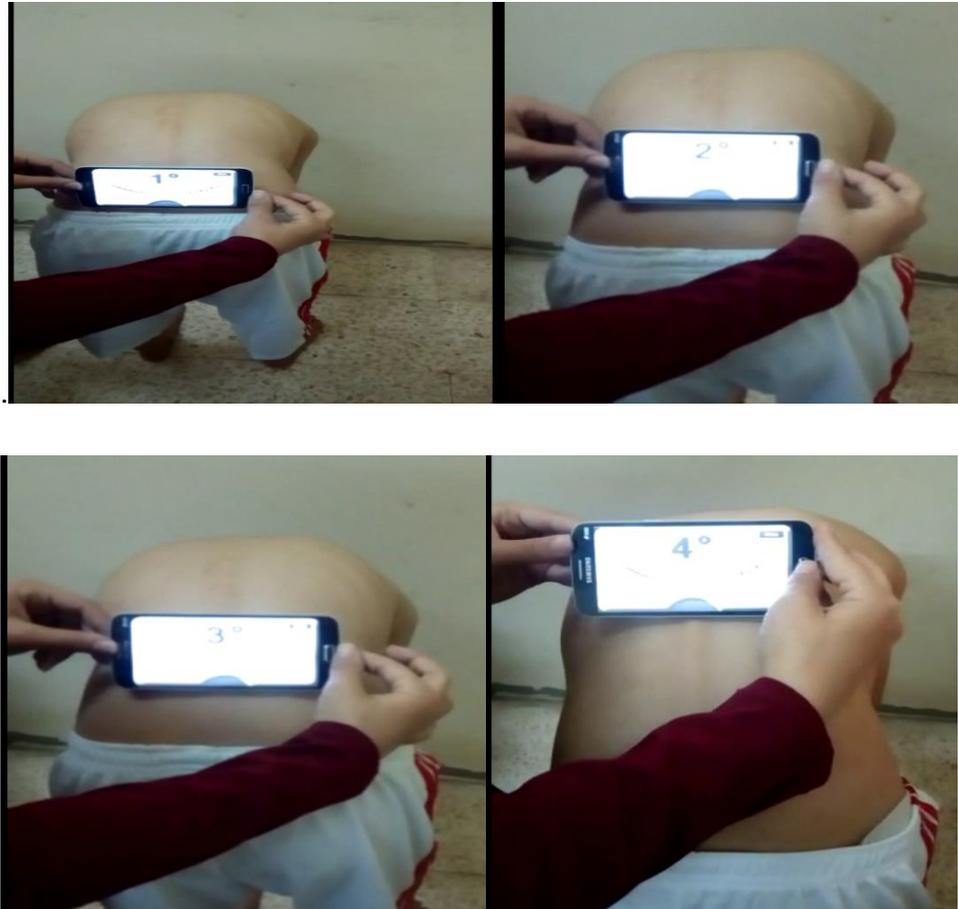


Figure (2), the use of scoliometer HD application in measurement of the angle of trunk rotation.

***Data analysis:***

According to Wang et al.,(2012) [11] the rigidity of both thoracic and lumbar curves in male patients with AIS with severe curves might contribute to the lower curve correction rate and poor response to brace than in female cases. So this study was conducted on males only for the early detection and treatment. Power analysis was used to calculate the sample size with the power of 0.95 and effect size of 0.25. Because this study compared between two independent variables (results of scoliometer HD application and Adam's forward bending test), the independent t-test was used. Statistical analyses were done using SPSS for windows, version 15.0 (SPSS, Inc., Chicago, IL, USA). Results are expressed as mean  $\pm$  standard deviation or median. The normality tests Shapiro-Wilk and Kolmogorov-Smirnov are both used to test for the normality of the

populations were the samples are randomly selected. The normality test showed that the population is normally distributed since the significance values for all the variables are  $> 0.05$ . This means that the data is suitable for applying parametric tests. This study was conducted on males only due to cultural differences and parents refused the participation of their daughters so there is no gender comparison.

- **Results:**

The result of this study described as regard to:

- 1- Adam's forward bending test:**

For the forward bending test (FBT) group A showed a higher positive results (41.43%) than group B (17.14%). The results indicated a correlation between a subject in urban location and positive forward bending test result as shown in figure (3). Age 12 years was the age of the highest positive forward bending test positive results with 12.86% in group A and (6.19%) for group B.

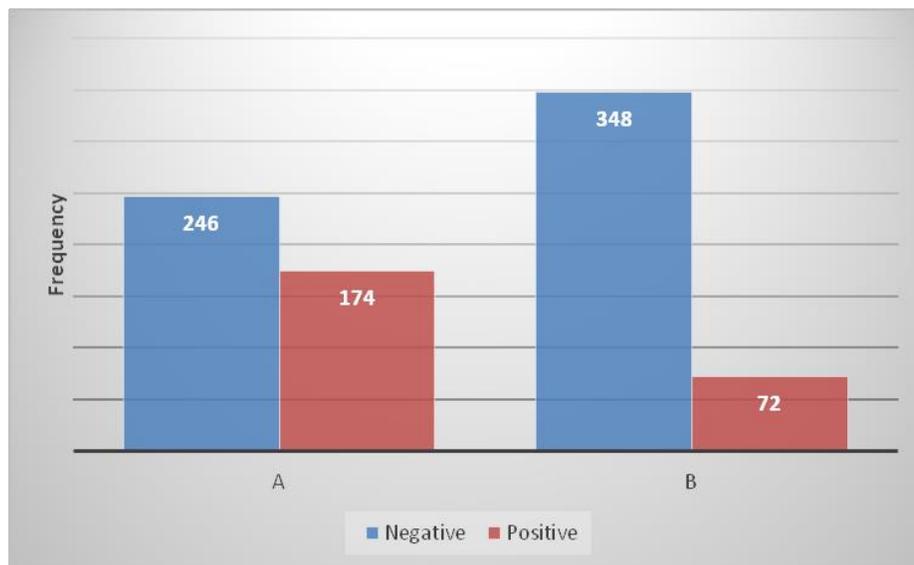


Fig. (3): Frequency values of the forward bending test in both groups (Group A , urban schools and group B, countryside schools).

- 2- Scoliometer HD application:**

The scoliometer HD application readings which (7 or more) showed a significance difference between two groups as group A was (12.61%) and group B was (5%) as shown in figure (4). This means that adolescent idiopathic scoliosis had a higher prevalence between males with the age between 10 to 15 years old in urban schools than in countryside ones. The age of the highest percentage of scoliometer HD readings of 7 or more was the age of 10 years old on the other side in group B the age of 12 years old was the age of the highest percentage. Urban group A has reading (5or 6) percentage was (20.9%). And the countryside group B was (11.42%). This means that the percentage of students who may develop adolescent idiopathic scoliosis in group A were higher than that in the group B. so early detection is of a great value for early treatment and prevention of curve progression.

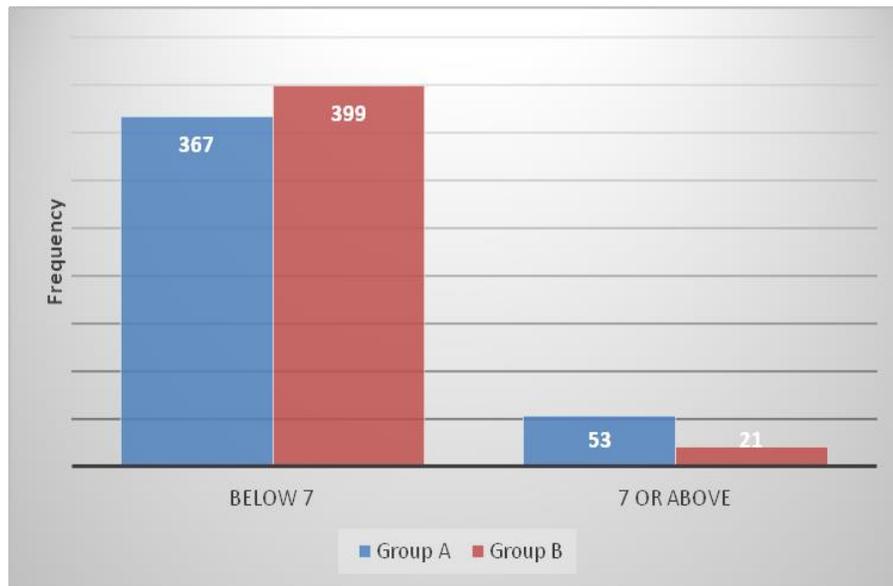


Fig. (4): Frequency values of the Scoliometer HD test in both groups.

### 3- Scoliometer HD readings and curve location.

According to the percentages of the scoliometer HD readings and curve location it was found that , the Scoliometer HD test in each group for (7 or more) reading for urban group were 26.4% lumber, and 73.6% thoracic, and Countryside had 14.29% lumber and 85.71% thoracic with the highest location of prevalence was the thoracic area (table 1) .

and the Scoliometer HD test in each group for (5 or 6) reading the percentages were 31.25% lumber, and 68.75% thoracic for the urban group, and 51.3% lumber and 48.7% thoracic for the Countryside one. So group A with (5 or6) readings highest prevalence location was the thoracic area but the other group (B) was the lumber area (table 2).

**Table (1):** Frequency, P values of the Scoliometer HD and the location groups in group (A and B).

Age	Frequency	Frequency	Chi-square Independency Tests
	Group A 7 or above	Group B 7 or above	
Lumber	14 (26.4%)	3 (14.29%)	
Thoracic	39 (73.6%)	18 (85.71%)	
P-value			0.364

\*Significant level is set at alpha level <0.05.

**Table (2):** Frequency, P values of the Scoliometer HD and the location groups in group (A and B).

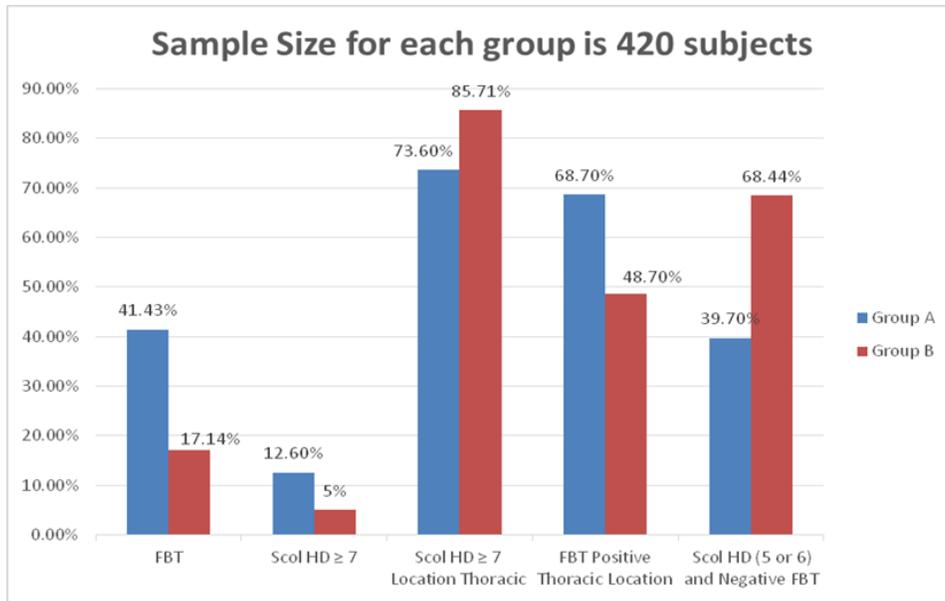
Age	Frequency	Frequency	Chi-square Independence Tests
	Group A 5 or 6	Group B 5 or 6	
Lumber	25 (31.25%)	20 (51.3%)	
Thoracic	55 (68.75%)	19 (48.7%)	
P-value			0.034

\*Significant level is set at alpha level <0.05.

#### **4- Scoliometer HD reading (5 or 6) and forward bending test.**

On the other hand, the within group comparison between the FBT (Negative/Positive) and the Scoliometer test in each group (5 or 6). As for the percentages, Urban group 39.77% negative, and 60.23% positive, and Countryside had 68.44% negative and 31.56% positive. Chi-square test of independence indicates significant relation of FBT in each group. This means urban students had a rib hump appearance (60.23%) even the scoliometer HD reading were (5 or 6), but countryside one develops less rib hump appearance Figure (5).

Moreover, the Urban group was with the highest percentage for the positive thoracic curves (69.81%) when the scoliometer HD application read (5 or 6) and forward bending test was positive and for the countryside group positive thoracic curves were (53.33%).



Figure(5): summarized figure for results.

- **Discussion:**

Scoliosis is a 3-dimensional deformity of the spine and trunk, which affects millions of people worldwide. While 20% of scoliosis cases can be attributed to neuromuscular, syndromic, or congenital disorders, as much as 80% of all scoliosis is termed “idiopathic” or of unknown etiology. Clinical and experimental documentation regarding the theories of etiology support the trend of many possible causes of idiopathic scoliosis [12].

Adolescent idiopathic scoliosis is a common disease with an overall prevalence of 0.47–5.2 % in the current literature. It develops at the age of 11–18 years and accounts for approximately 90 % of cases of idiopathic scoliosis in children [13]

This study was conducted to differentiate between urban and countryside students in the prevalence of adolescent idiopathic scoliosis by the use of a safe, non-invasive and not radiating method to avoid the danger use of x-ray. Eighty hundred and forty student were screened by the use of Adam’s forward bending test and scoliometer HD application after they were divided into two groups. Group A included 420 student who live in urban areas and group B 420 student live in countryside areas.

Physicians should avoid inappropriate use of x-rays for scoliosis screening in school students. New methods should be found rather than x-ray for scoliosis assessment and following up. So after the large spread of smartphones and new touch screens, researchers used it to screen children by using new applications which was designed to detect the degree of trunk rotation [14]. The application was found to be validated, reliable and cost effective tool for screening of scoliosis. It can also replace the expensive Scoliometer device for screening of scoliosis and can be included in school health programs [15].

The evaluative risk is proportional to the growth and initial angulation. So a high Cobb angle at 5 years has a higher risk than that occurs at the age of skeletal maturation. So it is very important to detect and manage aggressive degrees of scoliosis early as much as possible [16].

Scoliosis has a bad effect on cosmetic appearance, quality of life, Psychological well-being, disability, back Pain and breathing function. It may also progress in adulthood and need further treatment. So a multidimensional and comprehensive evaluation of scoliosis patients is necessary to design a complete therapeutic approach before skeletal maturation, so gives a good opportunity for early treatment or prevention of curve progression [17].

The results of this study revealed that there was a significant difference between both groups (group A & group B), with group A (urban schools) had a higher positive Adam's forward bending test results than group B (countryside schools). Age 12 years was the age of the highest positive Adam's forward bending test positive results with 12.86% in group A and (6.19%) for group B. The scoliometer HD application readings which (7 or more) showed a significance difference between two groups as group A was (12.61%) and group B was (5%). This results means that the urban school male students have a higher prevalence of adolescent idiopathic scoliosis. The age of the highest percentage of scoliometer HD readings of 7 or more was the age of 10 years old on the other side in group B the age of 12 years old was the age of the highest percentage.

as well as a higher scoliometer HD (7 or more) reading Thoracic curves were most common in both groups between students of scoliometer HD reading (7 or more). The forward bending positive test was with a higher prevalence in group A in the thoracic area than that in group B. when the scoliometer HD reading was (5 or 6) group B had a higher negative forward bending test result.

This difference may be due to different physical activity level between urban and countryside areas, as countryside students spend more time in playing in streets, running or assisting their parents in the field works as they said during screening when they were asked about their activity of the daily living. On the other side students lived in urban areas when they were asked about their activity of the daily living, asked that they spend their time on touch screens or doing their homework and studying with no or limited time for playing or running or practicing sports. Swimming and football was the most common sport that students in urban areas used to play if they can participate in sports.

The results of this study are agreed with a study was conducted on 1035 Lithuanian school children of 16-19 year old. Screening was conducted on schoolchildren of secondary schools. The aim of the study was to identify the impact of physical activity (PA) of 16-19 year Lithuanian adolescences on their physical health and emotional wellbeing. The city residences were compared with people who lives in small cities and villages. It was found that low physical activity in city residences led to higher posture disorders in city residences when compared to small cities and villages [8].

The results of this study are agreed with a study used the scoliosis research society outcomes instrument to compare between 100 American and Japanese idiopathic scoliosis patients. The scores in the Japanese idiopathic scoliosis population differed from that of the American population. Japanese patients had less back pain, a negative self-image regarding back deformity, higher general physical function, and daily activity. It is highly probable that patient's perceptions differ due to cultural differences. So it was concluded that cultural differences caused different patient perceptions of scoliosis. So more studies comparing between different environments were recommended to identify this differences, study their causes and treat it [18].

The results of this study disagreed with this study which was conducted on swimming sport especially during the first years of life. It was found that exposure to heated swimming pools significantly increased the rate of adolescent idiopathic scoliosis development. It was believed that early chlorine neurotoxin exposure in the vaporization of chlorine in a swimming pool can exacerbate AIS development in younger children [19].

The limitations of this study was the effusion of the parents and girls to participate in that study as screening needed the girls to take of their clothes to expose their back that's due to cultural differences and traditions. So studies on girls is recommended in the future and comparative studied between two genders.

- **Conclusion:**

Adolescent idiopathic scoliosis in males between ages from 10 to 15 years old has a higher prevalence in urban school students than that in countryside schools. The scoliometer HD can detect curves before the progression of rib humps. So prevent the occurrence of vertebral structural changes.

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