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Relationship Between Ergonomic Awareness and Work-related Musculoskeletal Disorders Among Staff Nurses in Oman: An Observational Study

Rabab M. Attia[1]*, Waseem A. Shaheen[2], Nawal S. Al Harrasi[2] and Aamir K. Al Toubi[2]

[1]Rehabilitation Department, National Heart Center, Royal Hospital, Muscat, Oman
[2]Medical Rehabilitation Department, Royal Hospital, Muscat, Oman

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ABSTRACT

Objectives: To detect the level of ergonomic awareness related to work-related musculoskeletal disorders among 200 staff nurses in a tertiary hospital. The additional objective was to study the relationship of such awareness with the prevalence of these disorders. ***Methods***: A group of 25–45-year-old staff nurses and a body mass index of ≤ 30 kg/m^2, with at least one year working experience were randomly selected from different wards of the Royal Hospital, Muscat. The study excluded nurses who were on leave and those who had sustained traffic accidents or sports injuries in the preceding year. Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was used to measure the work-related musculoskeletal disorders experienced by the nurses. A second questionnaire was administered to measure their ergonomic awareness. The data was statistically analyzed. Correlations were established by Spearman's rank correlation coefficient (ρ). ***Results:*** The participants were 200 staff nurses (male = 30 male, female = 170). Analysis of the ergonomics awareness construct indicated 'agreement' as an overall response with a mean of 3.2±0.6, indicating fair ergonomic awareness. For CMDQ, 50.3% reported discomfort in the low back region, 15.0% in the neck, and 6.9% in the right lower leg. The left wrist, left forearm, and right upper arm had the least reported discomfort (< 1.0%). The correlation between ergonomic awareness and working ability was weakly positive, yet statistically significant (ρ = 0.210; p = 0.003). Correlations were not statistically significant between ergonomic awareness and discomfort (ρ = -0.031; p = 0.664) and between ergonomic awareness and total frequency (ρ = 0.109; p = 0.123). ***Conclusions:*** There is a strong need to develop practical ergonomic awareness among nursing staff for a sustainable and safe work environment.

Work-related musculoskeletal disorders (WMSDs) are common work-related debilities where the surrounding work environment can largely contribute to their development or lead to worsening of the condition.[1] They mainly result from body reactions, repeated actions, and overexertion leading to substantial economic burden.[1,2] WMSDs increase absenteeism, decrease productivity, and affect the overall quality of life of workers,[2] cause early retirement and increase their need for health care.[1] Among healthcare personnel, nurses are particularly vulnerable to WMSDs due to the physically demanding nature of their profession.[3,4] This includes working in a single position or in awkward positions for a long time and catering to the physical needs of many patients during a shift. Furthermore, specific nursing tasks such as lifting patients, assisting them in ambulation, and repeatedly performing physically demanding tasks from twisted, bent, or otherwise restricted postures, cause WMSDs, mainly in the back and neck regions, followed by shoulder and lower limbs.[3–6] Studies have shown a significant association between work conditions and musculoskeletal disorders in specific body regions.[2] Consequently, to decrease the incidence of work-related musculoskeletal injuries, nurses need to develop ergonomic awareness and introduce appropriate changes in work behavior, for which specific training may be necessary.[7]

To our knowledge, no study has investigated ergonomic awareness or its relationship with musculoskeletal complaints among nurses in Oman. To narrow this research gap, we investigated the level of ergonomic awareness among the nursing staff of the Royal Hospital, the largest tertiary care hospital

*Corresponding author: ✉rabab.royal.pt@gmail.com

in Oman. We also explored the mutual relationship between ergonomic awareness and WMSDs, as well as between working ability and body discomfort.

METHODS

This observational, correlation study was conducted from December 2020 to December 2022 (25 months) at the Royal Hospital, Muscat. The study received ethical approval from the Royal Hospital ethical committee (Ref: SRC 132/2020).

The inclusion criteria were staff nurses—including junior, senior, and head staff nurses, all performing the same physically demanding jobs—aged between 25–45 years, with a body mass index of ≤ 30 kg/m^2, and at least one year of working experience at the Royal Hospital. We excluded nurses who were pregnant, on leave, had chronic diseases, and those who had a history of a traffic accident or sport injury in the preceding year.

To determine the study sample, the Krejcie and Morgan formula was applied using the Morgan's table. The total number of staff nurses at the Royal Hospital was 2962, and the sample size was calculated at 165. The sample size was increased to 200 to account for possible attrition. The participants were randomly selected. Informed consent was taken and confidentiality ensured through coding all personally identifiable data.

Two questionnaires namely, the Ergonomic Awareness Questionnaire and the female version of the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), were used to collect research data. The questionnaires were distributed to the participants during staff breaks within working hours. Each participant filled up the two instruments in the privacy of the staff rest area.

The Ergonomic Awareness Questionnaire [Table 1] has eight items with responses ranging from 'strongly agree' to 'strongly disagree'. The questionnaire was previously used among secretaries, typists, personal assistants, computer users, and other deskbound workers in Nigeria in 2017.[8]

The second instrument used was the female version of CMDQ. Though originally meant for sedentary female workers, however one study in Estonia used it on semi-active female production assembly workers.[9] Based on a diagram showing the body parts [Figure 1], there are questions about the incidence of musculoskeletal pain, or discomfort across 18 body regions in the past week, requiring 54 responses in all. The participants were asked to indicate the frequency with which they experienced discomfort on a 0–4 scale where, 'none' = 0 and 'daily' = 4. The severity of discomfort was also measured similarly, where 'comfortable' = 0, 'slightly uncomfortable' = 2, and 'very uncomfortable' = 3. Whether the discomfort interfered with work was measured in the scale of 'no interference' = 0 to 'substantial interference' = 2. The 'prevalence and frequency' severity threshold was detected at a response of 'moderately uncomfortable' describing the

Table 1: The Ergonomic Awareness Questionnaire and the mean responses thereof.[8]

No.	Items of the Construct	Mean ± SD	Response
1.	I am always aware of the term 'office ergonomics' as a branch of office safety and health before receiving this questionnaire.	3.1 ± 1.1	Agree
2	My organization gives training to office workers concerning sitting and work posture in the office.	3.0 ± 1.1	Agree
3.	I am quite aware that incorrect sitting posture while carrying out work causes body pains and work -related problems.	4.3 ± 0.7	Strongly agree
4.	My organization gives out periodicals, manuals, or handbooks with guidelines on proper sitting/correct work posture.	4.2 ± 0.7	Strongly agree
5.	My organization engages the services of office/medical experts to educate workers on the health implication of incorrect posture of work.	2.7 ± 1.0	Moderately agree
6.	My organization has a committee or any unit charged with the responsibility of educating workers concerning proper sitting posture during work.	2.9 ± 1.0	Moderately agree
7	I have been attending seminars and conferences on office ergonomics to learn about work posture and sitting position from time to time.	2.6 ± 1.1	Moderately agree
8.	I am aware that working for too long without a break causes serious body pains and health-related problems.	2.7 ± 1.0	Moderately agree
Total		3.2 ± 0.6	Agree

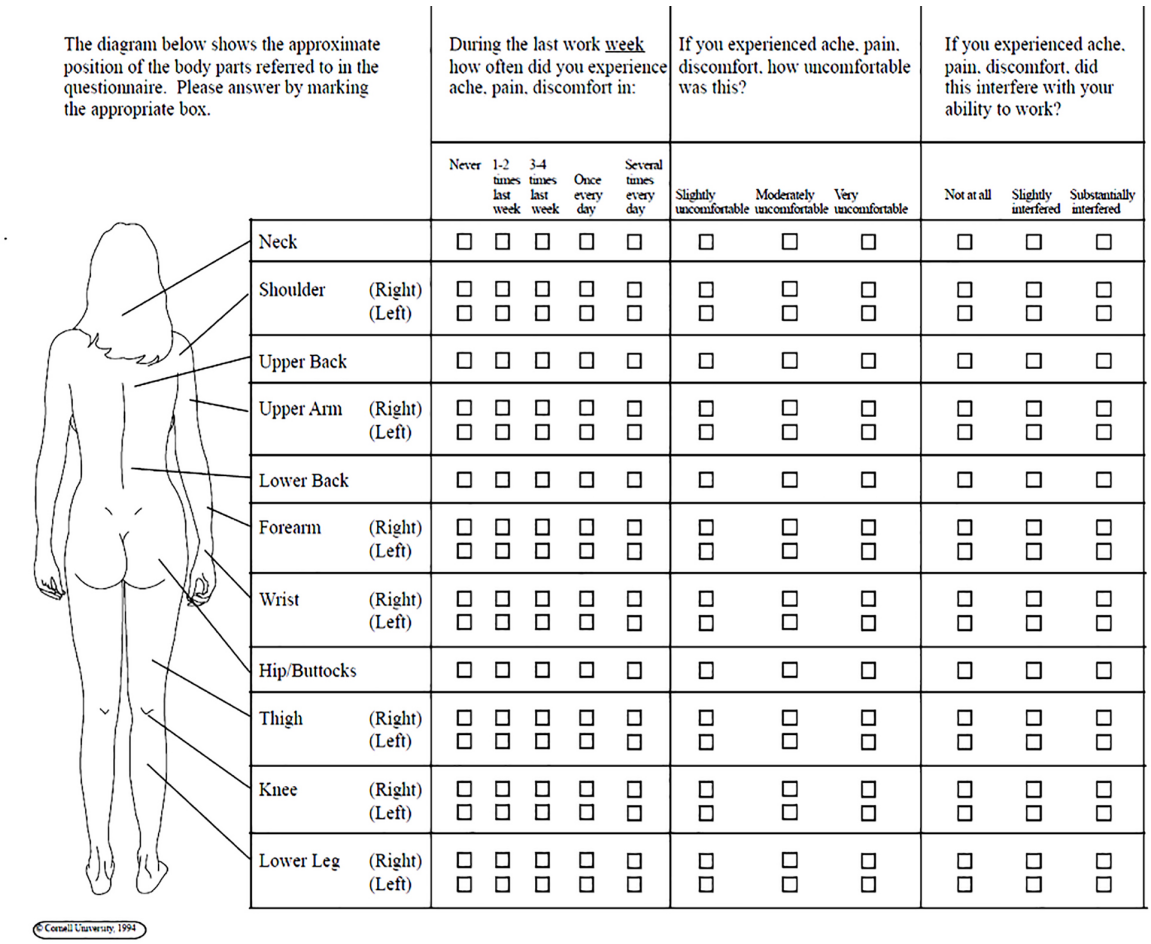

Figure 1: Cornell Musculoskeletal Discomfort Questionnaire.

pain level. The total discomfort score of an individual was calculated using the formula: discomfort score = frequency × discomfort × interference.[9]

For analyzing data from the questionnaires, descriptive statistics of mean and SD were applied, using IBM SPSS Statistics for Windows (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). To interpret the responses, the mean calibration of Hassanain,[10] was adopted, considering a mean response of 01.49 as 'strongly disagree', 1.50–2.49 as 'disagree', 2.50–299 as 'moderately agree or undecided,' 3.00–3.50 as 'agree', and mean responses above 3.50 as 'strongly agree.'

RESULTS

As shown in Table 1, the level of the staff ergonomic awareness was assessed based on the responses to the eight items of the ergonomic awareness construct. Adding up the eight items of the construct, the total mean for the whole construct was 3.2±0.6, showing an overall 'agreement' response and a fair level of ergonomic awareness among the workers in the Royal Hospital [Table 1].

The responses to CMDQ [Table 2] indicate that staff nurses felt discomfort mostly in the lower back (50.3%), neck (15.0%), and right lower leg (6.9%). From Table 3 it can be seen that 111 (55.5%) of the staff nurses reported low back discomfort occurring at least 1–2 times a week. Because of this discomfort, 78 (39.0%) nurses estimated that this had slightly affected their working ability. Ninety-nine (49.5%) nurses sensed discomfort in the neck at least 1–2 times a weeks, and 72 (36.0%) of them stated that the discomfort had slightly affected their ability to work. The right lower leg was more loaded than other body regions, and 76 (38.0%) of the participants fe discomfort there at least 1–2 times a week, in which 53 (26.5%) of them sensed that it had slightly affected their working performance.

As shown in Table 4, the Spearman's correlation coefficient between the average response of the Ergonomic Awareness Questionnaire and the ability to work was 0.210 with a *p*-value of 0.003, which indicates a statistically significant weak positive

Table 2: Frequency and total discomfort score for the assessed staff nurses.

Body parts	Frequency	Discomfort	Interference	Discomfort score (%)
Lower back	16.5	15.5	14.5	3708.4 (50.3)
Neck	12	11.5	8.0	1104.0 (15.0)
Right lower leg	10.5	7.5	6.5	511.9 (6.9)
Right shoulder	10.5	7.0	5.0	367.5 (4.9)
Left lower leg	8.5	7.0	5.5	327.3 (4.4)
Upper back	9.0	6.0	6.0	324 (4.4)
Left shoulder	9.0	7.0	4.5	283.5 (3.8)
Hip/buttocks	6.5	6.5	5.0	211.3 (2.9)
Right knee	6.0	6.5	4.0	156.0 (2.1)
Right wrist	3.0	6.0	5.5	99.0 (1.3)
Left knee	4.5	4.5	3.5	70.9 (0.9)
Right thigh	3.0	5.5	4.0	66.0 (0.9)
Left upper arm	4.0	3.5	2.5	35.0 (0.5)
Right forearm	1.5	5.5	3.5	28.9 (0.4)
Left thigh	2.0	4.5	3.0	27.0 (0.4)
Right upper arm	2.5	4.0	2.5	25.0 (0.3)
Left forearm	1.5	5.0	2.5	18.8 (0.3)
Left wrist	1.5	4.0	2.5	15.0 (0.2)

Table 3: Participants' estimation of their discomfort in various parts of the body using the Cornell Musculoskeletal Discomfort Questionnaire.

Question 1: During the last work week, how often did you experience ache, pain, or discomfort?					
Affected body part	**Number of responses (%)**				
	Never	**1–2 times last week**	**3–4 times last week**	**Once every day**	**Several times every day**
Neck	77 (38.5)	50 (25.0)	34 (17.0)	15 (7.5)	24 (12.0)
Right shoulder	106 (53.0)	39 (19.5)	22 (11.0)	12 (6.0)	21 (10.5)
Left shoulder	120 (60.0)	28 (14.0)	22 (11.0)	12 (6.0)	18 (9.0)
Upper back	90 (45.0)	44 (22.0)	26 (13.0)	22 (11.0)	18 (9.0)
Right upper arm	141 (70.5)	25 (12.5)	20 (10.0)	9 (4.5)	5 (2.5)
Left upper arm	153 (76.5)	21 (10.5)	12 (6.0)	6 (3.0)	8 (4.0)
Lower back	56 (28.0)	47 (23.5)	36 (18.0)	28 (14.0)	33 (16.5)
Right forearm	161 (80.5)	20 (10.0)	10 (5.0)	6 (3.0)	3 (1.5)
Left forearm	164 (82.0)	18 (9.0)	10 (5.0)	5 (2.5)	3 (1.5)
Right wrist	157 (78.5)	23 (11.5)	7 (3.5)	7 (3.5)	6 (3.0)
Left wrist	167 (83.5)	19 (9.5)	6 (3.0)	5 (2.5)	3 (1.5)
Hip/buttocks	130 (65.0)	31 (15.5)	13 (6.5)	13 (6.5)	13 (6.5)
Right thigh	141 (70.5)	26 (13.0)	12 (6.0)	15 (7.5)	6 (3.0)
Left thigh	145 (72.5)	25 (12.5)	10 (5.0)	16 (8.0)	4 (2.0)
Right knee	134 (67.0)	30 (15.0)	14 (7.0)	10 (5.0)	12 (6.0)
Left knee	142 (71.0)	26 (13.0)	14 (7.0)	9 (4.5)	9 (4.5)
Right lower leg	103 (51.5)	42 (21.0)	14 (7.0)	20 (10.0)	21 (10.5)
Left lower leg	109 (54.5)	40 (20.0)	14 (7.0)	20 (10.0)	17 (8.5)
Question 2: If you experienced ache, pain, discomfort, how uncomfortable was this?					
	Slightly uncomfortable		**Moderately uncomfortable**		**Very uncomfortable**
Neck	98 (49.0)		79 (39.5)		23 (11.5)
Right shoulder	121 (60.5)		65 (32.5)		14 (7.0)
Left shoulder	131 (65.5)		55 (27.5)		14 (7.0)

Table 3: Participants' estimation of their discomfort in various parts of the body using the Cornell Musculoskeletal Discomfort Questionnaire.

-continued

Question 2: If you experienced ache, pain, discomfort, how uncomfortable was this?			
	Slightly uncomfortable	**Moderately uncomfortable**	**Very uncomfortable**
Upper back	110 (55.0)	78 (39.0)	12 (6.0)
Right upper arm	151 (75.5)	41 (20.5)	8 (4.0)
Left upper arm	158 (79.0)	35 (17.5)	7 (3.5)
Lower back	74 (37.0)	95 (47.5)	31 (15.5)
Right forearm	157 (78.5)	32 (16.0)	11 (5.5)
Left forearm	163 (81.5)	27 (13.5)	10 (5.0)
Right wrist	152 (76.0)	36 (18.0)	12 (6.0)
Left wrist	163 (81.5)	29 (14.5)	8 (4.0)
Hip/buttocks	142 (71.0)	45 (22.5)	13 (6.5)
Right thigh	143 (71.5)	46 (23.0)	11 (5.5)
Left thigh	146 (73.0)	45 (22.5)	9 (4.5)
Right knee	137 (68.5)	50 (25.0)	13 (6.5)
Left knee	147 (73.5)	44 (22.0)	9 (4.5)
Right lower leg	120 (60.0)	65 (32.5)	15 (7.5)
Left lower leg	129 (64.5)	57 (28.5)	14 (7.0)
Question 3: If you experience ache, discomfort, did this affect your ability to work?			
	Not at all	**Slightly**	**Not at all**
Neck	112 (56.0)	72 (36.0)	16 (8.0)
Right shoulder	137 (68.5)	53 (26.5)	10 (5.0)
Left shoulder	145 (72.5)	46 (23.0)	9 (4.5)
Upper back	126 (63.0)	62 (31.0)	12 (6.0)
Right upper arm	159 (79.5)	36 (18.0)	5 (2.5)
Left upper arm	166 (83.0)	29 (14.5)	5 (2.5)
Lower back	93 (46.5)	78 (39.0)	29 (14.5)
Right forearm	164 (82.0)	29 (14.5)	7 (3.5)
Left forearm	166 (83.0)	29 (14.5)	5 (2.5)
Right wrist	160 (80.0)	29 (14.5)	11 (5.5)
Left wrist	177 (88.5)	18 (9.0)	5 (2.5)
Hip/buttocks	143 (71.5)	47 (23.5)	10 (5.0)
Right thigh	152 (76.0)	40 (20.0)	8 (4.0)
Left thigh	159 (79.5)	35 (17.5)	6 (3.0)
Right knee	150 (75.0)	42 (21.0)	8 (4.0)
Left knee	159 (79.5)	34 (17.0)	7 (3.5)
Right lower leg	134 (67.0)	53 (26.5)	13 (6.5)
Left lower leg	140 (70.0)	49 (24.5)	11 (5.5)

correlation, while there was no statistically significant correlation between the average Ergonomic Awareness Questionnaire response and the average discomfort ($p = 0.664$) nor total frequency ($p = 0.123$).

Table 4: Correlation between the average questionnaire response versus working ability, discomfort, and frequency.

Variables	**Average questionnaire**	
	Spearman correlation	***p*-value**
Average ability to work	0.210	0.003
Average discomfort	-0.031	0.664
Total frequency	0.109	0.123

DISCUSSION

Nurses are at risk for developing WMSDs because of the nature of their work. Hence, the necessity

for having appropriate ergonomic knowledge and orientation will help them minimize work-related injuries. Thus, the current study aimed to assess the nurses' severity and frequency of discomfort across vulnerable body regions and identify the level of ergonomic awareness among them. We also sought to explore the relationship between their degree of awareness of ergonomics and WMSDs. The study used two questionnaires to measure two aspects of the nursing staff's job. The first measured the WMSDs frequency and severity while the second probed the level of awareness and knowledge about ergonomics.

The responses to the Ergonomic Awareness Questionnaire suggested a fair level of awareness among the participants. For the second questionnaire, CMDQ, the nurses expressed discomfort mostly in the lower back followed by the neck and the lower leg of the right side, while the upper limb was the region of the least complaint. This agrees with multiple studies which reported the lumbar region as having the highest prevalence of musculoskeletal problems.[11–13] An Iranian study found that 77% of nurses suffered from musculoskeletal problems, mostly in the neck and shoulders and had the least problem in the elbow.[14] More specifically, a longitudinal study among nurses in Switzerland found that the most common sites for injuries were the low back, neck, shoulders, arms, wrist, and knees.[15]

Our results suggest a positive link between nurses' ergonomic awareness and their working ability. This finding agrees with Lee et al,[16] who showed that when nurses handled patients adopting ergonomic practices and using appropriate equipment, their likelihood of developing WMSDs reduced significantly. Furthermore, Lagerström et al,[17] claimed that using new nursing techniques for transporting patients reduced pain in the waist and pelvis. Mohammad et al,[14] suggested adopting multiple adjustments in the workplace, using the right equipment, and stress management methods among nurses.

To our knowledge, this is the first study to investigate WMSDs and ergonomic awareness and the relationship between them among nurses in Oman. However, the study had significant limitations. The questionnaire we used for ergonomic awareness had been previously used for deskbound workers—secretaries, typists, and other computer users—and not for those who spend most of their working hours on their feet such as staff nurses.[8] The second questionnaire, CMDQ, was meant for sedentary female workers (though one study used it for active female workers).[9] Another limitation was that no specific observational analysis of job activities was conducted while the nurses were working. In addition, no separate questionnaires were issued for male and female staff nurses, nor were the data from both sexes compared. Further, the study was conducted in a single tertiary center (where the participants had attended in-house ergonomic courses), and may not be generalizable to nurses working in dissimilar caregiving environments in Oman. Therefore, the current study's results should be taken as preliminary and exploratory. Based on our findings, a new multi-center study is being envisaged with larger and more diverse populations, using instruments specifically designed and validated for male and female nurses who are engaged in active patient care.

CONCLUSION

Staff nurses in Oman seem to have a fair degree of ergonomic awareness. There is a positive link between their ergonomic awareness and working ability. Further studies are needed to fully understand the prevalence of WMSDs among nurses in Oman and their ergonomic awareness.

Disclosure

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