https://doi.org/10.36570/jduhs.2024.1.2031

JDUHS

ORIGINAL ARTICLE

Relationship of Computer Misuse-Related Body Pain with Awareness of Workstation Ergonomics during Digital Learning Era

Zohour Ibrahim Rashwan,[1,2] Hala Mohamed Sanad,[1] Rasha Salah Eweida[1,3]

1. Department of Nursing, College of Health and Sport Sciences,University of Bahrain, Zallaq, Kingdom of Bahrain.
2. Department of Pediatric Nursing, Alexandria University, Alexandria, Egypt.
3. Department of Psychiatric and Mental Health Nursing, Alexandria University, Alexandria, Egypt.

Correspondence to: Dr. Zohour Ibrahim Rashwan, E-mail: zrashwan@uob.edu.bh, ORCiD: 0000-0002-1418-9516

ABSTRACT

Objective: To investigate the relationship between academicians' computer misuse-related body pain and their awareness of workstation ergonomics during digital learning era.

Methods: This cross-sectional study was conducted at the University of Bahrain from March to June 2022. Faculty members experienced musculoskeletal (MS) pain and utilized the e-learning approach for at least one academic year were included in the study. The outcome of the study was computer misuse-related body pain and awareness of workstation ergonomics. Body pain was assessed by using Body Map Tool and ergonomic knowledge questionnaire were used to assess awareness of workstation ergonomics.

Results: Of total 173 academicians, the mean age was 41.4 ±9.9 years. Among them, 108 (62.4%) experienced mild MS pain, while 65 (37.6%) reported moderate to severe MS pain. Academicians' mean scores of knowledge about the definition of ergonomics, MS disorders, and their risk factors were i.e., 3.42 ±1.03. It was found that females were nine times more likely at risk of moderate/severe pain as compared to males (cOR 9.00, 95% CI 2.05 to 39.49, p-value 0.004). There was 0.62 times less risk of moderate/severe pain for individuals had good/ very good level of knowledge about computer workstation ergonomics as compared to individuals had poor/fair levels of knowledge about computer workstation ergonomics (cOR 0.38, 95% CI 0.19 to 0.77, p-value 0.007).

Conclusion: The study revealed that individuals with a better understanding of computer workstation ergonomics demonstrated a reduced likelihood of experiencing moderate/severe MS pain. Gender differences also emerged, with females being more susceptible to such pain.

Keywords: Awareness, Distance Learning, Ergonomics, Faculty, Pain.

INTRODUCTION

Digital learning is a double-edged sword with both favorable and unfavorable features. It allows the faculty members to simultaneously provide educational sessions for many students, work from home, and save money on transport. However, prolonged computer use may result in serious health problems.[1] Thus, academicians are advised to adhere with computer workstation ergonomics.[2]

The word "ergonomic" is derived from Greek words: "ergo" means work, while "nomos" means law.[3] Ergonomics is "a systematic process of designing and arranging the human workplace that aims to improve the working environment and reduce the risk of bodily injury". Computer workstation ergonomics focuses on sustaining the optimal position of the monitor, keyboard, and mouse.[4] It is also concerned with adjusting the appropriate seat height and supporting the back on the backrest and the feet on the floor.[3] Moreover, assuming an adequate posture by maintaining the upright and neutral position of the head, neck, and trunk. Besides, the computer user should maintain the straight alignment of the wrist and the elbow using the armrest while sitting on a special chair with a seat pan and a stable five-legged base with caster wheels. Additional accessories like a mouse pad with an armrest, a free-glare monitor, and a document holder should also be utilized.[4,5] Furthermore, periodic rest and frequent exercises are crucial in preventing such muscle strain and pain.

The computer became an essential educational tool for all faculty members. They spent hours in front of their computer screens preparing and conducting lectures,

correcting assignments, and providing online feedback to their students. Indeed, computer misuse significantly affects academicians' health. Therefore, adopting computer workstation ergonomics facilitates users' work, protects their health, and enhances their competency and productivity with minimal exertion. However, a poorly designed workplace and the improper alignment of the body parts during computer use for long durations to a degree beyond the body's coping mechanism may result in poor health outcomes and occupational disability.[6] Musculoskeletal (MS) problems related to computer misuse are usually associated with pain, numbness, and tingling in various body parts like the wrists, shoulders, back, legs, and eyes. Since most of the working and educational environments may not be ergonomically friendly, the rate of MS pain is expected to increase sharply during the digital learning era. The objective of the study was to investigate the relationship between academicians' computer misuse-related body pain and their awareness of workstation ergonomics during the digital learning era. The current study's findings may necessitate conducting an awareness campaign among the academic faculty regarding the proper use of ergonomic computer workstations.

METHODS

This cross-sectional study was conducted at the University of Bahrain (UoB) from March 2022 to June 2022. Ethical approval for conducting the study was obtained from the Research and Publication Committee at the College of Health and Sport Sciences at the University of Bahrain (CHSS SPRC Recommendation No: 16/2020-21). The confidentiality of the obtained data was assured, and participants' anonymity was respected. Participation in the study was entirely voluntary. The right to refuse to participate or withdraw from the study at any time was emphasized after reassuring the participants that the collected data would only be used for research purposes, as stated in the written consent form.

UOB has nine colleges with a total of around 27,000 enrolled students. A convenience sample was obtained via an online questionnaire sent to all faculty members at the UOB, of whom we received 173 completed responses. All faculty members who experienced MS pain and utilized the e-learning approach for at least one academic year were included in the study. Faculty members with MS diseases, such as lumbar and cervical disc disorders, spondylosis, and carpal tunnel syndrome were excluded.

To assess respondents' pain locations in different body parts (12 areas), the "Body Map" tool was used. This tool was developed by Corlett and Bishop.[7] Respondents also rated the severity of pain on a five-point scale ranging from very severe pain "5" to very mild pain "1". The participants were asked to rate their emerging MS pain after utilizing distance learning. The total scores for severity ranged from 12 to 60. The scale's psychometric properties were previously assessed and reported to be valid and reliable, with excellent test-retest reliability. The Intraclass Correlation Coefficient (ICC) was 0.8.[8] Total scores were summed-up and transformed into three categories; using Equal Interval Classification as follows; Mild level of MS pain (12- 28), moderate level of MS pain (29- 44), and high level of MS pain (45 -60).[9]

To assess the ergonomic knowledge of computer professionals an ergonomic knowledge questionnaire was used. This questionnaire was developed by Sirajudeen et al.[10] It consisted of three sections: First section included personal characteristics like age and gender. Section two included computer use, daily keying, mouse usage, desktop, and laptop usage for academic and non-academic purposes, an external keyboard, and external mouse use. Section three comprises 35 items related to knowledge about MS disorders and their risk factors, working postures, seating, keyboard/mouse, monitor, table, and accessories, and finally, rest breaks and exercises. Each item ranges from "0" (no knowledge) to "5" (adequate knowledge). The total scores ranged from 0-35 and were categorized into four levels of knowledge: poor (scores 40%), satisfactory (scores 40%–60%), and good (scores $\geq$60%).[10] The questionnaire yielded a 0.98 overall content validity index.[10] The test-retest reliability of the sections of the knowledge questionnaire was reported to be fair to high.[11]

A pilot study was conducted with 18 faculty members to assess the feasibility, applicability, and clarity of the research tools, as well as the time required for completion. Participants in the pilot study were excluded from the total study sample. Researchers developed an online questionnaire and distributed the relevant link to participants via their academic email addresses. The study's objective was clearly stated in the first section of the form, accompanied by an online consent form. Participants indicated their voluntary agreement to take part in the study by clicking the 'agree' button and completing the questionnaires. To prevent duplication, researchers configured the electronic form settings to allow only one response per participant.

Data entry and analysis were performed using a Statistical Package for Social Sciences (SPSS) version 20.0. Mean ±SD was computed for quantitative variables like age and knowledge about computer workstation ergonomics, while frequency and percentages were computed for categorical variables like gender, teaching experience, academic rank, location of MS pain, and levels of MS pain. Both univariable and multivariable logistic regression were applied. Multivariable binary logistic regression was applied to all those variables found significant in the univariable contingency table. The p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Of the total 173 academicians, the mean age was 41.4 ±9.9 years. There were 147 (85.0%) females and 26 (15.0%) males. Approximately half of academicians had more than 15 years of academic teaching experience i.e., 82 (47.4%). Regarding academic rank, 49 (28.3%) of academicians were senior lecturers, and 41 (23.7%) were assistant professors. Among academicians, 108 (62.4%) experienced mild MS pain, while 65 (37.6%) reported moderate to severe MS pain.

The average number of years of using computers among academicians was 18.83 ±8.15, and they used a laptop for 6.43 ±4.91 hours per day. On average, academics reported 3.35 ±3.4 hours daily keying on a laptop or a desktop. Furthermore, nearly half of the academicians used an external mouse along with a laptop 79 (45.7%). It was found that 101 (58.4%) of participants took a break every 0 - 2 hours and 72 (41.6%) every >2 hours. One in five participants, 37 (21.4%) reported that the college is the source of information regarding appropriate ergonomic workstation layout (Table 1).

Academicians' mean scores of knowledge about the definition of ergonomics, MS disorders, and their risk factors were 3.42 ±1.03, working postures 3.31 ± 1.12, seating (chair) 3.24 ±1.15, monitor 3.51 ±1.11, table and accessories 3.72 ±1.25 respectively (Table 2). Table 3 shows that the majority of the academic faculty members suffered from neck pain 150 (86.7%) and shoulder pain 132 (76.3%).

Table 4 reveals binary logistic regression analysis for predicting moderate/severe MS pain in academicians. MS pain variable was converted as binary (Mild=0,

Table 1: Academicians' practices in academic computer use (n=173)

Practices	**Mean ±SD**
Years of Using Computer	18.83 ± 8.15
Hours of Using Desktop (per day)	4.90 ± 3.07
Hours of Using A Laptop (per day)	6.43 ± 4.91
Hours of Using I Pad (per day)	2.27 ± 2.92
Hours of Keying (Typing)	3.35 ± 3.42
	n (%)
In the Case of a Laptop, Using (n= 93)$	
External Keyboard	14 (8.1)
External Mouse	79 (45.7)
Frequency of Taking a Break while Working on a Desktop or Laptop	
Once in 0-2 Hours	101 (58.4)
Once in > 2 Hours	72 (41.6)
The Source of Information Regarding Appropriate Ergonomic Workstation Layout, Tips, and Techniques for Computer Use	
Not Aware	27 (15.6)
College	37 (21.4)
Family or Friends	23 (13.3)
Internet	48 (27.6)
News Paper	16 (9.3)
Television	22(12.8)

-Quantitative variables described by mean± standard deviation, Categorical variables described by frequencies (percentages), $Only 93 academicians used laptop

Table 2: Academicians' mean scores of knowledge about computer workstation ergonomics (n=173)

Items	Mean ±SD
Knowledge about Ergonomics, Musculoskeletal Disorders, and their Risk Factors	3.42 ± 1.03
Working Postures	3.31 ± 1.12
Monitor	3.51 ± 1.11
Seating (Chair)	3.24 ± 1.15
Keyboard/ Mouse	2.84 ± 0.94
Table and Accessories	3.72 ± 1.25
Rest Breaks and Exercises	2.82 ± 0.85

All data presented as mean ± standard deviation (SD)

Table 3: Body pain among academicians while working on computer (n= 173)

Pain Location	n (%)
Neck	150 (86.7)
Shoulder	132 (76.3)
Upper Back	112 (64.7)
Upper Arm	110 (63.6)
Mid-Back	118 (68.2)
Lower Arm	116 (67.1)
Lower Back	122 (70.5)
Buttocks	119 (68.8)
Right Thigh	104 (60.1)
Left Thigh	108 (62.4)
Right Leg	101 (58.4)
Left Leg	99 (57.2)

All data presented as number (%)

moderate/severe=1). It was found that females were nine times more likely at risk of moderate/severe pain as compared to males (cOR 9.00, 95% CI 2.05 to 39.49, p-value 0.004). There was 0.62 times less risk of moderate/severe pain for individuals who had good/very good level of knowledge about computer workstation ergonomics as compared to individuals who had poor/fair level of knowledge about computer workstation ergonomics (cOR 0.38, 95% CI 0.19 to 0.77, p-value 0.007). At the univariate level, gender (p-value 0.004), level of knowledge about computer workstation ergonomics (p-value 0.007), frequency of taking a break (per hour) (p-value 0.028), and hours of keying (per day) (p-value <0.001) showed significant odds ratios. Furthermore, the findings of the multivariable analysis were presented after adjusting the variables that were significant in the univariable analysis. At this stage, variables like gender, level of knowledge about computer workstation ergonomics, and hours of keying (per day) showed significant odds ratios.

DISCUSSION

This study aimed to investigate the relationship between academicians' computer misuse-related body pain and their awareness of workstation ergonomics during the digital learning era. The findings of the current study revealed that the majority of academicians have suffered from neck pain during the distance learning era. This high prevalence of pain among academicians is congruent with the findings of Xie *et al*., who stated that MS problems related to neck pain represent the highest prevalence rate, accounting for 67.8% of all digital users worldwide.[12] Sirajudeen *et al*. also reported that neck complaint is the most predominant work-related MS disorder among more than half of the faculty members in Saudi Arabia.[4] This could happen because since the influx of the corona virus disease (COVID-19) pandemic, digital technology has become more deeply embedded in academicians' lives than ever before, and work-related MS disorders are a consequence of this situation.[13] Faculty members

Table 4: Binary logistic regression analysis for predicting moderate/severe levels of MS pain in academicians (n= 173)

	Total	Levels of MS Pain		Univariable Analysis	p-value	Multivariable Analysis	p-value
		Mild (n= 108)	Moderate/Severe (n= 65)	cOR (95% C.I)		aOR (95% C.I)	
Age (years)							
≤ 30	24	18 (75.0)	6 (25.0)	1	0.075		
30 – 40	55	28 (50.9)	27 (49.1)	2.89 (0.99 to 8.38)	0.050*		
>40	94	62 (66.0)	32 (34.0)	1.54 (0.56 to 4.28)	0.400		
Gender							
Male	26	24 (92.3)	2 (7.7)	1	0.004*	1	
Female	147	84 (57.1)	63 (42.9)	9.00 (2.05 to 39.49)	0.004*	14.69 (2.78 to 77.57)	0.002*
Level of Knowledge about Computer Workstation Ergonomics							
Fair/Poor	46	21 (45.7)	25 (54.3)	1	0.007*	1	
Good/Very Good	127	87 (68.5)	40 (31.5)	0.38 (0.19 to 0.77)	0.007*	0.19 (0.07 to 0.51)	<0.001*
Hours of Using Computer (per day)							
≤2	91	64 (70.3)	27 (29.7)	1	0.057		
2 - 6	45	26 (57.8)	19 (42.2)	1.73 (0.82 to 3.64)	0.147		
>6	37	18 (48.6)	19 (51.4)	2.50 (1.14 to 5.49)	0.022*		
Frequency of Taking a Break (per hour)							
Once in 0 - 2 hours	101	70 (69.3)	31 (30.7)	1	0.028*	1	
Once in >2 hours	72	38 (52.8)	34 (47.2)	2.02 (1.07 to 3.78)	0.028*	1.37 (0.63 to 2.94)	0.420
External Mouse							
Yes	79	46 (58.2)	33 (41.8)	1	0.145		
No	94	62 (66.0)	32 (34.0)	0.71 (0.38 to 1.35)	0.296		
Hours of Keying (per day)							
<2	52	46 (88.5)	6 (11.5)	1	<0.001*	1	
2 - 4	67	40 (59.7)	27 (40.3)	5.17 (1.94 to 13.80)	<0.001*	8.38 (2.68 to 26.17)	<0.001*
>4	54	22 (40.7)	32 (59.3)	11.15 (4.06 to 30.59)	<0.001*	13.02 (4.09 to 41.48)	<0.001*

cOR: Crude odds ratio, aOR: Adjusted odds ratio, CI: confidence interval, MS: Musculoskeletal pain, *p-value ≤ 0.05

found themselves spending too much time in front of their computers in order to comply with their educational duties. For instance, they are required to design pedagogical activities such as planning online classes, preparing presentations, attending pedagogical and administrative meetings, correcting assignments, and developing online quizzes and exams.[14] In this scenario, sitting in an awkward posture and prolonged static position without interruption or micro-breaks would shorten the suboccipital muscles at the base of the user's skull, leading to muscle spasms and neck pain. In addition, the neck muscles become overly flexed or contracted to hold the head up, leading to more tension and chronic soreness throughout the neck region.[15,16]

Shah and Desai reported that the slouched and slumped forward position adopted by professionals during computer work, along with the failure of the computer users to support their forearm while typing on the keyboard, increases the load on the trapezius muscle, resulting in neck pain.[13] This could be corrected by better arrangement of the computer workstations.[17] Repetitive wrist and hand movements while using the mouse or keyboard are associated with computer use duration and hand symptoms.[18] Therefore, it is unsurprising that more than half of the current study participants complained of wrist and lower arm pain. Similarly, Gerr *et al*. reported a twofold escalation in hand symptoms among female applicants compared to their male counterparts. This could explain the findings of our study since the majority of the study participants were females. From another perspective, the learning process during the COVID-19 pandemic period was conducted by faculty members from home, where the required working environment may not exist.[19] Households have traditionally improperly designed workstations, and the available space and required materials for the range of activities are less than ideal.[20]

According to the current study findings, low back pain was one of the most prevalent work-related MS disorders. This finding corroborates the findings of two studies, which signified that the invariable computer use, along with sitting in an ergonomically poor posture for extended hours, was significantly correlated with low back pain.[21, 22] Gosain *et al*. outlined that low back pain is the most affected region related to work-related MS disorders, as computer users typically exhibited more prolonged periods of uninterrupted sitting with less micro-movement and rest periods.[23] As per the current study, taking breaks every 2 hours while working on a desktop or laptop reduces the severity of MS pain. Prolonged sitting and poor posture can lead to MS pain, and the stress related to the pandemic may exacerbate these issues. Furthermore, the lack of access to ergonomic workstations and physical therapy services during the pandemic may contribute to the development or worsening of MS pain.[24]

Sitting for uninterrupted extended periods ensued an adverse impact on the vertical torso morphological position and degree of spinal loading.[25] This is evident in the regression analysis results, as participants who spent more hours using the computers (desktop or laptop) and those who were keying for more than four hours/day demonstrated significantly higher levels of MS pain. From the neuro-anatomical theory standpoint, the complex and sustained sitting posture habit might activate the incessant compression on the intervertebral disc and decrease the disc nutrition, causing stiffness and chronic soreness.[26] Moreover, sustained pressure decreases blood circulation to joints, muscles, tendons, and ligaments and decreases tissue regeneration opportunities, leading to painful tensional syndromes. This mechanism might clarify the relationship between computer misuse and spinal pain.[26] In this regard, Cheung *et al*. indicated that the hunched posture adopted during work resulted in spinal muscle augmentation, decreased muscle endurance, and tendon inflammation, thus possibly being a factor in reports of increased back pain among digital users.[27]

Academicians in this study disclosed their awareness of the appropriate ergonomic practices; they attempted to apply the assimilated knowledge and continued to adopt uncomfortable and inadequate ergonomic positions. It is noticed from the regression analysis that having adequate knowledge about computer workstation ergonomics revealed a significant reduction in MS pain. According to Arumay and Asish, computer users should be familiarized with the correct ergonomic-related information on workstations to avoid work-related MS disorders.[28] For this reason, we propose that ongoing education and training workshops should be organized to educate academicians about applying ergonomics knowledge principles at work or home.[17] Simple measures such as setting a reminder on the digital users' phones to take frequent breaks could substantially reduce the risk of developing work-related MS disorders and thereby improve and maintain one's physical health status.

The study addresses a relevant, important, and timely topic that has implications for academic institutions, educators, and students in promoting ergonomically sound practices and mitigating the risk of computer-related musculoskeletal issues. The researchers used a

cross-sectional design which allowed for the examination of associations between variables at a specific point in time as well as the researchers adhered to ethical guidelines of the UoB. Despite the previously mentioned strength, the study has limitations, including a small sample size. While using electronic forms is a convenient and faster method for data collection, it is a shortcoming in health surveys since participants may not complete the answers to all the questions, particularly academicians with their heavy workload may have found the questionnaire lengthy. Besides, using convenient sampling techniques may be another limitation. Hence, replicating the study on a more representative sample using probability sampling would obtain more generalizable findings for the broader population. Longitudinal studies may shed light on the long-term relationship between musculoskeletal pain and sitting in an ergonomically poor position. Targeted educational programs sought to implement ergonomics knowledge principles and preventive measures are recommended to assess their impact on relieving computer misuse-related body pain. Furthermore, different academic cohorts are also recommended to be further explored to realize prospective variations in this relationship.

CONCLUSION

The study highlighted a notable prevalence of MS pain, especially in areas like the neck and shoulders. Individuals with a better understanding of computer workstation ergonomics demonstrated a reduced likelihood of experiencing moderate/severe MS pain. Gender differences also emerged, with females being more susceptible to such pain. These findings emphasize the critical need to enhance ergonomic awareness and practices among academicians to effectively mitigate computer misuse-related MS pain.

ETHICAL APPROVAL: Ethical approval for conducting the study was obtained from the Research and Publication Committee at the College of College of Health and Sport Sciences at the University of Bahrain (CHSS SPRC Recommendation No: 16/2020-21, dated: 5th May 2021).

AUTHORS' CONTRIBUTIONS: ZIR: Conceptualization, methodology, investigation, data collection, formal analysis, writing- original draft, writing- review, editing and supervision. HMS: Conceptualization, writing-original draft, data collection, review, supervision and editing. RSE: Conceptualization, writing final draft, review, supervision and review. All authors approved final version of the manuscript.

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

FUNDING: No funds or grants were received from any funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGMENT: The authors are grateful to all faculty members who participated in this study. In addition, we thank all the responsible authorities at the UOB for facilitating the data collection.

Received: December 22, 2023
Accepted: February 20, 2024

REFERENCES

1. Dhawan S. Online learning: A panacea in the time of COVID-19 crisis. J Educ Technol 2020; 49:5-22. doi:10.1177/0047239520934018
2. Kumah DB, Akuffo KO, Affram DE, Ankamah E, Osae EA. Ergonomic challenges of employees using computers at work in a tertiary institution in Ghana. Optometry 2016; 1:101-7. doi:10.4172/2476-2075.1000107
3. Khan R, Surti A, Rehman R, Ali U. Knowledge and practices of ergonomics in computer users. J Pak Med Assoc 2012; 62:213-7.
4. Sirajudeen MS, Alaidaros M, Waly M, Alqahtani M. Work-related musculoskeletal disorders among faculty members of college of Applied Medical Sciences, Majmaah University, Saudi Arabia: A cross-sectional study. Int J Health Sci 2018; 12:18-25.
5. Sirajudeen MS, Pillai PS, Vali GM. Assessment of knowledge of ergonomics among information technology professionals in India. Age (Years) 2013; 20:135.
6. Denadai MS, Alouche SR, Valentim DP, Padula RS. An ergonomics educational training program to prevent work-related musculoskeletal disorders to novice and experienced workers in the poultry processing industry: A quasi-experimental study. Appl Ergon 2021; 90:103234. doi:10.1016/j.apergo.2020.103234
7. Corlett EN, Bishop RP. A technique for assessing postural discomfort. Ergonomics 1976; 19:175-82. doi:10.1080/00140137608931530
8. Varghese MA, Atreya N, Bhatnagar A. Ergonomic studies in India. Tech. Bull Postgraduate, Dept. of Family Resource Management, SNDT Womens University, Mumbai. 1996.
9. Sun M, Wong D, Kronenfeld B. A heuristic multi-criteria classification approach incorporating data quality information for choropleth mapping. Cartogr Geogr Inf Sci 2017; 44:246-58. doi:10.1080/15230406.2016.1145072
10. Sirajudeen MS, Shah UN, Mohan N, Somasekharan P.

Content validity of a questionnaire to assess the ergonomic knowledge of computer professionals. Int J Curr Res Rev 2012; 411:114-21.
11. Sirajudeen M, Pillai P. Test-retest reliability of a questionnaire to assess the ergonomic knowledge of computer professionals. Int J Rehabil Health 2015; 4:239-43. doi:10.5455/IJHRS.000000094
12. Xie Y, Szeto G, Dai J. Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: A systematic review. Appl Ergon 2017; 59:132-42. doi:10.1016/j.apergo.2016.08.020
13. Shah M, Desai R. Prevalence of neck pain and back pain in computer users working from home during COVID-19 pandemic: a web-based survey. Int J Health Sci Res 2021; 11:26-31. doi10.1186/s43161-022-00110-x
14. Peters MA, Rizvi F, McCulloch G, Gibbs P, Gorur R, Hong M, et al. Reimagining the new pedagogical possibilities for universities post-Covid-19: An EPAT Collective Project. Edu Philos Theor 2022; 54:717-60. doi:10.1080/00131857.2020.1777655
15. Elsiddig AI, Altalhi IA, Althobaiti ME, Alwethainani MT, Alzahrani AM. Prevalence of neck and shoulder pain among Saudi universities' students who are using smartphones and computers. J Family Med Prim Care 2022; 11:194-200. doi:10.4103/jfmpc.jfmpc_1138_21
16. Abdali YA, Sherwani AA, Alsharif AA, Kariri AM, Khormi YB, Jobran M, et al. Text neck syndrome prevalence and knowledge among the Saudi population in Jazan, Kingdom of Saudi Arabia: A cross-sectional study. Int J Med Dev Count 2020; 207:53-8. doi:10.24911/IJMDC.51-1601384962
17. Shah M, Desai R. Prevalence of neck pain and back pain in computer users working from home during covid19 pandemic: a web-based survey. Int J Health Sci Res 2021; 2:26-31.
18. Alyahya F, Algarzaie K, Alsubeh Y, Khounganian R. Awareness of ergonomics and work-related musculoskeletal disorders among dental professionals and students in Riyadh, Saudi Arabia. J Phys Ther Sci 2018; 30:770-6. doi:10.1589/jpts.30.770.
19. Gerr F, Marcus M, Monteilh C. Epidemiology of musculoskeletal disorders among computer users: lesson learned from the role of posture and keyboard use. J Electromyogr Kinesiol 2004; 14:25-31. doi:10.1016/j.jelekin.2003.09.014
20. Gulotta CJ, Madeira-Revell K, Fendley ME. A heuristic international glimpse at SARS-CoV-2 effects on work-home equilibrium and women. Hum Factors Ergon Manuf 2021; 31:389-96. doi:10.1002/hfm.20905
21. Hasan AS, Salek AK, Ahmed SM. Awareness and practice of computer-related ergonomics among resident doctors. BSM Med Univ J 2020; 13:53-7. doi:10.3329/bsmmuj.v13i2.47605
22. Mohan P, Sudhan SG, Dhasara dharaman K, Suresh A. Work-related musculoskeletal injury risk assessment and its relevance to body mass index for computer professionals. Bio Pharm J 2020 25; 13:843-8. doi:10.13005/bpj/1950
23. Gosain L, Ahmad I, Rizvi MR, Sharma A, Saxena S. Prevalence of musculoskeletal pain among computer users working from home during the COVID-19 pandemic: a cross-sectional survey. Bull Fac Phy Ther 2022; 27:1-11. doi:10.1186/s43161-022-00110-x
24. Gomez IN, Gonzalez Suarez C, Sosa KE, Tapang ML. Work from-home-related musculoskeletal pain during the COVID-19 pandemic: A rapid review protocol. Int J Osteopath Med 2022; 43:49-52. doi:10.1016/j.ijosm.2022.04.005
25. Straker LM, O'Sullivan PB, Smith A, Perry M. Computer use and habitual spinal posture in Australian adolescents. Public Health Rep 2007; 122:634-43. doi:10.1177/003335490712200511
26. Bontrup C, Taylor W R, Fliesser M, Visscher R, Green T, Wippert PM, et al . Low back pain and its relationship with sitting behaviour among sedentary office workers. Appl Ergon 2019; 81:102894. doi:10.1016/j.apergo.2019.102894
27. Cheung MC, Lai JS, Yip J, Cheng JP. Increased computer use is associated with trunk asymmetry that negatively impacts health-related quality of life in early adolescents. Patient Prefer Adherence 2021; 15:2289-302. doi:10.2147/PPA.S329635
28. Jana A, Paul A. Epidemiology of low back pain: A literature review. Int J Phys Educ Sports Health 2019; 6;233-7.