Avaliação da prevalência de escoliose e dor nas costas em alunos do 9º ano de uma escola de polícia militar do estado de Goiás

Evaluation of the prevalence of scoliosis and back pain in 9th grade students of a military police school in the state of Goiás

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ABSTRACT
[Purpose] This study aimed to identify the prevalence of scoliosis and back pain in students enrolled in the 9th grade in a military police school in the State of Goiás. [Methods] A total of 113 students participated in the study, aged between 14 and 16 years. Palpatory methods were used to identify the main points that were marked with stickers highlighting the C7 and S2 vertebrae and the posterior superior iliac spine, which allowed obtaining information about the patient's back using the reports from the Vert 3D topographic system. The parameters presented were compared with the data from the questionnaire administered to the schoolchildren after they were examined. [Results] Among 113 students, 7% exhibited scoliosis. Additionally, 63.3% of boys and 87.3% of girls complained of back pain. The variables used in the statistical analyses investigated the relationship between the presence of pain and scoliosis. [Conclusion] This study

indicated a low prevalence of scoliosis in adolescent schoolchildren and a significant association between sex and back pain, with a higher prevalence of back pain among girls.

Keywords: schoolchildren, posture, exams

RESUMO

[Objetivo] Este estudo teve como objetivo identificar a prevalência de escoliose e dor nas costas em escolares matriculados no 9º ano de uma escola da Polícia Militar do Estado de Goiás. [Métodos] Um total de 113 alunos matriculados no estudo, com idades entre 14 e 16 anos. Métodos palpatórios foram utilizados para identificar os principais pontos marcados com adesivos destacando as vértebras C7 e S2 e a espinha ilíaca posterior superior, o que permitiu obter informações sobre as costas do paciente por meio dos laudos do sistema topográfico Vert 3D. Os parâmetros apresentados foram comparados com os dados do questionário aplicado aos escolares após o exame. [Resultados] Entre 113 alunos, 7% exibiram escoliose. Além disso, 63,3% dos meninos e 87,3% das meninas queixaram-se de dores nas costas. As variáveis utilizadas nas análises estatísticas investigaram a relação entre a presença de dor e escoliose. [Conclusão] Este estudo indicou baixa prevalência de escoliose em escolares adolescentes e associação significativa entre sexo e dor nas costas, com maior prevalência de dor nas costas entre as meninas.

Palavras-chave: escolares, postura, exames

1 INTRODUCTION

Postural problems related to the spine of children and adolescents, such as scoliosis, are currently considered as serious public health issues because the problems that develop in these age groups expose the individual to temporary or definitive morphological deformities. Spine-related diseases may hamper daily activities[1]. Changes in the spine are usually caused by improper postural habits. Some authors advocate promoting back-health education in the school setting [2].

Scoliosis is a lateral deformation of the spine due to factors, such as incorrect posture and limb asymmetry that consequently interfere with the erect posture of the back and may result in pain, difficulty in movement, and an inability to perform daily activities. In this context, scoliosis is characterized by a three-dimensional deformity of the spine, with a lateral inclination in the frontal plane, together with contralateral rotation in the transverse plane and alignment in the sagittal plane. [2]

Araújo, et al. [3] *stated that pain is a warning sign for the body, and when this pain is chronic, the symptoms generate stress and even lead to physical disability.* LBP in schoolchildren is a musculoskeletal discomfort that negatively affects the quality of life of these individuals and persists in adulthood[5]. *Studies by Sedrez, et al. [1] elucidate that back pain has become an issue of concern for public health organizations due to the*

frequency with which it affects people. Thus, posture is an important factor in the health of the musculoskeletal system [6].

Pain can be caused by incorrect postures adopted by schoolchildren as a consequence of spending long periods of time in the seated position, by the excess weight in their backpacks, by their posture when using the computer, as well as by their sleeping postures[4]. Moreover, time spent watching TV and practice (or not) of physical activity may also be associated with the onset of scoliosis or of pain alone. As stated by Rego and Scartoni [5], some biological and behavioral factors influence the alteration of the spine curvature, including heredity, incorrect posture in the classroom, improper ways of carrying objects, stress, and a sedentary lifestyle.

A lack of physical activity, in addition to incorrect body posture, either in the school environment or at home, causes an imbalance in the spinal muscles, leading to abnormal positions of the developing anatomical structures[6]. Appropriate posture results in proper musculoskeletal balance, thereby, protecting the supporting structures of the body against progressive deformities and injuries[7].

The prevalence of postural changes occurring in adolescents is concerning, considering that these issues worsen over time, requiring greater care[8]. Matelli and Traebert [9] state the importance of assessing the curvature and dorsal health status of and emphasize that spinal deformities during adolescence may cause irreversible problems in adulthood. In this way, studies with young elementary school students specified to improve back health through early detection and measures [13]. Döhnert and Tomasi[10] recognize that the aim of the examination in schoolchildren is to identify scoliosis early on, that is, before the progression of the spinal curvature and skeletal maturity.

Asadolescence is considered to be a phase wherein individuals are susceptible to the onset of spinal deformities, it is necessary to develop programs that allow early identification of the change, accessing information, and correction of postural habits. With the detailed study of posture, it is possible to identify changes in musculoskeletal structures, such as increased thoracic kyphosis and pelvic tilts and rotations. The earlier these changes are detected and treated, the greater are the chances are of preventing permanent deformities [12].

The evaluation of posture, curvature, and deviations in the spine is performed by means of standard radiological examination. However, exposure to radiation considerably increases the risks of developing cancer[12]. According to Döhnert and Tomasi,[10] radioactive tests are not recommended for adolescents. In addition to posing health risks,

these tests are quite expensive. Therefore, in our study, we used the technology of structured light stereography without ionizing radiation. In this perspective, this study aimed to determine the prevalence of scoliosis and back pain adolescents to identify associated factors through a questionnaire.

2 METHODS

This was a cross-sectional study. The sample size composed of 113 students (54 boys and 59 girls) enrolled in the 9th grade in the Military Police College of the state of Goiás, aged between 14 and 16 years. This study was approved by the Ethics and Research Committee of the Instituto Federal Goiano Campus Ceres (opinion no. 035/2014), in accordance with CNS Resolution 466/2012. Two copies each of the consent and assent forms were given to the students for authorizing their participation in the study.

The procedures used for data collection consisted of the Vert 3D system technology (MIOTEC, Porto Alegre/BR). The students were taken by bus from the school to the Laboratory of Health and Physical Evaluation of the Instituto Federal Goiano - Campus Ceres, where they assembled in a room and watched documentaries till all children underwent the examination in the order of call **(Figure 1 and 2).**

Figure 01 – Transportation used by the students

Figure 02 – Students waiting to undergo the topographic examination in order of call

The students were subjected to topographic evaluation using the apparatus and methods stated by Marques [12], i.e., the individuals were positioned in an orthostatic posture, with the back exposed, arms relaxed along the body, parallel, and barefoot **(Figure 03)**. Palpatory method was used in order to identify and mark the spinous processes of the C7 and S2 vertebrae with white stickers, as well as the right and left posterior superior iliac spines (PSISs).

The system consists of a computer, a projector, and a camera, coupled to a tower of adjustable height that projects a pattern of structured light on the spine [13] . The equipment used in this research is devoid of any type of ionizing radiation, and the light emitted is a white projection **(Figure 03)**, without any type of laser, and is, thus, inoffensive to the health and well-being of the patient.

Figure 03: Light projected on the back of the patient in orthostatic position, without any type of radiation
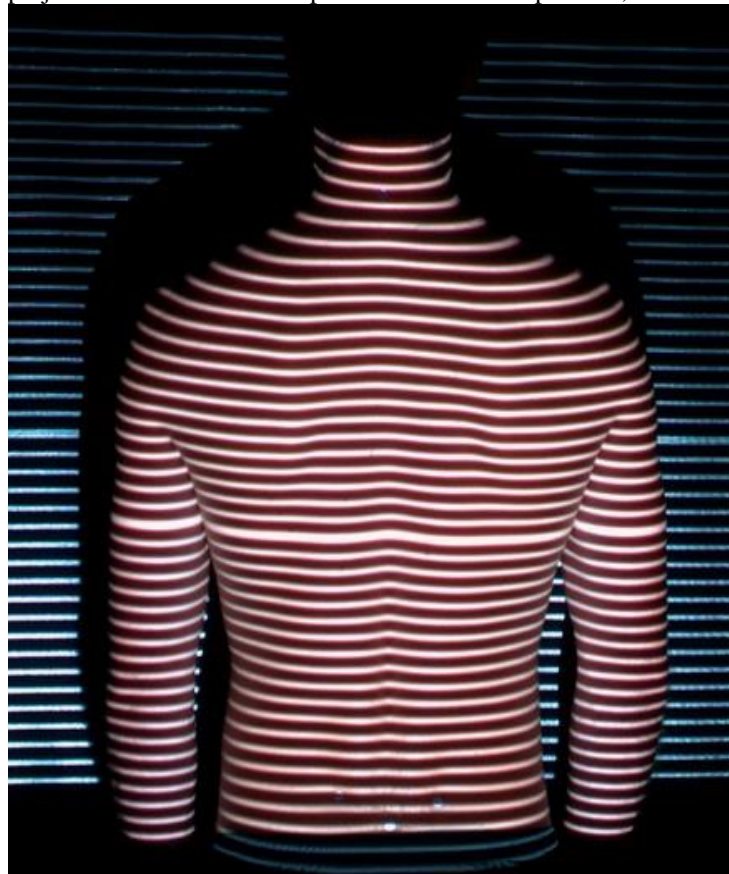
The evaluation consisted of the reflection of a topographic image of the spinal region, indicating reliefs, curvatures, and deviations that precisely diagnose scoliosis in adolescents. After positioning the skin markers (circles of adhesive reflective paper, 1.5 cm in diameter) on the C7, S2 vertebrae and PSISs, the image of the pattern was projected

and captured by the system. The deformation of the projected pattern caused by the relief of the dorsal surface was analyzed by a mathematical algorithm and digitized and converted into a three-dimensional surface through a geometric triangulation process **(Figure 04)**.

Figure 04: Spinal surface three-dimensional topography reproduced using the Vert 3D equipment
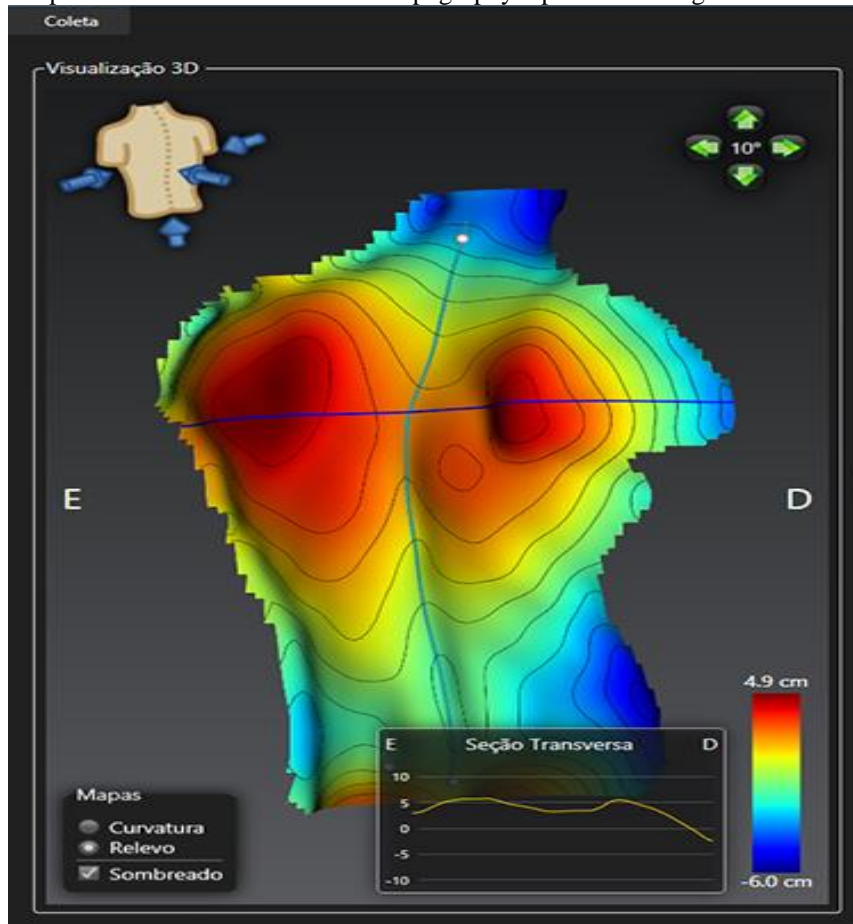
The system also generated graphs and tables that allowed quantifying parameters, such as lateral and anteroposterior trunk imbalance, posterior thoracic wall deformities, lateral inclination of the pelvis, trunk length, rotational asymmetry of the scapulae, and angles of curvatures to be viewed on the surface. Reports of the results of the examination were issued, containing relevant information for the current status of each participant, along with previous tests to evaluate the form and speed of evolution of an eventual clinical intervention.

After analyzing and collecting data on the status of the patient's spine curvature, the Back Pain and Body Posture Evaluation Instrument (BackPEI) [15] questionnaire was administered to obtain information about the patients' spine health status and the

frequency and location of pain. For data analysis, the following variables were considered: practice of physical exercise, sleeping position, habit of reading in bed, time spent in watching TV, presence of pain, type of backpack used, and the adequacy of backpack usage.

Scoliosis was evaluated according to the methodology proposed by Souza Junior et al. [16]. who defined scoliosis as changes in curvature greater than 10º. Thus, schoolchildren who exhibited an angle equal to or greater than 10º were deemed to have scoliosis.

For this analysis, the statistical software SPSS20.0, descriptive statistics, and inferential analysis using the chi-square test with a significance level of 5% were used. At the end, of the study, the reports were printed and provided to the participants with the results of the evaluation.

3 RESULTS

Among the 113 evaluated students, 7% were found to suffer from scoliosis **(Figure 05)**. **Table 01** shows that 4 girls (6.8%) and 4 boys (7.4%) had a spinal curvature with a Cobb angle greater than 10°, with no significant association between gender and scoliosis (p=0.897). Additionally, the study revealed that 31 out of 54 boys (63.3%) and 48 out of 55 girls (87.3%) had back pain. A significant association (p=0.04) was found between gender and the occurrence of back pain.

Table 01: Prevalence of scoliosis and back pain in male and female subjects participating in the study

Gender	Scoliosis (N=113)				Back Pain (N=104)			
	Absence (%)	N Presence N (%)	Total	Value (p)	Yes N (%)	No N (%)	Total	Value (p)
Male	50 (92.6)	4 (7.4)	54		31 (63.3)	18 (36.7)	49	
				0.897				0.04*
Female	55 (93.2)	4 (6.8)	59		48 (87.3)	7 (12.7)	55	

*significant association

Regarding the prevalence of the habits of schoolchildren with scoliosis (8 individuals or 7% of the total sample population; **Table 2**), all participants claimed to practice physical exercise. With respect to the time spent watching television, 3 of these students (9.1%) reported spending 0 to 1 hour of the watching television, 2 students (5.7%), 2 to 3 hours;and 1 student (1.3%), 4 to 5 hours. The remaining 2 students with

scoliosis chose not to answer the question. Regarding the habit of reading in bed, 4 (8.9%) reported reading in bed, 2 (7.1%) denied having this habit, and 2 (5.0%) reported reading in bed only sometimes. Considering the different sleeping positions, 7 (6.3%) students with scoliosis assumed an incorrect posture while sleeping. With respect to the different types of backpacks, 8 schoolchildren with scoliosis (7.1% of the total sample) declared having an adequate type of backpack but only 6 students (5.3%) carried it in the correct way. No significant association was found between these variables and the presence of scoliosis.

Table 02: Percentage of variables used in this study associated with scoliosis

| Variable	Total	Scoliosis		
		N	%	*P*
Practice of exercise (n=113)				
Yes	92 (81.4)	8	8.7	0,161
No	21 (18,8)	0	0,0	
TV/Hours (n=80)				
0 to 1 h	33 (41.3)	3	9.1	
2 to 3 h	35 (43.8)	2	5.7	
4 to 5 h	8 (10.0)	1	1.3	0.925
6 to 7 h	2 (2.5)	0	0.0	
8 h or more	2 (2.5)	0	0.0	
Reading in bed (n=113)				
Yes	45 (39.8)	4	8.9	
No	28 (24.8)	2	7.1	0.784
Sometimes	40 (35.4)	2	5.0	
Sleeping position (n=113)				
Suitable	5 (4.4)	1	0.9	0.420
Inadequate	108 (95.6)	7	6.3	
Backpack type (n=113)				
Adequate	111 (98.2)	8	7.1	0.925
Inadequate	2 (1.8)	0	0.0	
Backpack usage (n=113)				
Adequate	87 (77.0)	6	5.3	0.975
Inadequate	26 (23.0)	2	1.8	

Despite the discrepancy regarding the presence and absence of scoliosis in the students, 79 out of 113 students (76%) reported back pain. Independent variables related to pain indicated that 64 students suffering from back pain (76.2%), practiced physical activities **(Table 03)**. With respect to TV viewing, 22 students (68.8%) spent a maximum of 1 hour. Concerning reading in bed, 32 students experiencing back pain (72.7%), reported this habit. Furthermore, 77 students (77.7%) of those who reported back pain, slept inadequately. Additionally, it was noted that 77 students (75.5%) complaining of back pain, made the correct use of their backpack. Out of those, 58 students (73.4%) still suffered from back pain. Although these variables are important, none of them were significantly associated with the occurrence of pain.

Table 03: Percentage of variables used in this study associated with back pain

Variable	Total	Back Pain		
		N	%	P
Practice of exercise (n=104)				
Yes	84 (80.8)	64	76.2	0.911
No	20 (19.2)	15	75.0	
TV/Hours (n=75)				
0 to 1 h	32 (42.7)	22	68.8	
2 to 3 h	31 (41.3)	22	71.0	
4 to 5 h	8 (10.7)	7	87.5	0.608
6 to 7 h	2 (2.7)	2	100	
8 h or more	2 (2.7)	2	100	
Reading in bed (n=104)				
Yes	44 (42.3)	32	72.7	
No	26 (25.0)	18	69.2	0.284
Sometimes	34 (32.7)	29	85.3	
Sleeping position (n=104)				
Adequate	5 (4.8)	2	75.7	0.137
Inadequate	99 (95.2)	77	77.7	
Type of backpack (n=104)				
Adequate	102 (98.0)	77	75,5	0,724
Inadequate	2 (2.0)	2	100	
Backpack usage (n=104)				
Adequate	79 (76.0)	58	73.4	0.689
Inadequate	25 (24.0)	21	84.0	

Despite the bad habits revealed in this study, it was shown that 93% of the students enrolled in the 9th grade of a military police school in the state of Goiás exhibited normal curvatures. However, 76% of the remaining students reported to suffer from back pain; predominantly female students.

Figure 05: Prevalence of scoliosis in 9th grade students of the CPMEG-2019

■ **Normality** ■ **Scoliosis**
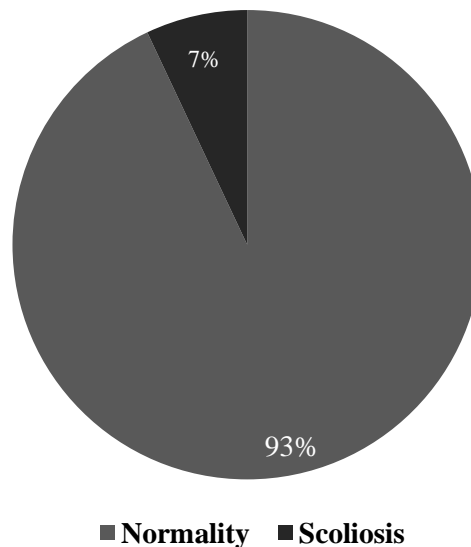
4 DISCUSSION

This study showed a low prevalence of scoliosis in adolescent schoolchildren enrolled in the 9th grade, as well as significant associations between sex and back pain, with a higher prevalence of pain among girls. However, the information presented in the literature justifies the parameters presented and associations of the data with other studies.

Investigations of postural changes and potentially related variables allow the adoption of prevention strategies[17]. However, the studies by Zonnenberg et al. [18] have shown that scoliosis progresses with body growth and may continue into adult life and become severe. Scoliosis is characterized by changes in the spine and schoolchildren are among the main risk groups, precisely because they are going through the growth phase in which the body is in constant transformation[2].

The human body has the formative potential for a good postural condition; this can be altered by the influence of bad habits, which can cause tensions and imbalances in the body's support structures, leading to discomfort and difficulties in locomotion due to pain and difficulties in maintaining the correct posture[19]. The spine is the first structure to be affected by poor postural habits, with the greatest pain complaints being of back pain, which may ultimately prevent the individual from performing daily activities[20].

According to Correa, Pereira and Da Silva,[22] a correct posture results in muscular and skeletal balance and protects the structures against injuries and deformities. An erect posture favors normal kyphosis and lordosis, providing the ideal alignment of the lower limbs for weight support.[11] On the contrary, a skeletal imbalance results in the occurrence of pathologies.[23]

Although this study did not show any significant association between the variables studied above, other studies have shown that these variables can trigger pain and pathologies in the spine. A prolonged time in the seated position while watching TV, for example, causes postural deviations that can damage musculoskeletal structures[24]. Weinstein et al. [25] consider that aesthetic issues and pain are the most common reasons for patients suffering from scoliosis to consult their physicians.

Sleeping position and rest are crucial to the musculoskeletal system. The sleeping position indicated for individuals complaining of back pain is lateral decubitus, which is achieved by placing one pillow under the head and another between the legs. This ensures that the head is at shoulder height and balance is maintained between the hips and the legs [26].

The weight of backpack, how it is supported, and the time spent by students in remaining seated have been reported as causes of scoliosis. Benini and Karolczak [27] state that backpacks should be carried using bilateral support of the straps, and the model considered appropriate in literature advocates the use of two loops. In the present study, all students who exhibited scoliosis were reported to carry their backpacks in a manner that the weight was distributed bilaterally.

Pain is an important warning to the body that something is wrong[3]. Therefore, a prolonged sitting period leads to bad posture and, consequently, to greater pressure on the vertebrae, which may in turn lead to pain, tingling, and other symptoms[6]. The percentage of students with pain in the present study (79 students or 76%) indicates their need for postural re-education, although according to Aktas, Daldal and Senkoylu [28] not all patients diagnosed with scoliosis feel pain.

It is worth mentioning that in the current study there were significant associations between sex and pain (p=0.004), with a higher prevalence of pain among girls (48 girls or 87.3%). Kreling et al. [29] presented similar results, reporting the presence of pain in 61.4% of the participants and stating that the presence of pain predominated in the female students, with a percentage of 69.2%. In an attempt to explain why the female participants were more affected by pain, the study mentions the social role of women and their multiple responsibilities, with pain events being more severe and potentially threatening.

Noll et al. [30] reported results similar to those obtained in the present study. They also emphasized that women were more affected by pain than men (60.1% of women and 48.7% of men). Despite the results of Vitta et al. [31], there were significant differences between genders (p< 0.001), also reporting a higher prevalence of pain in women, with a percentage of 64.4%.

The proportion of patients with of scoliosis in the present study (8 students or 7%) was lower than that found in the study by Ciaccia et al. [32] (24.3%) and similar to that obtained by Souza et al. [33] (4.3%). Scoliosis often develops during adolescence; thus, it is necessary to evaluate posture in this age group because it is still possible to prevent the onset or worsening of the pathology at an early age[34]. In relation to the percentage of scoliosis among boys and girls obtained in the present study (7.4% and 6.8% respectively), it is worth noting that similar studies such as that by Rivett et al. [35] show that scoliosis affects both genders equally.

The findings of the present study indicate the need to adopt correct postural habits, and that pain is a warning sign for the body. Postural education is crucial for adolescents in order to correct and, possibly, prevent scoliosis.

5 CONFLICTS OF INTEREST

The authors declare no conflicts of interest. The study benefits all participants involved in the research.

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