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Relationship of Physical Activity and Sedentary Occupation to Headache and Back Pain in 11-15-year-Old Adolescents in Slovakia

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Abstract: *The worldwide COVID-19 pandemic, as well as the increase in the use of technological devices, has greatly affected the education system, leading to increased sedentary behaviour among students due to prolonged computer use and limited physical activity. This article examines the increase in headaches and back pain (affecting any part of the back) among Slovak children and adolescents, exploring the relationship between these problems, physical activity and sedentary lifestyles. The representative sample consists of 12 randomly selected primary schools in Slovakia. The data were collected from 888 children and adolescents aged 11-15 years. Subjective data on the prevalence of headache and spinal pain during physical activity and sedentary activities were obtained using a questionnaire survey. The parametric Spearman's correlation coefficient was used to determine the relationship between these variables. The findings reveal a high incidence of pain among respondents, with 99.1% of children experiencing headaches daily or occasionally and 97.5% reporting spinal pain. Additionally, 74.5% engage in physical activity at least three times per week. When analyzing the relationships between pain indicators, we observed a statistically significant correlation at the 1% level, although the association was weak. Specifically, we found a significant relationship at the 1% level between headaches, physical activity, and the amount of time spent playing computer games. However, no significant relationship was found between back pain and either physical activity or sedentary activities.*

Keywords: *headache; physical activity; spinal pain.*

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Introduction

The aim of this study was to investigate the prevalence of headache and back pain in Slovak children aged 11 to 15 years. Since physical activity is a strong factor that may influence these pains, we also investigated the relationship between the prevalence of these pains and the relationship between pain and the level of physical activity, as well as sedentary occupation. Musculoskeletal disorders are a significant problem in modern society, particularly affecting young people and school-aged children. Poor ergonomic conditions, excessively heavy school bags, age-inappropriate school furniture, poor posture, sedentary habits and reduced physical activity are contributing factors. Physical activity is considered a key factor in reducing pain in any part of the spine (Hochheim et al., 2002; Bailly et al., 2022)

The COVID-19 pandemic, but also the increase in the use of modern technology, has changed lifestyles around the world, leading to a significant increase in back pain in people with limited physical activity. Persons with musculoskeletal pain often report limitations in daily functioning due to pain. Recently, the World Health Organization (WHO) in its International Classification of Function, Disability and Health (ICF) recommended that patients with musculoskeletal pain should prioritize "level of daily activity" to improve function and quality of life (Antonaci et al., 2014).

Low back pain, which is a significant global health problem, often begins at an early age. Children who experience low back pain are more likely to suffer from chronic low back pain in adulthood, highlighting the importance of prevention in childhood and adolescence for long-term benefit (Feldman et al., 2001). Some studies report a lifetime prevalence of low back pain of up to 84%, with approximately 23% of the population suffering from chronic low back pain and 11-12% currently experiencing low back pain. This widespread problem affects work performance with potential long-term social and economic consequences (Balagué et al., 2012; Garcia et al., 2014).

Physical activity during free time is thought to help prevent back pain; however, high-quality systematic reviews and meta-analyses to substantiate this are lacking (Shiri & Falah-Hassani, 2016; Heuch et al., 2016). Since many musculoskeletal issues begin in childhood, it is essential to identify preventive measures early. Numerous factors influence the development of these disorders, including obesity, sedentary occupations, lack of exercise, socio-economic conditions, and individual characteristics (such as gender and age).

Video games are a form of recreational activity characterized by sedentary behavior and repetitive upper limb movements. When performed excessively, these movements can lead to overuse injuries, and a sedentary

lifestyle is a known risk factor for musculoskeletal disorders (Tholl et al., 2022).

Physicians may not always be able to pinpoint the exact cause of back pain, and conservative treatment often resolves back pain in adults. However, much less is known about the prevalence and incidence of back pain among children and adolescents. Some studies have explored the overall incidence of back pain in this age group, with current literature indicating that a relatively high number of children experience back pain, though few seek medical attention for it (Howard, 1999).

Headaches and back pain are commonly associated, often beginning in childhood but peaking during puberty, with girls developing headaches earlier due to earlier adolescence (Lardon et al., 2014; Jeffries et al., 2007; Feldman & Keating, 2009; Kjaer et al., 2011; Calvo-Munoz et al., 2013). The highest incidence of headache was reported during primary and secondary school.

Numerous studies indicate that headaches are among the most common health issues in childhood, with approximately 75% of children experiencing significant headaches by age 15. This includes migraines, affecting up to 28% of teenagers. Headaches are the third leading cause of school absenteeism, causing considerable psychosocial impact in pediatric patients (Abu-Arafeh, 2014; Antonaci et al., 2014; Faedda et al., 2016; Mazzotta et al., 2005; Wöber-Bingöl, 2013; Lemes et al., 2021).

Headaches are often affected by puberty, especially in girls. A significant increase in recurrent headaches occurs around the age of 12 years, and often these pains are related to the menstrual cycle (Kröner-Herwig & Vath, 2009).

Fearon's research examines headaches across both childhood and adulthood, concluding that childhood headaches are a major predictor of persistent headaches in later life (Fearon & Hotopf 2001). Headaches are a significant global health burden, severely impacting the quality of life for children, adolescents, and adults. In 2013, an analysis of 64 cross-sectional studies from 32 countries, involving 227,249 participants, estimated an overall headache prevalence of 54.4% and a migraine prevalence of 9.1% (Wöber-Bingöl, 2013). Other studies report that headache prevalence among adolescents is around 60% (Abu-Arafeh, 2014).

Research on adolescents in Amsterdam found a strong association between headaches and stress in a sample of approximately 2,300 students aged 10 to 17 years. More than 15% reported weekly headaches, with fear of incompetence and school-related problems being the most common stressors.

Menstruation was found to have minimal effect on the frequency of headaches in girls.

Several older studies suggest that exercise may reduce the frequency or severity of migraine attacks. One study involving 56 headache patients (aged 17–64 years) and 145 similarly aged controls without chronic headaches found that those with headaches were generally less physically active. However, there was a significant difference between patients' self-reported activity levels and objective physical fitness test results (Neusüss et al., 1997).

As already mentioned, headaches and back pain are global health issues. According to the findings of the Global Burden of Disease project (GBD 2016 Headache Collaborators, 2018), headaches—particularly migraines and tension-type headaches—rank among the leading causes of health-related problems worldwide. These findings are supported by numerous studies conducted within the Global Burden of Disease project.

As professionals involved in the long-term education of children, adolescents, and adults, we are aware that headaches and back pain can significantly impact quality of life, school performance, mental well-being, and the social behavior of young people. Addressing these health problems requires a targeted approach and collaboration among various experts, as it is a multifactorial issue that affects the health of the entire population.

Research in this field helps to understand the links between lifestyle and the occurrence of pain and, at the same time, allows us to identify risks and implement preventive measures to reduce them. While many existing studies examine back pain, headaches, physical activity, and sedentary behavior separately, our contribution aims to offer a new perspective by exploring their common factors. We emphasize the importance of physical activity as a key factor in the prevention and mitigation of these health problems, within the context of a holistic lifestyle approach.

This paper responds to recent researches published in various renowned international journals (e.g. *The Lancet Neurology*, *Spine*, *Journal of Headache and Pain*, *Journal of Adolescent Health*, *BMC Musculoskeletal Disorders*, *American Journal of Preventive Medicine*, *International Journal of Environmental Research and Public Health (IJERPH)*, *Archives of Disease in Childhood*, *Journal of School Health*), many of whose authors and findings are referenced in this contribution.

Methodology

Data for this study were drawn from the **Health Behaviour in School-aged Children (HBSC)** study, conducted in Slovakia in 2018, prior

to the onset of the COVID-19 pandemic, ensuring that the results were not influenced by pandemic-related factors.

Research Design: We used a cross-sectional design with the collection of quantitative data through the standardized HBSC (Health Behaviour in School-aged Children) questionnaire.

Study Respondents: A total of 888 adolescents from grades five to nine from 12 elementary schools in Slovakia participated in the survey, focusing on students aged 11 to 15 years (mean age = 13.97; SD = 1.20; 56% boys / n = 498; 44% girls / n = 390).

Inclusion Criteria: Informed consent from parents, voluntary and anonymous participation, and no explicit incentives were offered for participation. Participants had no acute hospitalization, and they were capable of completing the questionnaire independently.

Exclusion Criteria: Parental disagreement with participation in the survey.

Data Collection: A standardized questionnaire with closed questions on an ordinal scale was used, where respondents selected one answer from the provided options, which were arranged according to frequency or range. This type of question allows for quantitative data processing and comparison between groups. The questionnaire included validated scales to assess the intensity of back and head pain, as well as questions regarding the frequency and duration of physical activity in accordance with World Health Organization (WHO) recommendations. The questionnaire was distributed electronically through secure platforms.

Ethical Considerations: The study was approved by the Ethics Committee of the Medical Faculty at P.J. Šafárik University in Košice (approval number: 16N/2017) and the Ethics Committee of the University of Constantine the Philosopher in Nitra (approval number: UKF-2020/1355-1:191013).

Data Analysis: In analyzing the data, we first used descriptive statistics to summarize the sample characteristics. To assess the relationship between pain intensity, physical activity levels, and sedentary activities, the Spearman correlation coefficient was applied according to the results of the normality test. Statistical processing of the data was conducted using SPSS software. The significance level was set at $p < 0.05$.

Results

Pain issues are prevalent among children and adolescents, presenting a significant public health concern. Most studies assessing recurrent or chronic

pain in this population have primarily focused on describing the intensity and duration of the pain. However, there is a lack of clear correlation between these pain experiences and other factors, such as physical activity or sedentary behavior.

Table 1: Total level of pain

	Valid		Missing		Total	
	n	***Percent***	***n***	***Percent***	***N***	***Percent***
you had a headache	880	99,3 %	8	0,7 %	888	100 %
your back hurt	866	97,3 %	22	2,7 %	888	100 %
your physical activity	874	73,4 %	12	26,6 %	888	100 %
watching TV	879	74,4 %	9	25,6 %	888	100 %
game on PC	878	37 %	10	63 %	888	100 %

Table 1 shows a high incidence of reported pain among children aged 11 to 15. A staggering 99.1% of the children acknowledged experiencing either daily or occasional headaches, while 97.5% reported having experienced back pain. Additionally, 74.5% indicated that they currently engage in exercise at least three times a week. Notably, 74.4% of respondents reported watching television for two hours or more each day. Although 37% of respondents reported spending at least two hours playing computer games, it is significant that 6.6% stated they played for five hours or more.

Table 2: Prevalence of Headaches and Back Pain by Gender

		gender	
	occurrence of pain	**boy**	**girl**
about every day	% you had a headache	1,2%	3,6%
	% your back hurt	5,2%	7,3%
more than once week	% you had a headache	4,3%	13,9%
	% your back hurt	6,2%	8,4%
about every week	% you had a headache	11,0%	16,5%
	% your back hurt	8,7%	9,7%
about every moon	% you had a headache	24,0%	22,4%
	% your back hurt	18,8%	15,2%
rarely or never	% you had a headache	59,5%	43,7%
	% your back hurt	61,2%	59,4%

An analysis of pain frequency revealed that boys reported experiencing pain more frequently than girls. Headaches were noted at least once a month by **118 boys (24%)** and **87 girls (22.4%).** When considering daily occurrences of pain, **back pain** emerged as the most commonly reported issue for both sexes, with **25 boys (5.2%)** and **28 girls (7.3%)** indicating they experienced it on a daily basis.

Table 3: Non-parametric Spearman's correlation coefficient (n=862)

		you had a headache	your back hurt	physical activity	watching TV	game on PC
you had a headache	Correl.coeff.		,251	,101	0,014	,101
	Sig. (2-tailed)		**,000****	**0,003****	**0,675**	**0,003****
your back hurt	Correl.coeff.	,251		-0,065	-0,052	-0,031
	Sig. (2-tailed)	0		0,057	0,126	0,36

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 presents the degree of association between headaches, back pain, physical activity, and sedentary behaviors, including watching TV and playing computer games. All relationships among these variables were statistically significant at the 1% level. However, the correlation coefficients (rs or srs) were not close to 1 for any indicator, suggesting a weak association between the occurrence of individual pain types. Notably, a statistically significant relationship was observed between headaches, physical activity, and the amount of time spent playing computer games. In contrast, no significant correlation was found between back pain and physical activity or sedentary behaviors, such as watching TV and playing computer games. When analyzing the correlation by gender, it became apparent that sex does not influence the relationship between headaches and back pain. The correlation coefficients remained low across the board, further indicating a weak dependence between the variables.

Discussion

Our study yielded results consistent with those reported in other research. We concur with previous studies (Antonaci et al., 2014; Faedda et al., 2016; Mazzotta et al., 2005; Wöber-Bingöl, 2013; Varkey et al., 2008) indicating that headaches are among the most common types of pain experienced during childhood. Our findings revealed that up to 99.1% of children report experiencing headaches—a highly alarming statistic, especially considering that

such problems may persist or worsen over time. The estimated overall incidence of migraine in our sample was 54.4%, with an average prevalence of 9.1%. Similarly, other studies suggest that the prevalence of headaches among children can reach up to 60% (Abu-Arafeh, 2014). Headaches are often associated with back pain, which our results also confirm. We therefore agree with other research findings (Feldman et al., 2001; Heneweer et al., 2011; Hill & Keating, 2009; Kjaer et al., 2011; Calvo-Munoz et al., 2013) that suggest a correlation between headaches and physical activity levels. Our study supports this connection, and similar associations were identified in the work of other authors (Neusüss et al., 1997).

In 2016, a study conducted among children aged 8 to 12 in Bosnia and Herzegovina found that 48% of participants experienced musculoskeletal pain. Shoulder and acute neck pain were significantly linked to prolonged sitting, either at school or at home in front of a computer. Moreover, acute neck and back pain showed strong correlations with the weight of school bags and the amount of time spent on homework (Azabagic et al., 2016).

A separate study published in 2022 examined the impact of video gaming on musculoskeletal health. Among the 16 studies analyzed (from 2021 to 2022), 11 reported statistically significant negative effects of a sedentary lifestyle caused by video gaming. The most commonly affected areas included the neck (n = 4), shoulders (n = 4), and back (n = 3). Notably, 10 of these studies linked musculoskeletal disorders directly to the duration of video game play (Tholl et al., 2022). However, four studies found no such changes, and one found no relationship between video game duration and musculoskeletal health.

Further evidence highlights the protective role of physical activity. In study Lemes et al. (2021) found that physically active individuals were 33% less likely to suffer from lower back pain compared to those who were insufficiently active. A significant association was noted among active individuals who sat for less than three hours per day; no such association was seen in those sitting for longer periods. Balagué et al. (2012) reported back pain in 23.6% of competitive athletes and 15.8% of recreational athletes (Varkey et al., 2008).

Despite previous strengths, recent findings show a concerning decline in physical activity. Slovakia once ranked among the top ten countries with the highest levels of regular physical activity in children aged 11–15 (Inchley et al., 2016). In 2018, nearly 30% of children were active for at least one hour per day (Hochheim et al., 2002; Hendrick et al., 2011; Soysal et al., 2013).

In 2020, a study investigated whether a low level of physical activity influenced muscle strength in the lower body and postural control among

individuals with and without non-chronic lower back pain. Twenty-four participants (mean age 28.8 ± 5.9 years) were studied, and findings suggested that sedentary behavior could be a significant risk factor for impaired postural control and weakened hip muscle strength—both critical for neuromuscular function (Alsufiany Muhsen et al., 2020).

Research published in 2019 involving 60,134 adults aged 16 and older from England and Scotland (collected from 1994–2008) found a correlation between the total volume of physical activity and the prevalence of chronic back diseases (Alzahrani et al., 2019). However, the relationship between different types of physical activity and chronic spinal conditions at the population level remains insufficiently understood.

In 2011, studies noted the inconsistent association between physical activity levels and back pain in cross-sectional designs. One study reported improvements in low back pain outcomes with increased leisure activity, while another linked lower sports activity to greater pain and disability. Nevertheless, no clear correlation was found between overall activity level and back pain or disability in 10 other studies (Heneweer et al., 2011).

A 2013 study assessed physical activity levels among patients with chronic lower back and neck pain. The study included 32 pre-operative patients, 32 outpatients, and 32 healthy individuals. Results showed statistically significant differences in disability, sleep quality, depression, physical activity, and quality of life across the groups ($p < 0.05$). Pre-operative scores were significantly worse, particularly in physical activity and quality of life, compared to healthy controls (Soysal et al., 2013).

While some evidence shows a relationship between back pain and an inactive lifestyle, our findings do not entirely align with studies that have identified a strong connection between general physical activity and chronic back disease (Gordon & Bloxham, 2016). It is likely that the unclear or weak associations may stem from the multifactorial nature of back pain, which can be influenced by other unhealthy lifestyle factors, especially during adolescence.

In conclusion, the results of our research on a sample of 888 respondents aged 11–15 are in line with those of other authors studying similar issues. It is highly probable that the COVID-19 pandemic exacerbated these problems—raising significant concern for the healthy development of today's youth.

Our findings can contribute at the international level to the education of professionals by highlighting the need for a holistic approach in the prevention and treatment of these health issues. Furthermore, they can serve as support for the development of new educational programs in the fields of health, physiotherapy, sports medicine, as well as multidisciplinary prevention.

At the same time, we provide scientifically grounded recommendations, opinions, and research from various authors around the world, making them applicable across different cultures and enhancing the universal applicability of the results. This approach aligns with current trends in health education, which emphasize the connection between theoretical knowledge and targeted intervention strategies.

Conclusion

We found a high incidence of pain among children aged 11 to 15 years, particularly associated with passive leisure activities, as nearly three-quarters of the children reported engaging in sedentary activities for two or more hours per day. Pain was observed more frequently in boys than in girls, although girls were predominantly affected by back pain.

Headaches were linked to a lack of physical activity and increased sedentary behavior. While we did observe some gender differences, they were minimal, indicating that the differences were not significant in our results.

Based on our findings, we recommend conducting further research while attempting to control for as many influencing factors as possible. This could help promote the healthy development of the adult population of children.

Additionally, it would be valuable to investigate the impact of the COVID-19 pandemic, as many children spent a significant portion of their day engaged in sedentary activities on computers, whether during mandatory schooling or leisure time.

In this paper, we present a new perspective on spinal and head pain, highlighting physical activity as a common significant factor. These findings complement existing knowledge, which is primarily focused on isolated aspects and does not address the issue in a comprehensive manner.

The results may contribute to new international research, spark discussions on solutions to musculoskeletal and neurological pain, and have the potential to influence preventive health interventions not only in Slovakia but also in all countries affected by this issue.

In contrast to previous studies, we focused on a comprehensive view of spinal and head pain, physical activity, and sedentary behavior, and identified new relationships between these variables.

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Limits of research

The presented research focuses on a highly important topic with broad international relevance. This study provides valuable insights into the prevalence of pain and its association with physical activity and sedentary behaviour among Slovak adolescents aged 11 to 15. However, several limitations must be taken into account, as they affect both the validity of the findings and the extent to which they can be generalized.

One significant limitation is that the results are based on data from a specific and limited population with a particular cultural, economic, and social environment. Therefore, caution is needed when generalizing the findings to other countries with different lifestyles, cultures, and resulting life habits. Cultural, educational, and societal differences may substantially influence both the perception of pain and behaviour patterns in children and adolescents. Although the sample included schools from both rural and urban areas, the results cannot be fully generalized to all regions of Slovakia. Nevertheless, we believe that our findings may serve as a starting point for further international research in this area.

Another key limitation is methodological, as the data were collected through self-administered questionnaires. While this method is suitable for capturing subjective experiences and behavioural tendencies, it is also prone (especially when distributed via online platforms) to potential biases—such as misinterpretation of questions, socially desirable responding, or inaccurate estimations of physical activity and time spent in sedentary behaviours.

Furthermore, the data collection took place before the COVID-19 pandemic. As pandemic-related measures likely had a significant impact on the movement patterns of children and adolescents, this may limit the current relevance of the findings.

Despite these limitations, the study offers an original and valuable contribution, particularly in its focus on the relationship between headaches and back pain in the context of physical activity and digital behaviour (such as television viewing and video gaming) among Slovak adolescents. This specific combination of variables has not yet been thoroughly examined in previous Slovak studies. An additional noteworthy aspect is the gender perspective—although gender differences were minimal overall, the study recorded a slightly higher frequency of reported pain among boys, which contrasts with findings from some other research. The study thus provides a relevant foundation for future investigations into postural health and the promotion of healthy lifestyles among adolescents.

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