นิพนธ์ต้นฉบับ

(Original article)

Relationship of working posture and musculoskeletal disorders among garment operators case study: Warin Market, Warinchamrap District, Ubonratchathani Province

ความสัมพันธ์ระหว่างท่าทางการทำงานกับอาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่างของช่างเย็บผ้า กรณีศึกษา: ตลาดวาริน อำเภอวารินชำราบ จังหวัดอุบลราชธานี

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ABSTRACT: This Cross-sectional analytical study evaluated the working posture and the occurrence of self-reported musculoskeletal disorders among 30 garment operators in Warin market Warinchamrap district, Ubonratchathani province. A questionnaire and direct observations of working postures using the rapid upper limb assessment (RULA) method were used. Demographic characteristics were analyzed by descriptive and inferential statistics. The relationship between factors was analyzed using the univariate and multiple logistic regression. The results showed that all garment operators were female (66.70%) with the average age of 45.76 ± 8.83 years old. Most operators had a primary school education (66.70%). A high prevalence of musculoskeletal disorders, particularly in the upper back (66.70%), thigh (60.00%) and waist (55.30%) was found. The average RULA score of 5.7 indicates significant ergonomic issues with the sewing workstations. Most garment operators were found to be at high risk for musculoskeletal disorders, requiring immediate investigation and adjustments to their work practices. Individual factors and work-related factors associated with musculoskeletal disorders in the multiple logistic regression models. The findings add to the understanding of the working posture of those jobs involving sewing activities and emphasize the need for ergonomic interventions to reduce musculoskeletal symptoms in the future.

Keywords: Working posture; Musculoskeletal disorders; Garment Workers; Rapid Upper Limb Assessment (RULA)

บทคัดย่อ: การวิจัยครั้งนี้เป็นการศึกษาเชิงวิเคราะห์แบบภาคตัดขวาง มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างท่าทางการทำงานกับอาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่างที่รายงานเอง กลุ่มตัวอย่าง คือ ช่างเย็บผ้าในตลาดวาริน อำเภอวารินชำราบ จังหวัดอุบลราชธานี จำนวน 30 คน เครื่องมือที่ใช้ในการวิจัย คือ แบบสัมภาษณ์ แบบสังเกตโดยตรง และการประเมินร่างกายส่วนบนแบบรวดเร็ว (Rapid Upper Limb Assessment: RULA) ข้อมูลลักษณะประชากร วิเคราะห์ด้วยสถิติเชิงพรรณนา และสถิติเชิงอนุมาน เพื่อศึกษาความสัมพันธ์ระหว่างปัจจัยต่างๆ กับอาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่าง โดยใช้สถิติถดถอยโลจิสติกแบบตัวแปรเดี่ยว (Univariate logistic regression) และสถิติการถดถอยโลจิสติกทวินามแบบพหุ (Multivariate logistic regression) ผลการศึกษา พบว่าช่างเย็บผ้าส่วนใหญ่เป็นเพศหญิง คิดเป็นร้อยละ 66.70 มีอายุเฉลี่ย 45.76 ± 8.83 ปี จบระดับประถมศึกษา คิดเป็นร้อยละ 66.70 พบความชุกอาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่างสูงที่บริเวณหลังส่วนบน คิดเป็นร้อยละ 66.70 ขา คิดเป็นร้อยละ 60.00 และข้อมือ คิดเป็นร้อยละ 55.30 การประเมินร่างกายส่วนบนแบบรวดเร็ว (Rapid Upper Limb Assessment: RULA) พบว่าคะแนน Final score เฉลี่ยเท่ากับ 5.7 การศึกษา พบว่าช่างเย็บผ้าส่วนใหญ่มีโอกาสสูงที่จะเกิดอาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่าง เนื่องจากท่าทางการทำงานที่ไม่เหมาะสม ทำให้จำเป็นต้องมีการปรับปรุงสภาพแวดล้อมในการทำงานโดยด่วน เพื่อป้องกันและลดความเสี่ยงในการเกิดอาการดังกล่าว จากการวิเคราะห์ความสัมพันธ์ พบว่า ปัจจัยส่วนบุคคลและปัจจัยการทำงานมีความสัมพันธ์กับอาการผิดปกติของระบบกล้ามเนื้อและกระดูก

โครงร่าง ผลการศึกษานี้ชี้ให้เห็นความสำคัญของการปรับปรุงสภาพการทำงานให้เหมาะสมกับสรีรศาสตร์ เพื่อช่วยลดอาการปวดเมื่อยและป้องกันการเกิดโรคเรื้อรังในระยะยาว

คำสำคัญ: ท่าทางการทำงาน; อาการผิดปกติของระบบกล้ามเนื้อและกระดูกโครงร่าง; ช่างเย็บผ้า; การประเมินร่างกายส่วนบนแบบรวดเร็ว

1. INTRODUCTION

The informal sector plays a crucial role in most developing economies, with Thailand being a prime example. Despite challenges in accurately measuring this elusive economic segment, its interactions and consequences for the formal sector have sparked significant interest among economists. Of particular concern is the informal sector's potential impact on inequality and poverty reduction.[1] In 2023 the number of informal employments over formal employment. From employed persons 40.1 million. That is number of informal employments was about 21.0 million (52.30%), while formal employment was about 9.4 million (44.76%) male informal employment over female informal employment. (55.24% of males, 44.76% of females). Informal employment distribution in the Northeast was the highest proportion of informal employment 74.60%.[2] In Ubonratchathani province, Thailand, 2023, there were about 744,394 informal workers (82.70%) (57.20% of males, 42.80% of females), which also locates the highest number of informal workers compared to other regions.[3] Many of these workers were seasoned garment operators. Across all work areas, they were exposed to a range of environmental hazards. Ergonomic risks, a primary cause of musculoskeletal disorders (MSDs) in garment manufacturing, were prevalent among them.

Musculoskeletal disorders (MSDs), typically characterized by injuries to the muscles, soft tissues, joints, and ligaments of the body, are the most prevalent occupational health issues among workers across the world.[4] Musculoskeletal disorders (MSDs) are a major health problem in both industrialized and industrially developing countries[5]. In many industries and occupations, musculoskeletal disorders (MSDs) are a leading cause of absenteeism[6], injury[7], disability[8] and decline in quality of life.[9] Several risk factors including physical, psychosocial, organizational, and socio-demographic aspects have been identified as being associated with the development of musculoskeletal disorders (MSDs) among different occupational groups, particularly in those involved in sedentary and repetitive activities[10]. Prevention of musculoskeletal disorders (MSDs) is, therefore, one of the most important factors impacting the productivity enhancement and the promotion of health and safety at work.[11] With specific reference to sewing machine operators, this occupational group may experience a high prevalence of musculoskeletal disorders (MSDs)[12]. This is commonly caused by prolonged, poor posture throughout the workday and the repetitive hand

and arm movements inherent to sewing machine operation.[13] Sewing machine operators perform highly repetitive tasks while maintaining a static sitting posture. The combination of one-sided upper and lower limb movements and awkward positions over extended periods significantly increases the risk of musculoskeletal disorders (MSDs), potentially leading to long-term work disability.[14]

Garment operators typically work on a piecework basis, assembling garment components. This fragmented work often involves highly repetitive, complex tasks requiring precise hand coordination, usually performed while seated for extended periods. To maintain focus and visual control, garment operators often adopt a forward leaning posture, straining the neck, back, and upper limbs. The stationary nature of the sewing machine necessitates postural adjustments to perform precision work, increasing the risk of developing musculoskeletal disorders in these areas.[12]

Enhanced knowledge of occupational hazards and corresponding prevention strategies within the sewing industry has the potential to significantly improve worker productivity and quality of life. Despite the prevalence of musculoskeletal disorders (MSDs) among garment operators, limited research exists on the specific risks and factors contributing to these conditions. This study aims to assess working postures and self-reported musculoskeletal disorders (MSDs) among this population. The findings will contribute to a deeper understanding of the challenges faced by garment operators and inform the development of effective preventive measures and guidelines.

2. METHODS

2.1 Study design and procedure

A cross-sectional analytical study. Data on garment operators was collected from Warin market in Warinchamrap district, Ubonratchathani province. The study population consisted of 30 individuals solely engaged in sewing machine operation, representing 100% of the garment operators within this specific area. The inclusion criteria for the sample group were as follows: 1) age 18 years or older; 2) at least 3 months of experience in garment sewing; 3) ability to communicate and understand the Thai language; and 4) voluntary consent to participate in the research. A questionnaire and direct observations of working postures using the rapid upper limb assessment (RULA) method were used.

2.2 Data collection

Data for demographic, work-related, were recorded using a questionnaire. Demographic details included: age, gender, height, weight, body mass index (BMI as weight/height^2), marital status (single or married), educational level (primary school, secondary school, and diploma), as well as individual habits such as being involved in regular sports/ physical activities. The questions regarding the work-related items were based on the relevant literature[10] and included, such as the number of years worked as an operator, and the number of hours worked per day and week.

The frequency of musculoskeletal disorders in different body regions was measured using the standardized Nordic Musculoskeletal Disorders Questionnaire by self-reported.[15] This questionnaire was translated and revised into Thai and has established validity and reliability. The respondents were asked to indicate if they had experienced any ache, pain, discomfort, or numbness in the last 12 months for different body regions using a body map. Those operators who reported musculoskeletal symptoms in any of the body regions were also asked to indicate the severity of these in each of the different body areas, using a scale of 0 – for no pain to 5 for high pain. The questionnaire was administered face-to-face by one of the authors interviewing the garment operators and took approximately 15 mins to complete. The questionnaire was tested through a pilot study on a sample of 30 participants from the Yai market in Ubonratchathani province and minor word modifications were made to a few questions. The test-retest reliability (stability) of the items of the questionnaire was evaluated with Kappa coefficients. The kappa coefficients ranged from 0.85 to 0.99, indicating good reliability of the measure.

In addition to these data, Rapid Upper Limb Assessment (RULA)[16] was used to evaluate the working postures of operators at their workstations. RULA, as a reliable and validated observational method, can be used for the assessment of biomechanical and postural loading on the musculoskeletal system which is known to contribute to musculoskeletal disorders (MSDs). This method was designed for assessing the severity of postural loading and is particularly applicable to sedentary jobs[17] similar to the sewing tasks in the present study. In this method, work postures are selected concerning their perceived severity, frequency of occurrence, or other such criteria, and a score is calculated for different body regions that are then used to calculate an overall 'Grand Score' which relates to one of four action levels:

Action Level 1 = a score of one or two indicates that the posture is acceptable if it is not maintained or repeated for long period.

Action Level 2 = a score of three or four indicates that further investigation is needed and changes may be required.

Action Level 3 = a score of five or six indicates that investigation is needed and changes are required soon.

Action Level 4 = a score of seven or more indicates that investigation and changes are required immediately.

The observations and recordings of postures in the present study were performed by two trained observers. Although the garment operations required a fairly static posture, the investigators made sure to examine the longest adopted posture during the task cycle for each individual and took approximately 15 mins to complete. A separate RULA assessment sheet was used for each operator to record the RULA scores.[18]

2.3 Data analysis

Demographic characteristics were described using percentages, mean, standard deviation. The relationship between factors was analyzed using the univariate and multiple logistic regression. The fit of the models was confirmed by the Hosmer – Lemeshow goodness of fit test. For all statistics tests, $p < 0.05$ was considered statistically significant.

This research has been approved by the Human Research Ethics Committee of Ubon Ratchathani University, as evidenced by the certificate number UBU-REC-13/2563.

3. RESULTS

3.1 Demographic data

Table 1 shows the demographic details of the study participants. The most of garment operators were female (66.70%). Their average ages were 45.76 ± 8.83 years old. Most of the participants were married (76.70%) and the study found that most participants had a higher than normal Body Mass Index (BMI), had a mean BMI of 24.10 kg/m^2 (SD = 4.1 kg/m^2, range = 13.1 – 36.0 kg/m^2). Among these participants, 66.70% had a primary school education. The majority of operators (74.50%) reported that they were not involved in regular sports/physical activities.

Table 1 Demographic details of aging sewing machine operators (N = 30).

Variables	N (%)
Gender (n (%))	
Male	10 (33.30)
Female	20 (66.70)
Age (years)	
Mean (SD)	45.76 (8.83)
Range	26 - 65
Body mass index (BMI) (kg/m^2)	
Mean (SD)	24.10 (4.10)
Range	13.10 - 36.00
Marital status (n (%))	
Single	7 (23.30)
Married	23 (76.70)
Educational level (n (%))	
Primary school	20 (66.70)
Secondary school	6 (20.00)
Diploma	4 (13.00)
Regular sports/physical activity (n (%))	
Yes	8 (26.70)
No	12 (73.30)

3.2 Work-related factors

The work-related factors of garment operators are presented in Table 2. The operators had been working in their current jobs between 11 and 20 years (mean = 19.34 years; SD = 11.97 years). The mean daily working hours spent on sewing garments (shirts, pants, jackets, etc.) were 8 hours. Only 10% of the operators had adjustable chairs and all of them were filled with the design of sewing machines and tables.

Table 2 Work-related factors of sewing machine operators (N = 30).

Variables	
Number of years worked as an operator (N (%))	
Mean (SD)	19.34 (11.97)
Range	11 - 20
Daily working hours	
Mean (SD)	8 (1.32)
Range	8 - 12
Use of adjustable chairs	
Yes	3 (43.30)
No	17 (56.70)
Satisfaction with sewing machine/table design	
High	30 (100.00)

3.3 RULA assessments of working postures

Table 3 shows the percentages of garment operators with each RULA score, including the RULA scoring for the two different regions of the body and the grand score. The upper arms score of the operators was generally 3 – the result that was characterized by the upper arms being slightly abducted and flexed between 20° and 45°. The lower arms score for the majority of operators was also 3, reflecting the need for operators to extend their arms across the midline of the body with elbow flexion of more than 100°. The wrist score was generally between 3 and 4, with the wrists in extension (sagittal plane) of 15° or more. The neck and trunk scores of 2 and 3 for the majority of the operators also indicated a high proportion of neck and trunk flexion of more than 20° to the front. However, the most common postures of the legs were determined to be within the normal limit which supported the use of RULA assessments in the first instance (with its focus on the upper body).

The final RULA grand score ranged from a minimum of 4 to a maximum of 7 with an average score of 5.70 (SD = 0.62). For the majority of operators (90.90%), the final RULA grand scores were determined to be 5 (30.70%) or 6 (60.20%), which indicates an action level of 3. The percentage of garment operators with a final RULA grand score at action level 4 was 6.40%. Additionally, none of the garment operators had a final RULA grand score of 1 or 2 (e.g., an acceptable working posture). The mean arm/wrist score (score A) was higher in females than in males (4.90 and 4.00, respectively; $p < 0.001$), although females mean neck/trunk/leg score (score B) was higher than

males (4.10 and 2.90, respectively; $p < 0.001$). Females also received higher RULA grand scores than males (mean 6.10 and 5.40, respectively, $p < 0.001$).

Table 3 Distribution of RULA scoring for study participants (N = 30)

	RULA score							Mean (SD)
	1	2	3	4	5	6	7	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Upper arms	3 (10.00)	4 (13.30)	23 (76.70)	-	-	-	-	2.9 (0.25)
Lower arms	-	5 (1.70)	25 (83.30)	-	-	-	-	2.9 (0.14)
Hands/ Wrists	-	3 (10.00)	10 (30.30)	17 (56.70)	-	-	-	3.5 (0.55)
Neck	-	8 (26.70)	22 (73.30)	-	-	-	-	2.6 (0.47)
Trunk	-	14 (46.70)	10 (30.30)	6 (20.00)	-	-	-	2.4 (0.53)
Legs	25 (83.30	5 (1.70)	-	-	-	-	-	1.0 (0.24)
A score	-	-	-	12 (40.00)	18 (60.00)	-	-	4.5 (0.49)
B score	-	6 (20.00)	-	18 (60.00)	6 (20.00)	-	-	3.4 (1.01)
Grand score	-	-	-	7 (23.30)	20 (66.70)	3 (10.00)	-	5.7 (0.62)

3.4 Prevalence of musculoskeletal disorders

Fig. 1 shows the prevalence of musculoskeletal disorders in different body regions was reported by the garment operators. A total of 100% of the garment operators (33.30% males and 66.70% females) reported some form of musculoskeletal disorders at some time during the 12 months preceding the data collection. Ninety-one percent of those who reported symptoms indicated more than one location of pain or discomfort. The most commonly affected body regions were low back (58.90%), neck (54.10%), hands/wrists (40.20%), upper back (37.80%), and shoulders (27.80%).

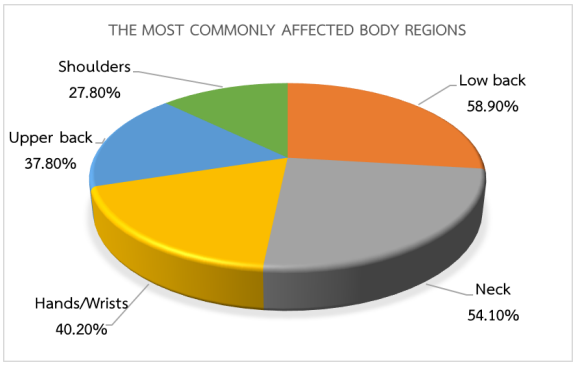

Fig. 1 The most commonly affected body regions

3.5 Risk factors for self-reported musculoskeletal disorders

Table 4 and Table 5 shows the results of univariate and multiple logistic regression indicated that many factors are associated with musculoskeletal disorders (MSDs) in different body regions. The results of multiple logistic regression analyses showed that the number of years worked as an operator, daily working hours, and working postures (assessed by the RULA method), as well as individual factors, including gender, age, and BMI and regular sports/physical activity were significantly associated with the presence of musculoskeletal symptoms of different body regions. However, no significant association was found between use of adjustable chairs, marital status, and educational level.

Table 4 Univariate and multiple logistic regression analyses of factors associated with neck, shoulder and hand/wrist symptoms.

Variables	Neck symptoms						Sholders symptoms						Hand/Wrists symptoms					
	Univariate			Multivariate			Univariate			Multivariate			Univariate			Multivariate		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Gender																		
Male	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Female	1.20	0.63-2.21	0.666	-	-	-	1.23	0.74-2.13	0.253	-	-	-	0.65	0.36-0.93	**0.003**	-	-	-
Age	1.02	1.01-1.06	**0.042**	-	-	-	1.04	1.01-1.07	**0.001**	-	-	-	1.01	0.96-1.02	0.405	-	-	-
BMI	0.28	0.94-1.10	0.288	-	-	-	0.96	0.91-1.05	0.305	-	-	-	1.01	0.94-1.05	0.725	-	-	-
Marital status																		
Single	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Married	1.83	1.02-3.55	**0.032**	-	-	-	1.72	0.90-3.31	0.094	-	-	-	1.55	0.85-2.83	0.122	-	-	-
Education level																		
Diploma	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Primary	0.40	0.16-1.21	0.123	-	-	-	0.87	0.41-1.83	0.745	-	-	-	0.75	0.35-1.58	0.485	-	-	-
Secondary	0.44	0.15-1.28	0.152	-	-	-	0.23	0.09-0.57	**0.003**	-	-	-	0.94	0.44-2.05	0.921	-	-	-
Regular sports/physical activity																		
No	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	1.00	-	-
Yes	0.93	0.45-1.78	0.845	-	-	-	1.51	0.83-2.75	0.152	-	-	-	0.27	0.13-0.54	**0.001**	0.30	0.13-0.58	**0.001**
Number of years worked as an operator	1.02	1.01-10.6	0.035	1.02	1.01-10.7	0.020	1.05	1.03-1.12	**0.001**	1.06	1.02-1.11	**0.001**	1.01	0.96-1.01	0.365	-	-	-
Daily working hours	1.23	0.95-1.59	0.080	-	-	-	1.61	1.23-2.11	**0.001**	-	-	-	0.93	0.75-1.20	0.714	-	-	-

Statistically significant values are shown in bold

Table 4 Univariate and multiple logistic regression analyses of factors associated with neck, shoulder and hand/wrist symptoms (Cont'd)

Variables	Neck symptoms						Sholders symptoms						Hand/Wrists symptoms					
	Univariate			Multivariate			Univariate			Multivariate			Univariate			Multivariate		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Use of adjustable chairs																		
No	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Yes	1.74	0.63-2.41	0.310	-	-	-	1.33	0.70-3.20	0.244	-	-	-	0.55	0.28-1.07	0.091	-	-	-
RULA A score				-	-	-	1.04	1.01-1.07	**0.001**	-	-	-	1.01	0.96-1.02	0.405	-	-	-
1-4	1.00	-	-	1.00	-	-	1.00	-		1.00	-	-	1.00	-	-	-	-	-
≥5	1.78	1.02-3.19	**0.041**	1.90	1.20-3.82	**0.020**	5.21	2.07-9.20	**0.001**	4.12	2.02-8.35	**0.001**	0.81	0.48-1.33	0.435	-	-	-
RULA B score																		
1-4	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
≥5	0.54	0.18-1.59	0.275	-	-	-	0.11	0.01-1.01	0.053	-	-	-	0.96	0.35-2.71	0.095	-	-	-
RULA grand score																		
1-4	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
≥5	1.85	0.78-5.98	0.320	-	-	-	2.85	0.32-8.23	0.333	-	-	-	1.85	0.85-3.98	0.108	-	-	-

Statistically significant values are shown in bold

Table 5 Univariate and multiple logistic regression analyses of factors associated with upper back and low back symptoms.

Variables	Upper back symptoms						Low back symptoms					
	Univariate			Multivariate			Univariate			Multivariate		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Gender												
Male	1.00	-	-	1.00	-	-	1.00	-	-	-	-	-
Female	11.2	5.73-20.4	**0.001**	10.9	5.1-18.3	**0.001**	1.25	0.38-2.53	0.465	-	-	-
Age	1.02	0.97-1.06	0.093	-	-	-	1.03	0.97-1.08	0.179	-	-	-
BMI	0.78	0.74-0.92	**0.001**	-	-	-	1.06	0.96-1.15	0.120	-	-	-
Marital status												
Single	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Married	1.23	0.66-2.14	0.458	-	-	-	1.12	0.59-2.43	0.694	-	-	-
Education level												
Diploma	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Primary	0.45	0.20-1.01	0.058	-	-	-	1.23	0.43-3.15	0.695	-	-	-
Secondary	0.07	0.02-1.18	**0.001**	-	-		0.83	0.29-2.17	0.653	-	-	-
Regular sports/physical activity												
No	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Yes	1.63	0.90-2.78	0.105	-	-	-	0.51	0.23-1.05	0.052	-	-	-
Number of years worked as an operator	1.07	1.02-1.16	**0.001**	-	-	-	1.03	0.98-1.12	0.441	-	-	-
Daily working hours	2.83	2.17-3.59	**0.001**	1.70	1.22-2.45	**0.003**	1.07	1.03-1.12	**0.015**	1.03	1.01-10.9	0.038
Use of adjustable chairs												
No	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Yes	0.51	0.25-1.20	0.075	-	-	-	1.20	0.64-3.32	0.206	-	-	-
RULA A score												
1-4	1.00	-	-	-	-	-	1.00	-	-	-	-	-
≥5	4.85	1.82-8.40	**0.001**	-	-	-	1.26	0.64-2.46	0.460	-	-	-
RULA B score												
1-4	1.00	-	-	-	-	-	1.00	-	-	-	-	-
≥5	1.23	1.05-1.39	**0.038**	-	-	-	0.86	0.22-3.24	0.857	-	-	-
RULA grand score												
1-4	1.00	-	-	1.00	-	-	1.00	-	-	1.00	-	-
≥5	1.24	1.07-1.18	**0.037**	1.27	0.10-1.37	**0.035**	1.25	1.16-2.43	**0.003**	1.65	1.16-2.39	**0.005**

Statistically significant values are shown in bold

4. DISCUSSION

This study provides new insights into the working conditions of garment operators, particularly regarding musculoskeletal disorders (MSDs) and their associated risk factors. The prevalence of self-reported musculoskeletal disorders (MSDs) was notably high among participants, with the low back, neck, hands/wrists, upper back, and shoulders being the most commonly affected areas. The average prevalence of complaints in the low back, neck, and upper back regions was rated moderately to severely (3 or 4 on a 0-5 scale), aligning with previous research on garment operators.[12] Symptom prevalence varied by gender. Females reported more severe upper back pain, and females experienced more severe hand and wrist symptoms.

Musculoskeletal disorders (MSDs) are the result of discomfort; thus, the operators may be able to make muscles work, but it will decrease their work performance.[19] Operators can avoid the prolong posture by body stretching, or taking walks around their workstations[20-21] suggested that stretching exercises might help muscles for more strength and endurance, which could help eliminate muscle weakness and fatigue.

The findings of this study confirm that the garment operators had frequent periods of long duration of sewing work (8 hours). Similar findings were established in some previous literature[22-23] where prolonged daily work was attributed to the development of musculoskeletal disorders (MSDs). Our findings were also in line with previous literatures[18, 24-25] stating that continuous work without an appropriate rest break (for recovery) substantially increased the risk of musculoskeletal disorders (MSDs) occurrence in different body regions. Several previous studies have shown that the long duration of sitting work may influence the risk for neck and shoulder complaints among different occupational groups such as garment operators[26] and hand-sewn shoe workers.[10] In the study conducted by L. McLean et al. (2001)[27], it was also shown that regular rest breaks reduced neck, shoulder, and low back discomfort among computer workers. Our findings also indicated that the duration of continuous work was associated with the occurrence of neck and shoulder complaints. Thus, to reduce musculoskeletal disorders (MSDs), sewing machine operators should be advised to take regular rest breaks to alleviate exposure and also to aid recovery from unhealthy postures.

Prolonged working hours have also been recognized as another risk factor for the development of musculoskeletal disorders (MSDs) among different occupational groups[10], Jalil Nazari et al. (2012)[28] found that the prolonged daily working hours contributed to a greater number of reports of upper back symptoms among hand-woven carpet weavers. Iman Dianat and Arezou Salimi (2014)[10] also found that the number of hours worked in a day was significantly positively

associated with knee symptoms in hand-sewn shoe workers. The significant positive association between the duration of the sewing task and reported symptoms in the upper back areas in the present study agrees with these previous studies. The findings of the present study also indicated a significant association between the number of years worked as an operator and the presence of symptoms in the neck and shoulders. This result is also similar to the findings of Mario Ferreira Jr and Paulo H N Saldiva (2002)[29] who reported a significant association between duration in the job and musculoskeletal disorders (MSDs) among the operators engaged in computer telephone interactive tasks.

Regarding individual risk factors, the results of multiple logistic regression models indicated that gender was a significant factor for upper back symptoms. This may be attributed to differences in working habits between gender (e.g. the number of hours worked in a day was higher for women than men).

This study's findings suggest that improving working conditions for SMEs, particularly in sewing tasks, can significantly benefit both the national economy and workers' well-being. To reduce musculoskeletal disorders (MSDs), prevention strategies should focus on both individual factors and workplace ergonomics. By addressing ergonomic factors such as workstation design and posture, it is possible to create safer and more ergonomic working environments.

5. CONCLUSION

A high prevalence of musculoskeletal disorders (MSDs), specifically affecting the neck, shoulders, upper back, hands/wrists, and lower back, has been observed among garment workers. The findings of this study indicate that ergonomic deficiencies, including poor workstation design and suboptimal working postures, are key risk factors for musculoskeletal disorders (MSDs). Additionally, work organization factors such as long working hours, job tenure, and perceived work stress contribute to the development of these musculoskeletal complaints.

Limitations of the study on musculoskeletal disorders:

The study evaluating the working posture and musculoskeletal disorders among garment operators has several limitations that should be acknowledged:

- Sample Size Limitations: The study's relatively small sample of 30 participants may restrict the generalizability of its findings to the broader population of garment operators. A larger sample size would enhance the study's statistical power and allow for more robust conclusions.

- Data Collection Method: The study relied on self-reported data, which may be subject to recall bias and social desirability bias. Participants' subjective reporting of musculoskeletal disorders (MSDs) could influence the accuracy of the findings.

Recommendation for further study:

Future research should focus on implementing and assessing the impact of ergonomic changes in the workplace.

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DECLARATION OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

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