

RESEARCH ARTICLE

Musculoskeletal disorders and quality of life among undergraduate health sciences students: A cross-sectional study

Nur Syafiqah Adilla Kamalruzaman¹, Tengku Adilah Tengku Sabri¹, Siti Nor Ismalina Isa^{2*}

¹Centre of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; ²Department of Basic Sciences, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia.

Abstract:

Musculoskeletal disorders (MSD) can deteriorate individuals' physical and mental health, thereby lowering their quality of life (QOL). The current study aim was to determine the relationship between MSD and socio-demographic characteristics with QOL among undergraduate health sciences students. A cross-sectional study was conducted by selecting 330 health sciences students in Universiti Teknologi MARA (UiTM) Puncak Alam. Nordic Musculoskeletal Questionnaire and WHOQOL-BREF questionnaires were used as research instruments. A total of 86.6% of the students had experience MSD at least in one body region, with the lower back being the most common site (63.3%). The Environmental domain of QOL scored the highest (M=68.16, SD=17.82), while the Psychological domain was the lowest (M=52.84, SD=12.66). Hips or thigh pain reported significantly lower scores in the Psychological domain only. Older age reported significantly lower score in the Physical, Psychological and Environmental domains. Higher body mass index (BMI) showed significantly lower scores in the Physical and Environmental domains. In contrast, those students who had a clinical training experience showed significantly higher scores in the Physical and Psychological domains. Hips or thigh showed an impact on QOL especially psychologically. The findings from this study can be used as a baseline for future research on the relationship between MSD and QOL, particularly among young adults.

Keywords: Musculoskeletal disorders, quality of life, psychological health, risk factors, students

*Corresponding Author

Siti Nor Ismalina Isa
Email:
ismalina@uitm.edu.my

1. INTRODUCTION

Musculoskeletal disorders (MSD) are defined as an injury or pain that affects the human body's muscles, bones, joints, tendons, and ligaments (WHO, 2021). When related to professional and personal activities, MSD becomes more common in academic settings. Undergraduate health sciences students are likely to be similar to health workers, exposed to various psychological, physical, and environmental elements that may subsequently influence an MSD episode (Morais et al., 2019). Several studies have found that a high prevalence of MSD among dental students which 91.2% experiencing MSD problems at least in one part of the body while 64.8% of the healthcare students and 73.6% among allied health sciences students developed MSD in one or more body parts (Felemban et al., 2021; Hendi et al., 2019; Senarath et al., 2021).

Most of the student's daily routine involves sitting for long periods, prolonged usage of computer, doing many curricular or assignment tasks and sometimes not getting enough of rest. All those activities can contribute to musculoskeletal overload (Caromano et al., 2015). Prolonged standing posture makes sore feet, leg swelled, varicose veins, muscle and body fatigue, stiffness of the neck and shoulders, low

back pain (LBP), and other health problems (Alias et al., 2020). They also spend time in academic environments, where they participate in internship programs and take practical courses. They perform professional activities in the appropriate position, often time-sensitive, resulting in the adoption of uncomfortable postures and the repetition of movement.

Quality of Life (QOL) is defined as an individual's perspective of their worth in life, such as their culture and value systems surrounding them and their achievement, expectations, concerns, and standards (WHO, 1997). The QOL is necessary for the students and needs to address it quickly when related to mental, physical, and social problems since they will be the future leaders of this developed nation.

Having MSD problems may affect the QOL of an individual. A study by Du et al. (2017) proved that having headaches and back pain due to standing for a prolonged time were the common issues students need to face and impact their QOL. A study by Casas et al. (2016) mentioned that having MSD problems such as back pain could limit the student's daily life activities by limiting their academic activities. Most people were suffering from MSD experience significant

physical and mental issues during their lives (Tavafian et al., 2007). Such as decreased physical, social relationships, mental poor general health, and chronic discomfort (Claiborne et al., 2002), all of which may contribute to a lower QOL. In addition, the students are unable to perform well in their academic tasks, which due to the impact of LBP. The intensity and duration of the pain would influence the university student's, QOL such as their life satisfaction and personal risk factors like sitting at home and eating habits (Vietri et al., 2016). However, no research specifically investigated the relationship between MSD, socio-demographic factors and QOL among health sciences students in Malaysia. Hence, it is still unclear whether MSD is one of the repercussions of having low QOL or caused by other factors.

Therefore, this study aimed to determine the relationship between MSD, socio-demographic factors (age, gender, BMI, year of study, course, clinical training experience, duration of clinical training and dominant hand) and QOL among health sciences students.

2. MATERIALS AND METHODS

2.1 Study Design and Procedure

Cross-sectional survey was conducted on 330 of health sciences students from January 2021 to April 2021. Since this study was conducted through an online survey, the location depended on the location of the students with internet access. Some of the participants answered it from Universiti Teknologi MARA (UiTM) Puncak Alam, Selangor and some of them filled in the form at their hometown. The researcher distributed the self-administered questionnaire to the health sciences students via Google form document. The questionnaire was given through email and WhatsApp.

Ethical clearance was obtained from the Research Ethics Committee (REC) of UiTM. Maintaining the confidentiality of study participants was respected, and all the questionnaires were only identifiable solely by respondent codes. The approval code for the study was (Reference no: REC 11/2020 (UG/MR/213).

2.2 Sampling

The health sciences students were included from eight programmes in Faculty of Health Sciences of UiTM: Nursing, Physiotherapy, Nutrition and Dietetics, Environmental Health and Safety, Medical Imaging, Optometry, Medical Laboratory Technology, and Occupational Therapy courses. The students were classified according to their academic years from year one to year four. Stratified random sampling was used to recruit the participants in the study. Participants with the following criteria: (i) full time and undergraduate students; (ii) students who are in year two to year four of bachelor's degree; and (iii) able to understand the English language were included

in this study. Students who were not willing to participate in the study were excluded.

2.3 Research Instrument

A self-administered questionnaire was used as a research instrument which consisted of three sections. The first section consisted of information on socio-demographic (age, gender, BMI, dominant hand, course, year of study, clinical training experience, duration of clinical training). The body mass index (BMI kg/m²) was measured based on self-reported weight and height values. The second section was the Standardized Nordic Musculoskeletal questionnaire, and the third section was the World Health Organization Quality of Life: Brief Version (WHOQOL-BREF) were used to screen low back, neck, shoulder, and general musculoskeletal disorders and to evaluate QOL respectively.

Standardized Nordic Musculoskeletal Questionnaire (NMQ) was resulted from a project capitalized by the Nordic Council of Ministers (Kuorinka et al., 1987). The purpose of this questionnaire was to assess the result of epidemiological studies on MSD. The questionnaire is a dependable and valid tool as it has been used to assess MSD repeatedly among health professionals and students in various countries (Alshagga et al., 2013; Felemban et al., 2021; Rendzova et al., 2021). The self-administered NMQ and the interview findings were identical (100%), and the specificity value was attained in the lower back, neck, and shoulder region above 85%. The Cronbach's alpha value for the reliability test was 0.945, indicating that the internal consistency reliability was excellent (Chairani et al., 2020).

WHOQOL-BREF is the simple version of the WHOQOL-100 that WHOQOL Group developed with fifteen international field centers that would be significant cross-culturally. It helps to assess someone's perceptions of their current life from culture and value system aspects related to their achievement. The WHOQOL-BREF instrument is a 26-item self-administered questionnaire that evaluates the four primary QOL domains: Physical domain, Psychological domain, Social domain, and Environmental domain (WHO, 1997). The WHOQOL-BREF had good internal consistency with Cronbach's alpha values of 0.80 for the Physical domain (seven items), 0.82 for the Psychological domain (six items), 0.71 for the Social domain (three items), and 0.81 for the Environmental domain (eight items) (Krägeloh et al., 2012).

2.4 Data Analysis

The data were coded and analyzed using IBM SPSS Statistics 26.0 version software (IBM Corp., USA) licenses for Universiti Teknologi MARA (UiTM). Descriptive statistics were used to describe the demographic data, MSD and QOL of the participants with the categorical variables were described in terms of frequency (n) and percentages (%). While numerical variables were reported in terms of mean and standard deviation. Multiple linear regression analysis was used to determine the relationship between

MSD, socio-demographic factors and QOL. All variables selection methods (forward, backward, stepwise) were done, and multicollinearity and model assumptions were checked. The final model was presented with adjusted regression coefficient (b), 95% confidence interval (CI), p-values and coefficient of determination value (R²). The statistical significance was set at 0.05.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic Characteristics and MSD of Health Sciences Students

A total of 330 students were participated in this study. Most of them were females (89.1%). The mean age of the students was 21.92 (SD= 1.42). Most of the participated students were from the programs of Physiotherapy (20.0%), Environmental Health and Safety (13.3%), Nutritional and Dietetics (13.0%), followed by Nursing, Medical Imaging, Occupational Therapy, Optometry, and Medical Laboratory Technology course with 11.5%, 10.9%, 9.7% and 9.1% respectively. Socio-demographic data are shown in Table 1.

Table 1. Participant’s characteristics (n=330)

Variables	n (%)
Age; mean (SD)	21.92 (1.42)
Gender	
Female	294 (89.1)
Male	36 (10.9)
BMI (kg/m²); mean (SD)	22.23 (4.24)
Clinical training experience	
Yes	158 (47.9)
No	172 (52.1)
Duration of clinical training (months); mean (SD)	1.75 (2.50)
Year of study	
2 nd Year	84 (25.5)
3 rd Year	118 (35.8)
4 th Year	128 (38.8)
Dominant hand	
Right	296 (89.7)
Left	34 (10.3)
Course	
Nursing	41 (12.4)
Medical Laboratory Technology	30 (9.1)
Medical Imaging	38 (11.5)

Environmental Health and Safety	44 (13.3)
Physiotherapy	66 (20.0)
Occupational Therapy	36 (10.9)
Optometry	32 (9.7)
Nutritional and Dietetics	43 (13.0)

The prevalence of MSD during the past 12 months (in at least one part of the body) among health sciences students was 86.6% with the lower back being the most common site (63.3%), followed by the neck (53.6%), shoulder (50.6%) and upper back (45.5%). During the last 7 days, students reported that they also had troubles in the lower back region (47.0%), followed by the neck (39.7%), upper back (35.5%) and shoulder (34.5%). When asked if the pain or discomfort had hindered them from engaging in professional, home, or recreational activities within last 12 months, the majority of the students said No (>80%) for all part of body regions.

3.2 Descriptive Statistics of Quality of Life Domains

About QOL domains, the Environmental domain scored the highest mean with 68.16 (SD=17.82), followed by the Social domain with mean 60.15 (SD=21.84), Physical domain with a mean 60.37 (SD=12.77), and Psychological domain at 52.84 (SD=12.66). The mean score of students’ overall self-reported QOL using was 3.68 (SD=1.08). Generally, 25.76% of the students reported their QOL as “very good,” 34.24% as “good,” and only 3.64% felt it was “very poor”. Other than that, the mean score of their self-rated satisfaction of the overall health was 3.74 (SD= 0.88). Most of the students felt satisfied with their health as 20.0% were “very satisfied” and 41.52% were “satisfied,” while only 1.82% recognized that they were “very dissatisfied” with their health (Table 2).

Table 2. Scores of QOL domains, general QOL and general health (n=330)

Item/Domain	n (%)	Mean (SD)
Physical domain		60.37 (12.77)
Psychological domain		52.84 (12.66)
Environmental domain		68.16 (17.82)
Social domain		60.15 (21.84)
General QOL		3.68 (1.08)
Very good	85 (25.76)	
Good	113 (34.24)	
Neither poor or good	86 (26.06)	
Poor	34 (10.30)	
Very Poor	12 (3.64)	

General health		3.74 (0.88)
Very satisfied	66 (20.00)	
Satisfied	137 (41.52)	
Neither dissatisfied or satisfied	109 (33.93)	
Dissatisfied	12 (3.64)	
Very dissatisfied	6 (1.82)	

3.3 Relationship between MSD and Socio-demographic Characteristics with QOL among Health Sciences Students

The simple and multiple linear regression analyses were applied to determine the relationship between MSD and socio-demographic factors (age, gender, course, year of study, clinical training experience, duration of the clinical training, dominant hand) with QOL domains that include Physical, Psychological, Social, and Environmental domains. The variables with a p-value less than 0.25 at simple linear regression analysis were considered potential predictors of QOL and included in the multiple linear regression analysis.

Results from multiple linear regression analysis showed that only age, BMI and clinical training experienced were the significant predictors of Physical domain (p<0.05). The result from the final model showed a significant negative relationship between age and Physical domain. Individual with age of 1 year older had 1.821 lower score in Physical domain (adjusted b = -1.821; 95% CI = -2.849, -7.93; p= 0.001). There was a significant negative relationship between BMI and the Physical domain. Individual who was 1-unit higher BMI had 0.257 lower score in Physical domain (adjusted b = -0.257; 95% CI = -0.445, -0.069; p=0.008). There was a significant positive relationship between clinical training experience and the Physical domain. Individual who had experienced in clinical training had 2.781 higher score in Physical domain (adjusted b = 2.781; 95% CI = 0.035, 5.526; p=0.047). About 5% of the variation in the Physical domain is explained by age, duration of clinical training and BMI according to the multiple linear regression model (R² = 0.051) (Table 3).

Table 3. Relationship between body region of MSD and socio-demographic characteristics with Physical domain of QOL (n=330)

Independent variables	Multiple Linear Regression	
	b ^a (95% CI)	p-value
Age	-1.821 (-2.849, -7.93)	0.001
BMI	-0.257 (-0.445, 0.069)	0.008
Clinical training	2.781 (0.035, 5.526)	0.047

experience

^a Crude regression coefficient; ^b Adjusted regression coefficient
Backward method was used. All assumptions were fulfilled.
Coefficient of determination (R²) = 0.051

For the Psychological domain of QOL, results from multiple linear regression analysis showed that hips or thigh, age and clinical training experience were the significant predictors of the Psychological domain (p<0.05). The result of the final model showed a significant negative relationship between hips or thigh and the Psychological domain. Individual with hips or thigh pain had 4.027 lower score in Psychological domain (adjusted b = -4.027; 95% CI = -7.770, 0.283; p=0.035). Next, the result showed a significant negative relationship between age and the Psychological domain. Individual with age of 1 year older had 1.040 lower score in Psychological domain (adjusted b = -1.040; 95% CI = -2.022, -0.057; p=0.038). Meanwhile, there was a significant positive relationship between clinical training experience and the Psychological domain. Individual with experienced of clinical training had 2.771 higher score in Psychological domain (adjusted b = 2.771; 95% CI = 0.030, 5.513; p=0.048). About 4% of the variation in the Psychological domain is explained by hips or thigh, age and clinical training experience according to the multiple linear regression model (R² = 0.036) (Table 4).

Table 4. Relationship between body region of MSD and socio-demographic characteristics with Psychological domain of QOL (n=330)

Independent variables	Multiple Linear Regression	
	b ^a (95% CI)	p-value
Hips or thigh	-4.027 (-7.770, 0.283)	0.035
Age	-1.040 (-2.022, 0.057)	0.038
Clinical training experience	2.771 (0.030, 5.513)	0.048

^a Crude regression coefficient; ^b Adjusted regression coefficient
Backward method was used. All assumptions were fulfilled.
Coefficient of determination (R²) = 0.036

For the Environmental domain, the results showed that only age and BMI were the significant predictors of the Environmental domain (p<0.05). The clinical training experience could be the predictor of the Environmental domain and was included in the multiple linear regression analysis, however, the result was not significant. The result from the final model showed that age had a significant negative relationship with the Environmental domain. Individual with age of 1 year older had 2.011 lower score in Environmental domain (adjusted b = -2.011; 95% CI = -3.459, -0.563; p= 0.007). There was a significant negative relationship between BMI and the Environmental domain. Individual who was 1-unit higher BMI had 0.269 lower score

in Environmental domain (adjusted $b = -0.269$; 95% CI = $-0.534, -0.004$; $p=0.047$). About 3% of the variation in the Environmental domain was explained by age, BMI and clinical training experience according to the multiple linear regression model ($R^2 = 0.032$) (Table 5).

For the Social domain, no MSD body regions and socio-demographic variables were significant at univariate and multivariate regression analyses ($p>0.05$).

Table 5. Relationship between body region of MSD and socio-demographic characteristics with Environmental domain of QOL (n=330)

Independent variables	Multiple Linear Regression	
	b ^a (95% CI)	p-value
Age	-2.011 (-3.459, -0.563)	0.007
BMI	-0.269 (-0.534, -0.004)	0.047
Clinical training experience	3.352 (-0.517, 7.221)	0.089

^a Crude regression coefficient; ^b Adjusted regression coefficient Backward method was used. All assumptions were fulfilled. Coefficient of determination (R^2) = 0.032

3.4 Discussion

This study showed that the health sciences students had the highest rating in the Environmental domain with mean scores of 68.16, while the lowest mean score is the Psychological domain (52.84). The students in this study may have a healthy family environment, both physically and in-home safety, and good accessibility to health and social services. This study also suggested that the students may be dealing with high amounts of pressure, low self-esteem, self-doubt with their self-confidence and have to deal with negative feelings during COVID-19 pandemic and lockdown restriction that might associated to a lower score in the Psychological domain. This result contradicts the previous study conducted by Ab Hamid et al. (2018), where it demonstrated that health sciences students in Selangor had the highest rating in the Psychological domain (64.1), and the lowest mean score is the Social domain (62.52). Health sciences students in the previous study may found satisfaction and contentment in university, allowing them to succeed well in the overall psychological relationships (Ab Hamid et al., 2018).

Other than that, this study revealed that most of the students rated their overall QOL and general health as “good” to “very good” and “satisfied” to “very satisfied” in their responses. According to Pital et al. (2020), those ratings and higher scores of each domain indicate a higher level of QOL. As a result, the student’s overall QOL and general health evaluations are not concerning. In the present study, the

domains of Physical, Psychological, Social, and Environmental domains of QOL with MSD on all parts of the body regions and socio-demographic characteristics were compared. However, the results were inconsistent. The presence of MSD somehow not affected the QOL of the students except for the hips or thigh region that showed a significant relationship with the Psychological domain. The present study showed that students with hips or thigh pain had a lower score in the Psychological domain might be because they have to cope with psychosocial issues (anxiety, depression, stress and fear of avoidance) compared to an individual with hips or thigh pain. This is consistent with a previous study that revealed that pain affecting various body segments would decrease QOL in both physical and mental regions (Dosea et al., 2019).

This current study revealed that the students with older age had a lower score in the Physical, Psychological and Environmental domains. This could be the younger students are more aware with the exposure of physical and mental health and awareness which is contrary to a study by Malibary et al. (2019) demonstrated the students with older age had more scores of physical health than the students due to the life experience in maintaining their physical health. The younger students might have a better productive strategy to cope with pain or discomfort, stress management, and better physical and mental health than an older age as they had a better coping mechanism (Ceratti et al., 2020).

The present study also showed that students with higher BMI had a lower score in the Physical and Environmental domains. The finding of the current study also was not surprising as an individual with a lower BMI had a good level of physical and emotional well-being compared to an individual with higher BMI. This finding was consistent with a study by Ab Hamid et al. (2018) indicated students with slightly higher body weight scored the lowest in the Physical domain because they tend to be insecure towards their body images. Individuals with lower BMI also had a better engagement in physical activity (Linder et al., 2021). In addition, students who had experience in clinical training had a higher score in the Physical and Psychological domains. The relation between the Physical and Psychological domain and students who had experience in clinical training may be linked to a better strategy of living a functional existence to cope with stress and depression issues (Pital et al., 2020).

Several limitations could not be avoided. The fact that information concerning musculoskeletal complaints was gathered by self-reporting may be a drawback of this study. Other than that, the lack of investigation of the student’s postural characteristics and their use of body biomechanics, computer usage and ergonomic concepts. Future studies

should include more information, including their sleeping pattern, environment, family or friend's relationship, and financial management. All of these factors are important aspects to be assessed in the association of QOL of university students. This study's findings can be used as a baseline for future research on the relationship between MSD and QOL, particularly among undergraduate students or young adults. It would be suggested for the organization in the university to develop a program that focused on prevention, detection, and treatment in people with musculoskeletal disorders to improve the QOL. Hence, it will give better research on the relationship between MSD and QOL.

4. CONCLUSION

The QOL of the health sciences students was excellent and satisfactory, based on the ratings. This study showed that the hips or thigh body region had an impact on QOL especially psychologically. On the other hand, we observed students with older age had a lower score in the Physical, Psychological and Environmental domains. Higher BMI of the students was associated with a lower score in the Physical and Environmental domains. Meanwhile, those who had experience in clinical training also impacted their QOL as they scored higher in the Physical and Psychological domains.

ACKNOWLEDGEMENTS

The authors would like to thank all the undergraduate health sciences students who participated in this study. We also would like to acknowledge all the individuals for providing support to this study directly or indirectly.

REFERENCES

- Ab Hamid, M. R., Azman, N. N., Said, N., & Rahman, A. N. A. (2018). Orthorexia nervosa and the quality of life among health sciences students in Universiti Teknologi MARA, Selangor. *Environment-Behaviour Proceedings J*, 3(7), 121-6.
- Alshagga, M. A., Nimer, A. R., Yan, L. P., Ibrahim, I. A., Al-Ghamdi, S. S., & Radman Al-Dubai, S. A. (2013). Prevalence and factors associated with neck, shoulder and low back pains among medical students in a Malaysian medical college. *BMC Research Notes*, 6(1). <https://doi.org/10.1186/1756-0500-6-244>
- Alias, A. N., Karuppiah, K., How, V., & Perumal, V. (2020). Prevalence of musculoskeletal disorders (MSDS) among primary school female teachers in Terengganu, Malaysia. *International Journal of Industrial Ergonomics*, 77, 102957. doi:10.1016/j.ergon.2020.102957
- Caromano, F. A., Amorim, C. A., Rebelo, C. D., Contesini, A. M., Fávero, F. M., Frutuoso, J. R., Kawai, M. M., & Voos, M. C. (2015). Prolonged sitting and physical discomfort in university students. *Acta Fisiátrica*, 22(4). <https://doi.org/10.5935/0104-7795.20150034>
- Casas S, A. S., Patiño S, M. S., & Camargo L, D. M. (2016). Association between the sitting posture and back pain in college students. *Revista de la Universidad Industrial de Santnader. Salud*, 48(4), 446-454. <https://doi.org/10.18273/revsal.v48n4-2016003>
- Ceratti, M. N., da Silva Fucuta, P., Quessada, F. N. P., Pacca, F. C., & Cury, P. M. (2020). Students' self-perception about their quality of life is overestimated: Is this the base of their mental Troubles? *MedEdPublish*, 9(1). <https://doi.org/10.15694/mep.2020.000004.1>
- Chairani A. (2020). Validity and reliability test of the Nordic Musculoskeletal questionnaire with formal and informal sector workers. *The 7th International Conference on Public Health*, 100. <https://doi.org/10.26911/the7thicph-FP.05.06>
- Claiborne, N., Vandenburg, H., Krause, T. M., & Leung, P. (2002). Measuring quality of life changes in individuals with chronic low back conditions: A back education program evaluation. *Evaluation and Program Planning*, 25(1), 61-70. [https://doi.org/10.1016/s0149-7189\(01\)00049-0](https://doi.org/10.1016/s0149-7189(01)00049-0)
- Dosea, G. S., Oliveira, C. C., & Lima, S. O. (2016). Musculoskeletal symptomatology and quality of life of patients with work-related musculoskeletal disorders. *Escola Anna Nery - Revista de Enfermagem*, 20(4). doi:10.5935/1414-8145.201601
- Du, J.Y., Alexander, A., Joshua E, S., Paul D, K., Joseph T, N., & Darren R, L. (2017). Neck pain and low back pain in medical students: A cross-sectional study. *International Archives of Public Health and Community Medicine*, 1(1). <https://doi.org/10.23937/iaphcm-2017/1710002>
- Felemban, R. A., Sofi, R. A., Alhebshi, S. A., Alharbi, S. G., Farsi, N. J., Abduljabbar, F. H., & Farsi, J. (2021). Prevalence and predictors of musculoskeletal pain among undergraduate students at a dental school in Saudi Arabia. *Clinical, Cosmetic and Investigational Dentistry*, 13, 39-46. <https://doi.org/10.2147/ccide.s292970>
- Hendi, O., Abdulaziz, A., Althaqafi, A., Hindi, A., Khan, S., & Atalla, A. (2019). Prevalence of musculoskeletal disorders and its correlation to physical activity among health specialty students. *International Journal of Preventive Medicine*, 10(1), 48. https://doi.org/10.4103/ijpvm.ijpvm_436_18
- Krägeloh, C. U., Kersten, P., Rex Billington, D., Hsu, P. H., Shepherd, D., Landon, J., & Feng, X. J. (2012). Validation of the WHOQOL-BREF quality of life questionnaire for general use in New Zealand: Confirmatory factor analysis and Rasch analysis. *Quality of Life Research*, 22(6), 1451-1457. <https://doi.org/10.1007/s11136-012-0265-9>
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., & Jørgensen, K. (1987). Standardised nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18(3), 233-237. [https://doi.org/10.1016/0003-6870\(87\)90010-x](https://doi.org/10.1016/0003-6870(87)90010-x)
- Linder, S., Abu-Omar, K., Geidl, W., Messing, S., Sarshar, M., Reimers, A. K., & Ziemainz, H. (2021). Physical inactivity in healthy, obese, and diabetic adults in Germany: An analysis of related socio-demographic variables. *PLOS ONE*, 16(2), e0246634. <https://doi.org/10.1371/journal.pone.0246634>
- Malibary, H., Zagzoog, M. M., Banjari, M. A., Bamashmous, R. O., & Omer, A. R. (2019). Quality of life (QoL) among medical students in Saudi Arabia: A study using the WHOQOL-BREF instrument. *BMC Medical Education*, 19(1). <https://doi.org/10.1186/s12909-019-1775-8>

- Morais, B. X., Dalmolin, G. D., Andolhe, R., Dullius, A. I., & Rocha, L. P. (2019). Musculoskeletal pain in undergraduate health students: Prevalence and associated factors. *Revista da Escola de Enfermagem da USP*, 53. <https://doi.org/10.1590/s1980-220x2018014403444>
- Pitil, P. P., Kadir, N. S., & Emeih Wahed, W. J. (2020). Quality of life among Malaysian University students: A cross-sectional study. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, 5(6), 11-18. <https://doi.org/10.47405/mjssh.v5i6.423>
- Rendzova, V., Nikolovska, J., Apostolska, S., & Petričević, N. (2021). Prevalence of work-related musculoskeletal symptoms among dental students at Ss. Cyril and Methodius University dental school in Skopje. *Open Access Macedonian Journal of Medical Sciences*, 9(D), 19-23. <https://doi.org/10.3889/oamjms.2021.5582>
- Senarath, M., Thalwaththe, S., & Tennakoon, S. (2021). Prevalence of selected musculoskeletal disorders among the students of faculty of Allied health sciences, University of Peradeniya. *Journal of Musculoskeletal Disorders and Treatment*, 7(2). <https://doi.org/10.23937/2572-3243.1510097>
- Sirajudeen, M. S., Alaidarous, M., Waly, M., & Alqahtani, M. (2018). Work-related musculoskeletal disorders among faculty members of college of Applied Medical Sciences, Majmaah University, Saudi Arabia: A cross-sectional study. *International journal of health sciences*, 12(4), 18–25.
- Tantawy, S. A., Rahman, A. A., & Ameer, M. A. (2017). The relationship between the development of musculoskeletal disorders, body mass index, and academic stress in Bahraini University students. *The Korean Journal of Pain*, 30(2), 126-133. <https://doi.org/10.3344/kjp.2017.30.2.126>
- Tavafian, S. S., Jamshidi, A., Mohammad, K., & Montazeri, A. (2007). Low back pain education and shortterm quality of life: A randomized trial. *BMC Musculoskeletal Disorders*, 8(1). <https://doi.org/10.1186/1471-2474-8-21>
- Vietri, J., Montgomery, W., Shi, J., Ogawa, K., Kariyasu, S., Alev, L., & Nakamura, M. (2016). The relationship between pain severity and patient-reported outcomes among patients with chronic low back pain in Japan. *Journal of Pain Research*, 337. <https://doi.org/10.2147/jpr.s102063>
- Wami, S. D., Mekonnen, T. H., Yirdaw, G., & Abere, G. (2020). Musculoskeletal problems and associated risk factors among health science students in Ethiopia: A cross-sectional study. *Journal of Public Health*. <https://doi.org/10.1007/s10389-020-01201-6>
- World Health Organization. Division of Mental Health and Prevention of Substance Abuse. (1997). *WHOQOL: measuring quality of life*. World Health Organization. <https://apps.who.int/iris/handle/10665/63482>
- World Health Organization. (2021). *Musculoskeletal conditions*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions>
- Yorks, D. M., Frothingham, C. A., & Schuenke, M. D. (2017). Effects of group fitness classes on stress and quality of life of medical students. *The Journal of the American Osteopathic Association*, 117(11), e17. <https://doi.org/10.7556/jaoa.2017.140>