



Postural Habits and Related Joint and Muscle Pain Among School-age Students: A Cross-sectional Study

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Abstract

Background and aims: Current lifestyles, with the growing use of contemporary technologies, have resulted in changes in people's behavior, causing them to become increasingly sedentary and develop unhealthy body habits. Posture is an essential variable determining an individual's physical and emotional well-being. The purpose of this study was to investigate postural habits and any related joint and muscle pain among school-aged students.

Methods: An online questionnaire was utilized to measure participants' postural habits and related joint and muscle pain. The questionnaire was completed by 43 660 school-aged students (15 532 boys and 28 128 girls in the age range of 8-17 years) by a non-randomized convenient sampling method through Google Forms via social media on the schools' platform in Chaharmahal and Bakhtiari province, Iran, in the middle of 2022. The questionnaire inquired about body postural patterns and any associated joint or muscle pain.

Results: The majority of participants (77%) reported spending most of their time in the sitting position. Overall, 57% of the students reported that they did not maintain the correct posture during their daily activities. The majority of respondents (54%) reported feeling some joint or muscle pain. The greatest pain was reported in the neck (28%), upper back (14%), and lower back (13%).

Conclusion: The findings indicated that schools and the medical profession may need to screen students for health risks such as poor postural status. Further, information related to bad posture should be provided to children, their families, and healthcare professionals to take care of them.

Keywords: Musculoskeletal pain, Sitting position, Public health, Injury prevention, Corrective exercises

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Introduction

Sedentary people spend most of their days sitting or lying down, reading, talking, watching television, or taking virtual classes on their phone or computer.^{1,2} Individuals find it challenging to be physically active and maintain good posture as a result of the rising use of electronics and associated keyboard activity.³ According to studies, there is an increasing need to treat postural difficulties and musculoskeletal disorders caused by excessive use of technology.^{3,4}

Individual posture is an essential aspect influencing human physical and mental health throughout the life span.⁵ Some factors influence human posture, including genetics, anatomical structural deficits, postural habits, and occupation.⁶ Posture is the position taken by the body with support during muscular activity or as a result of a coordinated action by a set of muscles working together to preserve stability.⁶ The way people present themselves in a stance is referred to as "static posture". The ability to maintain posture while completing functional tasks is referred to as "dynamic posture".⁶ The postural deviation

is defined as any deviation from the ideal posture.⁷ When a person has good posture, the body's alignment is balanced, resulting in less stress on anatomical body parts.^{8,9} When a person's posture is poor, body alignment suffers, causing excessive strain on various body parts.⁸ These postural deviations and forms can be found in all categories of life, and statistics show that the prevalence of poor posture is increasing.⁷ Even at low levels of bad posture, the continuous stress generates anatomical modifications over time.⁵ The ability to work and perform correct movement patterns pain-free is impacted by these changes.^{8,10} Healthcare professionals frequently examine both static and dynamic postures in order to guide treatment (e.g., by providing a baseline assessment of movement quality and/or musculoskeletal dysfunction).^{8,11}

Strong evidence exists to support the necessity of improving and monitoring the quality of children's postural habits.^{3,12} When muscle length is altered as a result of misalignment (i.e., poor posture), tension development is reduced, and the muscle is unable to deliver enough force to provide effective and efficient

movement.⁶ In children and adolescents, a systematic review represented a link between sitting posture and upper quadrant musculoskeletal pain.¹³ In addition, there are many different habits used in the home in addition to sitting posture that could eventually affect the spine and contribute to bad posture.⁷ The assumed position may place parts of the body at the very end of its range of motion and may cause some muscle imbalances and postural changes.⁷ Identifying if these modifiable household habits are linked to postural deviation could aid in the development of preventative methods¹⁴; early adulthood is crucial in the development of appropriate body behaviors and postural habits, which will help reduce postural problems and their repercussions later in life.¹²

The pubertal growth spurt is a critical stage in the process of postural genesis.¹⁵ Growing children often experience postural deformities as a result of poor postural habits that have developed over time.¹⁶ Although most of these postural abnormalities occur gradually, they can be identified after a few years.¹⁷ These defects may progress into structural deformities (i.e., idiopathic scoliosis) if left untreated, which could have an impact on a child's mental health and acceptance of one's own body image.¹⁵ In light of the available knowledge, there seems to be no doubt that children with postural defects should receive comprehensive care.³ However, there is little knowledge about the poor postural habits of developing children, despite the possibility that risk factor identification may facilitate their elimination.^{16,18} To design a preventative and educative program, it is crucial to identify postural abnormalities and musculoskeletal risk factors early. Therefore, the goal of this study was to look into students of school age's habitual postural positions and any associated joint and muscle pain.

Materials and Methods

The study comprised a cross-sectional online questionnaire distributed on May 20, 2022, and ended on June 5, 2022. Iranian school-aged students of both genders in Chaharmahal and Bakhtiari Province were invited to participate in the study. The questionnaire was sent out anonymously and electronically using Iran School's "Shad" social media platform. This study received ethical approval from the Iranian Ministry of Education's Department of Physical Education and Health. All participants were informed about the study's goals and provided electronic consent for inclusion. All participants were under the age of 18. A written informed consent form was attached to the screening questionnaire to obtain parental consent in advance of data collection. The exclusion criteria were any history of injury or trauma that caused joint or muscle pain. In this study, "school-aged students" refer to students who are in school and have not finished high school yet (ages 7-18).

The target population was recruited by a non-randomized, convenient sampling method and was representative of students available on social media

platforms. The study also demonstrated the beneficial use of social media as a method of data collection. This manuscript was written in accordance with Strengthening the Reporting of Observational Studies in Epidemiology guidelines.¹⁹

Questionnaire

The research team developed a questionnaire based on the primary study questions to learn more about postural habits and related joint and muscle pain among school-age students. The questionnaire's content and face validity were approved by 10 specialists and professors who were familiar with the research topic. Cronbach's alpha coefficient was also used to determine the tool's reliability, which was found to be 0.82. Demographics (age, gender, weight, height, and grade) and seven additional questions were included in the questionnaire, including kinds of body posture, sitting positions, lying positions, feeling joint or muscle pain, and the part of the body experiencing pain (Supplementary File 1).

The participants received the questionnaire as Google Forms via social media on the school's platform. For fifteen days, they had access to the information provided by the questionnaire via the provided link. With a mix of open-ended and closed-ended questions, the questionnaire was of a semi-structured type (including multiple-choice and ranking questions). To guarantee optimum participation, reminders were sent out to potential participants. Once the information was returned from participants, appropriate statistical analysis procedures were employed to analyze the data.

Statistics

The Shapiro-Wilk test was applied to verify the normality of the data ($P < 0.05$). The Chi-square goodness-of-fit test was used to determine the differences in the distribution of the participant responses (i.e., categorical variables such as not at all, very little, relatively high, and very much). The Kruskal-Wallis test was also applied to investigate differences in the characteristics of the school-age children of each gender. In addition, the Mann-Whitney U test was calculated for comparing boys and girls in each characteristic.

All the Google forms received were screened by the research team, and inappropriate and incomplete responses were discarded from the analysis. Closed-ended data were automatically analyzed using a Google Spreadsheet, and descriptive statistics were developed using percentages and frequency distribution. The data were analyzed using the Statistical Package for Social Sciences, version 26 (IBM Inc., Chicago, IL, USA), and a P value of < 0.05 was considered statistically significant. Microsoft Excel was utilized for data entry, editing, and sorting. Continuous and categorical data were presented as the mean and standard deviation (SD), as well as frequency and percentages, respectively.

Results

In Chaharmahal and Bakhtiari province, 43 660 students, including 15 532 boys (36%) and 28 128 girls (64%), completed the questionnaire. Table 1 provides the characteristics of school-aged children in full detail. A chi-square goodness-of-fit test demonstrated significant differences between the boys' and girls' responses to questions related to body posture ($\chi^2=40250.7, P=0.001$), different sitting positions ($\chi^2=8142.7, P=0.001$), place

of sitting ($\chi^2=2234.4, P=0.001$), different lying positions ($\chi^2=2523.1, P=0.001$), place of lying ($\chi^2=3225.2, P=0.001$), joint or muscle pain ($\chi^2=52832.2, P=0.001$), and joint or muscle pain in various parts of the body ($\chi^2=41643.9, P=0.001$). The details of school-aged students' responses to questions are presented in Figures 1 and 2.

Based on data in Figure 1, the majority of participants (77%) reported sitting most of the time during the day, while

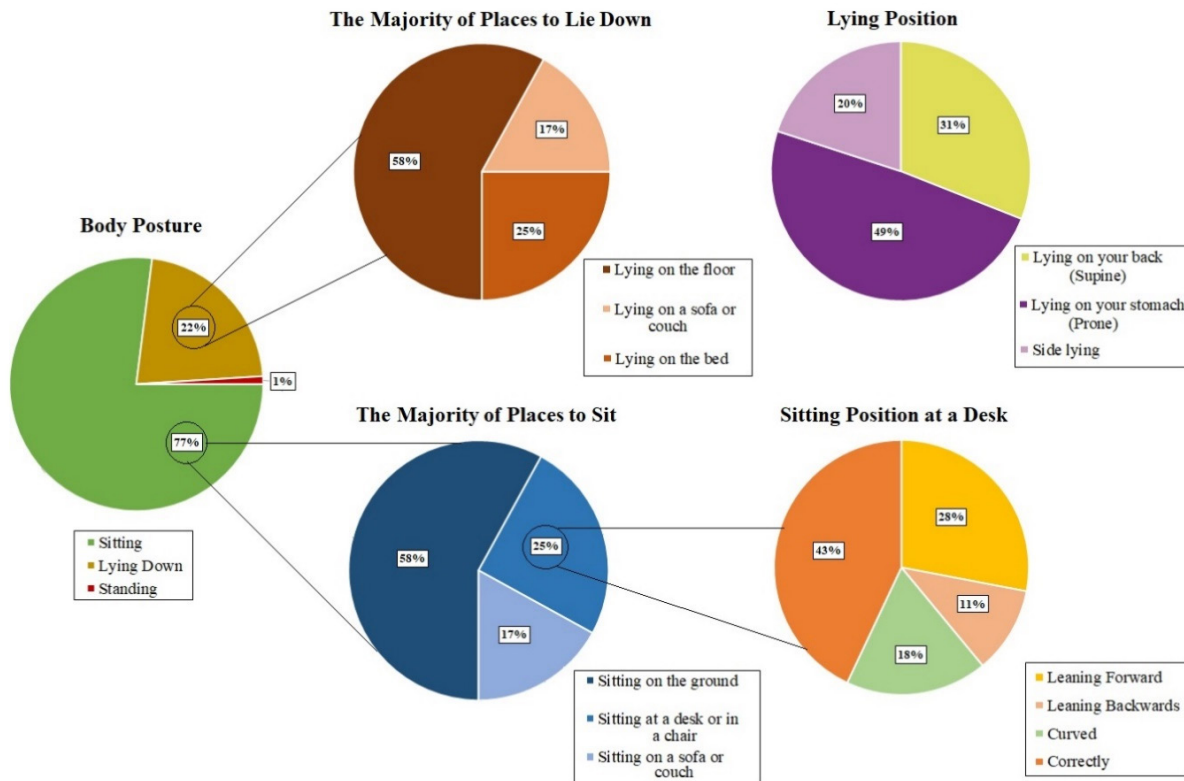


Figure 1. Postural Habits Among School-Aged Students.

Table 1. Characteristics of School-Age Children

Gender	Boys			Girls		
	Elementary (n=5017)	Secondary (n=6180)	High (n=4335)	Elementary (n=10355)	Secondary (n=10640)	High (n=7133)
Weight (kg)	46.1 ± 17.6 ^{ab}	52.7 ± 17.9	58.1 ± 12.8 ^b	43.6 ± 10.6 ^a	49.4 ± 10.1	53.4 ± 7.8
Height (cm)	139.1 ± 14.4 ^a	161.1 ± 10.5	167.8 ± 9.4	137.8 ± 13.6 ^a	159.2 ± 10.1	165.2 ± 9.8
BMI (kg/m ²)	24.4 ± 10.8 ^a	20.5 ± 7.3 ^b	20.8 ± 5.1 ^b	23.3 ± 5.9 ^a	21.2 ± 3.9	20.6 ± 2.9
Sitting position	n = 4324 ^{ab} (86%)	n = 4624 ^b (75%)	n = 3094 ^b (71%)	n = 8748 ^a (84%)	n = 7807 (73%)	n = 4976 (70%)
Standing position	n = 52 ^{ab} (1%)	n = 54 ^b (1%)	n = 42 ^b (1%)	n = 73 ^a (1%)	n = 99 (1%)	n = 78 (1%)
Lying position	n = 641 ^{ab} (13%)	n = 1502 ^b (24%)	n = 1199 ^b (28%)	n = 1534 ^a (15%)	n = 2734 (26%)	n = 2079 (29%)
Neck pain	n = 1330 ^{ab}	n = 1724 ^b	n = 1339 ^b	n = 2865 ^a	n = 2889	n = 2244
Shoulder pain	n = 464 ^{ab}	n = 645 ^b	n = 520 ^b	n = 998 ^a	n = 1086	n = 805
Upper back pain	n = 562 ^{ab}	n = 837 ^b	n = 695 ^b	n = 1115 ^a	n = 1482	n = 1116
Low back pain	n = 455 ^{ab}	n = 851 ^b	n = 682 ^b	n = 993 ^a	n = 1425	n = 1174
No pain	n = 2206 ^{ab}	n = 2123 ^b	n = 1099 ^b	n = 4384 ^a	n = 3758	n = 1794

Note. BMI: Body mass index.

^a Differences within characteristics of school-age children in each gender ($P \leq .05$); ^b indicates differences between boys and girls in terms of each characteristic ($P \leq 0.05$).

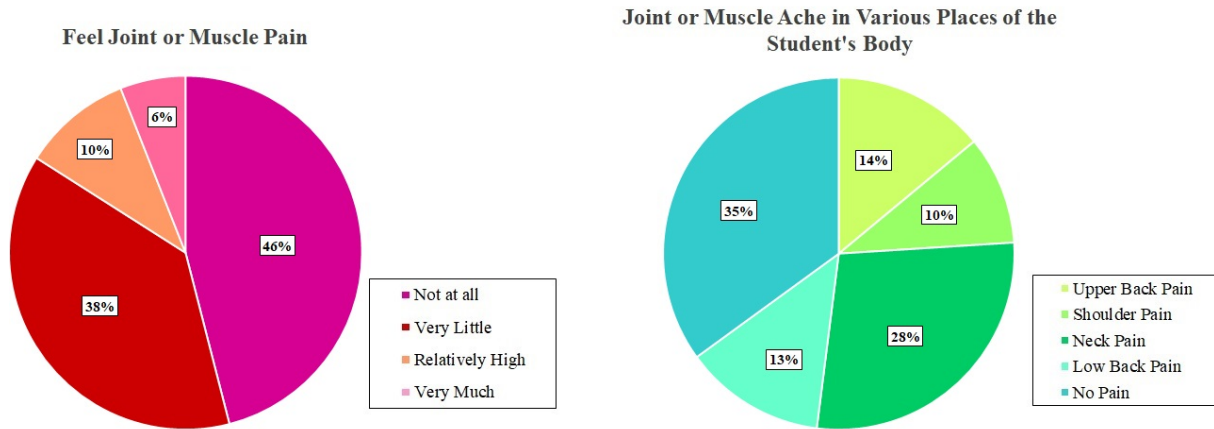


Figure 2. Related Joint and Muscle Pain Among School-Aged Students.

a few respondents reported lying (22%), standing (1%), or walking postures. For sitting posture, 57% of the students reported that they did not maintain correct posture while sitting, and they either leaned forward (28%), backward (11%), or curved their backs (18%). Regarding students who reported maintaining lying positions during the day, half of them indicated lying on their stomachs, while 31% and 20% of them reported lying on their backs and sides during the day, respectively. The majority of places where students sat during the day included sitting on the floor (58%), and the majority of places where students assumed a lying position were on the floor. The finding (Figure 2) revealed that the majority of respondents (54%) reported feeling some joint or muscle pain. The greatest pain areas were reported in the neck (28%), upper back (14%), and lower back (13%), respectively.

Discussion

This study attempted to examine posture positions and associated joint and muscle pain among school-aged students. The overall results showed significant differences between kinds of body posture, different sitting positions, the place of sitting, different lying positions, the place of lying, feeling joint or muscle pain, and joint or muscle pain in various parts of the body. To our knowledge, this is the first study to assess the impact of posture behaviors and joint and muscle pain among school-aged students in Iran. Over the previous decade, postural abnormalities linked to changes in young people’s habits have represented an increase.⁷ Bad posture is a modern-day health issue that affects large numbers of people and has implications for ill health.¹² People’s behavior has changed as a result of their lifestyles, which has resulted in individuals becoming more sedentary and developing bad physical habits, including bad posture during work and leisure activities.¹² Technological development has provided individuals with increased comfort and luxury but has also led to a decline in physical activity that includes increased sedentary behavior and related postural issues.¹⁴ Our results demonstrated that the majority of participants (77%) reported sitting postures during most daily activities, while some others mentioned lying (22%) or standing

(1%) postures. In the sitting posture, 57% of the students reported incorrect posture. They pointed out leaning forward (28%), leaning backward (11%), or curving (18%) during classes. The majority of places where students sit were on the floor (58%), and the majority of places where students lie were also on the floor. Regarding lying positions, half of the students reported lying on their stomachs, while 31% and 20% of them indicated lying on their back and side, respectively. Posture acts as a reference frame for the generation of accurate movement patterns because it ensures that balance is maintained during the start, continuation, and completion of any action.⁵ There is a link between poor posture and musculoskeletal disorders in people of all ages, and various variables can contribute to these changes, including adjustments and adaptations to body changes, psychosocial pressures, and ergonomic issues, among others.¹⁴ As a result, school-aged students must be screened by the school when starting in-person classes, and those who have postural abnormalities must receive medical or corrective exercise interventions and information. More research is needed to assess and compare the postural deviation of school-aged children before and after the pandemic.

Individuals who maintain long postures or execute repetitive actions develop tissue adaptations (tissue impairments).⁸ Short, stiff, lengthy, overworked, or weak muscles cause imprecise movement patterns, which can lead to tissue injury.⁶ Long periods of sitting, for example, have been linked to the development of back pain. According to the findings of this study, the majority of respondents (54%) reported feeling some joint or muscle pain. The most pain was reported in the neck (28%), upper back (14%), and lower back (13%). According to research on the effects of sustained stress, posture positions should not be maintained for longer than one hour. McGill and colleagues observed that 20 minutes in a sustained flexion position might cause creep in the soft tissues, requiring more than 40 minutes to fully recover.⁸ The study also demonstrated how bad posture affects muscles, joints, and connective tissue over time. Sitting with the head forward for an extended period of time while reading a book will elongate the ligaments and muscles in the posterior

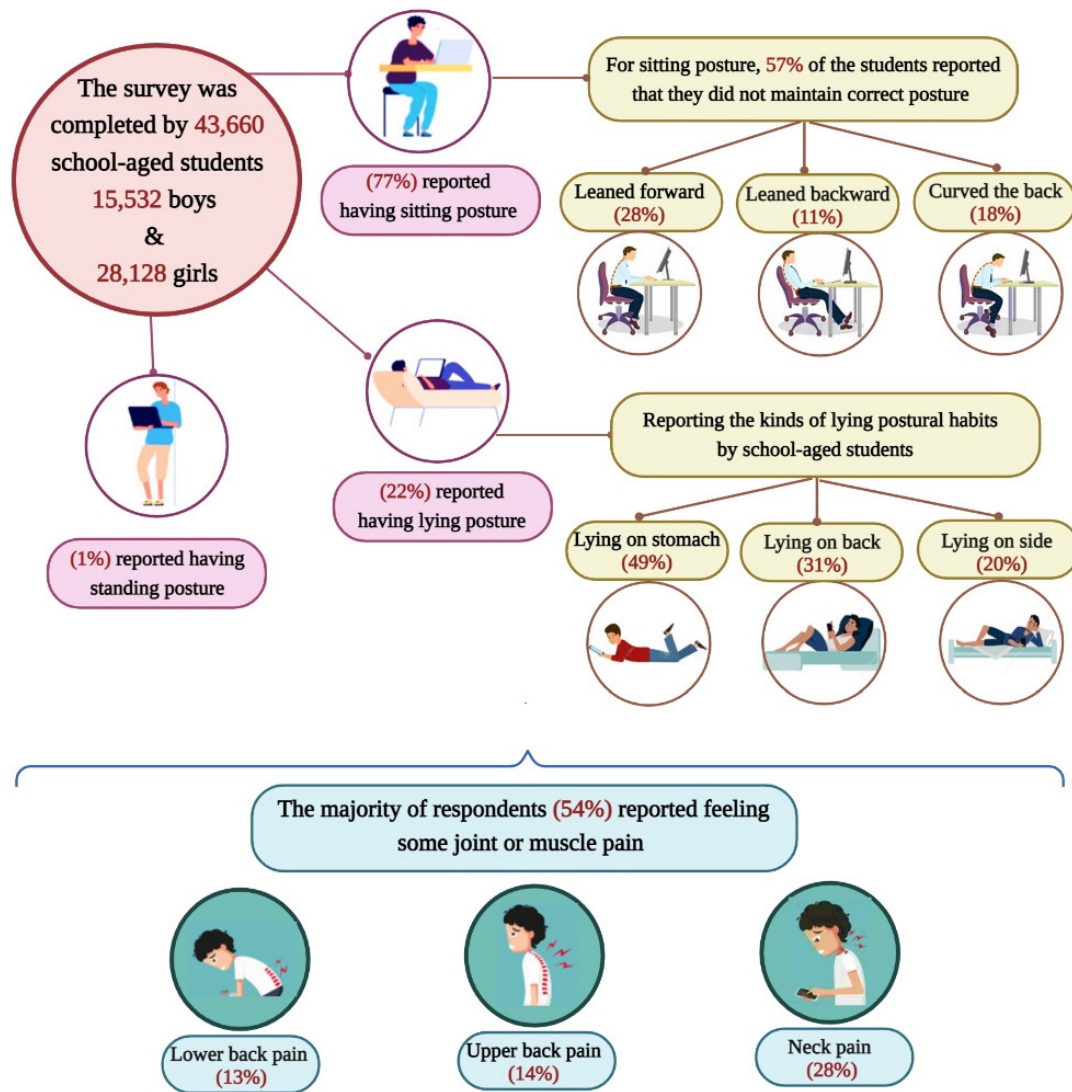


Figure 3. Interrelationships Between Postural Habits, and Related Joint and Muscle Pain Among School-Aged Students.

neck and upper back, making it more difficult to regain appropriate posture.

Poor posture can also weaken the scapular muscles and put persistent stress on the rotator cuff, leading to glenohumeral impingement, particularly when using overhead motions.²⁰ Future research should focus on interventions to inform people about the effect of postural habits on their health. Individuals also need to be reminded of the necessity of engaging in regular physical activity, and there is strong evidence that physical activity improves a variety of health outcomes, including posture.^{21,22} As a result, more research needs to be conducted on the health benefits of home-based exercise and the effects of daily routines on posture. Interventions to improve participation in home-based activities and reduce associated health risks need consideration (Figure 3).

This study has some limitations, including no assessment of postural deviations in person and the inability to assess the amount of time spent in different postural positions. The current study used an online self-report methodology, which may have included biases (e.g., social desirability and memory recall). Furthermore, this was a

cross-sectional study, thus we could not establish causality between any of the evaluated variables. Finally, we used specific general questions designed by the researchers rather than a standard questionnaire to assess participants' physical activity behaviors.

Conclusion

Half of the studied students reported that they did not use the correct posture. The majority of respondents indicated feeling some joint or muscle pain, especially in their neck, upper back, and lower back. The findings of this study may help guide efforts to protect and promote children's health. It may be necessary for schools and medical professions to screen students for health risks such as poor postural status that may have resulted from online classes. Examples of good posture practice should also be available to alleviate pain and discomfort.

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Authors' Contributions**Conceptualization:** Sajad Bagherian.**Data curation:** Sajad Bagherian.**Formal analysis:** Sajad Bagherian.**Funding acquisition:** Sajad Bagherian.**Investigation:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Methodology:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Project administration:** Sajad Bagherian, Khodayar Ghasempoor.**Resources:** Sajad Bagherian, Khodayar Ghasempoor.**Software:** Sajad Bagherian.**Supervision:** Sajad Bagherian.**Validation:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Visualization:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Writing—original draft:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Writing—review & editing:** Sajad Bagherian, Khodayar Ghasempoor, Julien S. Baker.**Competing Interests**

All authors declare that they have no competing interests.

Ethical Approval

The ethics approval was also obtained from the Ethics Committee of Shahrekord University (IR.SKU.REC.1401.012).

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Supplementary Files

Supplementary file 1. Questionnaire to Learn More About Postural Habits and Related Joint and Muscle Pain Among School-age Students

References

- Alomari MA, Khabour OF, Alzoubi KH. Changes in physical activity and sedentary behavior amid confinement: the BKSQ-COVID-19 project. *Risk Manag Healthc Policy*. 2020;13:1757-64. doi: [10.2147/rmhp.s268320](https://doi.org/10.2147/rmhp.s268320).
- Bagherian S, Ghasempoor K, Baker JS, Mashhadi M. Physical activity behaviors and overweight status among Iranian school-aged students during the COVID-19 pandemic: a big data analysis. *Iran J Public Health*. 2022;51(3):676-85. doi: [10.18502/ijph.v51i3.8946](https://doi.org/10.18502/ijph.v51i3.8946).
- Bagherian S, Nafian S. The impact of the COVID-19 pandemic on students' body posture during online learning should not be overlooked. *Iran J Pediatr*. 2021;31(5):e118197. doi: [10.5812/ijp.118197](https://doi.org/10.5812/ijp.118197).
- Domoff SE, Borgen AL, Foley RP, Maffett A. Excessive use of mobile devices and children's physical health. *Hum Behav Emerg Technol*. 2019;1(2):169-75. doi: [10.1002/hbe2.145](https://doi.org/10.1002/hbe2.145).
- Kendall FP, McCreary EK, Provance PG, Rodgers M, Romani WA. *Muscles: Testing and Function with Posture and Pain*. Baltimore, MD: Lippincott Williams & Wilkins; 1993.
- Clark M, Lucett S. *NASM Essentials of Corrective Exercise Training*. Lippincott Williams & Wilkins; 2010.
- Meziat-Filho N, Azevedo ESG, Coutinho ES, Mendonça R, Santos V. Association between home posture habits and neck pain in High School adolescents. *J Back Musculoskelet Rehabil*. 2017;30(3):467-75. doi: [10.3233/bmr-150339](https://doi.org/10.3233/bmr-150339).
- Houglum PA. *Therapeutic Exercise for Musculoskeletal Injuries*. 4th ed. Human Kinetics; 2016.
- Bagherian S, Ghasempoor K, Alizadeh MH. Is there any association between school-aged children's maturity and movement efficiency? *Journal of Shahrekord University of Medical Sciences*. 2022;25(2):62-70. doi: [10.34172/jsums.2023.657](https://doi.org/10.34172/jsums.2023.657).
- Bagherian S, Ghasempoor K. A cross-sectional study of functional movement quality in school-aged children. *BMC Pediatr*. 2022;22(1):399. doi: [10.1186/s12887-022-03410-2](https://doi.org/10.1186/s12887-022-03410-2).
- Bagherian S, Rahnama N, Wikstrom EA, Clark MA. Relationships between functional movement assessments and elements of sensorimotor function in collegiate athletes with chronic ankle instability. *Sci J Rehabil Med*. 2018;7(2):138-47. doi: [10.22037/jrm.2018.111034.1708](https://doi.org/10.22037/jrm.2018.111034.1708).
- Bettany-Saltikov J, Kandasamy G, Van Schaik P, McSherry R, Hogg J, Whittaker V, et al. School-based education programmes for improving knowledge of back health, ergonomics and postural behaviour of school children aged 4-18: a systematic review. *Campbell Syst Rev*. 2019;15(1-2):e1014. doi: [10.1002/cl2.1014](https://doi.org/10.1002/cl2.1014).
- Brink Y, Louw QA. A systematic review of the relationship between sitting and upper quadrant musculoskeletal pain in children and adolescents. *Man Ther*. 2013;18(4):281-8. doi: [10.1016/j.math.2012.11.003](https://doi.org/10.1016/j.math.2012.11.003).
- Schwertner DS, da Silva Oliveira RA, Beltrame TS, Capistrano R, Alexandre JM. Questionnaire on body awareness of postural habits in young people: construction and validation. *Fisioter Mov*. 2018;31:e003116. doi: [10.1590/1980-5918.031.a016](https://doi.org/10.1590/1980-5918.031.a016).
- Biernat M, Bąk-Sosnowska M. The impact of body posture on self-image and psychosocial functioning during adolescence. *Pediatr Med Rodz*. 2018;14(3):282-5. doi: [10.15557/PiMR.2018.0031](https://doi.org/10.15557/PiMR.2018.0031).
- Latalski M, Bylina J, Fatyga M, Repko M, Filipovic M, Jarosz MJ, et al. Risk factors of postural defects in children at school age. *Ann Agric Environ Med*. 2013;20(3):583-7.
- Mitova S, Popova D, Gramatikova M. Postural disorders and spinal deformities in children at primary school age. System for screening, examination, prevention and treatment. *Phys Educ Sport*. 2014;4(2):172-7.
- Kamali M, Ghasemi B, Moradi MR, Bagherian-Dehkordi S. Comparing the effect of two kinds of the traditional and the NASM corrective exercises training protocols on the correction of hyperlordosis in female students. *J Res Rehabil Sci*. 2015;11(2):155-63. doi: [10.22122/jrrs.v1i2.2279](https://doi.org/10.22122/jrrs.v1i2.2279).
- Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening of Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *Int J Surg*. 2014;12(12):1500-24. doi: [10.1016/j.ijsu.2014.07.014](https://doi.org/10.1016/j.ijsu.2014.07.014).
- Clark MA, Lucett S, Corn RJ. *NASM Essentials of Personal Fitness Training*. Lippincott Williams & Wilkins; 2008.
- Warburton DER, Bredin SSD. Health benefits of physical activity: a systematic review of current systematic reviews. *Curr Opin Cardiol*. 2017;32(5):541-56. doi: [10.1097/hco.0000000000000437](https://doi.org/10.1097/hco.0000000000000437).
- Poitras VJ, Gray CE, Borghese MM, Carson V, Chaput JP, Janssen I, et al. Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Appl Physiol Nutr Metab*. 2016;41(6 Suppl 3):S197-239. doi: [10.1139/apnm-2015-0663](https://doi.org/10.1139/apnm-2015-0663).