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# The association between works related musculoskeletal body discomfort and ergonomic risk level among female sewing machine operators in Sri Lanka.

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**Abstract**

**Background:** Work related musculoskeletal discomfort can occur in any region of the body. It affects sewing machine operator's activities of daily living and quality of life directly or indirectly. Poor ergonomics is a major contributor to work related musculoskeletal discomfort that develops over time. It is important to find out the association between work related musculoskeletal body discomfort and ergonomic risk level among female sewing machine operators of selected garment factories in western province, Sri Lanka.

**Methods**: A descriptive cross-sectional study was preceded, with a study population of one hundred and thirty-seven (137) female sewing machine operators within the age of 18-50 years at selected garment factories in the western province of Sri Lanka.

**Conclusion:** Of the total sample, 72.99% operators presented with musculoskeletal discomfort. Qualitative and quantitative data were obtained using a pre-validated questionnaire; Cornell musculoskeletal discomfort questionnaire and Rapid Entire Body Assessment (REBA). The mean age of study population was 33.55±1.64years. The highest prevalence of discomfort was reported in neck (53.94%) and lower back (69.2%) regions. The mean ergonomic risk level was 8.42±0.16 which is 50.36% in study population. The majority of the sewing machine operators were in high ergonomic risk level in western province of Sri Lanka and the prevalence of musculoskeletal disorders was more in the lower back and neck regions where the ergonomic interventions should have implemented.

**Keywords:** Work related musculoskeletal body discomfort, ergonomic risk level, REBA, sewing machine operators

## Introduction

There are 300-350 apparel manufactures in Sri Lanka which provide direct and indirect employment for over 300,000 and 600,000 employees respectively. It includes a considerable number of women. Dheerasinghe, reported that the garment industry has been Sri Lanka's largest gross wage earner since 1986 and accounted for more than 52% of the total export earnings of the country[1]. Therefore, sewing machine operators play a major role in the economy of Sri Lanka. Therefore, it is essential to study on problems regarding to them.

A work-related musculoskeletal discomfort (WRMSD) refers to the musculoskeletal aches and distresses that result from a work-related event[2]. There is a prevalence of 15.5% for having musculoskeletal problems in garment factory workers in Sri Lanka[3]. According to several studies, musculoskeletal discomfort became a major health complaint among sewing machine operators in the apparel industry in South Asian countries. Work related musculoskeletal discomfort can occur in any region of the body but the back pain was the most commonly reported disorder among those who suffered from musculoskeletal discomfort[4].

Female sewing machine operators in garment factories usually sit for more than 6 hours continuously for a minimum of 6 days per week. Without adequate breaks they work in a non-ergonomically fitted work station. Literature has proved that most of the female sewing machine operators are suffering from health issues such as work-related musculoskeletal discomforts [5-7].

As health care professionals, it is essential to understand the work-related musculoskeletal discomfort regarding their occupational history. Therefore, the current study was conducted to evaluate the prevalence of the work-related musculoskeletal discomfort and ergonomic risk level among sewing machine operators which is still lacking in the apparel industry of Sri Lanka. This study also revealed the association between work-related musculoskeletal discomfort and ergonomic risk level which is important to make suitable adaptations to prevent and minimize the ergonomic risk level among sewing machine operators.

## Materials and Methods

The current study was designed as a descriptive, cross-sectional study. One hundred and thirty seven (137) female sewing machine operators in two large scale garment factories (Kaluthara and Colombo) were recruited using simple random sampling, according to the inclusion criteria as female sewing machine operators in the age category of 18 - 50 years, minimum of 6 working hours, minimum working period of 6 months and participants who granted written informed consent. Exclusion criteria of the study considered as participants who did not grant the written informed consent, participants who have undergone surgeries in the spine and scoliosis and diagnosed with previous illness and diseases in the musculoskeletal system and pregnant. Ethical clearance was obtained from the Ethics Review Committee, Faculty of medicine, Kotelawala Defense University, Sri Lanka.

Pre-tested Interview-administrated assessment form was used to collect data about work related musculoskeletal discomforts and demographic data. Height and weight were measured using a stadiometer 282 (Seca GmBH and Co kg, Hamburg and Germany) and a weighing scale named Tanita HD 318 digital weighing scale (Tanita Co-operation, Tokyo, Japan). Three measurements were taken at the same time and the mean was calculated. Body Mass Index (BMI) was calculated using mean height and weight values measured.

The section1 of the form was consisted demographic data with work related factors of the participants and section 2 was consisted with Standard Cornell musculoskeletal discomfort questionnaire(CMDQ). The CMDQ is a 54-items questionnaire which has a body chart and questions on musculoskeletal ache, pain, or discomfort occurrence in 18 body parts over the past week. It is calculated in accordance with the CMDQ scoring guidelines[8].

Rapid ergonomic Body Assessment (REBA) was used to assess ergonomic risk level. It was included all body regions and considered the static force or load score coupling score and activity scores with postural score are to achieve the final score [9]. Data were analyzed using SPSS (Statistical Product and Service Solution) software version 26.0.

## Results

A majority of the participants, 100 out of 137 (72.99%) complained that they have been experiencing musculoskeletal body discomfort in various parts of their body which indicated that there was high incidence of Work-Related Musculoskeletal Discomfort.

Ergonomic risk level distribution was presented in Figure 1 under REBA category (medium risk, high risk and very high risk). Based on REBA score, it is revealed that the workers are under high ergonomic risk for musculoskeletal discomfort. No work posture received negligible and low ergonomic risk. The results shown that only 40.88% (n=56) workers were in medium risk where action level 2 i.e. further investigation and change are needed, and 50.3% (n=69) workers were in high ergonomic risk where action level 3 i.e. immediate interventions are needed. The finding shown that 8.8% (n=12) are in very high risk category.

Distribution of prevalence of total discomfort score of the study population presented in the Table 1. The Hundred of the subjects experienced discomfort in at least one body region in the 12 months prior to questionnaire completion (72.99%). The work related musculoskeletal discomforts of those participants were evaluated according to the total discomfort score of CMDQ. It was concluded that participants felt discomfort mostly in the neck (53.94%), lower back (42.18%) and the right shoulder (2.79%) while

it was less pronounced in the left shoulder (0.28%), upper back (0.%) and left thigh (1.62%).

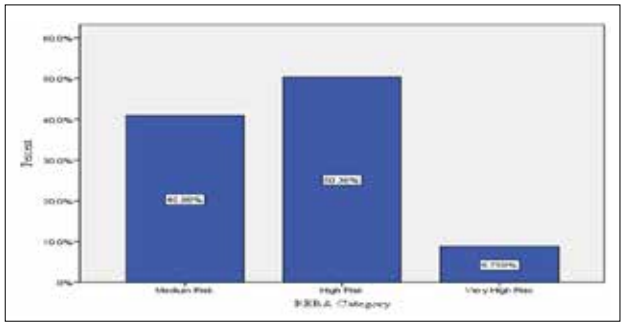

**Figure 1: Ergonomic Risk Level Distribution among Participants**

The difference between Works related musculoskeletal body discomfort employees with Ergonomic risk level was presented in the Table 2. An independent sample t-test was performed to compare the mean of ergonomic risk level among the group with WRMSD (N=100) and group without WRMSD (N=37). There is no significant difference between mean ergonomic risk level of participants with WRMSD and mean ergonomic risk level of participants without WRMSD (p>0.05).

The distribution between prevalence of work-related musculoskeletal body discomfort according to body region and ergonomic risk level among participants was evaluated in Table 3. Majority of the participants who experienced neck pain in very high-risk category (n=14) while there were 8 participants in high risk and 3 participants in medium risk category. There were equal number of the participants who experienced lower back pain in very high risk and high-risk category (n=10) while there were 3 participants in medium risk category. Majority of the participant who experienced right shoulder joint discomfort were in very high risk category (n=5).

**Table 1: Distribution of prevalence of total discomfort score of the study population**

| Body region | Frequency | Discomfort | Interference | Discomfort score | Percentage (%) |
|---|---|---|---|---|---|
| Neck | 44 | 39 | 37 | 62771 | 53.94 |
| Shoulder-right | 15 | 16 | 14 | 3248 | 2.79 |
| Shoulder-left | 6 | 8 | 7 | 336 | 0.28 |
| Upper back | 7 | 6 | 6 | 234 | 0.20 |
| Upper arm-right | 0 | 0 | 0 | 4 | 0.00 |
| Upper arm-left | 2 | 2 | 2 | 6 | 0.00 |
| Lower back | 43 | 35 | 33 | 49088 | 42.18 |
| Forearm-right | 0 | 2 | 3 | 6 | 0.00 |
| Forearm-left | 0 | 0 | 0 | 0 | 0.00 |
| Wrist-right | 3 | 6 | 5 | 90 | 0.07 |
| Wrist-left | 3 | 3 | 3 | 27 | 0.02 |
| Hip/buttock | 8 | 7 | 7 | 392 | 0.34 |
| Thigh-right | 2 | 2 | 2 | 6 | 0.00 |
| Thigh-left | 5 | 4 | 4 | 80 | 0.06 |
| Lower leg-right | 5 | 3 | 2 | 30 | 0.02 |
| Lower leg-left | 0 | 0 | 0 | 0 | 0.00 |
| Foot-right | 2 | 1 | 2 | 3 | 0.02 |
| Foot-left | 3 | 3 | 4 | 36 | 0.03 |

**Table 2: The difference between Works related musculoskeletal body discomfort employees with Ergonomic risk level**

| Variable | Participants with WRMSD group N=100 Mean ± SD | Participants without WRMSD group N=37 Mean ± SD | P value |
|---|---|---|---|
| Ergonomic risk level | 8.56± 1.91 | 8.05± 2.08 | 0.183 |

P< 0.05, group with WRMSD VS group without WRMSD, Independent sample T test

A one way ANOVA test was conducted to identify the association between the body regions discomfort complained by the participants and the ergonomic risk level (Table 5). Results showed that there was no statistically significance difference between the ergonomic risk level and work related musculoskeletal body discomfort (P ≥0.05).

## Discussion

The current study results have shown that 72.9% of the employees have experienced the Work-Related Musculoskeletal Discomfort (WRMSD) in the past twelve months. Similar to present study, De Silva *et al.*, also explained that the prevalence was 15.5% for having musculoskeletal problems in garment factory workers in Sri Lanka in 2013 [10]. Moreover Jahan *et al.*, in 2015 stated that the prevalence of Work-Related

Musculoskeletal Discomfort among the Bangladeshi workers was about 60.7% [11]. Many research studies revealed that sewing machine operators were more prone to have work related musculoskeletal discomforts[10,11]. The prolonged exposure to ergonomic risk factors such as force, repetition, static load, awkward posture, contact stress and short recovery time leads to Work-Related Musculoskeletal Discomfort[12]. The Work-Related Musculoskeletal Discomfort incurred vast human, social and economic losses.

**Table 3: Distribution of Ergonomic Risk Level and Work-Related Musculoskeletal Discomfort According to Region among study population**

| Region | | REBA Categories | | |
|---|---|---|---|---|
| | | Medium Risk | High Risk | Very High Risk |
| | Neck | 3 | 8 | 14 |
| | Shoulder-Right | 0 | 4 | 5 |
| | Shoulder-Left | 0 | 2 | 4 |
| | Upper Back | 1 | 4 | 0 |
| | Upper Arm-Right | 0 | 2 | 0 |
| | Upper Arm-Left | 1 | 1 | 0 |
| | Lower Back | 3 | 10 | 10 |
| | Forearm-Right | 0 | 2 | 0 |
| | Wrist-Right | 0 | 2 | 2 |
| | Wrist-Left | 1 | 2 | 1 |
| | Hip/Buttock | 1 | 3 | 1 |
| | Thigh-Right | 0 | 1 | 1 |
| | Thigh-Left | 0 | 3 | 0 |
| | Lower Leg-Right | 0 | 1 | 0 |
| | Lower Leg-Left | 0 | 0 | 1 |
| | Foot-Right | 1 | 0 | 1 |
| | Foot-Left | 0 | 1 | 3 |

**Table 4: The association between the body regions discomfort complained by the participants (n=137) and the ergonomic risk level.**

| | Mean Square | F | Sig. |
|---|---|---|---|
| Between Groups | 2.18 | 0.937 | 0.531 |
| Within Groups | 2.33 | | |
| Total | | | |

The results of current study indicated that female sewing machine operators felt most work-related discomfort in the neck (53.94%), lower back (42.18%) and right shoulder (2.79%). Similar to present study, Jahan *et al.,* in 2015 has stated that the workers had musculoskeletal pain in neck - 36.7%, lower back - 22.2% and shoulder - 18.9%[11]. Several past studies have shown that the female sewing machine operators had most work-related discomfort in the neck and the lower back regions similar to the present study [9, 12-14]. Differences between studies over the years of industry work and demographic differences may cause a variance in the prevalence of studies.

Ilson, evaluated that neck region has high risk of developing issues and discomfort than other regions in the body [15]. Further he stated that operating a sewing machine as an occupational risk for neck disorders. Several studies revealed that neck has the highest prevalence of musculoskeletal discomfort among sewing machine operators and the major complaint is neck pain [12, 16-18]. The sewing machine operators have to work long hours in same in corrected static postures with bent neck to achieve their production targets. And also poor ergonomically designed work environment, lack of intervals and lack of knowledge regarding good ergonomic practices are main reasons for the neck discomforts among sewing machine operators. According to Kanniappan, in 2022 females have higher prevalence of having neck discomforts than males[19]. The job involves monotonous, highly repetitive tasks performed in a sitting working posture with upper back curved and head bent over the sewing machine lead for occurring musculoskeletal complaints in neck.

Lifting heavy objects at work' was identified as a cause of lower back MSD was particularly high. And also the poorly designed chairs, non-work activities, and physical problems such as past injuries, as causes of lower back problems. Garment workers may experience a decline in back and hip pain if they are provided height-adjustable task chairs that can swivel [11]. It is also noted that improperly designed equipment cause the aches and symptoms around the neck, nape and waist, and to the problems with the muscle and skeleton systems [20]. A Recent study showed that the physical burdens lead to problems at the left shoulder, the neck, the back and in the lower extremities of sewing machine operators[19]. These problems either arise from or become more pronounced when lifting the weights, bending the head and body forward,

and by the less recovery periods while working for extended periods in a seated position.

In present study interpreted the mean of ergonomic risk level was 8.42±0.16.The group of subjects exposed to high level of risk required immediate intervention to reduce the exposure among the sewing machine operators. Similar to present study, several studies concluded that there was high risk level of musculoskeletal symptoms and it was significantly high among female garment manufacturing industry[10-12] . In contrast, a study done by using 37 female sewing machine operators interpreted that most of employees had medium level risk in ergonomic postures in readymade garment industry[9].

The findings of the current study have disclosed that there was no a significant difference between work related musculoskeletal body discomfort with ergonomic risk level. In contrast to current study, another study has recently interpreted a significant association between prevalence of Work-Related Musculoskeletal Discomfort and ergonomic risk factors among sewing machine operators in the Sri Lankan textile industry[21]. There were limited literature done related to association of ergonomic risk level and the prevalence of work related musculoskeletal discomfort among sewing machine operators. However, one study conducted with pre-cast construction workers [22] showed similar findings and another study with nursings professionals [23] showed contrast findings compared to the present study.

Several factors that can create an impact on work related musculoskeletal diseases rather than ergonomic risk level[11]. According to his findings, WRMD were also associated with the measure of command over a person's own capacities (as colleagues, supervisors, job conflicts and working timetable) may prompt work environment stress.

## Conclusion

The present study concluded the sewing machine operators suffer the neck region discomfort to be greater in compared to other body regions. This study also found that the majority of sewing machine operators in western province were in high ergonomic risk level (50.36%) though, it has no impact on work related musculoskeletal discomfort. It is recommended to carry out future studies with larger samples to represent the whole sewing machine operators in Sri Lanka elite level to ensure the suitable ergonomic interventions in the workstations.

### Conflicts of Interest

The author(s) declare that they have no competing interests.

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## References

1. Dheerasinghe, R: Garment Industry in Sri Lanka Challenges, Prospects and Strategies,*Staff Studies*, 2009; 33(1), p33.
2. Hima Bindu, P. and Thiruppathi, A: Work Related Musculoskeletal Discomfort (WRMSD) among Physiotherapists, *International Journal of Physiotherapy* ,2014;1(4), p.200.
3. Lombardo, S., Vijitha de Silva, P., Lipscomb, H. and Østbye, T: Musculoskeletal symptoms among female garment factory workers in Sri Lanka, *International Journal of Occupational and Environmental Health* ,2012; 18(3), pp 210-219.
4. Jackobs, K: Ergonomics for Therapists. United States: Mosby Elsevier.2008.
5. Henry, L., Jafarzadeh Esfehani, A., Ramli, A., Ishak, I., Justine, M. and Mohan, V: Patterns of Work-Related Musculoskeletal Disorders Among Workers in Palm Plantation Occupation,*Asia Pacific Journal of Public Health* , 2013; 27(2), pp. 1785-1792.
6. Chandra. J, Manisha, Rajib, Sunanda, Trissa, Rahima: Prevalence of Musculoskeletal Disorders among the Bangladeshi Garments Workers,*SMU Med. J* ,2015; 2(1), pp. 102–113.
7. Lillypet, S., Jain, T. and Joseph, B: Health problems among garment factory workers: A narrative literature review,*Journal of Occupational Health and Epidemiology* ,2017; 6(2), pp 114-121.
8. Çakıt: Ergonomic Risk Assessment using Cornell Musculoskeletal Discomfort Questionnaire in a Grocery Store,*Ergonomics International Journal* , 2019; 3(6), pp-60-65.
9. Ahmed: Ergonomic to design safe and comfort work station of garment workers: bangladesh prespective,*1st international Conference Business and Management*, ,2017; pp 92–102.
10. Silva, M. & Lankathilake, Kantha. Living conditions in boarding houses and health status among female industrial workers in Katunayake free trade zone, Sri Lanka. International Journal of Community Medicine and Public Health. 2016; 1503-1509. 10.18203/2394-6040.ijcmph20161619.

11. Jahan, Nusrat & Das, Manisha & Mondal, Rajib & Paul, Sunanda & Saha, Trissa & Akhtar, Rahima & Khan, Abdul & Banik, Palash. Prevalence of Musculoskeletal Disorders among the Bangladeshi Garments Workers. *SMU Medical Journal*. 2015; 2. 102 - 113.

12. Vihma T, Nurminen M and Mutanen P: Sewing-machine operators' work and musculo-skeletal complaints,*The Ergonomics journal* , 1982; 25 (4): pp295 – 298.

13. Maduagwu, S .Prevalence and Patterns of Work-related Musculoskeletal Disorders among Bankers in Maiduguri, Northeast Nigeria,Occupational Medicine & Health Affairs; 2014; 02(03).

14. Sarder, B., Imrhan. N., & Mandahawi: Ergonomic workplace evaluation of an Asian garment-factory.,*J. Human Ergoly* , 2006; 35,pp 45–51**.**

15. Ilson A. Effective Management of Musculoskeletal Injury A Clinical Ergonomics Approach to Prevention Treatment and rehabilitation.1st Ed, Harcourt publishers, Toronto, London.; 2000.

16. Kaergaard A and Andersen J: Musculoskeletal disorders of the neck and shoulders in female sewing machine operators: prevalence, incidence, and prognosis,*The Occupation and Environmental Medicine* journal, 2000; 57(8):pp 528–534.

17. Schibye B, Skov T, Ekner D, Christiansen JU and Sjogaard G : Musculoskeletal symptoms among sewing machine operators,*Scand Journal of Work Environment and Health '* 1998; 21 (6): pp 427-434.

18. Wang P C, Rempel D M, Harrison R J,Chan J and B R : Work-organizational and personal factors associated with upper body musculoskeletal disorders among sewing machine operators, *Occupational and Environmental Medicine journal* 2007; 64 (1): pp 806-813.

19. Kanniappan V, Palani V. Prevalence of Musculoskeletal Disorders among Sewing Machine Workers in a Leather Industry. *J Lifestyle Med*. 2020;10(2):121-125. doi:10.15280/jlm.2020.10.2.121.

20. Kalinkara, V. Cekal, N. Akdogan, I. & Kacar, N: Anthropometric measurements related to the workplace design for female workers employed in the textiles sector in Denizli, Turkey,Eurasian Journal of Anthropology , 2011;2 (2), pp102−111.

21. Sakthi Nagaraj, T. and Jeyapaul, R: Ergonomic Study on Work Postures of Sewing Machine Operators in Government Industry: A Case in Lean Environment Garment Industry,*Ergonomic Design of Products and Worksystems - 21st Century Perspectives of Asia*, , 2017; pp 83-101.

22. Moussavi najarkola, s., & mirzaeir: evaluation of upper limb musculoskeletal loads due to posture, repetition, and force by rapid upper limb assessment in a textile factory. health scope1(1), 2012; pp 18-24. https:// www.sid.ir/en/journal/ViewPaper.aspx?id=268438.

23. Kurd, N., Omidi, M., Jalilian, M., Kazemi, M., Kamalvandi, M. and Jamshidzad, M: Using of Cornell measuring tool (Cornell musculoskeletal discomfort questionnaires) for assessment of the musculoskeletal disorders prevalence among Ilam teaching hospitals nurses: Cross-sectional study in 2016, *Annals of Tropical Medicine and Public Health* , 2017; 10(6), p1729.