

Prevalence and risk factors of musculoskeletal disorders among undergraduate students

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ABSTRACT

Background: Musculoskeletal disorders (MSDs) are a typical cause of pain and physical disability, with a high commonness in educational environments. During the learning process, students spend most of their time sitting. Static conditions of the body for a long time and poor posture coupled with insufficient ergonomics in the work environment can increase the body's susceptibility to musculoskeletal disorders. This literature review aimed to know the musculoskeletal disorders that university students undergo.

Methods: The research method used in this paper was a literature review study utilizing secondary data from studies related to musculoskeletal disorders in university students. Journal searches were carried out on the PubMed, Google Scholar, and SpringerLink databases using the keywords "Musculoskeletal Disorders," "Musculoskeletal Pain," "University Student," and "Factors Associated with MSDs."

Results: The study reviewed multiple articles, ultimately selecting six that met the inclusion criteria. The research revealed that students frequently experience MSDs during classroom learning, particularly in the lower back, neck, and shoulders. The occurrence of these symptoms is strongly linked to factors such as workplace ergonomics, individual characteristics, and a combination of organizational and psychosocial influences. These findings highlight the significant impact of physical and behavioral factors and broader organizational elements on the development of MSDs in students.

Conclusion: This review has found that musculoskeletal disorders are prevalent among university students, with complaints of the lower back, shoulders, and neck as the most frequently reported sources of pain.

Keywords: musculoskeletal disorders, prevalence, risk factors, undergraduate students

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Introduction

The musculoskeletal system consists of a skeletal and muscular system that allows the body to move. Musculoskeletal disorders (MSDs) can occur in muscles, tendons, ligaments, cartilage, the nervous system, bone structures, and blood vessels. Generally, musculoskeletal disorders are characterized by pain, numbness, tingling, joint stiffness, and other discomfort in the body.¹

In the WHO report regarding the Global Burden of Disease (GBD), there were 1.71 billion people with musculoskeletal disorders out of a total population of 7.7 billion on Earth in 2019.² In Indonesia, based on the results of a study conducted in 12 districts on 9,482 workers, it was found that with 16% of workers suffered from MSDs as the primary disorder.³ Musculoskeletal disorders are also found in the education sector. Research results in various countries show a high rate of MSDs that occur in students, especially

those majoring in health studies, with a range of 31.8%-74.4% incidence. The most frequently reported pain originates in the lower back, neck, and wrist areas.⁴ Students become vulnerable to musculoskeletal disorders because they are often exposed to workplace risk factors such as sitting for long periods, using less ergonomic footwear, and professional physical skills that must be learned as students in the health sector.⁵ Non-ergonomic work postures lead muscles to contract continually, resulting in muscular strain or shortening.⁶

For example, students spend time in class or other static conditions in learning activities. Staying in this body position for a perpetual period will increase the risk of damage to the spine, reduced joint nutrition, limited blood flow, and accelerated muscle fatigue, which will ultimately trigger symptoms of musculoskeletal disorders.⁷ The problem of MSDs is crucial among young adults because it significantly

impacts the difficulty of carrying out physical activities and daily activities.⁵

Other risk factors for MSDs include the type of electronic gadgets used for learning and their location.^{8,9} Furthermore, there is evidence to show that the field of study may influence the likelihood of getting MSDs, with students in the health sector having a higher risk of MSDs than those in non-health disciplines.^{10,11} For example, research in health and science has found a higher prevalence of temporomandibular problems and related headache discomfort in women.¹²

Furthermore, exercise is frequently cited as a preventive factor against MSDs; nevertheless, past research on undergraduate students indicated that participation in competitive sports may increase the risk of knee discomfort. There is also extensive research indicating a link between mental health and MSDs. With the rising frequency of mental health issues and stress among university students, the transition to adulthood is a susceptible time for them to develop MSDs.¹³

Therefore, this literature review was conducted to determine what musculoskeletal disorders students experience and the risk factors that cause them. It is hoped that the results of this study will increase insight and knowledge for readers and writers.

Methods

The research used a literature review design by studying research journals on musculoskeletal disorders in university students as a secondary data source. Journal searches were carried out on the PubMed, Google Scholar, and SpringerLink databases using the keywords "Musculoskeletal Disorders," "Musculoskeletal Pain," "University Student," and "Factors Associated with MSD." From the journals obtained from the search engine results, journals relevant to the discussion topic were selected for the literature review. The inclusion criteria were the article's publication year within the last ten years, journal articles with open-access categories, and full-text articles. The exclusion criteria were as follows: if there were duplicate articles, the others were excluded, along with abstracts and theses. The author determined the inclusion and exclusion criteria. The collected publications were then analyzed and synthesized to address the study questions.

Results

Based on this research, six kinds of literature were identified, with the number of publications over the previous ten years detailing the prevalence and risk factors of musculoskeletal disorders in university students, as shown in Table 1. Abdulaziz AA et al. (2019) stated that 64.8% of research subject students experienced MSDs. The highest prevalence among health students was 48.8%, with the most frequent experience in the lower back (33.4%), followed by the neck region (29.3%) and the upper back (23.7%). The subjects report that the MSDs they are experiencing are interfering with their daily activities. There is a significant relationship between the level of physical activity and the incidence of MSDs.

Dighriri YH et al. (2019) stated total prevalence for MSP is 53.5% (95% CI: 49.2-58.4). One hundred ninety-seven subjects reported MSP in the neck (44.8%), MSP on the shoulder region was reported by 231 subjects (52.5%), and the lower back reported by 147 subjects (33.4%) occurred during the last week. There is a significant relationship between depressive symptoms, psychosomatic symptoms, and a history of trauma with the occurrence of MSDs.

Algarni et al. (2017) stated the prevalence of MSP in the lower back region is 40.5%, in the shoulder region, it is 25.6%, and in the neck region, it has a prevalence of 24.1% as of last week. There is a significant relationship between learning levels (year of study), depressive symptoms, and history of trauma with the event MSDs.

Wami et al. (2020) stated the prevalence of musculoskeletal disorders in subjects is 69.4%. The occurrence of MSDs in the lower back region is the most frequently reported (54.0%) by subjects. Followed by the neck region (36.70%), hands and wrists (14.9%), the shoulder region (12.3%), elbow and arm region (10.4%). There is a significant relationship linking learning levels (year of study) and the poor ergonomic design of the chair with incidents of MSDs.

Ogunlana MO et al. (2021) stated the regions with the most frequent reports of musculoskeletal problems are the neck (66.2%) and lower back (64.4%). There is a significant relationship between age, trips taken, the level of participation in regular sports, prolonged static posture, and sedentary lifestyle with the incidence of MSDs in students.

Jahromi MM et al. (2022) stated the study results show that four regions have the highest prevalence of pain. They are the lower back (47%), hand complex (34%), neck (30.18%), and shoulders (30.18%). Measurement of research subjects' posture with the REBA instrument showed that 36% and 49% of students who were research subjects had medium- to high-risk musculoskeletal problems.

Discussion

Musculoskeletal disorders (MSDs) are a group of symptoms or pathological conditions that can affect the musculoskeletal system's regular function, which involves nerves, tendons, muscles, and supporting structures such as intervertebral discs. Perceived musculoskeletal disorders can range from mild complaints to severe complaints in the form of damage. Musculoskeletal complaints can be grouped into temporary complaints that will disappear when the load is stopped and persistent complaints where the pain will continue even though the muscles no longer support the load.^{14,15} These conditions can affect an individual's ability, efficiency, and work activities. Welfare, productivity, and quality of work will also be affected.⁷

Causal factors or risk factors for the emergence of MSD symptoms can be grouped into workplace factors, individual factors (personal factors), and a combination of organizational and psychosocial factors. Factors originating

Table 1. The results following the prevalence and risk factors of musculoskeletal disorders in university students

Author	Research Title	Methods	Results
Abdulaziz AA et al. (2019)	Prevalence of Musculoskeletal Disorders and its Correlation to Physical Activity Among Health Specialty Students	This study described a cross-sectional study involving 392 students. The study used the Nordic Musculoskeletal Questionnaire (NMQ) to assess musculoskeletal disorders and the International Physical Activity Questionnaire's short form (IPAQ-SF) to measure the physical activity levels of level 3 subjects.	64.8% of students experienced musculoskeletal disorders (MSDs), with the highest prevalence among health students at 48.8%. The most affected areas were the lower back (33.4%), neck (29.3%), and upper back (23.7%). Students reported that these MSDs interfered with their daily activities. A significant relationship was found between high levels of physical activity and the incidence of MSDs.
Dighriri YH et al. (2019)	Prevalence and Associated Factors of Neck, Shoulder, and Low Back pains among Medical Students at Jazan University, Saudi Arabia: A cross-sectional study	This cross-sectional study involved 440 students. Data were collected using a questionnaire adapted from previous research, covering age, gender, physical activity, caffeine consumption, smoking habits, trauma, depression, psychosomatic symptoms, and musculoskeletal pain in the neck, shoulders, and lower back.	The overall prevalence of musculoskeletal pain (MSP) was 53.5%. MSP was reported in the neck by 44.8% of subjects, in the shoulders by 52.5%, and in the lower back by 33.4% during the last week. A significant relationship was found between depressive symptoms, psychosomatic symptoms, and a history of trauma with the occurrence of musculoskeletal disorders (MSDs).
Algarni et al. (2017)	The Prevalence of and Factors Associated with Neck, Shoulder, and Low-Back Pains among Medical Students at University Hospitals in Central Saudi Arabia	This cross-sectional study involved 469 students and utilized a self-administered questionnaire adapted from The Nordic Musculoskeletal Questionnaire (NMQ). It included demographic information and questions on exercise, caffeine consumption, smoking, trauma, and pain in the neck, shoulders, and lower back.	The prevalence of musculoskeletal pain (MSP) last week was 40.5% in the lower back, 25.6% in the shoulders, and 24.1% in the neck. A significant relationship was found between learning levels, depressive symptoms, and a history of trauma with the occurrence of musculoskeletal disorders (MSDs).
Wami et al. (2020)	Musculoskeletal Problems and Associated Risk Factors among Health Science Students in Ethiopia: a cross-sectional study	This cross-sectional study involved 422 students. Musculoskeletal disorders were assessed using the Nordic Musculoskeletal Questionnaire (NMQ), and the data were analyzed using bivariate and multivariable binary logistic regression in SPSS.	The prevalence of musculoskeletal disorders (MSDs) among subjects was 69.4%. The most reported areas were the lower back (54.0%), neck (36.7%), hands and wrists (14.9%), shoulders (12.3%), and elbows and arms (10.4%). A significant relationship was found between learning levels, poor chair ergonomics, and the incidence of MSDs.
Ogunlana MO et al. (2021)	Prevalence and patterns of musculoskeletal pain among undergraduate students of occupational therapy and physiotherapy in a South African university	This cross-sectional study involved 145 students. Data were collected using a questionnaire divided into three segments: demographic data, student perspectives on ergonomic risks, and the Nordic Musculoskeletal Questionnaire (NMQ).	The most frequently reported musculoskeletal problems were in the neck (66.2%) and lower back (64.4%). A significant relationship was found between age, number of trips, regular sports participation, prolonged static posture, and a sedentary lifestyle with the incidence of musculoskeletal disorders (MSDs) in students.
Jahromi MM et al. (2022)	Prevalence of Musculoskeletal Disorders Risk Factors and Ergonomic Assessment of Posture among Senior Students of Rehabilitation School of Shiraz University: A Cross-sectional Study	This cross-sectional study involved 53 students. Musculoskeletal disorders (MSDs) were assessed using the Nordic Musculoskeletal Questionnaire (NMQ), and posture analysis was conducted using the Rapid Entire Body Assessment (REBA).	The study found the highest prevalence of pain in the lower back (47%), hand complex (34%), neck (30.18%), and shoulders (30.18%). Posture analysis with the REBA instrument indicated that 36% and 49% of students had medium- to high-risk musculoskeletal problems.

from the workplace can be described as body posture and movements, repetitive movements, style, work speed, room temperature, etc. Individual factors include age, anthropometry, education, physical capacity, and body fitness. Organizational and psychosocial factors come from the individual worker's perspective on work organization, for example, work duration, work-rest cycle, management style, overtime hours, work environment, room layout, and other organizational psychosocial factors.¹⁶ Groups of organizational and psychosocial factors influence a person psychologically or socially. Psychosocial factors describe an individual's relationship with their social environment and how this influences their physical and mental health.¹⁷ The research results of Abdulaziz AA support the statement above. This research was conducted on 392 students from four health faculties (medicine, pharmacy, dentistry, and health science) at Taif University. The inclusion criteria are all students in the four health faculties; students outside the health faculties are excluded. Students who were not present during data collection, refused, or did not complete the research questionnaire were also included in the exclusion group. The research used the Standardized NMQ to measure MSD symptoms with a sensitivity of 66%-92%.¹⁸

The Nordic Musculoskeletal Questionnaire is a questionnaire consisting of 28 multiple-choice questions that are divided into two divisions. The first part refers to the symptoms felt in nine human body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, and ankles/feet) within 12 months or the last seven days. Meanwhile, the following part analyzes specific symptoms in three body regions (neck, shoulders, and lower back).¹⁹

The IPAQ-SF measuring instrument was used to analyze the sample's physical activity level. IPAQ, or International Physical Activity Questionnaire, is a questionnaire that can be used to obtain comparative data on physical activity and its relationship with health. There are two types of IPAQ. The first type consists of 5 physical activity domains, and the second type has only four general items, also called IPAQ-SF (short form). IPAQ has a test-retest $\alpha < 80$, which indicates an instrument with good stability.²⁰

Without a sample dropout, data from 392 respondents was analyzed. 64.8% of the students who were research subjects showed MSD complaints, with the highest prevalence among health students, with a figure of 64.8%. A total of 392 male and female students participated in this study. The most frequently reported musculoskeletal disorders were in the lower back region (33.4%), the neck region (29.3%), and the upper back region (23.7%). Variations in the prevalence of body regions experiencing musculoskeletal problems are caused by different work postures in each research subject discipline.¹⁸

Risk factors for the level of physical activity that affects the incidence of MSDs are divided into three groups. There are three groups: one with a high level of physical activity, one with a moderate level of activity, and one with a low level of activity. The data analysis results show a

significant result with $p < 0.005$. However, the study also shows that the group with a moderate level of PA reported the highest incidence of MSDs. This explains that physical activity can influence the incidence of MSDs but is not the main factor in the appearance of these symptoms.¹⁸

Other research was conducted on 480 second and sixth-year medical faculty students at Jazan University, who were selected through systematic random sampling 91.7% of students, or 440 student samples, filled out a questionnaire. Research was carried out using Standardized NMQ to measure the symptoms of MSDs.²¹

Analysis of the research's data found that 61.4% of participants reported pain in the lower back region within the last year before the research began. Followed by the neck region at 60.9%, and finally, the shoulder region with 175 reports, or 39.8% of participants experiencing it. The results also show a significant influence of trauma history (OR = 2.70; 95% CI: 1.36–5.36), depressive symptoms (OR = 1.94; 95% CI: 1.03–3.66), and the presence of psychosomatic symptoms (OR = 2.98; 95% CI: 1.71–5.18) on MSD reports.²¹

The same findings also exist in the research results among 2,357 students at the Faculty of Medicine at King Saud University and the Faculty of Health Science at King Saud Bin Abdulaziz University. The research was conducted on first- to fifth-year students with a response rate of 19.9%, or 469 students who filled out questionnaires until the end of the research, with details of 185 men and 284 women aged 19-29 years. Research was carried out using standardized NMQ to measure symptoms of MSDs.²²

The questionnaire measures pain that appears between any time, the past week, and the past year. The highest prevalence of pain is still in the lower back region, with 40.5% reporting pain symptoms in the past week and 67% reporting pain symptoms felt in the past year. The neck region recorded 24.1% of reports in the last week and 56.6% of reports of pain in the last year. Meanwhile, the shoulder region had 25.6% of reports of pain in the last week and 45.6% of reports of pain in the last year before the study.²² The results of the research data analysis also showed a significant relationship between factors such as history of trauma (OR 2.1, 95% CI 0.96–4.53, $P = 0.036$) and the presence of depressive symptoms (OR 2.69, 95% CI 1.37–5.27, $P = 0.004$) with the appearance of MSD complaints. The study found a significant association between study levels (OR 2.93, 95% CI 1.73–4.98, $p < 0.001$) and MSDs.²²

During the studying process, students spend most of their time in a sitting position. Sitting on furniture that does not support the body appropriately will force the muscular system to work optimally to maintain its structure. This will impact the spine's shape and cause impairment to the muscular system over time. Apart from affecting the body's ability to support its structures, this condition can also cause abnormal stretching of the muscles, which can cause pain.⁴ This agrees with the research results on 422 second to fifth-year students in the College of Medicine and Health Sciences, University of Gondar, Ethiopia. Sample selection was executed using a simple random sampling method, and then

the results were grouped based on each college's major and year level. Research was carried out using a standardized NMQ to measure the symptoms of MSDs. The questionnaire was previously translated into Amharic and reviewed by professionals so that samples could easily understand it.⁴ With all samples following the research until the end, the results of the data analysis show that the prevalence of MSDs was dominated by pain in the lower back (54.0%), neck (36.70%), and hand-to-wrist (14.9%). The study results also show that subjects who sit most of the time in chairs with poor ergonomic design have a 2.27 times higher risk of having MSDs compared to subjects who sit on chairs with hand and back support. Apart from that, research also reveals that the study level significantly influences the incidence of MSD complaints. These findings shed light on the relationship between workplace factors and the occurrence of MSDs.⁴

Another study was conducted on physiotherapy and occupational therapy students at the University of KwaZulu, South Africa. This research involved 145 students from a minimum sample size of 137 people. Students were selected based on the criteria of knowing MSDs and awareness of good body posture and motor control. Data collection was fulfilled using a questionnaire containing demographic data and student perspectives on ergonomic hazards and a standardized NMQ.⁵

With no dropout samples, 145 research data were analyzed. The research results show that the region with the most frequent reports of musculoskeletal problems is the neck, with a percentage of 66.2%, and the lower back, with a percentage of 64.4%. Data analysis shows the relationship between risk factors, prolonged static posture, and a sedentary lifestyle and the incidence of MSDs in the sample. Physical activity level ($P=0.03$) and trip duration ($P=0.02$) similarly show a significant relationship with the incidence of MSDs. These three factors are related to the body being static for a long time and the ergonomic value of the furniture not being good.⁵

The connection between workplace factors and the incidence of MSDs can also be seen from the research results on 53 physiotherapy students and occupational therapists at Shiraz University. The sample was selected using the inclusion criteria of students working 4 hours or more. Students with absences from class for one week or more are included in the exclusion group for this study. Research was carried out using Standardized NMQ to measure symptoms of MSDs and Rapid Entire Body Assessment (REBA) as a postural analysis tool.²³ The REBA measurement instrument is a system for assessing all muscle activity in the body, which is divided into two groups: group A and group B. Group A consists of the back, neck, and legs, while Group B consists of the upper arms, forearms, and wrists. The score calculation starts with group A and then continues with group B. Both results are then entered into Table C to determine the final score from the posture measurements and the classification of existing risk levels.²⁴ The validity of the REBA measuring instrument was proven by the developer of this instrument himself, Dr. Sue Hignett and Dr. Lynn McAtamney is an ergonomist from the

University of Nottingham's Institute of Occupational Ergonomics, with a validity level of between 62% and 85%.²⁵ Apart from showing a high prevalence of pain in the lower back (47%), research at Shiraz University also collected posture analysis data on research subjects. REBA measurement results showed that 36% of subjects had a medium-risk prevalence of 49% for musculoskeletal disorders.²³

This literature review has several limitations. First, the inclusion criteria limited the review to open-access articles. This restriction may have excluded high-quality research that is not freely accessible, potentially skewing the findings. Second, the authors determined the criteria for including or excluding articles, which introduces an element of subjectivity. This might affect the review's objectivity and the selected articles' representativeness. Third, The study synthesized data from various research articles, which might vary in quality, methodology, and rigor. This variability could affect the consistency and reliability of the study's conclusions.

Conclusion

Based on the literature review that has been carried out, it can be concluded that musculoskeletal disorders in students during classroom learning are often characterized by the appearance of pain in the lower back, neck, and shoulders. The results of this study also show that the symptoms of MSDs are closely related to workplace factors (furniture design, duration of mobility, and body posture), personal factors (history of trauma and level of physical activity), as well as a combination of organizational and psychosocial factors (such as depressive symptoms, psychosomatic symptoms, and study level).

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Conflict of interest

The author states no potential conflict of interest with this article's research, authorship, and publication.

Author contributions

NKW conceived the study design and data collection and drafted the manuscript; IP and NKAJA collected and revised the data.

Ethical Consideration

The review study used accessible published articles. Thus, this study did not require any informed consent or ethical considerations.

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