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An Integrated Analysis of Perceived Stress, Relaxation Behaviors, and Musculoskeletal Symptoms Among Undergraduate Health Science Students

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ABSTRACT

Undergraduate health science students are exposed to academic demands, prolonged screen use, and sustained static posture, which may contribute to both perceived stress and neck–shoulder musculoskeletal symptoms. Previous student-based studies have reported that approximately one-third of university students experience moderate to high stress, while musculoskeletal discomfort, particularly in the neck and shoulder regions, affects around 40–60% of students. This study aimed to examine the associations among perceived stress, stretching and relaxation behavior, static posture duration, and neck–shoulder musculoskeletal symptoms among undergraduate health science students. This observational analytic study used a cross-sectional design involving 100 undergraduate health science students at Universitas Pembangunan Nasional "Veteran" Jakarta. Participants completed the Perceived Stress Scale, a stretching and relaxation behavior questionnaire, and the Nordic Musculoskeletal Questionnaire. Data were analyzed using descriptive statistics, Pearson correlation, and multiple linear regression. The mean age of respondents was 20.8 ± 1.2 years, and 76% were female. Neck pain and shoulder pain in the past 12 months were reported by 68% and 65% of students, respectively. Static posture for 4–8 hours per day was reported by 51% of respondents. Perceived stress was categorized as mild in 43%, moderate in 21%, and high in 36% of students. Perceived stress was negatively correlated with stretching frequency ($r = -0.38$, $p < 0.001$), and positively correlated with static posture duration ($r = 0.31$, $p = 0.002$) and neck–shoulder pain ($r = 0.41$, $p < 0.001$). Regression analysis showed that stretching frequency, static posture duration, and neck–shoulder pain were significantly associated with perceived stress and explained 43% of its variance. Perceived stress among undergraduate health science students is associated with modifiable physical and behavioral factors, particularly static posture, neck–shoulder symptoms, and stretching or relaxation behavior. Campus wellness programs should integrate posture education, scheduled movement breaks, stretching routines, and relaxation practices to support both physical comfort and psychological well-being.

Keywords: perceived stress; musculoskeletal pain; static posture; stretching; relaxation; health science students.

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INTRODUCTION

Student well-being in higher education is best understood as a combined academic, psychological, and physical issue. Undergraduate students face continuous academic demands that can affect learning capacity, motivation, sleep, and mental health, while their study routines increasingly rely on prolonged sitting and screen-based tasks. This evidence on student well-being[1–3].

Health science students are particularly vulnerable because their workload combines theoretical learning, laboratory or clinical preparation, assignments, and extensive use of laptops or smartphones. Neck and shoulder complaints may seem minor at first, but they can interfere with reading. These two conditions rarely occur separately. Sedentary learning may increase musculoskeletal discomfort, which may, in turn, reduce concentration and tolerance to academic pressure. In Indonesia, national health surveillance has also placed mental health as a public health concern, underscoring the need for campus-level skill performance, sleep, and daily activities. Recent evidence among college students shows that improper sitting posture, prolonged electronic device use, high stress, and emotional problems are associated with neck pain, while smartphone-related study time has been linked to neck and shoulder pain duration and severity[4,5]. Studies on online learning further suggest that academic stressors, workstation conditions, posture, and time spent at a workstation jointly contribute to musculoskeletal pain among undergraduates[6].

Perceived stress is a key variable in this relationship because it connects academic demands with bodily responses. From a biopsychosocial perspective, musculoskeletal pain is shaped not only by mechanical load but also by psychological and behavioral factors. When stress is sustained, students may experience higher muscle tension, reduced recovery time, and greater sensitivity to discomfort; when pain persists, it may become an additional source of worry and functional limitation. Evidence among undergraduate health students supports this pattern, showing that higher perceived stress is associated with musculoskeletal pain in the spinal, upper-limb, and lower-limb regions[7,8].

Recent literature has shifted from merely documenting student complaints to explaining musculoskeletal and psychological strain through a biopsychosocial lens. Systematic reviews have shown that neck pain among college students is associated not only with mechanical exposure, such as poor sitting posture and prolonged electronic-device use, but also with lack of exercise, high stress, and emotional problems[4]. Evidence on sedentary behaviour further indicates that musculoskeletal pain is shaped by the duration and context of sitting, rather than by sitting time alone[2]. In undergraduate populations, online-learning studies have added that workstation conditions, working posture, academic stressors, and time spent at a workstation jointly contribute to musculoskeletal pain[6]. At the same time, intervention studies suggest that stretching, ergonomic modification, mindfulness meditation, and progressive muscle relaxation can reduce musculoskeletal discomfort or perceived stress[9–11].

METHOD

This study used an observational analytic design with a cross-sectional approach. The design was selected because the study aimed to examine the associations among perceived stress, stretching and

relaxation behavior, static posture duration, and neck–shoulder musculoskeletal symptoms at a single point in time. The study was conducted among undergraduate students enrolled in health science programs at Universitas Pembangunan Nasional "Veteran" Jakarta. The target population consisted of active undergraduate students in the Faculty of Health Sciences, with a total accessible population of 130 students. A total of 100 participants were recruited using purposive sampling based on predefined eligibility criteria. Purposive sampling was used because the study required respondents who were active students and able to provide information related to academic routines, perceived stress, posture habits, and musculoskeletal symptoms. Students were included if they were officially registered during the academic year, agreed to participate by providing informed consent, and were able to complete the online questionnaire independently. Students were excluded if they submitted incomplete responses or reported recent injury, neurological disorder, diagnosed musculoskeletal disorder, or psychiatric condition that could substantially influence stress perception or musculoskeletal assessment.

The main variables in this study were perceived stress, stretching and relaxation behavior, static posture duration, and neck–shoulder musculoskeletal symptoms. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10), which assesses the extent to which respondents perceived their lives as unpredictable, uncontrollable, and overloaded over the past month. Each item was scored on a 5-point Likert scale ranging from 0 to 4. Positively worded items were reverse-coded before calculating the total score. The total PSS score ranged from 0 to 40, with higher scores indicating higher perceived stress. For descriptive analysis, stress levels were categorized as low, moderate, or high; for correlation and regression analysis, the total PSS score was used as a continuous variable.

Stretching and relaxation behavior was assessed using a structured self-report questionnaire that captured the frequency of stretching, breathing exercises, and relaxation practices commonly performed during study routines. Frequency responses were coded ordinally, with higher scores indicating more frequent engagement in stretching or relaxation. For descriptive analysis, responses were summarized into practice patterns, perceived benefit, intention to continue the behavior, and perceived barriers. For inferential analysis, stretching and relaxation frequency was treated as the main behavioral predictor, after checking the distribution and linearity of the data. Musculoskeletal symptoms were assessed using the Nordic Musculoskeletal Questionnaire framework, focusing on neck and shoulder regions because these areas were most relevant to prolonged sitting, laptop use, and study-related static posture. Respondents reported whether they had experienced neck or shoulder pain during the past 12 months and the past 7 days. Each symptom item was coded as 0 = no and 1 = yes. A composite neck–shoulder pain variable was created for regression analysis, coded as 1 when the respondent reported pain in either the neck or shoulder region during the past 12 months, and 0 when no pain was reported in both regions. Functional limitation due to neck or shoulder pain was also coded dichotomously as 0 = no and 1 = yes. Static posture duration was assessed based on the average daily time spent sitting or maintaining a fixed posture during studying or screen use, and was categorized as <4 hours, 4–8 hours, and >8 hours per

day. For analysis, these categories were coded ordinally from 1 to 3, with higher values representing longer static posture duration.

Several steps were taken to strengthen the validity and reliability of the measurements. Standardized instruments were selected for perceived stress and musculoskeletal symptoms because the PSS and Nordic Musculoskeletal Questionnaire have been widely used in student and health-related populations. The structured stretching and relaxation questionnaire was reviewed for clarity, relevance, and consistency with the study variables before distribution. In the present sample, internal consistency was assessed for scale-type variables using Cronbach's alpha, with a value of 0.70 or higher considered acceptable. Corrected item-total correlation was also examined to identify poorly performing items. Because the musculoskeletal symptom items were dichotomous regional indicators rather than a single latent psychological scale, their quality was evaluated through coding consistency, completeness of responses, and alignment with the standardized body-region definitions used in the questionnaire.

Potential sources of bias were considered during the study process. The use of purposive sampling may have introduced selection bias, because participants were selected based on eligibility criteria and willingness to participate; therefore, the findings should be interpreted as applicable to students with similar characteristics rather than to all university students. To reduce this risk, the inclusion and exclusion criteria were determined before data collection, and eligible students received the same study information. Because the study used self-reported questionnaires, information bias and social desirability bias were also possible. To minimize these effects, respondents were informed that their participation was voluntary, their responses would remain confidential, and there were no academic consequences for their answers. Recall bias was also considered, particularly for 12-month musculoskeletal symptoms; therefore, both 12-month and 7-day symptom periods were collected to provide broader and more recent symptom information. Data were collected using a self-administered online questionnaire distributed through Google Forms. Before completing the questionnaire, all respondents received an information sheet explaining the study objectives, procedures, confidentiality, voluntary participation, and ethical considerations. Only respondents who provided informed consent were allowed to proceed to the questionnaire. Submitted responses were screened for completeness and logical consistency before analysis. This study received ethical clearance from the Health Research Ethics Committee of Universitas Pembangunan Nasional "Veteran" Jakarta with approval number 60/VI/2025/KEP.

RESULTS

Characteristics of Research Subjects

A total of 100 undergraduate health science students completed all study instruments. The mean age of respondents was 20.8 ± 1.2 years, and most participants were female. The majority were in their second or third year of study, and more than half reported using a computer or smartphone for at least four hours per day. The characteristics of respondents are presented in Table 1.

Table 1. Characteristics of Respondents

Characteristic	Category	n	%
Age	Mean ± SD	20.8 ± 1.2	-
Sex	Female	76	76.0
Year of study	Second or third year	82	82.0
Daily computer/smartphone use	≥ 4 hours/day	63	63.0

Neck and Shoulder Pain

Neck and shoulder pain were frequently reported among respondents. Neck pain in the past 12 months was reported by 68% of students, while 56% reported neck pain in the past 7 days. Shoulder pain was reported by 65% of students in the past 12 months and by 50% in the past 7 days, as shown in Table 2.

Table 2. Prevalence of Neck and Shoulder Pain

Variable	Category	n	%
Neck pain, past 12 months	Yes	68	68.0
Neck pain, past 7 days	Yes	56	56.0
Shoulder pain, past 12 months	Yes	65	65.0
Shoulder pain, past 7 days	Yes	50	50.0

Functional Limitation Due to Pain

Functional limitation was reported by 39% of respondents with neck pain and 35% of respondents with shoulder pain. The distribution is shown in Table 3.

Table 3. Functional Limitation Due to Neck and Shoulder Pain

Region	Category	n	%
Neck	Yes	39	39.0
Shoulder	Yes	35	35.0

Static Posture Duration

Most respondents reported spending four to eight hours per day in static posture. A smaller proportion reported maintaining static posture for more than eight hours per day. The distribution of static posture duration is presented in Table 4.

Table 4. Daily Static Posture Duration

Duration Category	Frequency (n)	Percentage (%)
< 4 hours	45	45.0
4–8 hours	51	51.0
> 8 hours	4	4.0

Perceived Stress Level

Based on the Perceived Stress Scale, most respondents were classified as having mild to high perceived stress. The distribution of perceived stress levels is shown in Table 5.

Table 5. Perceived Stress Level

Stress level	n	%
Mild	43	43.0
Moderate	21	21.0
High	36	36.0
Total	100	100.0

Stretching and Relaxation Practices

More than half of respondents reported regularly performing stretching or relaxation practices. Most respondents perceived these practices as helpful in reducing stress or tension and expressed interest in continuing or improving the habit. However, lack of time or motivation was reported as the main barrier. The results are shown in Table 6.

Table 6. Stretching and Relaxation Practices

Aspect	n	%
Regularly performs stretching/relaxation	52	52.0
Perceives stretching/relaxation as helpful	73	73.0
Plans to continue or improve the habit	94	94.0
Reports lack of time/motivation as the main barrier	57	57.0

Correlation Between Study Variables

Correlation analysis showed that perceived stress was negatively correlated with stretching frequency and positively correlated with static posture duration and neck–shoulder pain. Stretching frequency was also negatively correlated with neck–shoulder complaints. The results are presented in Table 7.

Table 7. Correlation Between Study Variables

Variables	r	p-value	Interpretation
Perceived stress and stretching frequency	-0.38	<0.001	Moderate negative correlation
Perceived stress and static posture duration	0.31	0.002	Moderate positive correlation
Perceived stress and neck–shoulder pain	0.41	<0.001	Moderate positive correlation
Stretching frequency and neck–shoulder complaints	-0.27	<0.05	Weak negative correlation

Factors Associated with Perceived Stress

Multiple linear regression analysis showed that stretching frequency, static posture duration, and neck–shoulder pain were significantly associated with perceived stress. Stretching frequency was negatively associated with perceived stress, whereas static posture duration and neck–shoulder pain were positively associated with perceived stress. The model explained 43% of the variance in perceived stress, as shown in Table 8.

Table 8. Factors Associated with Perceived Stress

Predictor	β	t	p-value
Stretching frequency	-0.316	-3.45	0.001
Static posture duration	0.294	3.02	0.003
Neck–shoulder pain	0.357	3.78	<0.001
Model summary	$R^2 = 0.43$		

DISCUSSION

The findings of this study show that neck and shoulder discomfort is a prominent health concern among undergraduate health science students. More than half of the respondents reported neck and shoulder pain in the past year, indicating that musculoskeletal symptoms are not merely occasional complaints but are part of the daily physical burden many students experience. This pattern is understandable considering the academic environment at the study site, where students spend substantial time reading, completing assignments, attending online or screen-based learning activities, and preparing for laboratory or practical sessions. These routines often require prolonged sitting and continuous use of laptops or smartphones, which may increase strain on the cervical and shoulder regions. This finding is consistent with previous evidence showing that neck pain is common among university students and young adults, particularly in learning environments that involve prolonged screen exposure and limited postural variation[3,4,11–14].

The high proportion of students who reported static posture for four to eight hours per day further supports this interpretation. In academic settings, prolonged sitting is rarely passive; students often maintain forward-head posture, elevated shoulders, or unsupported sitting positions while concentrating on screens or written materials. Over time, this posture may increase muscle tension around the neck and shoulder area and reduce opportunities for movement recovery. Previous studies have similarly shown that neck pain among university students is associated with poor posture, prolonged electronic device use, limited physical activity, and psychosocial strain[3,4,11–13,15,16]. More recent evidence also indicates that sedentary behavior is associated with neck pain, particularly when it involves screen-based activities and sustained sitting, while prolonged computer typing may alter sitting posture and increase the need for postural awareness[17,18]. Therefore, the findings of this study are consistent with broader evidence that student musculoskeletal problems are shaped by both ergonomic and behavioral conditions, rather than by sitting duration alone[2,5,19].

The functional impact of pain also deserves attention. A considerable number of students reported that neck and shoulder pain limited their activities. For health science students, this limitation may affect more than comfort; it may interfere with reading endurance, concentration, laboratory participation, and clinical skill preparation. Pain that persists during study activities can create frustration and reduce students' ability to remain engaged with academic tasks. This finding strengthens the view that musculoskeletal symptoms among students should not be treated as minor physical

complaints, but as factors that may influence academic readiness and overall well-being. Similar findings have been reported in online and distance-learning contexts, where workstation conditions, academic stressors, working posture, and time spent at a workstation contributed to musculoskeletal pain among undergraduates[5,20].

Perceived stress was also an important finding in this study. Many students reported moderate to high levels of stress, which may reflect the academic pressure commonly experienced in health science education. Students in this field are expected to master theoretical knowledge, develop practical skills, manage deadlines, and prepare for professional responsibilities. When these demands occur alongside physical discomfort, the burden may become heavier. From a biopsychosocial perspective, stress and musculoskeletal symptoms can be understood as interconnected conditions rather than separate problems. Psychological strain may increase muscle tension and pain sensitivity, while persistent pain may add to emotional fatigue and reduce students' sense of control over their academic routine[1,6,7]. Evidence among nursing and health-related students also suggests that academic workload, clinical preparation, limited rest time, and coping capacity are important contributors to perceived stress[21].

The pattern found in this study suggests that students who experienced neck–shoulder symptoms and longer static posture tended to report greater stress. This does not mean that posture or pain directly causes stress, but it indicates that physical and psychological burdens may coexist in the same student group. Such a pattern is relevant in the context of health science students because their learning schedule often combines mental workload with long periods of physical inactivity. In this situation, physical discomfort may become part of the academic stress experience, while stress may reduce students' motivation to move, stretch, or take adequate rest. This interpretation aligns with studies showing that sedentary behavior, workstation factors, and psychosocial demands can jointly influence musculoskeletal symptoms and student well-being[2,5,6,19].

Stretching and relaxation behaviors appeared to be important protective habits in this study. Students who practiced stretching or relaxation more regularly tended to report lower stress and fewer neck–shoulder complaints. This finding is meaningful because stretching and relaxation are simple, low-cost strategies that can be integrated into daily academic routines without requiring specialized equipment. In the present study, many students perceived these practices as helpful for reducing stress and tension, but lack of time and motivation remained common barriers. This suggests that students may already understand the value of self-care, yet still need structural support from the learning environment to practice it consistently.

Previous intervention studies support the potential benefit of these behaviors. Stretching combined with ergonomic modification has been shown to reduce discomfort in the neck, shoulder, and lower back regions[8]. Mindfulness and relaxation-based interventions have also been reported to reduce perceived stress among nursing and health-related students[9,10,22] Progressive muscle relaxation has been discussed as a feasible strategy in medical education because it directly links physical relaxation with

psychological regulation[23]. Although the present study did not test an intervention, its findings indicate that routine stretching and relaxation may serve as practical self-regulation strategies for students exposed to prolonged sitting, academic pressure, and musculoskeletal discomfort.

These findings highlight the need for campus health promotion programs that address physical and psychological well-being together. At the study site, preventive strategies should not focus only on general mental health education or isolated ergonomic advice. A more integrated approach is needed, including posture education, scheduled movement breaks, short stretching routines, breathing exercises, and relaxation practices during lectures, laboratory sessions, or independent study periods. Active-break interventions have been reported to improve physical activity and reduce sedentary patterns in educational settings, supporting the feasibility of movement-based strategies within learning environments[24]. These recommendations are also consistent with global guidance emphasizing the importance of reducing sedentary behavior and promoting regular physical activity for health and well-being[25].

This study also has several limitations. Because the design was cross-sectional, the findings can only describe associations and cannot determine the direction of the relationship between stress, posture, stretching behavior, and musculoskeletal symptoms. The use of self-reported questionnaires may also lead to recall bias, especially for symptoms reported over the past 12 months. In addition, the use of purposive sampling from one institution may limit the generalizability of the findings to other student populations. Future studies should consider longitudinal or intervention designs to examine whether structured stretching, ergonomic education, and relaxation programs can improve both musculoskeletal comfort and perceived stress over time.

CONCLUSIONS AND RECOMMENDATIONS

This study found that perceived stress among undergraduate health science students was associated with neck–shoulder musculoskeletal symptoms, prolonged static posture, and stretching or relaxation behavior. Students who reported longer static posture duration and neck–shoulder pain tended to have higher perceived stress, whereas those who practiced stretching and relaxation more frequently tended to report lower stress. These findings suggest that student well-being should be addressed through an integrated approach that considers both psychological and physical factors. Based on these findings, health science programs are recommended to promote simple and sustainable wellness strategies, including posture education, scheduled movement breaks, brief stretching routines, and relaxation practices during academic activities. Students should also be encouraged to reduce prolonged static posture and adopt regular self-care habits to prevent musculoskeletal discomfort and manage stress. Future studies are suggested to use longitudinal or intervention designs to evaluate whether structured stretching, ergonomic education, and relaxation programs can effectively reduce perceived stress and musculoskeletal complaints among university students.

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