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Prevalence and factors associated with low back pain in school adolescents: a cross-sectional study

Prevalência e fatores associados a dor lombar em adolescentes escolares: um estudo transversal

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ABSTRACT

This study aimed to evaluate the prevalence and factors associated with low back pain in school adolescents. This cross-sectional study was conducted from September to October 2019 at State Professional Education Schools (EEEPs). The target population comprised 286 adolescents aged 15 to 19. Schoolchildren regularly enrolled in the selete schools were included, composing a probabilistic sample. The following questionnaires were applied: The Sociodemographic and Health History, International Physical Activity Questionnaire (IPAQ), Smartphone Addiction Inventory (SPAI-BR), Nordic Musculoskeletal Symptom Questionnaire (NMQ), and Self-Report Questionnaire (SRQ-20). The data was analyzed by descriptive and inferential statistics using the SPSS Statistic program version 23.0 IBM®; the Pearson Chi-square test was adopted in the bivariate analysis. The mean age was 16.24 (± 1.01), with prevailing self-reported brown skin color (53.8%), followed by white color 72 (25.2%), social classes with a predominance of D 150 (52.4%) and E 90 (31.5%). The prevalence of licking pain found was 50.7% (n=157).

A significant association was found between adolescents who are dependent on smartphones (p=0.024), do not sleep well (p=0.000), and those who were suspected of having CMD (p=0.000). A high prevalence of low back pain among adolescents was evidenced, and its association with multiple factors. Therefore, understanding these relationships can be crucial to developing prevention and intervention strategies aimed at adolescents.

Keywords: Adolescents. Back pain. Risk factor.

RESUMO

O objetivo deste estudo foi avaliar a prevalência e os fatores associados a dor lombar em adolescentes escolares. Trata-se de um estudo transversal, desenvolvido entre setembro e outubro de 2019, nas Escolas Estaduais de Educação Profissional (EEEPs). A população-alvo foi composta por 286 adolescentes, de 15 a 19 anos. Foram incluídos escolares regularmente matriculados nas escolas selecionadas, compondo uma amostra probabilística. Aplicou-se os questionários: Sociodemográfico e histórico de saúde; International Physical Activity Questionnaire (IPAQ); Smartphone Addiction Inventory (SPAI-BR); Questionário Nórdico de Sintomas Musculoesqueléticos (NMQ) e Self- Report Questionnaire (SRQ-20). Os dados foram analisados pela estatística descritiva e inferencial pelo programa SPSS Statistic versão 23.0 IBM®, na análise bivariada utilizou-se o teste de Qui-quadrado de Pearson. A média de idade foi de 16,24 (± 1,01), de cor da pele autorreferida parda (53,8%), de classes sociais com predomínio D 150 (52,4%) e E 90 (31,5%). A prevalência de dor lombar encontrada foi de 50,7% (n=157). Verificou-se associação significativa entre os adolescentes que são dependentes do smartphone (p=0,024), não dormem bem (p=0,000) e os que apresentaram suspeita de transtorno mental comum (p=0,000). Foi evidenciada alta prevalência de dor lombar entre os adolescentes, e sua associação com múltiplos fatores. Diante disso, alerta-se para compreensão dessas relações, que pode ser crucial para desenvolver estratégias de prevenção e intervenções direcionadas para os adolescentes.

Palavras-chave: Adolescente. Dor lombar. Fatores de risco.

Introduction

Low back pain, also known as lumbago, is defined as pain or discomfort located below the costal arch and above the gluteal folds. It can affect the cervical region and is classified as mild, moderate, severe, or serious (Chiotto and Koes, 2022). In recent years, low back pain has been identified as a significant public health concern, affecting a considerable proportion of the global population across all age groups (Akbari-Chehrehbargh; Tavafian; Montazeri, 2020). Individuals with low back pain may experience limitations in activities such as dressing, sitting, maintaining an upright posture, walking, cervical rotation, thoracolumbar rotation, upper limb elevation, and lifting or holding objects. In addition to low sleep quality, headache, asthenia, stress, anxiety, and depression (Calvo-Muñoz *et al.*, 2018).

Regarding adolescents, there are few studies that address this health condition. These studies indicate that, of the pathological manifestations that affect the musculoskeletal system in a punctual, systematic, or chronic way in this school-age population, low back pain has been the most prevalent musculoskeletal disorder. Despite the well-documented prevalence of low back pain among adults, this condition in children and adolescents remains underreported (Calvo-Muñoz *et al*., 2018; França *et al*., 2020).

According to data reported by the World Health Organization (WHO) in 2015, low back pain ranked ninth and fourth in children aged 10 to 14 and adolescents aged 15 to 19, respectively, surpassing the prevalence of non-communicable diseases such as cancer and anxiety disorders in this population. Considering these findings, it is imperative to highlight the alarming increase in the prevalence of low back pain in children as they transition from childhood to adolescence (Akbari-Chehrehbargh; Tavafian; Montazeri, 2020).

Despite the paucity of research, the scientific literature indicates that, as in adults, the multifactorial nature of low back pain in children and adolescents may be attributed to behavioral, psychosocial, physical, genetic, occupational, and postural factors. This highlights the biomechanical and neurophysiological nature of this pathology. Considering the aforementioned, it can be posited that a number of variables, including age, gender, sleep quality, level of physical activity, anxiety and depression, heredity, smoking, sedentary lifestyle, excessive use of electronic devices, weight overload due to wearing a backpack and inadequate sitting posture, sitting time, as well as inadequate student furniture, may serve as predictors of low back pain. (Al., 2020; Calvo-Muñoz *et al*., 2018; França *et al*., 2020; López Hernández *et al*., 2020; Sainz De Baranda *et al*., 2020). In this context, it is evident that adolescents in school maintain a routine comprising a series of activities that could potentially act as risk factors for low back pain. Consequently, the objective of this study was to assess the prevalence and associated factors of low back pain in adolescent schoolchildren.

2 Methodology

A cross-sectional, analytical study was conducted as part of the umbrella project entitled "Study of the Relationship between Postural Alterations and Pain in the Region with the Use of Smartphones in Adolescents." The study was approved by the Ethics Committee for Research on Human Beings of the University of Fortaleza (COÉTICA/UNIFOR) under protocol number 3.341.394, in accordance with Resolution 466/12 of the National Health Council.

The study was conducted between September and October 2019 at the State Vocational Education Schools (EEEPs) in Fortaleza, Ceará, with a full-time academic schedule. The target population consisted of 286 adolescents, aged 15 to 19 years old, who were enrolled in the 2019 school year in the selected schools and were distributed across the six Regional Executive Secretariats in the city of Fortaleza. This constituted a probabilistic sample.

Adolescents who did not attend classes on the day of data collection, those diagnosed with scoliosis, fractures or degenerative lesions in the cervical spine, recent traumatic lesions and those with physical disabilities were excluded, as these are factors related to the presence of postural alterations and back pain. In addition, pregnant women were excluded due to physiological changes, and people with visual, hearing and cognitive disabilities were excluded due to the particularities and lack of suitability of the instruments used in the study.

Initially, public schools were selected in two stages. In the first stage, an EEEP was selected by lottery in each regional Executive Secretariat. In the second stage, one class was selected per grade (1st to 3rd of high school), in the morning or afternoon shifts. Prior to commencing data collection, authorization to conduct the research was sought from the school management and then from the high school coordinators, to avoid any disruption to the school's normal operations.

Participants were recruited through lectures in each school, which presented the objectives of the research, the timeline, potential risks and benefits of the study, and the importance of participation for parents/guardians and adolescents. Those present at the lecture were invited to take part in the study by the researchers. Parents'/guardians' authorization was granted by signing the Informed Consent Form (ICF), and adolescents by signing the consent form. Both forms emphasized that each teenager's participation would be entirely voluntary, without compensation, and unrelated to academic performance. Following authorization, the adolescents were subjected to data collection, which occurred in two stages. In the initial stage, they were administered five questionnaires. These were: The data collection process involved the administration of five questionnaires:

1) Sociodemographic questionnaire and health history;

2) International Physical Activity Questionnaire short version (IPAQ);

3) Smartphone Addiction Inventory (SPAI-BR);

4) Nordic Musculoskeletal Symptoms Questionnaire (NMQ) and

5) Self-Report Questionnaire (SRQ-20).

The 28-item Sociodemographic and Health History Questionnaire was developed by the researchers based on the information contained in the National Health Survey (IBGE, 2019). It collects sociodemographic data (age, gender, dominant member, race, who they live with, social class, paternal and maternal education) and health history (sleep characteristics, cell phone use, satisfaction with body weight, general health assessment and visual impairment).

The International Physical Activity Questionnaire (IPAQ) was developed to estimate the level of habitual physical activity of populations in different countries and has been validated in Brazil for use with adults, the elderly, and adolescents. The abbreviated version comprises eight open-ended questions, suitable for use with adolescents, which permit the estimation of the time spent per week on different dimensions of physical activity (walking and physical exertion of moderate and vigorous intensity) and sedentary behavior (sitting). In this study, the level of physical activity was categorized as follows: active (engaging in physical activity for more than 150 minutes per week), irregularly active (engaging in physical activity for between 10 and 150 minutes per week), and sedentary (engaging in less than 10 minutes per week of any physical activity) (Franco *et al*., 2021; Matsudo *et al*., 2001).

The Smartphone Addiction Inventory (SPAI-BR) is a 26-item questionnaire comprising yes/no responses designed to assess cell phone addiction. It has been validated and adapted for Portuguese. The inventory is divided into four subscales that measure the constructs "compulsive behavior," "functional impairment," "withdrawal syndrome," and "tolerance syndrome." The optimal cutoff point for cell phone addiction was determined to be seven points, exhibiting a sensitivity of 90.54% and a specificity of 59.93% (KHOURY *et al*., 2017).

The Nordic Musculoskeletal Symptom Questionnaire (NMQ) was developed by Kuorinka *et al*. (1987) with the objective of verifying the standardization of the measurement of musculoskeletal symptom reports. The instrument was validated in Portuguese (Pinheiro; Tróccoli; Carvalho, 2002) and underwent cross-cultural adaptation by Barros and Alexandre (2003). The NMQ comprises a human figure viewed from the posterior aspect, delineated into nine regions encompassing all the anatomical areas: neck, shoulders, chest, elbows, wrists/hands, lower back, hips/thighs, knees, and ankles/feet. The instrument comprises binary choices related to each anatomical area. It is used to ascertain whether the interviewees have experienced pain in the last twelve months and in the last seven days, as well as to determine whether they have been absent from routine activities in the last year (De Barros; Alexandre, 2003).

The Brazilian version of the Self-Report Questionnaire (SRQ-20) is a 20-item instrument comprising yes/no questions organized into four dimensions. It is designed for the screening of common mental disorders (CMD) and is self-administered, recognized by the World Health Organization (WHO), and validated in Brazil. The cutoff point adopted was 8, as this has been demonstrated to have high sensitivity and a low false-positive rate (De Jesus Mari & Williams, 1986).

In the second stage, an anthropometric assessment was conducted, including measurements of weight and height, to calculate the body mass index (BMI), expressed in kilograms per square meter (kg/m2). The weight of the subjects was measured using a portable Omron digital scale with a capacity of up to 150 kg, calibrated and positioned on a firm surface. The participants' heights were measured using a duly calibrated Macrosul compact portable stadiometer. BMI was classified as either the presence or absence of excess weight in accordance with the table proposed by the World Health Organization (BRASIL, 2017).

The data obtained from the questionnaires and the anthropometric assessment were subjected to descriptive and inferential statistical analysis using the SPSS Statistics software, version 23.0 IBM®. Categorical variables were presented using absolute and relative frequencies, while numerical variables were presented using the mean ± standard deviation (SD). Parametric or non-parametric tests were selected following the Kolmogorov-Smirnov (KS) normality test to assess the relationship between low back pain and associated factors. These tests were also employed to analyze the relationship between the outcome variables (low back pain) and the variables of interest. The Pearson's Chi-squared test was employed, followed by the determination of the odds ratio and its confidence intervals to calculate the measure of association. A significance level of 5% ($p < 0.05$) was adopted.

3. Results

Table 1 illustrates that the target population consisted of 286 adolescents between the ages of 15 and 19, with 153 (53.5%) being male and an average age of 16.24 years (SD ± Most of the sample (53.8%) self-reported brown skin color, followed by white skin color (25.2%), with social classes predominantly D (52.4%) and E (31.5%). The prevalence of low back pain was 50.7% (n=157), 40.2% (n=115) were classified as sedentary, and 23.4% (n=66) were classified as overweight. The prevalence of smartphone dependence was 62.6% (n=179), poor sleep quality ("doesn't sleep well") was reported by 68.2% (n=195), and 52.4% (n=150) had suspected CMD.

Table 1. Distribution of the variables investigated, Fortaleza, Ceará, 2019.

Variables	N	%	Mean + SD
Age			16,24 (± 1,014).
15	80	28,0	
16	90	31,5	
17	88	30,8	
18	22	7,7	
19	6	2,1	
Sex			
Male	153	53,5	
Female	133	46,5	
Self-reported color			
White	72	25,2	
Black	39	13,6	
Yellow	12	4,2	
Mixed	154	53,8	
Indigenous	9	3,1	
Social Class			
A	3	1,0	
B	6	2.1	
C	37	12.9	
D	150	52,4	
E	90	31,5	
Back pain			
Yes	154	50,7	
No	141	49,3	
Level of physical activity			
Sedentary	115	40,2	
Not sedentary	171	29,8	
BMI			
Overweight	66	23,4	
Not overweight	220	76,9	
Smartphone dependency			
Yes	179	62,6	
No	107	37,4	
Sleep well			
Yes	91	31,8	
No	195	68,2	
Suspected CMD			
With suspicion	150	52,4	
No suspicion	136	47,6	

Note: n=absolute frequency; %=percentage; SD=standard deviation; CMD=Common Mental Disorder; BMI=Body Mass Index.
Source: Research data.

The analysis of the relationship between lower back pain and the other variables investigated revealed a significant association with three groups: those who are dependent on smartphones (p=0.024), those who do not sleep well (p=0.000), and those with suspected CMD (p=0.000). The relationship between lower back pain and the level of physical activity among the adolescent sample was not statistically significant (p = 0.374). Similarly, no statistically significant correlation was observed between lower back pain and BMI (p = 0.059).

Table 2. Analysis of the relationship between low back pain and associated factors in adolescents, Fortaleza, Ceará, 2019.

Variables	Low back pain		Crude OR (95%CI)	p-value
	Yes n (%)	No n (%)		
Smartphone dependency				0,024*
No dependency	45 (42,1)	62 (57,9)	1	
With addiction	100 (55,9)	79 (44,1)	1,774 (1,075-2,830)	
Sleeping well				0,000*
Yes	60 (65,9)	31 (34,1)	1	
No	85 (43,6)	110 (56,4)	2,505 (1,492-4,204)	
CMD				0,000*
No suspicion of CMD	85 (62,5)	51 (37,5)	1	
With suspected CMD	60 (40,0)	90 (60,0)	1,400 (0,248-0,644)	
Physical activity level (IPAQ)				0,374
Not sedentary	83 (48,5)	88 (51,5)	1	
Sedentary	62 (53,9)	53 (46,1)	1,240 (0,772-1,992)	
BMI				0,059
No excess weight	108 (49,1)	112 (50,4)	1	
Overweight	37 (56,1)	29 (43,9)	1,323 (0,761-2,301)	

Note: CMD = Common Mental Disorder; BMI = Body Mass Index.
OR*: odds ratio*; 95%CI: 95% confidence interval; Chi-square test; *p<0.05. Source: Research data.

3 Discussion

The objective of this study was to verify the relationship between the prevalence of low back pain and associated factors in adolescents attending full-time school. Low back pain has emerged as a global public health issue, with an increase in prevalence among children and adolescents observed in recent years (Hwang *et al*., 2019; Minghelli, 2017). Studies indicate that approximately 39% of this age group experiences low back pain throughout their lives, with a prevalence similar to that observed in adults (Calvo-Muñoz *et al*., 2018).

Furthermore, the presence of low back pain during childhood and adolescence is associated with an increased risk of manifesting this condition in adulthood (Hwang *et al*., 2019).

A high prevalence was found in the sample investigated. The results are in accordance with the data presented in the existing literature, which indicates a rising prevalence of this condition among the target population in various countries, as evidenced by a meta-analysis study (Kędra *et al*., 2021). In Brazil, there are few studies evaluating the prevalence of low back pain in adolescents. The prevalence of low back pain in this population ranges from 13.7% to 31.6%. This condition is more frequent in females (Lemos *et al*., 2013; Onofrio *et al*., 2012). These results are possibly due to early female puberty and hormonal changes, along with different anatomical and functional characteristics compared to males. Furthermore, it has been observed that boys generally have a higher pain threshold than girls. Additionally, women are more socially acceptable than men when it comes to expressing their symptoms and feelings, which is influenced by social and educational factors (Ben Ayed *et al*., 2019).

Our results indicate a significant association between low back pain and multiple factors. As evidenced in the national and international literature, low back pain in adolescents is associated with a range of factors, including sociodemographic characteristics, physical activity, smoking habits, nutritional status, and school-related conditions. These conditions encompass the way materials are transported, the weight of school bags, school furniture, and other factors. Additionally, the use of electronic devices, such as televisions and computers, has been linked to an increased risk of low back pain in adolescents (Casser *et al*., 2015; Moncer *et al*., 2016). Furthermore, there is a significant association between the use of electronic devices (computer, tablet, and cell phone) and mental health issues (Lemos *et al*., 2013; Moncer *et al*., 2016). However, there is a paucity of Brazilian data concerning the specific association between tablet and cell phone use and low back pain in adolescents. In this context, the present study identified an association between low back pain and smartphone dependence. The findings of this research are corroborated by those of previous studies. As reported by Yang *et al*. (2017), adolescents who utilize smartphones for a period exceeding three hours per day exhibited a 37.4% prevalence of lower back pain. Furthermore, Shan *et al*. (2013) observed in a study involving 3,500 adolescents that 85.4% of the participants used smartphones. Those who used the device for more than two hours per day exhibited a notable increase in reports of pain in the neck, shoulder, and lower back.

In light of these findings, it is crucial to contextualize the dependence on smartphones in the daily lives of adolescents. The multifunctionality of these devices can influence not only the time of use, but also patterns of physical activity, sleep, and social interactions. These factors may be related to spinal health. This is in accordance with the findings of Dervensky, Hayman, and Lynette Gilbeau (2019) and Dervensky, Hayman, and Lynette Gilbeau (2019b). Thus, an understanding of these contexts is crucial for a more complete approach to the relationship between smartphone addiction and low back pain. Another association with low back pain was the suspicion of common mental disorder (CMD). These data corroborate the findings of prior research conducted in Iran (Dianat; Alipour; Asghari Jafarabadi, 2017), New Zealand (Trevelyan; Legg, 2011) and the southern region of Brazil (Lemos *et al*., 2013). It is evident that emotional symptoms are a common occurrence among students, which can be triggered by various factors, such as the context experienced, pressures in the school environment, economic difficulties and relationship issues. There is a growing body of evidence that suggests a link between emotional symptoms and physical manifestations, including an increase in cortisol and changes in hormonal regulation. These alterations have been found to result in inhibitory effects on the immune response, digestion and symptoms of excessive wear and tear on the body. These symptoms include tiredness, fatigue, muscle pain, joint disorders, and reduced physical capacity (Trevelyan; Legg, 2011).

We investigated the relationship between low back pain and sleeping well, where there was a significant association among adolescents who did not sleep well. Previous reports indicate that alterations in sleep have been associated with musculoskeletal pain. However, it should be noted that the correlation between the two does not imply causality. Rather, it suggests a direct relationship in which pain can disturb sleep, and insufficient sleep can intensify pain (Harrison; Wilson; Munafò, 2014). However, the role of sleep associated with pain in adolescents remains poorly understood. Nevertheless, some evidence suggests that sleep problems may represent a risk factor for developing musculoskeletal pain in this population (Roman-Juan; Jensen; Miró, 2023). Therefore, it is important to note that a lack of adequate sleep can have a negative impact on musculoskeletal health, including complaints of pain in the lumbar region.

Investigating the prevalence of low back pain and possible associated factors in adolescents is an emerging and important issue, as it has social and economic implications for both individuals and public authorities (Bento *et al*., 2020). For adolescents, this

condition is associated with a reduction in quality of life, while for the state it results in significant expenses related to treatment and rehabilitation. Due to the physiological changes associated with growth and development, adolescents are more susceptible to developing postural abnormalities and pain in the lumbar spine, which can have a direct impact on their academic performance. Furthermore, adolescents who experience low back pain are more likely to experience pain during their economically active years, which contributes to increased indirect costs, such as absenteeism, a drop in productivity, and early retirement (Silva *et al*., 2016). Consequently, it is imperative to implement preventative measures to mitigate this issue.

The study was limited by the exclusion of private schools, which made it challenging to analyze socioeconomic factors. Furthermore, the restriction of the age group to 15-19 years also represents a limitation. Although these limitations may have an impact on the generalizations of the results, it is believed that the findings of this study will contribute significantly to the ongoing discussion of the subject and encourage future research.

Final considerations

Finally, it is important to note that a high prevalence of low back pain was observed among adolescents. Moreover, our findings indicate a potential correlation between low back pain and various factors, including smartphone usage, sleep quality, and suspected CMD. Considering these findings, it is important to recognize the potential value of further investigation into the relationships between these factors and the development of prevention and intervention strategies aimed at adolescents.

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