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Prevalence and Determinants of Musculoskeletal Disorders among University students in Ajman UAE

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Abstract – Background: Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. This study aimed to determine the prevalence of musculoskeletal disorders among university students in Ajman UAE and to assess the factors associated with such disorders.
Methods: A cross-sectional study was conducted among medical university students using an online self-administered Nordic questionnaire. SPSS version 27 was used for analysis. The association between dependent and independent variables was assessed using the Chi-square test. Statistical significance was set at p<=0.05.
Results: The sample size of this research was a total of 1008 students. Of these, 978 students responded with issues with one of the listed sites. Most students had an issue with their neck-978 (97%) while the least had issues with ankle/feet-342(33.9%).
Conclusion: The research concluded that the overall prevalence rate of MSDs among university students is high. Females have a greater rate due to their smaller body size and lower muscular tone as compared to males. The most common factors significantly associated with MSDs were found to be female gender, age >-24 years, from EMRO countries, students of the college of pharmacy and health sciences, being physically inactive, having irregular physical exercise, positive history of MSK problems, history of trauma and accident, and chronic diseases, in the study.

Keywords – Prevalence, Determinants, Musculoskeletal disorders, University students,

I. INTRODUCTION

Musculoskeletal disorders (MSDs) among university students have been a topic of discussion in various studies conducted worldwide. The prevalence of MSDs among university students can be influenced by various factors. Sedentary lifestyles, poor ergonomics, heavy backpacks, stress, and mental health issues, lack of physical fitness, repetitive movements, insufficient rest, and lack of awareness are some common contributors. Prolonged sitting, inadequate workstation setup, carrying heavy loads, academic pressure, lack of exercise, repetitive motions, insufficient rest, and limited knowledge about MSD prevention can increase the risk. Additionally, the increased use of smartphones, tablets, and laptops for academic purposes can contribute to poor neck and back posture. This report identifies positive evidence for the prevalence of musculoskeletal problems among university students in the neck, Upper back, Lower back, Hips/thighs, Knee, and ankle/feet.

A repetitive strain injury (RSI) is an injury to a part of the musculoskeletal or nervous system caused by repetitive use, vibrations, compression, or long periods in a fixed position. Commonly, it happens in the arm, shoulder, and neck. Other common names include repetitive stress disorders, cumulative trauma disorders (CTDs), and overuse syndrome. Many factors are related to

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shoulder and neck pain, such as high levels of physical activity and sports participation. The psychological problems and poor self-assessed health also increase the spread of neck and shoulder pain. [1]

An Italian study revealed that fourth-year university students who spent extended periods using computers were more exposed to risk factors like prolonged use, lack of breaks, excessive mouse usage, and poor workstation ergonomics. Neck pain (69%), hand/wrist pain (53%), shoulder pain (49%), and arm pain (8%) were commonly reported symptoms, particularly among fourth-year students. The prevalence of neck and hand/wrist pain was significantly higher as students progressed through their course. The study also found a low awareness of computer-related health risks among students. These findings emphasize the need for preventive measures, including educating students about computer ergonomics. [2] A study conducted in the United Kingdom revealed alarming prevalence rates of pain among dental students, highlighting potential implications for both individuals and the dental profession. Approximately 22% of students were uncertain about the optimal patient height to ensure proper posture during treatment, which showed lack of awareness about ergonomics. [3] Another study from the United States found that neck problems were most frequently reported (41.6% within the past 12 months), followed by ankle/foot problems impacting daily activities (18.9%). [4]

In a study conducted at Taif University in Saudi Arabia, it was found that 45% of participants used smartphones, with 35.1% spending an average of 6-9 hours on their devices. Among smartphone users, 40.5% held their devices with one hand, tilting their neck slightly below the horizon line, and 59.1% experienced neck or shoulder pain while using their devices. Additionally, participants using both iPads/tablets and computers had a higher likelihood of experiencing neck or shoulder pain. [1] A separate study at Marmara University in Turkey revealed that university students had a high frequency of smartphone use, and the most common symptoms were reported in the neck, shoulder, and upper back regions. [5] In a study conducted in Ajman reported that the prevalence of MSP in at least one body site in the past week, and in the past year was 48.5% and 68.3% respectively. The factors significantly associated with MSP in at least one body site at any time were having a history of trauma, lack of exercise, longer clinical sessions, and higher BMI. [6] Musculoskeletal disorders (MSDs) have been a worldwide concern for the past century, especially with the emergence of new technologies that encourage the risk factors of MSDs. MSDs can lead to sleep disturbance, according to a cohort study, thus influencing adolescents' growth and their ability to function properly. This is represented via detrimental effects on their relationship with their surroundings and ultimately it leads to poor academic performance.

II. Materials & Methods

This research was conducted using a cross-sectional study design among students studying in a Medical University in Ajman, UAE. After conducting a comprehensive literature search, a self-administered questionnaire was prepared to fulfill the objectives of the study. The questionnaire consisted of various categories, including socio-demographic profile, previous history of musculoskeletal disorders (MSDs), medical history, usage of electrical gadgets, physical activity, posture, and Nordic scale was used to assess the musculoskeletal problems among the participants. Students who were over the age of 18 and from any country who were willing to engage in this study were included. It is a population-based study and 1009 students from various programs participated in this research. It was conducted after obtaining approval from the Institutional Review Board of the medical university (Ref. no. IRB/COM/STD/55/SEPT-2022 Dated 23rd September 2022)

Before commencing the research, the research's purpose was thoroughly explained to the participants. Following approval from the Institutional Review Board (IRB), the questionnaire was administered, and participants provided signed, written informed consent at the initiation of the study. Participants were assured that their involvement was entirely voluntary, and they retained the right to withdraw from the study at any point if they chose not to participate or respond.

The data collected underwent analysis using SPSS version 27, and the findings were presented through tables and figures. Descriptive statistics were employed to gauge the prevalence of musculoskeletal disorders among university students. Inferential statistics, including the Chi-square test was conducted to assess the association between various factors and musculoskeletal disorders. A statistical significance threshold was set at a p-value less than or equal to 0.05.

III. RESULTS

A total of 1008 responded to the research. The socio-demographic characteristics showed that participants were between ages 18 and 30 years, about gender, majority were females their nationality was categorized according to WHO region and the majority from the EMRO region.

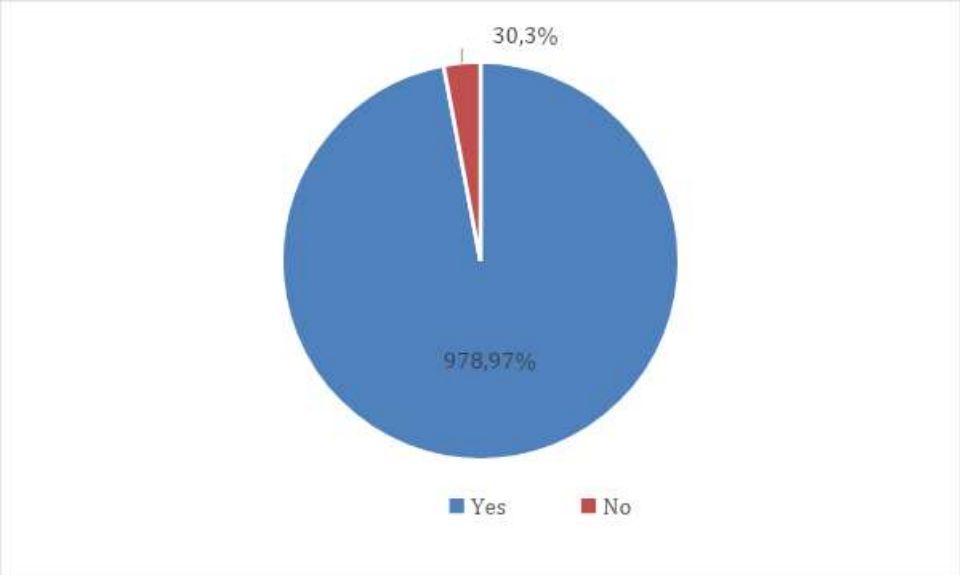

Fig.1 Distribution of participants according to history of Musculoskeletal disorders in the past 12 months

Out of the total participants 978 (97%) students had responded with issues with one of the listed common sites. The majority had problems with the upper back and neck region followed by lower back and ankle joint.

Table 1: Association between Socio-demographic characteristics and Musculoskeletal disorders in the past 12 months

Socio-demographic variables	Group	Musculoskeletal disorders in the past 12 months				P value
		Yes		No		
		No.	%	No.	%	
Gender	Male	508	97.5	13	2.5	.010
	female	484	99.4	3	0.6	
Age group	<24	585	97.3	16	2.7	.002
	>=24	407	100	0	0	
Nationality (Categorized according to WHO region wise)	EMRO	668	99	7	1	.053
	SEAR and others	324	97.3	9	2.7	
Program under study	College of Medicine	489	97	15	3	.014
	College of Pharmacy	170	100	0	0	
	College of Health Science	202	99.5	1	0.5	
	others	131	100	0	0	

The association between self-reported history of musculoskeletal disorders in the past 12 months and socio-demographic variables among 354 participants reported in table 1. Regarding gender, females showed the highest number 484 (99.4%) compared to males. This association was found to be statistically significant with a p value 0.01.

The group that showed the most participants with musculoskeletal disorders in the past 12 months were in the age groups greater than or equal to 24 years 407 (100%) compared to the other group that involved age groups less than 24 years months. A statistically significant association was observed between age group and musculoskeletal disorders with a p value 0.002.

Participants from the Eastern Mediterranean Region showed the highest number with musculoskeletal disorders (99%) as compared to the participants from the Southeast Asia region. The association observed was statistically significant with a p value less than or equal to 0.05.

With regard to program under study and presence of musculoskeletal disorders, students from pharmacy and health sciences field suffered more from musculoskeletal disorders as compared to their counter parts.

Table2: Association between Behaviour variables and Musculoskeletal disorders in the past 12 months

Behavior related variables	Group	Musculoskeletal disorders in the 12 months				P
		Yes		No		
		No.	%	No.	%	
Physically active	No	8	53.3	7	46.7	.001
	yes	9	0.9	984	99.1	
Tobacco use	Yes	2	66.7	1	33.3	.001
	No	15	1.5	990	98.5	
Alcohol use	Yes	2	50	2	50	.001
	No	990	98.6	14	1.4	
Perform Physical Exercise	Yes	261	96.3	10	3.7	.001
	No	731	99.2	6	0.8	
Regularity of Physical Exercise	No	731	99.2	6	0.8	.006
	regular	125	95.4	6	4.6	
	irregular	136	97.1	16	1.6	

The association between behavior and the presence of musculoskeletal disorders in the past 12 months is found to be significant statistically. The variables significantly associated were physical inactivity, tobacco use, non-alcohol use, not performing physical exercise, and irregular in performing physical activity. Details are given in table 2.

Table 3: Association between self-reported history of Musculoskeletal disorders in the 12 months and history of co-morbidity.

Co-morbidity	Group	Musculoskeletal disorders in the past 12 months				P
		Yes		No		
		No.	%	No.	%	
Past history of MSDs	No	988	98.4	16	1.6	.812
	yes	4	100	0	0	
History trauma or accident	No	987	98.4	16	1.6	.790
	Yes	5	100	0	0	
History of Chronic diseases	No	987	98.5	15	1.5	.771
	yes	5	83.3	1	16.7	
Level of BMI	Underweight	57	100	0	0	.775
	Normal weight	297	97.4	8	2.6	
	Overweight	255	98.8	3	1.2	
	obese	383	98.7	5	1.3	

In our study the MSDs were significantly higher with history of musculoskeletal problems, history of trauma and accidents, chronic diseases, underweight. Details are given in table 3.

IV. Discussion

This research was conducted to assess the prevalence and factors associated with musculoskeletal disorders among university students in Ajman UAE. The present study showed that 97% of students have musculoskeletal diseases. A study among Malaysian medical students depicted that the prevalence of MSDs was 50% (Alshagga M), and it was 64% among health specialty students in Taif University (Hendi O,).

In the present study, 97.5 % of males and 99.5% of females reported musculoskeletal pain. Whereas research conducted in Saudi Arabia among medical University students- 46% of males and 54.1% of females reported musculoskeletal pain (Obadah Mohammed Hendi,). In the study among Dental Students of King Saud University, Nearly, 142 (95%) students returned the completed questionnaire, 88 (62%) were females and 54 (38%) were males. [7]

In a study conducted by Muniba Mehmood Hasan stated that Females exhibited a higher prevalence of musculoskeletal pain. An association was observed with the use of backpacks. The study examined various daily activities such as exercise and outdoor sports, but no significant relationship was found. Which was similar to our study. [8] The higher rate in females is attributed to their smaller body size, and reduced muscle tone compared to males. EMRO region can be attributed to the environmental conditions and habits.

In the present study, 97 % reported Neck pain. A study conducted by Hendi et al reported that neck pain was the highest site of complaint (33.4%) followed by low back pain (15.1%) and shoulder pain (12.8%). [1] In the study of the Prevalence of musculoskeletal disorders (MSD) and smartphone addictions among university students in Malaysia, about 82.3% (n=186) of participants reported the presence of MSD symptoms in at least one body part and neck has the highest prevalence of MSD, 65.9% (n=149). Moreover, the study also found that 73.5% (n=166) of participants were at risk of having smartphone addiction. [9]

Comparing Jeffrey N. Katz et al's study to our own, notable findings emerged. In Katz's study, 3.6% of participants did not complete the upper extremity symptoms item, while the remaining students reported varying levels of symptoms based on computer use duration. In our study, a higher prevalence of musculoskeletal pain was observed, with 97.5% of males and 99.5% of females affected. The neck region had the highest prevalence at 97%, followed by the upper back, lower back, hips/thighs, knees, and ankles/feet. Neglecting ergonomics and the influence of the EMRO region were significant contributing factors. [10]

A study conducted by Abdullah M. Alsalameh et al on Evaluating the relationship between smartphone addiction/overuse and musculoskeletal pain among medical students at Qassim University showed that the most frequent pain related to smartphone addiction was in the neck (60.8%), followed by lower back (46.8%), shoulder (40.0%) whereas in our study most students had an issue in their neck-978 (97%) and Lower back- 976 (96.8%). [11]

In a study conducted by Tim Morse et al on Musculoskeletal disorders of the neck and shoulder in dental hygienists and dental hygiene students stated that neck symptoms were reported by 37%, 43%, and 72%, respectively ($p<.001$), while shoulder symptoms were reported by 11%, 20%, and 35% of participants ($p<.05$). Regression analysis revealed that self-reported shoulder pain was associated with working above shoulder height, and neck symptoms were associated with working with a bent neck. High supervisor support had a protective effect on neck symptoms. Whereas in our study most students had an issue in their neck-978 (97%) and Lower back- 976 (96.8%) [12]

In a study conducted in japan by Derek Richard Smith et al showed that Shoulder musculoskeletal disorders (MSDs) were the most prevalent condition, affecting 14.9% of participants. This was followed by lower back MSDs (13.5%), neck MSDs (9.5%), knee MSDs (5.0%), forearm MSDs (2.7%), leg MSDs (2.3%), and foot MSDs (1.8%). Headache was also reported by 4.5% of participants. Whereas in our study neck-978 (97%) Upper back- 396 (39.3%), Lower back- 976 (96.8%),Hips/thighs-518(51.4%), Knee-431(42.8%), ankle/feet-342(33.9%) were the areas of pain. [13]

In a study conducted in China by Yunzhi Lin et al stated that out of the 1,178 participants who completed the survey (response rate = 79.6%), comprising 722 medical students and 456 dental students there were 553 males and 625 females. A total of 523 students (44.4%) reported experiencing neck pain (NP), 361 students (30.6%) reported low back pain (LBP), and 182 students (15.4%) reported joint pain (JP). Whereas in our studyneck-978 (97%) Upper back- 396 (39.3%), Lower back- 976 (96.8%),Hips/thighs-518(51.4%), Knee-431(42.8%), ankle/feet-342(33.9%) was reported. [14]

In another study by Senarath MKID et al stated that Neck problems were the most prevalent, affecting 41.6% of students in the last 12 months. Among the nine anatomical regions assessed, ankle/foot problems significantly impacted students' day-to-day activities, with a prevalence of 18.9%. Additionally, a relatively high proportion of students experienced lower back problems (8.6%), leading them to seek medication, while neck problems prompted more students to seek physiotherapy (7.4%). The involvement of the wrist/hand region was the least reported site. [15]

In a study conducted by Rakhadani PB stated that a significant majority (84.6%) of the participants reported using computers primarily for internet browsing, word processing, and gaming. Musculoskeletal pain was commonly reported among students when using computers, particularly in the neck (52.3%), shoulder (47.0%), fingers (45.0%), lower back (43.1%), and general body (42.9%) areas. Factors contributing to these pains included prolonged computer use, uncomfortable seating positions, low chairs, and stress.The duration of computer use was significantly associated with neck, shoulder, and wrist pain. [16]

In a study conducted by Sana Shokr stated that the computer-related musculoskeletal disorders questionnaire revealed that a majority of the participants experienced pain in their right shoulder (23.9%). Whereas in our study neck and lower back was the most common site. [17]

In a study conducted by Peter A Leggat in Northern Queensland stated that over a 72-month period, the prevalence of low back pain (LBP) was found to be 64.6%. Among the participants, 38.8% stated that LBP affected their daily lives, and 24.5% sought medical treatment for their condition. The prevalence of LBP varied significantly, ranging from 45.5% to 77.1% ($p = 0.004$). Logistic regression analysis revealed that the year of study and weekly computer usage were identified as statistically significant risk factors for LBP. Which was similar to our study. [18]

In a study carried out by Antonio Lorusso stated that Out of the participants, 37% reported experiencing complaints in any part of the body within the last 12 months. The most reported symptom was low back pain, reported by 27% of the participants. This was followed by neck pain (16%), shoulder pain (11%), leg pain (8%), and hand/wrist pain (5%). The presence of complaints was

found to be associated with poor physical activity. Whereas in our study neck-978 (97%) Upper back- 396 (39.3%),Lower back-976 (96.8%),Hips/thighs-518(51.4%), Knee-431(42.8%), ankle/feet-342(33.9%) were the results. [19]

In a study carried out by Asifa Qurat Ul Ain stated that among a total of 173 students, 141 (81.5%) reported experiencing musculoskeletal pain. Exams-induced stress was reported to increase the pain in 28 (16.2%) students. In conclusion, the prevalence of musculoskeletal pain was high among medical students, with lower back pain being the most common. Neck and shoulder pain were also frequently reported. Stress, exams, work, and prolonged sitting or standing were identified as common aggravating factors for musculoskeletal pain. [20]

In a study conducted by Omar Q Samarah et al. involving 593 Jordanian university students, the prevalence rates of musculoskeletal (MSK) pain in the neck, shoulder, and lower back were 34.6%, 27%, and 41% respectively. The average daily hours of computer use were significantly associated with MSK pain, whereas gender, depressive symptoms, and average hours of study at home per day did not show significant relationships with MSK pain over the year. [21]

A study conducted by Dorsa Nouri Parto,In 2018, there were a total of 289 participants, and the number of participants decreased in the following years (173 in 2019, 131 in 2020, and 76 in 2021). Across all four years, participants consistently reported a median of 2-3 pain sites in the last year and 1-2 pain sites in the last week. The most reported sources of pain were the lower back and neck. The risk factors varied depending on the year and gender, but overall, factors such as poorer mental health, studying in healthcare, regular sports participation (in males only), older age, and fewer hours of sleep were significantly associated with a higher prevalence of musculoskeletal disorders. [22] As any research this has some limitations. It adopted a cross-sectional research design and conducted among a small population, Hence the results may not be generalizable to the entire population. This research used a self-reported questionnaire, due to which there is a possibility of over-reporting or under-reporting of the required information.

V. Conclusion

Our research concluded that the overall prevalence rate of MSDs among university students in the last 12 months was found to be 97%, and the highest prevalence was found to be neck and lower back and the least reported site was ankle and feet.

The most common factors significantly associated with MSDs were found to be female gender, age >-24 years, from EMRO countries, college of pharmacy and health sciences, physically inactive, irregular physical exercise, history of MSK problems, history of trauma and accident, and chronic diseases, in the study.

These variables have been demonstrated to be significantly related to Musculoskeletal problems. Females have a greater rate due to their smaller body size and lower muscular tone as compared to males. The environmental conditions and customs can be attributed to the EMRO region.

References

[1]. Elsiddig, Amal I; Altalhi, Ibtisam A; Althobaiti, Manal E; Alwethainani, Manal T; Alzahrani, Amjad M. et.al. Prevalence of neck and shoulder pain among Saudi universities' students who are using smartphones and computers, Journal of Family Medicine and Primary Care: 2022;11(1)194-200 doi:10.4103/jfmpc.jfmpc_1138_21 https://journals.lww.com/jfmpc/Fulltext/2022/01000/Prevalence_of_neck_and_shoulder_pain_among_Saudi.32.aspx

[2]. Lorusso A, Bruno S, L'Abbate N. Disturbi muscolo-scheletrici in studenti universitari che utilizzano il computer [Musculoskeletal disorders among university student computer users]. Med Lav. 2009 Jan-Feb;100(1):29-34. Italian. PMID: 19263870.

[3]. Vijay S, Ide M. Musculoskeletal neck and back pain in undergraduate dental students at a UK dental school - a cross-sectional study [Internet]. Nature News. Nature Publishing Group; 2016 [cited 2022Mar20]. Available from: https://www.nature.com/articles/sj.bdj.2016.642

[4]. 4.. Tantawy SA, Abdul Rahman A, Abdul Ameer M. The relationship between the development of musculoskeletal disorders, body mass index, and academic stress in Bahraini University students [Internet]. The Korean journal of pain. The Korean Pain Society; 2017 [cited 2022Mar20]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5392656/

[5]. Tonga E, Özgül B, Timurtas E, et al FRI0756-HPR Evaluation of musculoskeletal complaints associated with smartphone use among university students and related risk factors Annals of the Rheumatic Diseases 2017;76:1504. https://ard.bmj.com/content/76/Suppl_2/1504.1.

[6]. Koornneef, E., Robben, P. & Blair, I. Progress and outcomes of health systems reform in the United Arab Emirates: a systematic review. BMC Health Serv Res 17, 672 (2017). https://doi.org/10.1186/s12913-017-2597-1

[7]. Felemban RA, Sofi RA, Al Hebshi SA, Alharbi SG, Farsi NJ, Abduljabbar FH, et al. Prevalence and Predictors of Musculoskeletal Pain Among Undergraduate Students at a Dental School in Saudi Arabia. Clinical, Cosmetic and Investigational Dentistry. 2021 Feb;Volume 13:39–46.

[8]. Hasan MM, Yaqoob U, Ali SS, Siddiqui AA. Frequency of musculoskeletal pain and associated factors among undergraduate students [Internet]. Scientific Research Publishing; 2018 [cited 2023 Jun 21]. Available from: https://www.scirp.org/journal/paperinformation.aspx?paperid=82472

[9]. Hua BH, Sugumaran SV, Faryza E, Atiqah N, Jasvindar K, Kabir MS, et al. Prevalence of musculoskeletal disorders (MSD) and smartphone addictions among university students in Malaysia. International journal of health sciences. 2022 Mar 25;1075–88.

[10]. 10.Coley C. Prevalence of upper extremity musculoskeletal disorders in college students [Internet]. Elsevier BV; 2022 [cited 2023 Jun 21]. Available from: https://www.academia.edu/es/20781740/Prevalence_of_upper_extremity_musculoskeletal_disorders_in_college_students

[11]. 11. Coley C. Prevalence of upper extremity musculoskeletal disorders in college students [Internet]. Elsevier BV; 2022 [cited 2023 Jun 21]. Available from: https://www.academia.edu/es/20781740/Prevalence_of_upper_extremity_musculoskeletal_disorders_in_college_students

[12]. 12. Morse T, Bruneau H, Michalak-Turcotte C, Sanders M, Warren N, Dussetschleger J, et al. Musculoskeletal disorders of the neck and shoulder in dental hygienists and dental hygiene students [Internet]. American Dental Hygienists' Association; 2007 [cited 2023 Jun 21]. Available from: https://jdh.adha.org/content/81/1/10.short

[13]. 13. Author links open overlay panelDerek Richard Smith a DRS, a MS b, b TM b, AbstractWe conducted an epidemiological investigation of musculoskeletal disorders (MSD) among a complete cohort of 222 female nursing students in Yamanashi prefecture TM a, Zentaro Yamagata a. Musculoskeletal disorders self-reported by female nursing students in Central Japan: A Complete Cross-sectional survey [Internet]. Pergamon; 2003 [cited 2023 Jun 21]. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0020748903000129?via%3Dihub

[14]. 14. Lin Y, Zhang X, Li H, Huang Y, Zhang W, Zhang C. Musculoskeletal pain is prevalent in Chinese medical and dental students: A cross-sectional study [Internet]. U.S. National Library of Medicine; 2022 [cited 2023 Jun 21]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9730812/

[15]. 15. MKID S. Prevalence of selected musculoskeletal disorders among the students of Faculty of Allied Health Sciences, University of Peradeniya [Internet]. 2021 [cited 2023 Jun 21]. Available from: https://clinmedjournals.org/articles/jmdt/journal-of-musculoskeletal-disorders-and-treatment-jmdt-7-097.php?jid=jmdt

[16]. 16 .Rakhadani PB, Goon DT, Mandeya A. Musculoskeletal Problems Associated with University Students Computer Users: A Cross-Sectional Study. *Online J Health Allied Scs.* 2017;16(2):7. Available at URL: http://www.ojhas.org/issue62/2017-2-7.html

[17]. 17. Shokri S, Qhalenoy M, Taban E, Ahmadi O, Kohnavard B. Evaluation of prevalence of musculoskeletal disorders among students using portable computers in Faculty of Health, Qazvin University of Medical Sciences [Internet]. Journal of health research in community; 2015 [cited 2023 Jun 21]. Available from: http://jhc.mazums.ac.ir/browse.php?a_code=A-10-4368-1&sid=1&slc_lang=en

[18]. 18. 1. MJ; LPD. Prevalence and correlates of low back pain among occupational therapy students in Northern Queensland [Internet]. U.S. National Library of Medicine; 2008 [cited 2023 Jun 21]. Available from: https://pubmed.ncbi.nlm.nih.gov/18323366/

[19]. 19. N; LAL. Musculoskeletal complaints among Italian X-ray technology students: A cross-sectional questionnaire survey [Internet]. U.S. National Library of Medicine; 2010 [cited 2023 Jun 21]. Available from: https://pubmed.ncbi.nlm.nih.gov/20416101/

[20]. 20. 1. Asifa Qurat Ul Ain, Filza Shoukat, Filza Shoukat, A. Ahmed [Internet]. 2018 [cited 2023 Jun 21]. Available from: https://www.researchgate.net/profile/Asifa-Qurat-Ul-Ain/publication/325581036_Musculoskeletal_pain_and_discomfort_among_medical_students_of_University_of_Lahore_Pakistan/links/63c12325b687a938af5e7a75/Musculoskeletal-pain-and-discomfort-among-medical-students-of-University-of-Lahore-Pakistan.pdf

[21]. 21. Samarah OQ, Maden HA, Sanwar BO, Farhad AP, Alomoush F, Alawneh A, Hadidi FA, Bashaireh K, Hammad YS. Musculoskeletal pain among medical students at two Jordanian universities. J Back Musculoskelet Rehabil. 2023;36(2):429-436. doi: 10.3233/BMR-220065. PMID: 36120767.

[22]. 22. Parto DN, Wong AY, Macedo L. Prevalence of musculoskeletal disorders and associated risk factors in Canadian university students. BMC Musculoskelet Disord. 2023 Jun 19;24(1):501. doi: 10.1186/s12891-023-06630-4. PMID: 37337246.