

Evaluation of Ergonomic Needs Among Female Sewing Machine Operators in Garments Industry of Bangladesh: A Pilot Study

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ABSTRACT

The readymade garments sector in Bangladesh has given employment to millions of people, especially women. However, with cellular manufacturing, enhanced productivity accompanies increased musculoskeletal disorders in workers. Female sewing operators working with sustained awkward postures are the population with a high risk of musculoskeletal symptoms. Seven female sewing operators in a garment manufacturing unit in Dhaka, Bangladesh, were recruited in this pilot study. A combined survey sheet was developed, including demographic questions and Cornell Musculoskeletal Discomfort Questionnaires. Anthropometric data and sewing chair dimensions were measured with metallic tape. Subjects were interviewed about their subjective opinions on the ergonomic functions of sewing facilities. Based on observations, subjects sat for around 10 hours daily with a 1-hour lunch break. All of them reported musculoskeletal pain after a whole day of work. The average pain score was highest in the lower back, followed by the arm, neck and leg. The mismatch computations showed that the backrest was lower mismatched with 42.9% of subjects, the seat width was lower mismatched with 100% of them, and the seat height was higher mismatched with 100% of them. According to interviews, subjects complained about their current working chair without elbow rest and inappropriate seat and desk height.

Keywords: Sewing machine operator, Female, Garment industry, Bangladesh

INTRODUCTION

Bangladesh has enriched in garments industry in recent past years. It is a promising step in industrialization, which has given employment to millions of unemployed people, especially women (Kabir et al., 2019, Sikdar et al., 2014). However, with cellular manufacturing, enhanced productivity accompanies increased musculoskeletal disorders. It may be due to the given focus on production rather than workers' health condition (Kabir and Ahmed, 2003). A study revealed that most female workers in the garment sector suffer from musculoskeletal diseases such as neck and back pain (Ahmed and Raihan, 2014). Among them, sewing operators who work with sustained awkward posture are the population with a high risk of musculoskeletal symptoms (Dianat et al., 2015, Sealetsa and Thatcher, 2011). However, there is

limited research to uncover their working conditions and ergonomic needs (Ali et al., 2014).

Therefore, this study aims to investigate the ergonomic needs of female sewing machine operators in the garments industry of Bangladesh and propose a design concept of a ‘relaxing chair’ based on interviews, questionnaires, and arthrometric measurements.

METHODS

Seven female sewing machine operators, mean age 31.6 ± 8.8 years old, mean weight 56.4 ± 8.4 kg, and mean height 5.27 ± 0.35 ft, in a garment manufacturing unit in Dhaka, Bangladesh, were recruited for this pilot study. A combined survey sheet was developed, including demographic questions and Cornell Musculoskeletal Discomfort Questionnaires (CMDQ). Because most of the subjects were illiterate, surveys were conducted by questioning. The demographics included age, weight, height, marital status, and education level. CMDQ is a survey sheet used to evaluate the rating of symptoms in specific body parts (neck, shoulder, arm, upper back, lower back, and leg) 1 hour after work and after a whole day of work by multiplying the frequency, severity, and interference scores. Table 1 shows the details of CMDQ.

Anthropometric measurements and sewing chair dimension measurements were conducted manually using a metallic tape. Figure 1 shows the working chair and its measurements. Subjects were also interviewed about their opinions on the ergonomic functions of sewing facilities.

Table 1. Cornell musculoskeletal discomfort questionnaires for specific body part.

Frequency	Severity	Interference
0 = Never	1 = slightly uncomfortable	1 = not at all
1.5 = 1-2 times/week	2 = moderately uncomfortable	2 = slightly interfered
3.5 = 3-4 times/week	3 = very uncomfortable	3 = substantially interfered
5 = once in every day		
10 = several times every day		



Figure 1: (A) current working chair and (B) working chair dimensions.

RESULTS

The subjects' demographic information and anthropometric data are shown in Tables 2 and 3, respectively. Subjects were all married, and their educational levels ranged from class 5 to 8.

Based on observations and interviews, a typical daily work process of a female sewing machine operator in a garment manufacturing unit in Bangladesh is constantly sitting for more than 10 hours with a 1-hour lunch break. They hardly move around, only to pick up their work in the morning and submit their production to their supervisor at the end of the day.

Among seven subjects, no one reported shoulder and upper back pain. After 1 hour of work, the lower back got the highest average discomfort score (3.57 ± 5.62), followed by the neck (1.43 ± 2.56), arm (1.00 ± 2.65), and leg (0.43 ± 0.73). After a whole day of work, the average discomfort score of the lower back increased to 6.21 ± 8.42 , followed by the arm (3.00 ± 7.94), neck (1.86 ± 2.53) and leg (1.86 ± 3.18) (see Tables 4 and 5).

The mismatched computations between body measurements and chair dimensions showed that the current sewing facilities were unsuitable for them ergonomically (see Table 3). The mismatched computations showed that the backrest was lower mismatched with 42.9% of subjects, the seat width was lower mismatched with 100% of them, and the seat height was higher mismatched with 100% of them. According to interviews, the subject complained about their current sewing chairs without an elbow rest which was quite uncomfortable for them to work. It could be one of the reasons that workers are facing severe arm pain. Consistent with anthropometric measurement results, several subjects mentioned that the seat and desk heights were

Table 2. Subjects' demographic information.

Subject	Age (years)	Weight (kg)	Height (ft)	Marital Status	Education
1	40	69	6	Married	Class 5
2	45	45	5	Married	Class 8
3	21	50	5	Married	Class 5
4	24	52	5.3	Married	Class 8
5	25	64	5.3	Married	Class 7
6	33	55	5.3	Married	Class 8
7	33	60	5	Married	Class 8

Table 3. Subjects' anthropometric measurements.

Measurements	Mean \pm SD (cm)	Mismatch percentage
Sitting Height	83.1 ± 2.3	
Shoulder Height	55.6 ± 2.4	42.9% LM with UEB
Elbow Rest Height	31.2 ± 1.5	
Popliteal Height	40.0 ± 1.2	100% HM with SH
Hip Breadth	36.1 ± 0.9	100% LM with SW
Knee to Knee breadth	15.5 ± 0.3	

Note. UEB = upper edge of backrest; SH = seat height; SW = seat width; LM = lower mismatch; HM = higher mismatch

Table 4. CMDQ scores after one hour of work. F = Frequency, S = Severity, I = Interference.

Subject	Neck	Shoulder	Arm	Upper Back	Lower Back	Leg
1	0	0	0	0	0	F-1.5, S-1, I-1
2	0	0	0	0	0	0
3	0	0	0	0	F-1.5, S-1, I-1	0
4	F-1.5, S-1, I-1	0	0	0	F-1.5, S-1, I-1	F-1.5, S-1, I-1
5	F-1.5, S-1, I-1	0	F-3.5, S-2, I-1	0	0	0
6	0	0	0	0	F-3.5, S-2, I-1	0
7	F-3.5, S-2, I-1	0	0	0	F-5, S-3, I-1	0
Mean \pm SD	1.43 \pm 2.56	0	1.00 \pm 2.65	0	3.57 \pm 5.62	0.43 \pm 0.73

Table 5. CMDQ scores after a whole day of work. F = Frequency, S = Severity, I = Interference.

Subject	Neck	Shoulder	Arm	Upper Back	Lower Back	Leg
1	0	0	0	0	0	F-1.5, S-2, I-2
2	F-1.5, S-1, I-1	0	0	0	0	0
3	0	0	0	0	F-1.5, S-3, I-1	0
4	F-1.5, S-1, I-1	0	0	0	F-1.5, S-1, I-2	F-3.5, S-1, I-2
5	F-1.5, S-2, I-1	0	F-3.5, S-3, I-2	0	0	0
6	0	0	0	0	F-3.5, S-3, I-2	0
7	F-3.5, S-2, I-1	0	0	0	F-5, S-3, I-1	0
Mean \pm SD	1.86 \pm 2.53	0	3.00 \pm 7.94	0	6.21 \pm 8.42	1.86 \pm 3.18

inappropriate. They had to use a cushion on the seat to make them more comfortable (see Figure 1 left).

DISCUSSIONS

The results gave an insight into the working conditions of female sewing machine operators. They sat for more than 10 hours a day with a 1-hour lunch break and barely moved around. The CMDQ analysis showed that, after a whole day of work, their localized discomfort scored highest in the lower back, followed by the arm, neck, and leg, but not in the shoulder and upper back. Meanwhile, the mismatched calculations found that the upper edge of the backrest and the seat width was too low, while the seat height was too high for them. However, at the same time, we found that female operators liked having a soft cushion on their seats to make themselves comfortable, which may indicate unsuitable desk-chair dimensions in the sewing workplace.

It has been reported that sewing operations require the coordination of feet, hands, and eyes with the body statically inclined forward (Dianat et al., 2015). Prolonged forward inclination, with lower back muscles contracting continuously, is a high-risk factor for musculoskeletal disorders. And the design of the backrest may become useless under this condition.

Currently, research on improving sewing operators' workplaces is limited. This study has limitations in terms of sample size and needs further exploration.

CONCLUSION

With this pilot study, we found that female sewing operators in Bangladesh's garments industry faced a high risk of musculoskeletal disorders due to the following factors: 1) prolonged working hours without rest; 2) mismatched facility dimensions; 3) non-adjustable chairs without armrests. Therefore, we developed a design concept of a 'relaxing chair', which will be produced based on anthropometric data of a larger sample size. It would have a soft cushion and an armrest that would be height-adjustable. Moreover, it will be equipped with neck and lumbar support to reduce disc pressure during sustained work. Which hopefully will improve the health conditions of female sewing operators in Bangladesh. Future work would evaluate the comfort level and discomfort scores of sewing operators after a whole day sitting in the current and the modified chair.

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