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School Screening for Scoliosis among Male Adolescents in Abha City, Southwestern Saudi Arabia

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ABSTRACT

Aim: *To study the prevalence of scoliosis and its associated factors among male adolescents in Abha city intermediate and secondary schools, Aseer Region, Southwestern Saudi Arabia.* ***Methods:*** *Through a cross-sectional study, students were interviewed about personal and demographic data, method of back-bag carriage, and regular practice of any physical exercise. Body mass index (BMI) was measured and student's bag weight/BMI ratio (%) was computed. Screening for scoliosis was performed using inspection of the vertebral column and Adam's Forward Bending Test (FBT). Using scolimeter a reading equal or exceed 5 degrees was considered positive.* ***Results:*** *Out of 417 screened adolescents, 90 students were positive giving a prevalence rate of scoliosis of 19.1% (95% CI: 15.7-23.0). Using multivariable logistic regression analysis, the probability of positive scoliosis was significantly higher in secondary school (aOR=2.304. 95% CI: 1.447-3.676) and obese and overweight (aOR=2.433. 95% CI: 1.565-3.787) adolescents. On the other hand, regular practicing of physical exercises was significantly negatively associated with scoliosis (aOR=0.469, 95% CI: -316-0.695).* ***Conclusion:*** *The present study identified scoliosis as a substantial problem among adolescents. School health authorities need to foster a screening program for scoliosis, particularly among secondary school adolescents. School health promotion programs should address overweight and promote physical exercise to deal with this problem.*

Keywords: Adolescents, Scoliosis screening, Southwestern Saudi Arabia

INTRODUCTION

Scoliosis is a common and relatively slowly evolving condition. Scoliosis in children tends to present as a cosmetic problem, whereas scoliosis in adults more often presents with pain and neurological symptoms [1]. Scoliosis that develops over 10 years old is known as adolescent scoliosis. More than 80% of people with scoliosis have idiopathic scoliosis, and the majority of those are adolescent [2].

The prevalence rates of school children scoliosis vary widely worldwide. A recent study in China in 2016, found a prevalence of clinical scoliosis of 6.5% among school children [3]. A systematic review of 20 studies performed between 1977 and 2011 found a prevalence rate of scoliosis among school children ranging from 1% to 14.8% [4]. Differences in the method of detection targeted age and sex and influences of geography, socioeconomic and environmental factors on human biology may explain this variation [5].

Prompt detection of scoliosis and appropriate management are the secrets to satisfactory outcomes. School screening is a valuable method for the early detection of scoliosis [6]. Numerous methods have been termed for school-based scoliosis screening, and the most broadly described technique is Adam's forward bending test [5,7].

The Aseer region is situated in the southwest of Saudi Arabia. Abha city is the capital of Aseer region. Recently published data regarding the prevalence of scoliosis among school adolescents in Saudi Arabia in general and in Abha city, in particular, are scarce and even lacking. The aim of the present work was to study the prevalence of scoliosis and its associated factors among male adolescent in Abha city schools.

MATERIALS AND METHODS

Design

It is a cross-sectional study.

Target Population

Male intermediate and secondary school age adolescents in Abha City, Aseer Region, Southwestern Saudi Arabia.

Sample Size Determination and Sampling Technique

Using the WHO manual for sample size determination in health study with a conservative anticipated proportion of 6.5% and absolute precision of 3% at 95% confidence interval, the minimal sample size required for the study was calculated to be 260 children [3,8]. Multistage stratified proportional cluster random sample method was followed to select the study population. The stratification factors to be taken into consideration were the relative number of students in intermediate and secondary schools.

Questionnaire Interview

An anonymous questionnaire was distributed for each student. The questionnaire included personal and demographic data, the preferred method of back-bag carriage (any side or always on the back), and regular practice of any physical exercise.

Adolescent's Weight, Height, and School Bag Weight Measurements

Height and weight were taken while the student is standing erect without shoes with minimal clothes. Body mass index (BMI) was calculated. Weight of the child's school bag was measured in kg. Bag weight/BMI ratio (%) was computed.

School Screening for Scoliosis

Screening of students was clinically performed in an isolated place to keep the confidentiality and dignity of the students. Physical examinations, including examination of shoulder asymmetry, scapula prominence, unequal waistline or arm span, and abnormalities involving the trunk or spine, such as humps in the ribs or lumbar regions were performed. The Adam's Forward Bending Test (FBT) combined with the determination of the angle of trunk rotation (ATO) by colorimeter (Orthopedic Systems Inc., Union City, California, USA) were performed while allowing the upper extremities to hang freely with the palms opposed in a relaxed manner [9]. This process took approximately 1 minute for each student. Students with an ATO reading of at least 5 degrees were considered positive for scoliosis screening [10].

Students omitted from the study were either those absent on the day of the visit or those with a parental request not to participate in this study. Permission for the study was obtained from the superintendent of the school district, district school health manager, and the institutional review board at our facility.

Data Analysis

Data were analyzed using SPSS version 18. Prevalence rates were calculated with concomitant 95% confidence intervals (95% CI). To study the factors associated with scoliosis, multivariable binary logistic regression analysis was used. Adjusted odds ratio (aOR) and the concomitant (95% CI) were computed.

RESULTS

Description of the Study Sample

The present study included a representative sample of 471 male students recruited from intermediate (145) and secondary schools (326) in Abha City, during the academic year 2016-2017. The age ranged from 11 to 19 years with an average age of 16.5 ± 1.48 years and a median of 17 years. Most of the parents' educational level of the students was secondary and higher (fathers: 65.6% and mothers: 47.4%, respectively).

Clinical Screening for Scoliosis

Clinical examination (by back inspection, Adam bending test using scoliometer of 5 degrees and more) of the study sample showed that 90 students were positive for scoliosis. These figures gave a prevalence rate of 19.1% (95% CI: 15.7%-23.0%).

Table 1 shows that the prevalence of scoliosis among secondary school adolescents amounted to 19.3% (95% CI: 15.2%-24.0%) compared to 18.6% (95% CI: 12.6%-25.9%) among intermediate school adolescents. Regarding the way of carrying school bag, the prevalence among those children carrying the bag on any side reached 19.4% (95% CI: 15.8%-23.5%) compared to those carrying the bag always on their backs (16.3%, 95% CI: 7.3%-29.7%). The prevalence among overweight and obese school children (BMI of 25 and more) amounted to 19.4% (95% CI: 15.2%-24.2%) compared to 18.8% (95% CI: 12.9%-26.0%) among those with BMI less than 25. As for bag weight to the BMI ratio, the chosen cut off point was the median (22%). The prevalence among those with a ratio of 22% and more amounted to 28.6% (95% CI: 22.7%-35.2%) compared to 11.2% (95% CI: 7.7%-15.8%) among those with a ratio of less than 22. Among those regularly practicing any physical exercise, the prevalence amounted to 18.1% (95% CI: 13.7%-23.3%) compared to 20.4% (95% CI: 15.1%-26.6%) among those who did not.

Table 1 Prevalence of positive scoliosis and their 95% confidence intervals among the study sample

Variable		Number of positive Scoliosis	Prevalence (%)	95% CI
Grade	Secondary	63	19.3%	15.2-24.0
	Intermediate	27	18.6%	12.6-25.9
Carrying school bag	Any side	82	19.4%	15.8-23.5
	Always on back	8	16.3%	7.3-29.7
Overweight and obesity	BMI 25+	61	19.4%	15.2-24.2
	BMI <25	28	18.8%	12.9-26.0
Bag weight/BMI ratio	Ratio of 22% +	61	28.6%	22.7-35.2
	Ratio of <22%	28	11.2%	7.7-15.8
Practicing any physical exercise	Yes	49	18.1%	13.7-23.3
	No	41	20.4%	15.1-26.6
95% CI=95% Confidence Interval				

Determinants of Clinically Detected Scoliosis

After adjusting all variables to each other in a logistic multivariable regression analysis (Table 2), secondary school adolescents had significantly more than twice the risk to develop scoliosis (aOR=2.304. 95% CI: 1.447-3.676) compared to intermediate school adolescents. Similarly, obese and overweight adolescents had more than twice the risk of developing scoliosis (aOR=2.433. 95% CI: 1.565-3.787). On the other hand, regular practicing of any physical exercise was negatively associated with scoliosis (aOR=0.469, 95% CI: -316-0.695).

Table 2 Multivariate determinants of positive scoliosis among the study sample

Variable		Multivariable	
		aOR	95% CI
Grade	Secondary vs. Intermediate	**2.304**	**1.447-3.676**
Carrying school Bag	Any side vs. Always on back	0.565	0.251-1.271

Overweight and Obesity	BMI 25+ vs. BMI <25	**2.433**	**1.565-3.787**
Bag weight / BMI ratio	Ratio of 22% + vs. Ratio of <22%	1.246	0.875-1.776
Practicing any physical exercise	Yes vs. No	**0.469**	**0.316-0.695**

BMI=Body Mass Index, aOR=adjusted Odds Ratio, 95% CI=95% Confidence Interval, Bold OR=Significant

DISCUSSION

Out of 417 students included in the present study, 90 adolescents were positive for scoliosis. These figures gave a prevalence rate of 19.1% with a 95% confidence interval of 15.7%-23.0%. Literature review reported a variation of the prevalence in other countries. A systematic review of 20 studies on school scoliosis screening using FBT found rates ranging from 1% in Turkey to 14.8% in Quebec Canada [4,11,12]. A study in Korea using FBT and scoliometer of 5 degrees and more found a rate of 12.1% [5]. A recent study in Brazil in 2017 using FBT reported a higher figure to our results of 24.3% [13]. In 2014, Ortega, et al., found a prevalence of 14.2% of scoliosis in Mexican school children [14]. The variation found in the prevalence of the various studies may be due to the different methods used.

In our screening of male adolescents' scoliosis, the results revealed that secondary school adolescents were at higher risk for clinically detected scoliosis compared to those in intermediate schools. This result is in consistent with a study in Singapore which described a rising trend in the frequency of scoliosis with increasing age [15]. Similarly, in Germany, a study found the increasing prevalence of scoliosis with age [16]. Also, in a review study, a substantial increase in prevalence and curve of scoliosis among children with increasing age was found [17]. Additionally, in China, a study reported a significant correlation between the prevalence of scoliosis and age [3]. The possibility of developing male adolescents' scoliosis with age, makes the American Academy of Pediatrics recommend performing Adam's test as a screening test at the ages of 10 years, 12 years, 14 years, and 16 years [18].

Obesity and overweight were positively associated with clinically detected scoliosis in the current study. The positive association between obesity and positive Adam's test was reported in a study in Brazil [13]. Another study in Brazil reported an elevated prevalence of postural deviations among obese adolescents [19]. However, other studies observed a negative relationship between body mass index and scoliosis [20-22]. The observed controversy may suggest the presence of other factors not examined and may also affect the development of scoliosis as an ergonomic mismatch in schools at homes [13].

In the current study practicing physical activity in and outside schools was negatively associated with scoliosis. Due to the inherited nature of the cross-sectional study, it is difficult to judge whether practicing physical activity has a protective effect against scoliosis or scoliosis has a negative impact on physical activity participation. Studies showed that physical exercises and sports participation may be reduced among adolescents with scoliosis compared to individuals without scoliosis. The associated loss of flexibility and back pain may explain this [23].

In the other-etiological- direction, McMaster, et al., observed in their case-control study a significant association between adolescent idiopathic scoliosis and lack of physical activity especially in early childhood [24]. Also, a recently published cohort study concluded that reduced physical ability and activity in early childhood is a risk factor for developing scoliosis by the age of 15 years [25]. Study limitations include being a cross-sectional study among males only and lack of confirmatory radiological tests.

CONCLUSION

In conclusion, the present study identified scoliosis as a substantial problem among adolescents in the region. School health authorities need to foster a screening program for scoliosis, particularly among secondary school children. School health promotion programs should address overweight and promote physical exercise to deal with this problem. National wide studies are needed to identify the magnitude of the problem.

DECLARATIONS

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Gummerson, Nigel W., and Peter A. Millner. "(ii) Scoliosis in children and teenagers." *Orthopedics and Trauma,* Vol. 25, No. 6, 2011, pp. 403-12.

[2] Trobisch, Per, Olaf Suess, and Frank Schwab. "Idiopathic scoliosis." *Deutsches Ärzteblatt International,* Vol. 107, No. 49, 2010, p. 875.

[3] Du, Qing, et al. "Scoliosis epidemiology is not similar all over the world: a study from a scoliosis school screening on Chongming Island (China)." *BMC Musculoskeletal Disorders,* Vol. 17, No. 1, 2016, p. 303.

[4] Altaf, Farhaan, et al. "Systematic Review of School Scoliosis Screening." *Spine Deformity,* Vol. 5, No. 5, 2017, pp. 303-09.

[5] Suh, Seung-Woo, et al. "Idiopathic scoliosis in Korean schoolchildren: a prospective screening study of over 1 million children." *European Spine Journal,* Vol. 20, No. 7, 2011, pp. 1087-94.

[6] Komang-Agung, I. S., S. B. Dwi-Purnomo, and A. Susilowati. "Prevalence Rate of Adolescent Idiopathic Scoliosis: Results of School-based Screening in Surabaya, Indonesia." *Malaysian Orthopaedic Journal,* Vol. 11, No. 3, 2017, p. 17.

[7] Renshaw, Thomas S. "Screening school children for scoliosis." *Clinical Orthopaedics and Related Research,* Vol. 229, 1988, pp. 26-33.

[8] Lwanga, Stephen Kaggwa, Stanley Lemeshow, and World Health Organization. "Sample size determination in health studies: a practical manual." 1991.

[9] Côté, Pierre, et al. "A study of the diagnostic accuracy and reliability of the Scoliometer and Adam's forward bend test." *Spine,* Vol. 23, No. 7, 1998, pp. 796-802.

[10] Huang, Shier-Chieg. "Cut-off point of the Scoliometer in school scoliosis screening." *Spine,* Vol. 22, No. 17, 1997, pp. 1985-89.

[11] Ugras, Ali Akin, et al. "Prevalence of scoliosis and cost-effectiveness of screening in schools in Turkey." *Journal of Back and Musculoskeletal Rehabilitation,* Vol. 23, No. 1, 2010, pp. 45-48.

[12] Morais, Thérèse, Michèle Bernier, and Fernand Turcotte. "Age-and sex-specific prevalence of scoliosis and the value of school screening programs." *American Journal of Public Health,* Vol. 75, No. 12, 1985, pp. 1377-80.

[13] Ciaccia, Maria Célia Cunha, et al. "Prevalence of scoliosis in Public elementary school students." *Revista Paulista de Pediatria,* Vol. 35, No. 2, 2017, pp. 191-98.

[14] Ortega, Félix Zurita, et al. "Predictors of scoliosis in school-aged children." *Gaceta Medica de Mexico,* Vol. 150, No. 6, 2014, pp. 533-39.

[15] Yong, Flordeliza, Hee-Kit Wong, and Khuan-Yew Chow. "Prevalence of adolescent idiopathic scoliosis among female school children in Singapore." *Annals Academy of Medicine Singapore,* Vol. 38, No. 12, 2009, p. 1056.

[16] Kamtsiuris, P., et al. "Prevalence of somatic diseases in German children and adolescents. Results of the German Health Interview and Examination Survey for Children and Adolescents, KiGGS)." *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz,* Vol. 50, No. 5-6, 2007, pp. 686-700.

[17] Konieczny, Markus Rafael, Hüsseyin Senyurt, and Rüdiger Krauspe. "Epidemiology of adolescent idiopathic scoliosis." *Journal of Children's Orthopaedics,* Vol. 7, No. 1, 2012, pp. 3-9.

[18] Grivas, Theodoros B., et al. "SOSORT consensus paper: school screening for scoliosis. Where are we today?." *Scoliosis,* Vol. 2, No. 1, 2007, p. 17.

[19] da Silva, Larissa Rosa, et al. "Postural changes in obese and non-obese children and adolescents." *Rev Bras Cineantropom Performance Hum,* Vol. 13, No. 6, 2011, pp. 448-54.

[20] Lonner, Baron S., et al. "Body mass index in adolescent spinal deformity: Comparison of Scheuermann's

Kyphosis, Adolescent Idiopathic Scoliosis, and Normal Controls." *Spine Deformity,* Vol. 3, No. 4, 2015, pp. 318-26.

[21] Qui, Yong, et al. "Body mass index in girls with adolescent idiopathic scoliosis." *Zhonghua wai ke za zhi,* Vol. 46, No. 8, 2008, pp. 588-91.

[22] Nery, Lenice Sberse, et al. "Prevalence of scoliosis among school students in a town in southern Brazil." *Sao Paulo Medical Journal,* Vol. 128, No. 2, 2010, pp. 69-73.

[23] Kakar, Rumit Singh, et al. "Review of physical activity benefits and potential considerations for individuals with surgical fusion of spine for scoliosis." *International Journal of Exercise Science,* Vol. 10, No. 2, 2017, p. 166.

[24] McMaster, Marianne E., Amanda Jane Lee, and R. Geoffrey Burwell. "Physical activities of Patients with adolescent idiopathic scoliosis (AIS): preliminary longitudinal case-control study historical evaluation of possible risk factors." *Scoliosis,* Vol. 10, No. 1, 2015, p. 6.

[25] Tobias, Jon H., et al. "Association between physical activity and scoliosis: A prospective cohort study." *International Journal of Epidemiology,* 2018.