ORIGINAL ARTICLE

Prevalence of Work Related Musculoskeletal Morbidity among Handloom Weavers of Kanchipuram District, Tamil Nadu: An Ergonomic Study

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ABSTRACT

Introduction: Handloom weaving, a traditional craft is deeply embedded in the cultural and economic life of Kanchipuram District, Tamil Nadu. Despite their significance, the ergonomic challenges faced by handloom weavers often remain overlooked. This study aims to assess the prevalence of work-related musculoskeletal morbidity among handloom weavers in Kanchipuram District. **Methods:** A cross-sectional ergonomic study was conducted among 121 handloom weavers in Kanchipuram District, Tamil Nadu. A structured questionnaire based tools was employed to collect data on demographic characteristics, work-related factors, and musculoskeletal symptoms. The Nordic Musculoskeletal Questionnaire (NMQ) and Numerical Pain Rating Scale (NPRS) were used to assess the prevalence of musculoskeletal symptoms. **Results:** The study included a sample of handloom weavers (n=121) from various weaving clusters in Kanchipuram District. Preliminary findings reveal a high prevalence of musculoskeletal symptoms among handloom weavers, particularly in the knees 62% and ankles/feet 54.5%. Statistically significant relationship was found between WMSDs with gender in neck ($p = 0.031$), upper back ($p = 0.021$) and thighs/hip/buttock ($p = 0.028$). Factors such as prolonged sitting posture, repetitive tasks, and inadequate workstation ergonomics were identified as significant contributors to musculoskeletal morbidity. **Conclusion:** This study sheds light on the prevalent musculoskeletal issues faced by handloom weavers in Kanchipuram District, Tamil Nadu, emphasizing the need for ergonomic interventions to mitigate occupational health risks. Implementing ergonomic interventions tailored to the specific needs of handloom weavers can enhance their well-being, productivity, and overall quality of life.

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Keywords: Work-related musculoskeletal morbidity, Handloom weavers, Ergonomic study, Occupational health, Nordic musculoskeletal questionnaire.

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INTRODUCTION

In developing countries, handloom is an important cottage industry where traditional ways of handloom weaving are still practiced. India has a significant population handloom weavers, with Tamil Nadu being a prominent state in this sector accounting for 2.43 lakh handloom workers, according to the fourth all-India handloom census report (1). Kanchipuram, famously known as "The Silk City of India," has about 10,000 families directly involved in handloom silk weaving, making it a crucial hub for handloom weaving activities (2). The weavers in the Kanchipuram area are part of a larger group of around 60,000 silk weavers, with 50,000 working in cooperative societies (3). These cooperatives play a vital role in providing employment, ensuring fixed wages, and implementing government schemes for the weavers.

"Work-related musculoskeletal disorders (WMSDs) are painful disorders often caused by overuse of the muscles, joints, nerves, tendons and soft tissues of the body. WMSDs are one of the most costly occupational disorders because of their consequential impact on workers health and productivity at work" (4). Weavers operate hand-operated looms that necessitate sitting and using foot pedals positioned below. This activity involves repetitive movements of both the upper and lower limbs to control the pedals and shuttles, with the arms

extended away from the body (5). During the weaving process, handloom workers assume awkward postures, significantly contributing to their reduced working efficiency and the high incidence of musculoskeletal disorders. Most workers must maintain static and uncomfortable positions, experiencing contact pressure while performing their tasks (6).

Addressing these musculoskeletal issues is crucial to improving the well-being and quality of life of handloom weavers. To emphasize the preventive measures and interventions to minimize the burden of MSDs in this vulnerable population, an attempt was made to estimate the prevalence of musculoskeletal disorders among handloom weavers in Kanchipuram

MATERIALS AND METHODS

This cross-sectional survey was done in Kanchipuram to evaluate the prevalence of WMSDs among handloom weavers and the factors associated with them. Ethical clearance was obtained from the Institutional Ethics Committee of Saveetha Medical College and Hospital (SMCH) Ref.no: [104/06/2023/IEC/SMCH]. A minimum sample size of 121 was required for the study, considering the prevalence rate of 91% of WMSDs and confidence levels of 95% calculated using OpenEpi software (7). We used simple random sampling by the lottery method to select the study participants. The study participants include both male and female weavers aged more than 18 years, with work experience of more than 1 year, and excluded those who did not give consent for participation. Data is collected through structured interviews conducted by trained researchers. Our survey instrument for measuring musculoskeletal symptoms was adapted from the Standardized Nordic Questionnaire and Numerical Pain Rating Scale and assessed after obtaining informed consent. Statistical analyses were conducted using the SPSS 26 software, with a significance level set at $p < 0.05$ for all tests. Descriptive statistics such as frequencies and percentages are calculated to summarize the distribution of demographic variables within the sample population. Chi-square analysis was applied to determine the association of the prevalence of musculoskeletal symptoms with parameters.

RESULTS

Table I presents demographic data on various variables related to handloom weavers. The age distribution is nearly even, with 49.6% below 54 years and 50.4% above. Males constitute 70.2%, females 29.8%. A significant majority of individuals (98.3%) are married. Socioeconomic status shows a varied distribution, with the majority of individuals falling into the lower middle class (67.8%). Other socioeconomic classes have smaller representation, with no individuals reported in the upper class and minimal percentages in the upper-middle, middle, and lower classes. Education levels vary among the weavers, with the largest proportions being illiterate (41.3%) and primary-educated (48.8%). A smaller percentage of individuals have attained higher education levels, with 8.3% having completed higher secondary education and very few having obtained a diploma or graduate degree.

Table II presents data regarding the work-related characteristics of the handloom weavers. Experience spans three categories: 1–20 years, 21–40 years, and 41–60 years. Most fall within 21–40 years (57%), while 16.5% have 1–20 years and 26.4% have 41–60 years. 81% do not work overtime, and 19% reported working overtime (more than 8 hours). Only 4.1% reside away from home for work, while 95.9% do not.

Table I: Socio-demographic characteristics of the participants (N=121)

S.NO	Variables	N (%)
1	**Age (years)**	
	≤54	60 (49.6)
	>54	61 (50.4)
2	**Gender**	
	Male	85 (70.2)
	Female	36 (29.8)
3	**Marital status**	
	Married	119 (98.3)
	Unmarried	2 (1.7)
4	**Socio economic status***	
	Class I (Upper)	0 (0)
	Class II (Upper Middle)	5 (4.1)
	Class III (Middle)	21 (17.4)
	Class IV (Lower Middle)	82 (67.8)
	Class V (Lower)	13 (10.7)
5	**Education**	
	Illiterate	50 (41.3)
	Primary	59 (48.8)
	Higher Secondary	10 (8.3)
	Diploma	01 (0.8)
	Graduate	01 (0.8)

Table II: Work related characteristics of the participants (N=121)

S.NO	Variables	N (%)
1	**Job Experience**	
	1-20 years	20 (16.5)
	21-40 years	69 (57)
	41-60 years	32 (26.4)
2	**Working over time**	
	Yes (>8 hrs)	23 (19)
	No (≤8 hrs)	98 (81)
3	**Residing away from home for work**	
	Yes	05 (4.1)
	No	116 (95.9)

Table III presents data concerning the personal characteristics of the handloom weavers. Approximately 17.4% of the weavers reported using tobacco. The majority, constituting 82.6% of the population, stated that they do not use tobacco. A quarter of the surveyed population, accounting for 24%, reported consuming alcohol. The remaining 76% stated that they do not consume alcohol. A notable portion of the surveyed population (33.9%) reported having a chronic illness. Conversely, 66.1% reported not having any chronic

illnesses. Nearly half of the surveyed population (47.9%) reported being beneficiaries of health insurance. The remaining 52.1% stated that they were not beneficiaries of health insurance.

Table IV details pain prevalence in various body parts over 12-month and 7-day periods, along with pain absence. Neck pain over 12 months was 28.1%, the 7-day rate was 19.8%, and 71.9% reported no neck pain. Shoulder pain over 12 months was 48.8%, the 7-day rate was 42.1%, and only 51.2% reported no shoulder pain. Elbow pain was 14.9% over 12 months, the same for 7 days, with 85.1% reporting no elbow pain. Wrists/hands pain over 12 months was 17.4%, the 7-day rate was 14.9%, and 82.6% reported no pain. Upper back pain was 29.8% over 12 months, 23.1% over 7 days, with 70.2% reporting no pain. Lower back pain was 38.8% over 12 months, 32.2% over 7 days, with 61% reporting no pain. Thighs/hips/buttock pain was 23.1% over 12 months, 19.0% over 7 days, with 76.9% reporting no pain. Knee pain was 62% over 12 months, 50.4% over 7 days, with 38% reporting no pain. Ankle/foot pain was 54.5% over 12 months, 47.9% over 7 days, with 45.5% reporting no pain.

Table III: Personal characteristics of the participants (N=121)

S.NO	Variables	N (%)
	Tobacco usage	
1	Yes	21 (17.4)
	No	100 (82.6)
	Alcohol consumption	
2	Yes	29 (24)
	No	92 (76)
	Chronic illness	
3	Yes	41 (33.9)
	No	80 (66.1)
	Beneficiary of health insurance	
4.	Yes	58 (47.9)
	No	63 (52.1)

Table IV: Assessment of pain in each of the body parts using Nordic Musculoskeletal Questionnaire (N=121)

Body parts	Pain		No pain N (%)
	12 months N (%)	7 days N (%)	
Neck	34 (28.1)	24 (19.8)	87 (71.9)
Shoulder	59 (48.8)	51 (42.1)	62 (51.2)
Elbow	18 (14.9)	18 (14.9)	103 (85.1)
Wrists/Hands	21 (17.4)	18 (14.9)	100 (82.6)
Upper back	36 (29.8)	28 (23.1)	85 (70.2)
Lower back	47 (38.8)	39 (32.2)	74 (61)
Thighs/Hips/Buttock	28 (23.1)	23 (19.0)	93 (76.9)
Knees	75 (62)	61 (50.4)	46 (38)
Ankles/Feet	66 (54.5)	58 (47.9)	55 (45.5)

Table V presents the mean (average) Numeric Pain Rating Scale (NPRS) scores along with their standard deviations (SD) for different body parts. The NPRS is commonly used to assess pain intensity, typically ranging from 0 (no pain) to 10 (worst possible pain). Generally, low average pain intensity is reported across most body parts, with mean NPRS scores ranging from 0.7 to 2.3. The highest average pain intensity is reported for knees, with a mean NPRS score of 3.1 and a SD of 2.61, followed by ankles/feet, with a mean NPRS score of 2.9 and a SD of 2.80.

Table VI compares musculoskeletal pain prevalence between male and female weavers across body parts. Females show lower neck pain prevalence (44.1%) compared to males (54.9%), with an odds ratio (OR) of 0.403 (95% CI: 0.175–0.930), significant at p = 0.031*. Similar patterns are observed for the upper back and thighs/hips/buttocks, with females less likely to experience pain OR < 1, p = 0.021* and p = 0.028*, respectively. Overall, this suggests gender-based differences in pain distribution, informing potential interventions for both male and female populations.

Table V: Quantification of pain using Numerical pain rating scale NPRS (N=121)

NPRS – Numerical pain rating scale

Body parts	NPRS mean ± SD
Neck	1.2 ±1.95
Shoulder	2.3 ±2.55
Elbow	0.7 ±1.98
Wrists/Hands	0.9 ±2.05
Upper back	1.2 ±2.04
Lower back	1.9 ±2.49
Thighs/Hips/Buttock	1.0 ±2.01
Knees	3.1 ±2.61
Ankles/Feet	2.9 ±2.80

Table VI: Association between gender and pain in each of the body parts (N=121)

*P-value <0.05- Significant (Pearson's Chi Square test)

Body parts		Male N (%)	Female N (%)	OR (95% CI)	Chi square (P-value)
Neck	No pain	66 (75.9)	21 (24.1)	0.403 (0.175-0.930)	4.669 (0.031)*
	Pain	19 (55.9)	15 (44.1)		
Shoulder	No pain	48 (77.4)	14 (22.6)	0.491 (0.221-1.087)	3.129 (0.077)
	Pain	37 (62.7)	22 (37.3)		
Elbow	No pain	74 (71.8)	29 (28.2)	0.616 (0.218-1.743)	0.845 (0.358)
	Pain	11 (61.1)	7 (38.9)		
Wrist/Hands	No pain	72 (72)	28 (28)	0.632 (0.236-1.689)	0.846 (0.358)
	Pain	13 (61.9)	8 (38.1)		
Upper Back	No pain	65 (76.5)	20 (23.5)	0.385 (0.168-0.879)	5.293 (0.021)*
	Pain	20 (55.6)	16 (44.4)		
Lower Back	No pain	53 (71.6)	21 (28.4)	0.845 (0.382-1.871)	0.172 (0.678)
	Pain	32 (68.1)	15 (31.9)		
Thighs/Hip/ Buttock	No pain	70 (75.3)	15 (53.6)	0.379 (0.157-0.914)	4.848 (0.028)*
	Pain	23 (24.7)	13 (46.4)		
Knees	No pain	35 (76.1)	11 (23.9)	0.629 (0.274-1.442)	1.211 (0.271)
	Pain	50 (66.7)	25 (33.3)		
Ankle/Feet	No pain	42 (76.4)	13 (23.6)	0.579 (0.259-1.291)	1.804 (0.179)
	Pain	43 (65.2)	23 (34.8)		

DISCUSSION

The prevalence of work-related musculoskeletal morbidity among handloom weavers in Kanchipuram District, Tamil Nadu, as highlighted in various studies, underscores the significant occupational health challenges faced by these weavers. Studies from different

regions like Ethiopia and Uttarakhand also emphasize the high prevalence of musculoskeletal disorders among traditional cloth weavers, attributing it to factors such as prolonged sitting, awkward postures, and repetitive movements involved in weaving activities (6,8). The prevalence of musculoskeletal disorders among handloom weavers not only impacts their health but also affects their productivity and quality of life. Collaborative efforts involving researchers, policymakers, industry stakeholders, and artisan communities are essential for the successful implementation of ergonomic interventions tailored to the specific needs of handloom weavers in Kanchipuram District (9).

The prevalence of work-related musculoskeletal morbidity among handloom weavers is a significant concern highlighted in various studies focusing on different regions like Varanasi and Arunachal Pradesh. These studies consistently emphasize the high incidence of musculoskeletal disorders among traditional weavers, particularly in areas such as the upper back, lower back, knees, and shoulders (4,10). Hossain (2018) in bangladesh found a high 12-month prevalence of WMSD symptoms among the surveyed RMG workers, with females being more affected. The lower back, neck, and knees were identified as the most impacted areas (11).

Habib (2015) discovered that the nature of jobs and working conditions in Bangladeshi garment factories facilitated the development of WMSDs. Consequently, ergonomic interventions and corrective measures are essential to enhance working conditions and reduce exposure to musculoskeletal disorders. Improving worker health in garment factories involves addressing WMSD risk factors through ergonomic solutions (12). Ahmed's (2007) research on garment workers Findings of our study showed a statistically significant relationship between twelve-month WMSD's in different anatomical regions with age, BMI, total job experience, and daily working hours. Earlier handful studies (13). Satheeshkumar's (2020) study in Kerala uncovered a notable occurrence of work-related musculoskeletal disorders (WMSDs) among workers in every segment of the handloom industry (14). Choobineh's (2007) extensive investigation in Iran demonstrated a significant prevalence of musculoskeletal issues and substandard working conditions within the handwoven carpet industry. Consequently, enhancing working conditions and managing risk factors associated with musculoskeletal disorders appeared imperative (15).

CONCLUSION

This study underscores the significant prevalence of work-related musculoskeletal disorders (WMSDs) among handloom weavers in Kanchipuram District, Tamil Nadu, revealing a high incidence of symptoms particularly in the knees, ankles/feet, neck, upper back, and thighs/hips/buttocks. The findings attribute these disorders to prolonged sitting, repetitive tasks, and suboptimal workstation ergonomics, necessitating immediate ergonomic interventions. Gender-specific differences in symptom prevalence further highlight the need for tailored ergonomic solutions. Implementing such interventions is imperative to ameliorate the working conditions, thereby enhancing the well-being, productivity, and quality of life of the weavers. This is essential not only for preserving the traditional craft but also for ensuring the economic sustainability of the weaving communities in Kanchipuram District

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