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Musculoskeletal Pain Symptoms Among Health Science Undergraduates at MNU: Prevalence and Associated Factors

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ABSTRACT *Musculoskeletal pain symptoms (MPS) are increasingly common in both occupational and educational settings. University students, particularly those enrolled in health science programs, face multiple risk factors that elevate their likelihood of developing MPS. These include long hours of computer use, prolonged sitting, high academic demands, and physically demanding clinical training. Considering the rising global prevalence of MPS, this study aimed to investigate the impact of MPS on health science students at the Maldives National University and to identify associated risk factors. Using stratified sampling, a cross-sectional survey was conducted among undergraduate health science students from MNU's Malé campuses. Data was collected from students through a self-administered questionnaire and analyzed using SPSS version 21.0. Chi-square tests were used to examine the associations between selected variables and 12-month MPS prevalence, with a significance threshold of $p < .05$. Among the 283 participants who completed the survey, 92.57% reported experiencing MPS in at least one body region during the past year. Among those affected, 66.23% indicated that the pain had interfered with their daily tasks. Lower back pain (18.5%) was the most reported, followed by neck (16.99%) and upper back pain (14.5%). MPS was significantly associated with increased stress, heavy physical workload at home, high screen time, and prolonged sitting. The study highlights an urgent need for preventive strategies addressing physical and psychological contributors to MPS among students. Interventions should include early education, ergonomic awareness, stress management, and promotion of healthy routines to reduce the long-term burden of MPS on future healthcare professionals.*

Keywords: Musculoskeletal Pain Symptoms, Health Science Education, Risk Factors, Occupational Health

Background

Musculoskeletal pain symptoms (MPS) refer to the pain experienced in various body regions resulting from issues with musculoskeletal tissues, including bones, joints, muscles, ligaments, and tendons. The peripheral and central nervous systems, as well as other chemical mediators, are also believed to play a role in perceiving this type of pain. MPS can manifest discomfort, stiffness, or soreness in one or multiple body regions and may range in intensity from mild to severely debilitating. The symptoms often interfere with daily activities, posture, mobility, and sleep quality. Individuals with MPS may also experience tenderness on palpation, reduced range of motion, and muscular fatigue.

However, the experience of musculoskeletal pain is not solely determined by physical injury or tissue damage. It is also influenced by a complex interplay of

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biopsychosocial factors that modulate how pain is perceived and managed by individuals (Puntillo et al., 2021). Additionally, factors such as age, sex, other social factors, beliefs, and pain behaviours can also influence how pain is perceived (Puntillo et al., 2021). Pain that resolves within three months is known as acute pain, and pain that persists beyond this duration without healing is known as chronic pain. Musculoskeletal pain is associated with several risk factors, including working long hours in poor ergonomic environments, adopting sustained static postures for extended periods, performing repetitive movements repeatedly, and experiencing mental stress (Ogunlana et al., 2021).

According to the Global Burden of Disease report (2016), , musculoskeletal disorders (MSDs) were identified as the second leading cause of disability worldwide. According to Moghadas Tabrizi et al. (2021), approximately 20% to 30% of the global population experiences at least one form of musculoskeletal pain. The prevalence of MPS is on the rise in both occupational and educational settings a trend that is believed to be related to the daily activities done in these environments and the life habits of the people involved (Ogunlana et al., 2019). It is observed that among occupations, workers in public health institutions have a prevalence of MPS ranging from 65.7% to 92.1% (Morais et al., 2019).

MPS occurring due to work-related causes are known more specifically as work-related musculoskeletal disorders (WRMDs), which are caused by physical exertion in the work environment. Previous studies have shown high levels of occupational stress and WRMDs among allied health professions workers (AHP). These symptoms lead to physical and mental stress, increased sick leaves from work, decreased productivity and increased demand for healthcare services (Almhdawi et al., 2017). Like health workers, health students in their undergraduate years are exposed to the same factors as health workers due to their work in clinical settings and academic environments, which increases the risk of developing MPS (Morais et al., 2019; Almhdawi et al., 2017; Ogunlana et al., 2021). Findings from previous studies conducted among both medical and non-medical students worldwide have reported high prevalence rates of musculoskeletal pain, ranging from 31.8% to 74.4%. (Ogunlana et al., 2021; Wami et al., 2020).

Systematic reviews have been instrumental in synthesizing global epidemiological trends in musculoskeletal pain syndromes (MPS), providing a broader context for interpreting these findings. A systematic review conducted by Wohlmuth-Cohen and León-Avila (2021) presents epidemiological trends across various countries, based on studies from Saudi Arabia, the UAE, Turkey, the USA, Brazil, Australia, Ireland, Spain, South Africa, Ethiopia, India, Pakistan, and China. All of this indicates that the prevalence rates of this problem are high globally (Wohlmuth-Cohen & León-Avila, 2021). These findings are further supported by a study conducted by Ogunlana et al. (2021), which examined patterns of MPS among undergraduate university students and drew evidence from multiple countries, including the UAE, Malaysia, Ghana, Ethiopia, Pakistan, India, Saudi Arabia, China, Australia, and Brazil.

Building on this global overview, several studies have also explored the factors contributing to the development of MPS among students. Many of these studies have identified different causes that increase the risk of developing MPS in

university students. Differences in MPS rates were observed based on the students' field of study and the specific body regions affected. The year of study and gender also appeared to influence the prevalence of MPS in certain groups (Ogunlana et al., 2021; Hashim et al., 2021; Moodley et al., 2020; Wami et al., 2020; Morais et al., 2019; Hasan et al., 2019).

Most risk factors identified were modifiable, meaning they could be changed or managed (Zirek et al., 2020; Wami et al., 2020). These included frequent use of computers and phones, prolonged sitting, physical work in clinical settings, maintaining fixed postures for extended periods, and stress from a heavy academic and clinical workload (Zirek et al., 2020; Wami et al., 2020; Legan & Zupan, 2020). Neck pain and lower back pain were the areas most reported to be affected by MPS (Moghadas Tabrizi et al., 2021; Morais et al., 2019; Hasan et al., 2018). These insights underscore the need to investigate how MPS impact health science students in specific university contexts, particularly where such data are scarce.

Problem Statement

Musculoskeletal pain symptoms (MPS) are increasingly recognized as a public health concern among university students, particularly those in health science disciplines. These students are exposed to a range of risk factors, such as prolonged sitting, repetitive use of computers and mobile devices, heavy academic workloads, and physically demanding clinical placements, that make them especially vulnerable to the early onset of musculoskeletal issues. Though largely modifiable, these factors are prevalent in academic environments and often unaddressed.

In student populations, MPS can lead to disruptions in academic performance, increased absenteeism, and a decline in psychological well-being. Even if moderate, persistent pain may reduce concentration, impair engagement in classroom and clinical activities, and negatively affect quality of life. If left unmanaged, these symptoms may persist into students' professional lives, influencing work productivity and long-term physical health.

Despite its potential impact, limited research addresses the burden of MPS among university students in the Maldives. Given that the Maldives National University (MNU) serves as the primary institution for training future healthcare professionals, it is essential to investigate the scope of this problem within its student body. Understanding the prevalence and determinants of MPS will not only aid in improving student health outcomes but also inform efforts to address these issues. Additionally, it will also contribute to preparing a physically resilient and clinically competent health workforce for the nation.

Therefore, the study aims to investigate the prevalence of musculoskeletal pain symptoms (MPS) among health science undergraduates at MNU and identify the key factors contributing to its development.

Objectives of the Study

The study's specific objectives are twofold. The first, is to determine the prevalence rates of musculoskeletal pain symptoms (MPS) among undergraduate students enrolled in various health science programs at the Maldives National University. The second, is to investigate the key physical, behavioural, ergonomic, and psychosocial factors that may be associated with the onset and development of

MPS in this population.

Methodology

Study design and Setting

This study employed a quantitative, institutional cross-sectional design to investigate the prevalence and associated factors of musculoskeletal pain symptoms (MPS) among undergraduate students in the health sciences. The study was conducted in Malé, the capital city of the Maldives, where the main campuses of Maldives National University (MNU) are located. Specifically, the research was conducted within the Faculty of Health Sciences (FHS), the country's foremost institution for producing a qualified healthcare workforce. Established to meet the nation's evolving health needs, FHS offers undergraduate and postgraduate degree programs that integrate academic coursework with supervised clinical placements. The programs are designed to equip students with the skills and knowledge necessary to serve in community and hospital settings.

Given that health science students engage in prolonged theoretical lectures, extensive practical sessions, and often perform physically and mentally demanding clinical duties, they represent a high-risk group for developing musculoskeletal disorders. These contextual features make the Faculty of Health Sciences a relevant and ideal setting for investigating the burden and determinants of MPS.

Participants

The study targeted 950 undergraduate students enrolled in 10 academic programs within the Faculty of Health Sciences, School of Nursing and School of Medicine (Medicine, Nursing, Medical Laboratory Science, Physiotherapy, Pharmacy, Primary Health Care, Psychology, Counselling, Health Service Management, and Social Work). These programs differ in curriculum structure, clinical exposure, and academic demands, allowing for comparative insights into the variability of MPS across disciplines.

To ensure representativeness across programs, stratified sampling was employed. The total sample size was determined using the RaoSoft sample size calculator, with parameters set to a 5% margin of error, a 95% confidence level, and an assumed response distribution of 50%, resulting in a required sample size of 274 students. The number of samples drawn from each academic program (stratum) was proportionate to the overall enrollment in that program. For instance, the Bachelor of Nursing, the most extensive program, contributed 106 participants, while smaller programs such as Social Work and Health Service Management contributed proportionally fewer.

This stratification ensured that all disciplines were adequately represented, allowing for meaningful subgroup analysis and enhancing the generalizability of the findings within the context of MNU. Table 1 presents a detailed distribution of participants by program, along with their respective sample sizes. After stratification, participants were selected using simple random sampling within each stratum to ensure that every student had an equal chance of being included. This process ensured unbiased selection while maintaining proportional representation. This approach enhanced the generalizability of findings and allowed for subgroup analyses.

$$\frac{x}{y}100 = z$$

$$\frac{z}{100}n = A$$

Where,

- x is the total number of students in the strata
- y is the population size (950)
- n is the number of samples needed (274)
- A is the number of samples needed from the strata

Table 1. Strata and sample size

Strata	**Total (x)**	**No. of samples (A)**
Bachelor of Nursing	370	106
Bachelor of Medicine	150	43
Bachelors in medical laboratory science	132	38
Bachelors in psychology	94	27
Bachelor in Physiotherapy	54	16
Bachelors in Primary Health Care	44	13
Bachelor Counseling	41	12
Bachelor of Pharmacy	37	11
Bachelor's in Health Service Management	23	7
Bachelor of Social Work	5	1
Total	*950*	*274*

Instruments

The research instrument employed in this study was a self-administered questionnaire, comprising two distinct parts. The first part was the Universal Nordic questionnaire, which aimed to evaluate the presence and location of musculoskeletal pain symptoms experienced by the participants within the last seven days and the previous twelve months, respectively. Additionally, this section sought to determine whether the participants had been prevented from performing their regular work duties due to pain within the aforementioned twelve-month period. The second part of the questionnaire was designed to gather data pertaining to socio-demographic, academic, and lifestyle-related inquiries.

Data Collection and Data Analysis

The data for this study were obtained through the distribution of hard copies of a questionnaire to students by their respective lecturers. The completed forms were then returned to the lecturers, who subsequently handed them over to the researcher. The data collected underwent a cleaning process to ensure that only

valid responses were retained. The data was then transferred to an Excel sheet and then to the Social Sciences Package (SPSS) v. 21.0 for analysis. The variables were summarized using frequency distributions and percentages. The association between selected variables and the 12-month prevalence of MPS was analyzed using the chi-square test. A p-value of less than 0.05 was considered to be statistically significant.

Ethical Consideration

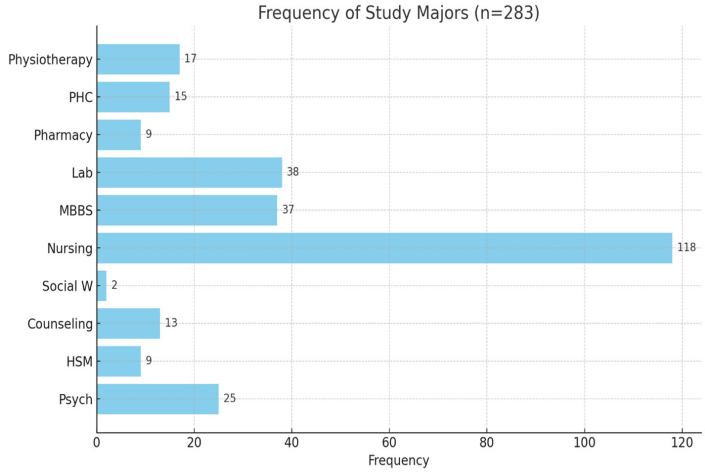
To uphold ethical standards, a serial number system was implemented to anonymize all questionnaires, thereby ensuring participant confidentiality. No personally identifiable information was collected. Before data collection, informed consent was obtained from all participants using signed consent forms. Participants were informed about the purpose of the study, their right to refuse or withdraw at any stage, and that no financial compensation would be provided. Furthermore, the researcher refrained from distributing questionnaires directly to avoid any bias or undue influence. Instead, trained course lecturers were requested to distribute a predetermined number of forms to students across various programs and academic years. The MNU research ethics committee and the National Health Council for Research approved the study.

Results

Participant's characteristics

The study involved a total of 283 participants with three participants being excluded from the study due to their pre-existing medical condition and irregular attendance, distributed across various academic backgrounds as follows: Bachelor of Physiotherapy (17), Bachelor of Public Health Science (16), Bachelor of Pharmacy (9), Bachelor of Laboratory Science (39), MBBS (37), Bachelor of Nursing (119), Bachelor of Social Work (2), Bachelor of Counseling (13), Bachelor of Health Service Management (9), and Bachelor of Psychology (25). Participants were distributed across different academic majors, as shown in Figure 1, stratified by sample size. The mean age of the participants was 21.8 ± 3.6 years, with 90.1% of the participants being females and 9.9% being males. Participants were enrolled across different years of study. Second-year students represented the largest group, comprising 27.6% of the sample, followed by third-year (25.8%) and first-year students (24.7%). Fourth-year students accounted for 20.8%, while only a tiny proportion (1.1%) were in their fifth year.

Figure 1. Course Distribution of the Participants



Lifestyle Patterns and Health-Related Behaviors

As Tables 2 and 3 outlined, participants demonstrated diverse lifestyle and time-use patterns. Regarding academic and postural activities (Table 2), most students reported studying for 2–4 hours daily (43.8%) and standing for similar durations (59.0%). A notable proportion reported extended periods of sitting, with 31.8% sitting for more than 8 hours daily. Regarding screen time, 28.3% used computers for 4–6 hours, and 32.5% reported mobile phone use exceeding 8 hours daily.

Lifestyle-related behaviors (Table 3) revealed that 45.9% of participants slept less than 6 hours per night, and only 11.7% engaged in regular physical activity. Nearly half (48.8%) described themselves as primarily sedentary. While 45.6% were involved in leisure activities when feeling stressed, 30.7% reported not participating in such activities at all. Dietary habits were mixed, with 49.5% reporting a balanced intake and 41.0% mainly indicating unhealthy diets. Stress and burnout were frequently experienced by 62.2% of the respondents, and 60.1% reported heavy physical workload at home. Most participants (81.3%) were not engaged in any employment.

Table 2. Frequency and percentages of average time spent studying, standing, sitting, and computer and phone usage (n = 283)

Variable	Frequency	Percentage (%)
Average time spent in studying (Hours)		
2–4	124	43.8
4–6	85	30.0
6–8	50	17.7
More than 8	23	8.1
No response	1	0.4
Average time spent in standing (Hours)		
2–4	167	59.0
4–6	76	26.9

6–8	28	9.9
More than 8	11	3.9
No response	1	0.4
Average time spent sitting (Hours)		
2–4	33	11.7
4–6	79	27.9
6–8	81	28.6
More than 8	90	31.8
Average time spent using the computer (Hours)		
2–4	78	27.6
4–6	80	28.3
6–8	53	18.7
More than 8	71	25.1
No response	1	0.4
Average time spent using mobile phone (Hours)		
Less than 4	48	17.0
4–6	73	25.8
6–8	70	24.7

Table 3. Frequency and percentages of lifestyle habits include sleep, exercise, leisure activity, diet, stress/burnout, and physical workload at home (n = 283)

Variable	Frequency	Percentage (%)
Average time spent sleeping (Hours)		
Less than 6	130	45.9
6–8	119	42.0
8–10	32	11.3
More than 10	2	0.7
Exercise habits		
Regularly	33	11.7
Do exercises, but not regularly	112	39.6
Do not, mostly sedentary	138	48.8
Leisure activity habits		
Take time regularly	66	23.3
When feeling stressed	129	45.6
Do not take part	87	30.7
No response	1	0.4
Dietary habits		
Mostly healthy	26	9.2
Mostly not healthy	116	41.0
Both equally	140	49.5
No response	1	0.4
Experienced stress/burnout		
Frequently	176	62.2
Sometimes	101	35.7
Never	6	2.1
Heavy physical load at home		

Usually	26	9.2
Sometimes	170	60.1
Never	87	30.7
Employed		
Yes	53	18.7
No	230	81.3

Prevalence of musculoskeletal symptoms

Musculoskeletal pain symptoms (MPS) were highly prevalent among students, with 92.57% (n = 262) reporting pain in at least one body region during the past 12 months and/or the past 7 days. Only 7.4% (n = 21) of participants reported being symptom-free, as assessed using the standardized Nordic Musculoskeletal Questionnaire. These findings indicate a substantial burden of musculoskeletal complaints in this population, underscoring the need for proactive strategies in student health management.

As detailed in Table 4, the spinal region, specifically the lower back (71.73%), neck (66.08%), and upper back (56.89%), exhibited the highest prevalence of symptoms over the 12-month period. These results are consistent with previous literature suggesting that sedentary behaviors, poor postural ergonomics during prolonged study sessions, and inadequate physical activity during university life significantly contribute to spinal discomfort in students. Notably, the lower back emerged as the most affected region across both points, highlighting a persistent vulnerability among students.

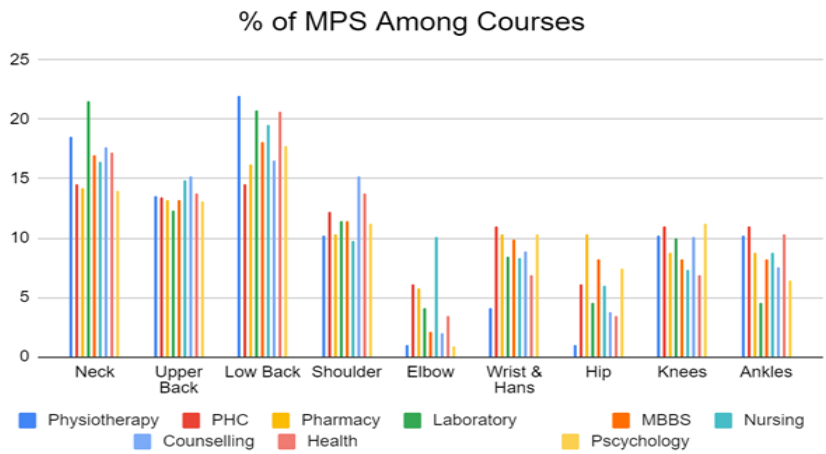
The 7-day prevalence pattern closely mirrors the 12-month data, with neck pain (65.37%) and lower back pain (42.76%) reported at relatively high frequencies. The consistency in short- and long-term symptom prevalence in certain regions, such as the neck, may indicate ongoing strain or chronicity of symptoms. Moreover, the upper extremities exhibited a significant prevalence, particularly in the shoulder (47.00%) and wrist (38.16%), suggesting repetitive strain or overuse, which may be linked to prolonged use of digital devices and suboptimal workstation setups. The lower extremities, including the hips/thighs (23.32%), knees (34.98%), and ankles/feet (33.92%) were less commonly affected than the spine and upper limbs but still presented with noteworthy prevalence.

Upon examining the variations across different study majors, it was observed that low back pain was most prevalent among students of the Bachelor of Physiotherapy (22%), Bachelor of Medical Laboratory Science (20.8%), and bachelor's in health service management (20.7%). Neck pain was predominantly observed among Bachelor of Laboratory Science students (21.5%), Bachelor of Physiotherapy students (18.6%), and Bachelor of Counselling students (17.7%). The majors that exhibited the most upper back pain were Bachelor of Counselling (15.2%), Bachelor of Nursing (14.9%), and Bachelor of Health Service Management (13.8%). This is highlighted in Figure 2.

Table 4. Body Regions Affected by MPS

Body Region	Trouble in the Last 12 Months n (%)	Trouble During the Last 7 Days n (%)
Neck	187 (66.08%)	185 (65.37%)
Upper Back	161 (56.89%)	89 (31.45%)
Lower Back	203 (71.73%)	121 (42.76%)
Shoulder	133 (47.00%)	72 (25.44%)
Elbow	29 (10.25%)	17 (6.01%)
Wrist	108 (38.16%)	57 (20.14%)
Hip/Thighs	66 (23.32%)	29 (10.25%)
Knee	99 (34.98%)	54 (19.08%)
Ankles/Feet	96 (33.92%)	46 (16.25%)

Figure 2. Prevalence of MPS among different courses in different regions of the body



MPS and Functional Limitations

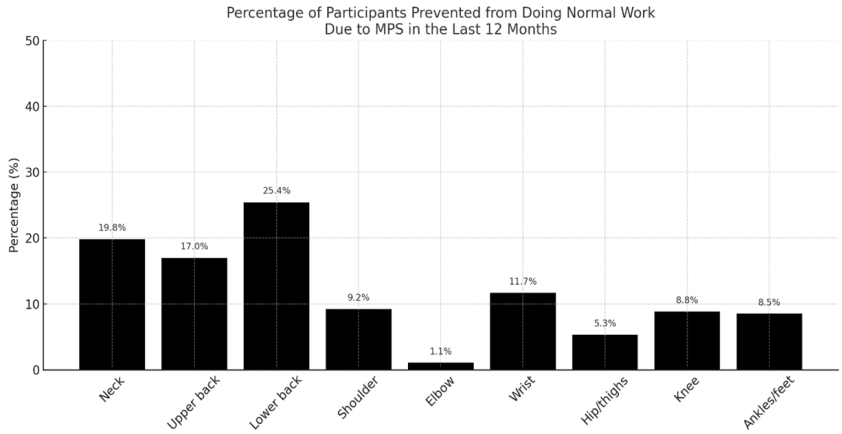
A considerable proportion of students who reported experiencing musculoskeletal pain symptoms (MPS) over the past 12 months also experienced significant functional impairment. Specifically, 66.23% (n = 187) of those affected indicated that their symptoms had interfered with their ability to perform routine daily activities.

Most of these activity limitations were linked to symptoms in the spinal regions. Lower back pain emerged as the most disabling, with 25.44% of participants

reporting that it had prevented them from engaging in daily tasks. This was followed by neck pain (19.79%) and upper back pain (16.96%), underscoring the cumulative impact of postural strain and sedentary behaviors typically associated with student lifestyles.

Pain in the upper extremities also contributed to functional limitations. Wrist pain was reported as disabling by 11.66%, followed by shoulder pain (9.19%). In contrast, symptoms in the lower extremities, such as the knee (8.83%), ankles/feet (8.48%), and hips/thighs (5.30%) had a relatively lower impact on function. Notably, elbow pain resulted in the least interference, with only 1.06% of students indicating that it limited their everyday activities. These patterns are illustrated in Figure 3.

Figure 3. Percentage of participants prevented from performing normal daily activities due to musculoskeletal pain symptoms (MPS)



Associations between MPS and Class Attendance

A chi-square test assessed the association between musculoskeletal pain symptoms (MPS) in the past 12 months and students' regular class attendance. Table 5 shows a statistically significant association for neck pain ($\chi^2 = 5.906$, p = .015). No significant associations were observed for upper back pain ($\chi^2 = 0.686$, $p = .407$), lower back pain ($\chi^2 = 0.038$, $p = .845$), shoulder pain ($\chi^2 = 0.227$, $p = .634$), elbow pain ($\chi^2 = 0.346$, $p = .556$), wrist pain ($\chi^2 = 0.030$, $p = .863$), hip/thigh pain ($\chi^2 = 0.922$, p = .337), knee pain ($\chi^2 = 0.004$, $p = .952$), or ankle/foot pain ($\chi^2 = 1.557$, $p = .212$).

Table 5. Association between Trouble in the Last 12 Months and Regularly Attending Classes

Body Region	Total	Chi-square	p-value
Neck	187	5.906	0.015
Upper back	161	0.686	0.407

Lower back	203	0.038	0.845
Shoulder	133	0.227	0.634
Elbow	29	0.346	0.556
Wrist	108	0.030	0.863
Hip/thighs	66	0.922	0.337
Knee	99	0.004	0.952
Ankles/feet	96	1.557	0.212

Associations between MPS and Computer Usage Time

Chi-square analysis was also used to examine the association between MPS in the past 12 months and average computer usage time. Table 6 shows a statistically significant association for neck pain ($\chi^2 = 10.556$, $p = .032$) and upper back pain ($\chi^2 = 11.309$, $p = .023$). No significant associations were observed for lower back pain ($\chi^2 = 1.457$, $p = .834$), shoulder pain ($\chi^2 = 8.448$, $p = .076$), elbow pain ($\chi^2 = 5.701$, $p = .223$), wrist pain ($\chi^2 = 1.345$, $p = .854$), hip/thigh pain ($\chi^2 = 5.837$, $p = .212$), or knee pain ($\chi^2 = 3.579$, $p = .466$).

Body Region	2–4 hrs	4–6 hrs	6–8 hrs	>8 hrs	Total	Chi-square	p-value
Neck	49	53	29	56	187	10.556	0.032
Upper back	37	42	31	51	161	11.309	0.023
Lower back	55	55	38	54	203	1.457	0.834
Shoulder	34	40	18	41	133	8.448	0.076
Elbow	3	12	6	8	29	5.701	0.223
Wrist	27	31	22	28	108	1.345	0.854
Hip/thighs	16	13	16	21	66	5.837	0.212
Knee	28	25	22	23	99	3.579	0.466

Association between MPS and Heavy Physical Workload at Home

The association between musculoskeletal pain symptoms (MPS) in the past 12 months and engagement in heavy physical workload at home is illustrated in Table 7. The analysis showed a statistically significant association between shoulder pain ($\chi^2 = 11.218$, $p = .004$) and elbow pain ($\chi^2 = 8.713$, $p = .013$). No significant associations were observed for neck ($\chi^2 = 0.029$, $p = .985$), upper back ($\chi^2 = 4.690$, $p = .096$), lower back ($\chi^2 = 0.679$, $p = .712$), wrist ($\chi^2 = 1.676$, $p = .433$), hip/thighs ($\chi^2 = 0.280$, $p = .869$), knee ($\chi^2 = 0.467$, $p = .792$), or ankles/feet ($\chi^2 = 1.936$, $p = .380$).

Table 7. Association Between MPS and Heavy Physical Workload at Home

Body Region	Usually	Sometimes	Never	Total	Chi-square	p-value
Neck	17	113	57	187	0.029	0.985
Upper back	16	88	57	161	4.690	0.096
Lower back	18	125	60	203	0.679	0.712
Shoulder	13	92	28	133	11.218	0.004
Elbow	4	23	2	29	8.713	0.013
Wrist	12	67	29	108	1.676	0.433
Hip/thighs	5	40	21	66	0.280	0.869
Knee	9	62	28	99	0.467	0.792
Ankles/feet	12	55	29	96	1.936	0.380

Association between MPS and Experiencing Stress and Burnout

A chi-square test was performed to examine the association between musculoskeletal pain symptoms (MPS) in the past 12 months and self-reported experiences of stress and burnout. As shown in Table 8, statistically significant associations were found for neck pain ($\chi^2 = 19.537$, $p < .001$), upper back pain ($\chi^2 = 9.040$, $p = .011$), lower back pain ($\chi^2 = 13.668$, $p = .001$), shoulder pain ($\chi^2 = 16.827$, $p < .001$), wrist pain ($\chi^2 = 10.732$, $p = .005$), and ankle/foot pain ($\chi^2 = 7.273$, $p = .026$). No significant associations were observed for elbow ($\chi^2 = 2.020$, $p = .364$), hip/thigh ($\chi^2 = 0.044$, $p = .817$), or knee pain ($\chi^2 = 0.482$, $p = .786$). Due to low expected frequencies in some categories, Fisher's Exact Test was applied for the shoulder and elbow regions. The association between shoulder pain and stress remained statistically significant ($p = .015$), while the association for elbow pain remained non-significant ($p = 1.00$)."

Table 8. Association Between MPS and Experiencing Stress and Burnout

Body Region	Frequently	Sometimes	Never	Total	Chi-square/ Fisher Test	p-value
Neck	133	52	2	187	19.537	0.000
Upper back	112	47	2	161	9.040	0.011
Lower back	136	66	1	203	13.668	0.001
Shoulder	98	35	0	133	16.827	0.000
Elbow	21	7	1	29	2.020	0.364
Wrist	80	27	1	108	10.732	0.005

Hip/thighs	43	22	1	66	0.044	0.817
Knee	59	38	2	99	0.482	0.786
Ankles/feet	70	25	1	96	7.273	0.026

Discussion

The present study aimed to investigate the prevalence of musculoskeletal pain symptoms (MPS) and associated factors among undergraduate health science students at MNU. The results provided valuable insights into these factors.

This study's results showed a concerningly high prevalence rate of MPS among participants. Most participants (92.57%) reported experiencing trouble in one or more body regions. Notably, the spinal regions (lower back, neck and upper back) exhibited the highest prevalence rates over the 12-month and 7-day periods. These findings are consistent with previous research that also highlighted the high prevalence of MPS in undergraduate health science students, especially in the regions of the lower back and neck (Ogunlana et al., 2021; Wami et al., 2020).

The reason for this can be multifactorial. Undergraduate students of different health majors typically have demanding study curricula compared to students of other disciplines. In addition to standard written exams, health science students must complete clinical exams and clinical placements within healthcare institutions, which can be highly demanding and stressful. Academic workload and pressure may contribute to the development of MPS. Moreover, their studies often involve significant screen time and prolonged sitting, which can lead to poor posture and musculoskeletal strain. The increased sedentary behavior and lack of regular physical activity can further contribute to the development of MPS. Poor dietary habits may contribute to increased inflammation and susceptibility to MPS.

A variation in prevalence rates among different academic majors is a noteworthy finding that is seen in this study, which was also a trend seen in literature (Algarni et al., 2017; Hasan et al., 2018; Haroon et al., 2018; Sklempe Kokic et al., 2019; Pugh et al., 2019; Morais et al., 2019; Wami et al., 2020). Some academic majors, such as Bachelor of Physiotherapy, Bachelor of Laboratory Science and bachelor's in health service management, showed higher prevalence rates of specific MPS. This finding suggests that specific academic majors may expose students to certain risk factors or activities that contribute to MPS. This suggests that undergraduate health science students may begin to develop musculoskeletal issues during their academic years, mirroring the occupational risks observed in practicing clinicians such as physiotherapists (Proma et al., 2022) Further research is needed to understand the underlying reasons for these differences. So that planning can be done to develop targeted interventions for at-risk student populations.

A significant proportion of the participants of this study (66.23%) reported that they could not perform their daily activities due to their MPS. This result shows us the impact of MPS on students' everyday functioning. This is a concerning fact as this can negatively affect students' learning and participation. Most of the time, trouble in the spinal regions (neck, lower back, upper back) was the reason for this limitation. Results of previous research align with this finding in showing that back pain significantly contributes to the impairment of functional abilities (Algarni et al., 2017; Hasan et al.; Wami et al., 2020). Reasons for this can be due

to students not seeking proper medical attention for the MPS, lack of education about preventative measures such as proper posture and good body mechanics in everyday life activities, as well as lack of physical activity and sedentary lifestyle with increased stress from academic workload and family responsibilities. These findings show the need for the availability of early detection and proper intervention to minimize the impact of MPS on students' academic performance and overall well-being.

This study examined multiple factors that can contribute to MPS in this population. While several factors studied did not show statistical significance as contributing factors to the occurrence of trouble, some important associations emerged. Regular attendance to classes and clinical training was significantly associated with MPS in the neck region. This can suggest that academic activities that require prolonged postural positions can contribute to neck pain in students. Prolonged, isometric muscle contraction can lead to reduced blood circulation and accumulation of metabolic waste in the muscles, worsening MPS (Osada et al., 2015). Additionally, high computer usage time was also associated with MPS symptoms in the neck and upper back regions, bringing to light the potential role of excessive screen time in the development of musculoskeletal pain symptoms.

Stress emerged as a significant factor associated with MPS in multiple body regions, including the neck, shoulder and lower back. This finding is consistent with the existing literature, which suggests that psychological factors such as stress and burnout can contribute to the development and exacerbation of MPS, as stress is a factor that can suppress the immune system and result in tissue damage (Algarni et al., 2017; Almhdawi et al., 2017; Hasan et al., 2018; Haroon et al., 2018; Wami et al., 2020; Sklempe Kokic et al., 2019)

Numerous factors can contribute to an increased mental burden among students. These can be a heavy study syllabus and course content, the need to meet assignment deadlines, both written and clinical exams, stressful clinical placements, and added responsibilities of managing family obligations and balancing time with family and friends. It is important to note that the population of MNU students being studied consists of individuals who lived with their families rather than in hostel settings, further highlighting the potential impact of familial and social connections in conjunction with a demanding study syllabus on the mental well-being of these students. Addressing stress management strategies and promoting well-being among students should be a priority in preventing and managing MPS in these students.

These findings underscore the need to view MPS not merely as a physical health issue but as a multidimensional problem shaped by academic stressors, lifestyle patterns, and social environments. The cumulative academic workload, emotionally demanding clinical experiences, and responsibilities outside the university, particularly among students living with families, may all act as psychosocial stressors that exacerbate physical strain. Considering this, adopting a biopsychosocial framework will offer a more comprehensive lens for interpreting the occurrence and persistence of MPS among undergraduate students. This model considers the dynamic interaction between biological (e.g., posture, physical workload), psychological (e.g., stress, coping styles), and social (e.g.,

living arrangements, support systems) factors that influence pain experience and disability. Integrating this approach into future research and preventive strategies may enable a more holistic understanding and address the underlying contributors to MPS more effectively within university populations.

Moreover, this perspective aligns closely with Occupational Safety and Health (OSH) frameworks, which emphasize the importance of addressing both physical and psychosocial risk factors in promoting student and worker well-being.

Strengths and Limitations

The study findings must be viewed in the light of their strengths and limitations. One limitation of the study is that it included only students from the Malé campus of the Maldives National University (MNU). As a result, the findings may not fully represent students' experiences studying in other campuses across the Maldives. Including participants from regional campuses in future research could provide a more comprehensive and nationally representative understanding of musculoskeletal pain symptoms among university students. Another limitation is that the study focused exclusively on health science students. While this group is at high risk due to academic and clinical demands, excluding non-health science students restricts the ability to compare MPS's prevalence and contributing factors across different academic disciplines. Including students from non-health science programs could offer valuable insights into how academic context and lifestyle variations influence MPS.

Despite these limitations, studying possesses several notable strengths. First, it is among the first empirical investigations to assess the prevalence and associated risk factors of MPS among undergraduate health science students in the Maldivian context, addressing a clear gap in regional evidence. Including students from ten distinct academic programs within the Faculty of Health Sciences at Maldives National University ensured wide disciplinary representation, capturing the diversity of academic demands and clinical exposures that may contribute to musculoskeletal pain.

Secondly, stratified sampling allowed for proportional representation of the student population based on course enrollment sizes, which enhanced the generalizability of the findings within the institution. The study provided a balanced view of the problem across different health disciplines by ensuring that smaller programs were not underrepresented. The sample size was statistically calculated using validated software, which ensured appropriate power and minimized sampling bias.

Thirdly, the study used a structured and anonymous data collection process to ensure participant confidentiality and minimize social desirability bias. Ethical standards were upheld throughout the process, including informed consent, voluntary participation, and non-interference by researchers during data collection. Moreover, the study integrated a wide range of variables, including sociodemographic, behavioral, ergonomic, and psychosocial factors, allowing for a comprehensive analysis of the determinants of MPS.

Finally, the study's findings have practical implications for student support systems, curriculum planning, and preventive health initiatives. By identifying

modifiable risk factors such as stress, screen time, and workload, the results can inform targeted interventions within academic institutions and promote student well-being. The study also sets a foundation for future research in occupational health among student populations. It aligns with global calls to integrate mental and physical health considerations in academic and clinical training environments.

Recommendations for future research and interventions

Based on the findings of our study, several recommendations can be made for future research and interventions. To gain a more comprehensive understanding of the prevalence and impact of MPS, it would be beneficial to conduct comparison studies between health science students and non-health science students within the same institution. Also, expanding the scope of research to include students at different levels of courses within the institution, not limited to undergraduate students, would provide a much broader understanding of the effect of MPS on students. Additionally, conducting longitudinal studies can provide a better and deeper understanding of the temporal relationship between associated factors and the development of MPS. Secondly, implementing ergonomic interventions, such as promoting proper posture, providing ergonomic equipment in academic settings, and implementing micro-breaks during study hours, can help reduce this prevalence.

Developing and implementing stress management programs such as counselling, mindfulness training, and relaxation techniques tailored to the students' specific needs is essential to minimize the impact of MPS on the students' health. The promotion of health education among students is of paramount importance. Enhancing awareness regarding maintaining a healthy lifestyle is crucial, and it encompasses regular physical exercise, a well-balanced diet, and sufficient sleep. These practices can positively impact students' well-being, not only in the present but also in the long term. Moreover, the availability of avenues that facilitate health promotion is equally essential. Campuses should provide adequate gym and sports facilities, while canteens should prioritize offering affordable and nutritious meals instead of unhealthy options. These changes and implementations can significantly benefit students pursuing a healthy lifestyle. Lastly, collaborating with different academic departments can help identify major-specific risk factors and target education and interventions in areas needed.

Conclusion

The findings of this study shed light on the high prevalence rates of MPS among undergraduate health science students of MNU and the factors that contribute to these symptoms. The results highlight the need for proactive interventions such as ergonomic modifications, stress management programs, and health education initiatives, as well as the availability of health-promoting avenues for university students to reduce the impact of MPS on students' well-being and academic performance. Early interventions are significant for health science students, as they will eventually contribute to the healthcare industry of the Maldives. The undergraduate years are crucial for students to develop health and lifestyle behaviours and work-related discipline. Therefore, it is imperative to prevent the development of chronic pain, which can have numerous detrimental effects on both work and personal life. By implementing these interventions and promoting

a healthy lifestyle, students can be better equipped to succeed academically and maintain their well-being throughout their careers.

Conflict of Interest

The authors declare that they have no conflicts of interest related to the publication of this manuscript.

Declaration

This paper was originally submitted as a research project as part of a course requirement for Bachelor of Physiotherapy at Maldives National University in August 2023. As a result, it appears in the MNU Moodle/ Turnitin, which has contributed to the current similarity index of 39%. I confirm that we are the original author(s) of this work, and the content is entirely our own. All external sources used have been properly cited according to the journal's required citation style. This work has not been previously published or submitted to any other journal.

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