Assessment of the Prevalence and its Determinants of Musculoskeletal Pain among Hand Loom and Power Loom Weavers in North Bengal, Bangladesh

Md. Emdadul Hasan Mukul[1], Mahdi Hasan[2], Mohammed Aamir[3], Neeru Chaudhary[4], Habib Mohammad Ali[5], Quazi Istiaque Bari[6], Md. Kamrul Hasan Shimul[9], ABM Alauddin Chowdhury[7], Asma Akhter[7], Faisal Muhammad[8], Safayet Jamil[7,8*] ID

[1]Department of Pharmacy, University of Rajshahi, Bangladesh
[2]Department of Statistics, Dhaka College, Dhaka 1205, Bangladesh
[3]Department of Social Work, Central University of Rajasthan, India
[4]Delhi Pharmaceutical Sciences and Research University, New Delhi, India
[5]Department of Media Studies and Journalism, University of Liberal Arts (ULAB), Mohammadpur, Dhaka, Bangladesh
[6]Department of Pharmacy, State University of Bangladesh, Dhaka, Bangladesh
[7]Department of Public Health, Daffodil International University, Dhaka 1216, Bangladesh
[8]Department of Public and Community Health, Faculty of Medical and Health Science, Frontier University Garowe, Puntland, Somalia
[9]Department of Marketing, School of Business Administration, University of Rajshahi, Bangladesh

Corresponding author*
Safayet Jamil
Department of Public Health,
Daffodil International University,
Dhaka 1216, Bangladesh.
Email:safayetkyau333@gmail.com

ABSTRACT

Loom weavers play a vital role in the economic development of Bangladesh. Due to their working load, they suffer from musculoskeletal pain. This study aimed to identify the prevalence of musculoskeletal pain and its determinants among handloom and powerloom weavers in the North Bengal area of Bangladesh. This study followed the cross-sectional method by using an open-ended and close-ended questionnaire. For sample size determination, the convenience sampling technique was adopted. A total of 500 participants were included in this study. Frequency analysis and the chi-square test were performed during data analysis using R programming software. A total of 69.2% of respondents had musculoskeletal pain. Most of the respondents suffered from knee pain (46.8%). 42.6% of respondents suffered from lower back pain. 37.8% of respondents suffered from shoulder pain can be clubbed under pain at other sites. Most of them took treatment with medication. Age (<0.001) and number of working days (<0.001) were found to be significantly associated with the prevalence of musculoskeletal pain. Given the prevalence of musculoskeletal issues among weavers, it is imperative to ensure that they receive appropriate knowledge and interventions to enhance their quality of life. The implementation of awareness programs on musculoskeletal pain should be undertaken by the government of Bangladesh as well as by non-governmental organizations (NGOs) and other relevant institutions.

INTRODUCTION

The loom sector is Bangladesh's most significant traditional rural and cottage industry. This sector has a vital role in the Bangladesh economy. It provides employment opportunities to around one million rural people. At the same time, half a million people indirectly depend on the loom industry for livelihood (Jamil et al., 2022).

After the readymade garments (RMG) Industry and Agriculture, it is the third largest source of employment in rural areas (BHB, 2022). This handloom sector is primarily located in the northern region of the country specifically Sirajganj (Jamil et al., 2022).

A workforce of about 1.5 million, including weavers, dyers, hand spinners, embroiderers and allied artisans, are engaged in over 0.3 million looms to produce 620 million meters of cloth yearly (BHB, 2022). Working with warping and weaving machinery is a part of power loom weaving. The workers come under (are exposed to) vibration, noise, and cotton dust exposure. Operating three looms simultaneously requires maintaining a standing work posture for the whole shift. Unlike the power loom sector, all activities in the handloom sector are done manually (Khan, 2013). Workplace factors such as long working hours, repetitive tasks, and the strenuous nature of work make weavers vulnerable to work-related musculoskeletal disorders (WMSDs), primarily low back pain (LBP). Work-related musculoskeletal diseases (WMSDs) are debilitating conditions that frequently arise due to excessive use of the musculature, articulations, nerves, tendons, and soft tissues of the human body. These disorders significantly compromise the well-being and efficiency of workers in their occupational settings (Eurofound, 2012; National Research Council, 1999). Work-related musculoskeletal disorders (WMSDs) represent a significant health issue for employees in both developed and developing nations (Banerjee and Gangopadhyay, 2003; Westgaard and Winkel, 1997).

Furthermore, it has been shown that the presence of elevated physical requirements, diminished job satisfaction, and inadequate levels of workplace autonomy have been identified as contributing factors to the development of low back pain (Prista et al., 2004). Prior research has documented an elevated incidence of lower back pain (LBP) within the population of weavers in Bangladesh (Hossain et al., 2018; Jamil et al., 2022). Research conducted in Iran has revealed a significant frequency of musculoskeletal issues among individuals engaged in weaving activities. According to earlier studies (Choobineh et al., 2004, 2007; Motamedzade & Moghimbeigi, 2012), there were a number of causes for the observed outcomes. These factors encompassed constraints on working postures, inappropriate loom design, extended working hours, repetitive tasks, and the type of seating arrangement.

Globally, musculoskeletal pain (MSP) is considered a serious health issue (Awan & Nasrullah, 2013; Das et al., 1992; Motamedzade & Moghimbeigi, 2012; Tefera Zele et al., 2020) and leads to a reduction in working capacity and quality of life of workers (McBeth et al., 2010; Neupane et al., 2013). This problem poses significant direct and indirect economic implications for individuals as well as society (McBeth et al., 2010; Neupane et al., 2013). MSP also contributed to sickness leaves from work (Choobineh et al., 2004). In addition, the prevalence of multisite MSP varies with the nature of the profession and culture (Harkness et al., 2004). Therefore, identifying MSP's contributing factors could facilitate the development of prevention strategies.

There is a limited study in Bangladesh to reveal the prevalence of musculoskeletal pain of loom weavers. Therefore, the aim of the study was to assess the prevalence of musculoskeletal pain (MSP) and its' associated factors among hand loom and power loom weavers in north Bengal, Bangladesh.

METHODS
Study Design

This study was a cross-sectional study following quantitative approach. utilizing a

survey instrument consisting of 36 questions that are a combination of open-ended and close-ended formats (Jamil et al.,2023a). The present questionnaire encompassed the demographic attributes of the participants as well as their musculoskeletal pain state and level of practice. The purpose of this study was to assess the prevalence rate of musculoskeletal pain among handloom and powerloom weavers, as well as their level of practice. All inquiries were presented in the Bengali language to participants. This study investigated the presence of musculoskeletal pain in many regions of the body, including the lower back, shoulders, fingers, thighs, arms, ankles, knees, upper back, wrists, elbows, and neck.

Study Population, Sampling and Data Collection

The study employed a convenient sampling technique (Kabir et al.,2022). As the total number of populations was unknown, we used an equation to calculate sample size which was n= z2. [p*q]/d2) (Mohammed et al., 2023). After calculating, the sample size was 383. To reduce sampling bias, we considered 500 participants in our study. There were 251 handloom weavers and 249 powerloom weavers. The present study was undertaken in the northern region of Bangladesh, with a specific focus on Sirajganj District. This study focuses on the selection of handloom and powerloom weavers who are engaged in full-time employment. Within various sectors, a selection of weavers was subjected to a face-to-face interview utilizing a questionnaire as a means of data collection (Akhter et al.,2022). The data collector initially provided an explanation of the objective of the study and thereafter selected those who expressed their willingness to participate in the questionnaire. The participants were provided with the assurance that their personal information would remain confidential. In addition, the study adhered to all the principles and methods outlined in the World Medical Declaration of Helsinki (Jamil et al., 2023b). This study was approved by Ethical Committee of Khwaja Yunus Ali University, Sirajganj 6751, Bangladesh. The reference number of this study was KYAU/DEAN/SBS/2023/002. The selection criteria for participants encompass individuals who are of adult age and possess an active interest in the subject matter under investigation. The exclusion criteria for the respondents pertain to their mental health conditions. The data was obtained within the time frame of March 11, 2022, to September 9, 2022..

Questionnaire

All questions in have been derived from previously published research studies (Jamil et al.,2022; Durlov et al.,2014; Hossain et al.,2018). According to our objectives, we modified the questions. The questionnaire had two sections. First section was included with demographic characteristics (age, educational level, income, job experiences, number of working days, taking exercise regularly). Another section was included with pain related questions. Each pain was quantified by yes and no. For example: Do you have any pain in shoulder? And answer was yes and no. People who respond yes that means, they have pain.

Statistical Analysis
The data was analyzed using R programming language. During the analysis, descriptive analysis, and the Chi-square (χ2) test were conducted. The demographic profile of the respondents and the frequency analysis of the questions were conducted. A chi-square analysis was conducted to assess the relationship between a respondent's working days, age, exercise habits, forms of treatment, and their pain levels. Additionally, a Chi-square test was used to ascertain the association between

the prevalence of pain and the duration and effectiveness of treatment.

RESULTS

Table 1 represents the distribution of demographic variables of respondents. In our study, the participants of handloom weavers were 251 (50.2%) and power loom weavers 249 (49.8%). Among them, 26% were less than 30 years old, 39.8% were 31-40 years old, and 34.2% were more than 40 years old. More than half of the respondents (56.4%) were illiterate and 43.6% respondents had primary and secondary education degree. Half of the weavers (51.8%) earned 10-15 thousand taka per month and 43.4% of weavers earned less than 10 thousand taka per month. Almost half of the participants had more than 10 years job experience. 35.6% and 15.4% of participants had 5-10 years and less than 5 years of job experience. Almost all people (88%) worked 6 days every week. Only 7% weavers took physical exercise regularly.

Variables	Level	N	%
Type of weavers	Hand loom	251	50.2
	Power loom	249	49.8
Age	< 30 years	130	26.0
	31-40	199	39.8
	> 40 years	171	34.2
Education level	Illiterate	282	56.4
	Primary and secondary	218	43.6
Income	<10K	217	43.4
	10-15K	259	51.8
	>16 K	23	4.6
	Undisclosed	1	0.2
Job experience	< 5 years	77	15.4
	5-10	178	35.6
	>10 years	245	49.0
Number of working days	2-3 days	0	0.0
	4	1	0.2
	5	23	4.6
	6	440	88.0
	7	36	7.2
Taking exercise regularly	Yes	35	7.0
	No	465	93.0

Table 01 Demographic characteristics of loom weavers

Table 2 reports the prevalence of distribution of different types of musculoskeletal pain of weavers. 69.2% of participants suffered musculoskeletal pain. The prevalence of musculoskeletal pain was very high. 23.4% of respondents had pain for more than 15 months. 18.4%, 12.6%, and 11% of respondents had pain, respectively, for less than 5 months, 5-10 months and 11-15 months. 38.4% and 25.4% of respondent's pain level was respectively mild and moderate. 6% had severe pain. Among them, 42.6% of respondents had lower back pain and 25.2% of respondent's pain level was mild and 57.2% did not recognize their pain level. 17.4% had neck pain. 37.8% weavers suffered in shoulder pain. Among them, 25.2% respondent's pain level was mild. 20% respondents had elbow pain and 13.6% had mild pain. 25.1% respondents suffered in wrist pain and among them 15.8% had mild wrist pain. 26.9% weavers had upper back pain. Among them, 19.2% weavers felt their pain as mild. 46.8% of participants suffered knee pain and 30.2% of respondents' pain level was mild. 29.6% respondents had ankle pain and among them 20.2% respondent's pain level was mild. 35.4% participants had arm pain; among them, 21.2 % respondents felt their pain level was mild. 27.6% participants had thigh pain; among them, 20.0% participants felt their pain level was mild. Only 15.8% participants suffered in finger pain and 12.4 % reported their pain level as mild.

Pain related variables	Categories	N	%
Presence of musculoskeletal pain	Yes	346	69.2
	No	154	30.8
Duration of pain	<5 months	92	18.4
	5-10months	63	12.6
	11-15months	55	11.0
	>15 months	117	23.4
	Undecided	173	34.6
Level of pain	mild	192	38.4
	moderate	127	25.4
	severe	30	6.0
	Undecided	151	30.2
Lower back pain	Yes	213	42.6
	No	287	57.4
Lower back pain level	mild	126	25.2
	moderate	64	12.8
	severe	24	4.8
	Undecided	286	57.2
Neck pain	Yes	87	17.4

	No	413	82.6
Neck pain level	mild	61	12.2
	moderate	15	3.0
	severe	9	1.8
	Undecided	415	83.0
Shoulder pain	Yes	189	37.8
	No	311	62.2
Shoulder pain level	mild	126	25.2
	moderate	57	11.4
	severe	7	1.4
	Undecided	310	62.0
Elbow pain	Yes	100	20.0
	No	400	80.0
Elbow pain level	mild	68	13.6
	moderate	22	4.4
	severe	8	1.6
	Undecided	402	80.4
Wrist pain	Yes	125	25.1
	No	374	74.9
Wrist pain level	mild	79	15.8
	moderate	38	7.6
	severe	7	1.4
	Undecided	376	75.2
Upper back pain	Yes	134	26.9
	No	365	73.1
Upper back pain level	mild	96	19.2
	moderate	35	7.0
	severe	6	1.2
	Undecided	363	72.6
Knee pain	Yes	234	46.8
	No	266	53.2
Knee pain level	mild	151	30.2
	moderate	57	11.4
	severe	26	5.2

	Undecided	266	53.2
Ankle pain	Yes	148	29.6
	No	352	70.4
Ankle pain level	mild	101	20.2
	moderate	43	8.6
	severe	9	1.8
	Undecided	347	69.4
Arm pain	Yes	177	35.4
	No	323	64.6
Arm pain level	mild	106	21.2
	moderate	59	11.8
	severe	15	3.0
	Undecided	320	64.0
Thigh pain	Yes	138	27.6
	No	362	72.4
Thigh pain level	mild	100	20.0
	moderate	30	6.0
	severe	7	1.4
	Undecided	363	72.6
Finger pain	Yes	79	15.8
	No	421	84.2
Finger pain level	mild	62	12.4
	moderate	16	3.2
	severe	1	0.2
	Undecided	421	84.2

Table 02: Distribution of pain related variables

Table 3 shows the treatment taking behavior of respondents. Total 55.8% participants took treatment and 21.2% participants had taken treatment from less than 5 months. More than half of the respondents (56.5%) had taken medication and only 17.4% improved by treatment.

Treatment related variables	Category	N	%
Taking treatment	Yes	279	55.8
	No	221	44.2
Duration of treatment	< 5 months	106	21.2

	5-10 months	74	14.8	
	11-15 months	51	10.2	
	>15 months	45	9.0	
	None	224	44.8	
Type of treatment	massage	0	0.0	
	medication	281	56.5	
	surgery	1	0.2	
	None	215	43.3	
Efficacy of treatment	improved	87	17.4	
	partially improved	170	34.0	
	not improved	23	4.6	
	Undecided	220	44.0	

Table 03: Treatment related variables distribution

Table 4 represents the association between the demographic factors and pain and loom weavers. Maximum handloom weavers were more than 40 years old (<0.001) and power loom weavers were 31-40 years old. Most weavers, both hand loom and power loom, were working 6 days per week (<0.001). Maximum hand loom and power loom weavers took medication (<0.001).

Variables	Level	Hand loom	Power loom	p-value
Total N (%)		251 (50.2)	249 (49.8)	
Age	< 30 years	44 (17.5)	86 (34.5)	**<0.001**
	31-40	91 (36.3)	108 (43.4)	
	> 40 years	116 (46.2)	55 (22.1)	
Number of working days	2-3 days	0 (0.0)	0 (0.0)	**<0.001**
	4	1 (0.4)	0 (0.0)	
	5	11 (4.4)	12 (4.8)	
	6	206 (82.1)	234 (94.0)	
	7	33 (13.1)	3 (1.2)	
Taking exercise regularly	Yes	23 (9.2)	12 (4.8)	0.084
	No	228 (90.8)	237 (95.2)	
Type of treatment	massage	0 (0.0)	0 (0.0)	**<0.001**
	medication	170 (68.0)	111 (44.9)	
	surgery	1 (0.4)	0 (0.0)	
	None	79 (31.6)	136 (55.1)	

Lower back pain	Yes	125 (49.8)	88 (35.3)	**0.001**
	No	126 (50.2)	161 (64.7)	
Neck pain	Yes	56 (22.3)	31 (12.4)	**0.005**
	No	195 (77.7)	218 (87.6)	
Shoulder pain	Yes	122 (48.6)	67 (26.9)	**<0.001**
	No	129 (51.4)	182 (73.1)	
Elbow pain	Yes	59 (23.5)	41 (16.5)	0.063
	No	192 (76.5)	208 (83.5)	
Wrist pain	Yes	86 (34.4)	39 (15.7)	**<0.001**
	No	164 (65.6)	210 (84.3)	
Upper back pain	Yes	76 (30.3)	58 (23.4)	0.102
	No	175 (69.7)	190 (76.6)	
Knee pain	Yes	117 (46.6)	117 (47.0)	1.000
	No	134 (53.4)	132 (53.0)	
Ankle pain	Yes	63 (25.1)	85 (34.1)	**0.034**
	No	188 (74.9)	164 (65.9)	
Arm pain	Yes	94 (37.5)	83 (33.3)	0.385
	No	157 (62.5)	166 (66.7)	
Thigh pain	Yes	54 (21.5)	84 (33.7)	**0.003**
	No	197 (78.5)	165 (66.3)	
Finger pain	Yes	49 (19.5)	30 (12.0)	**0.030**
	No	202 (80.5)	219 (88.0)	
Taking treatment	Yes	169 (67.3)	110 (44.2)	**<0.001**
	No	82 (32.7)	139 (55.8)	
Duration of treatment	< 5 months	66 (26.3)	40 (16.1)	**<0.001**
	5-10 months	46 (18.3)	28 (11.2)	
	11-15 months	24 (9.6)	27 (10.8)	
	>15 months	29 (11.6)	16 (6.4)	
	None	86 (34.3)	138 (55.4)	
Efficacy of treatment	improved	54 (21.5)	33 (13.3)	**<0.001**
	partially improved	95 (37.8)	75 (30.1)	
	not improved	20 (8.0)	3 (1.2)	
	Undecided	82 (32.7)	138 (55.4)	

Table 04: Chi-square test for finding the associated factors and pains with loom weavers

Most of the weavers suffered in lower back pain (0.001), neck pain (0.005), shoulder pain (<0.001), wrist pain (<0.001), ankle pain (0.034), thigh pain (0.003) and finger pain (0.030). 67.3% hand loom weavers had taken treatment (<0.001) and 44.2% power loom weavers had taken treatment (<0.001). Most of the hand loom (26.3%) and power loom (16.1%) weavers had taken treatment for less than 5 months (<0.001). Most of the hand loom (37.8%) and power loom (30.1%) got partially improved by taking treatment (<0.001).

DISCUSSION

In contemporary society, the enduring significance of the conventional cultural custom of handloom weaving is evident, necessitating the provision of adequate support and acknowledgment for weavers as both skilled artisans and diligent workers. Moreover, this profession provides a means of livelihood for a significant segment of the working populace in North Bengal, Bangladesh. The significance of this research extends beyond the occupational health and financial stability of the weavers, encompassing the preservation of the aesthetic and cultural value associated with the handloom weaving profession.

This study provides proof that weavers' labor is physically demanding. As a result, weavers suffer from musculoskeletal diseases caused by various factors, the most important of which is the adoption of a confined sitting posture for extended periods of time.

The results of this study indicate that the prevalence of musculoskeletal pain was widespread. 23.4% of those had been in pain for more than 15 months. 18.4%, 12.6%, and 11% of respondents reported discomfort for less than 5 months, 5-10 months, and 11-15 months, respectively. The pain levels of 38.4% and 25.4% of respondents were mild and moderate, respectively. 6% were in excruciating agony. The locations that were most reported, in order of predominance, included the low back, right shoulder, left shoulder, right wrist/hand, left knee, right knee, left wrist/hand, neck, right elbow, and left elbow. Based on the issues this study looked at, the results show that the numbers we found are lower than those found in earlier research on Iranian carpet weavers (Choobineh et al., 2007; Motamedzade & Moghimbeigi, 2012; Nag et al., 2010). This divergence may be attributed to variations in the age, work experience, educational attainment, and ergonomic conditions of the participants, as well as the specific study groups employed in previous investigations.

In the present study, 26% of participants were under the age of 30, 39.8% were between the ages of 31 and 40, and 34.2% were beyond the age of 40. The corresponding amounts were reported in the other two studies where the participants' age was between 13-81 years and 13-70 years (Choobineh et al., 2007; Motamedzade & Moghimbeigi, 2012). Considering the education level of the study participants, half of the respondents (56.4%) were illiterate and 43.6% had primary and secondary education degrees. According to Motamedzade and Moghimbeigi's research 74.4% of carpet weavers had either elementary school literacy or no formal education at all.

A sample of 1,234 carpet weavers living in nine different regions of Iran participated in the study by Choobineh et al. (2007) to assess the musculoskeletal problems (MSP) they were experiencing. According to their research, the locations with the highest prevalence rates in the preceding 12-month period were shoulders (46.9%), low back (42.2%), wrists (36.5%), knees (33.4%), and neck (32.1%). The researchers found the

shoulders and low back as the two most prevalent locations among the participants, a finding that aligns with the results of the present study.

Another study on carpet weavers in Tabriz discovered that the most commonly reported regions of discomfort were the neck, lower back, and ankle foot (Nazari et al., 2012).

According to a World Health Organization survey of a rural population in Iran, the most common MSDs in the previous 7 days were knee pain, low back pain, and shoulder pain (Davatchi et al., 2009).

Afshari et al. stated that inadequate workstation design, as well as awkward trunk posture, low seat height, and arm speed, might be the most significant risk factors for back and shoulder issues among weavers (Afshari et al., 2014).

It is worth noting that this research did not look at psychological risk factors. According to the statistical findings, the number of painful musculoskeletal areas is connected to the following factors: Age, number of working days, kind of therapy, length of treatment, and treatment effectiveness. A substantial relationship between the level of low back pain and the number of years of job experience was discovered. This conclusion is consistent with previous studies. Banerjee and Gangopadhyay found a substantial association between pain severity and years of experience in a prior study with weavers, with participants who worked for longer durations experiencing higher pain (Banerjee & Gangopadhyay, 2003; Durlov et al., 2014).

In summary, our findings indicate that, akin to the factors contributing to work-related pain among workers in large-scale industries, there exists a correlation between psychological risk factors and physical loading and the prevalence of musculoskeletal aches in small-scale workshops operating from home.

One notable aspect of this study is the employment of a standardized questionnaire, which yielded a commendable level of participant engagement. The present investigation is a study that relies solely on questionnaires and lacks clinical evaluation, which may pose a limitation.

In order to mitigate these issues pertaining to the primary focus of the present study, it is advisable to contemplate ergonomic intervention strategies aimed at diminishing the hazards associated with task monotony. Furthermore, it is crucial to ensure an ergonomic workload that strikes a balance between excessive and insufficient demands, establish reasonable deadlines and expectations, foster effective communication, promote job satisfaction, encourage the reporting of problems, monitor, and regulate overtime work, and provide suitable training. These measures are strongly recommended.

Finally, the authors advise that psychological job variables and physical loading factors should be included when building future preventative programs. Furthermore, more longitudinal studies are needed to study the association between psychological risk factors and musculoskeletal disorders in handloom and power loom weavers.

CONCLUSION

Our research uncovered a high frequency of musculoskeletal pain among rural weavers in North Bengal, Bangladesh. Musculoskeletal pain was significantly influenced by age, duration of weaving, kind of loom, and working postures. The outcomes of this study demonstrate the need for measures to reduce the burden of musculoskeletal pain in this group. These remedies could include ergonomic adjustments to the looms, teaching about correct working postures, and providing pain-relieving health services. Future research should investigate other factors leading to musculoskeletal pain among rural loom weavers and assess the efficacy of pain-relieving therapies.

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DECLARATION OF COMPETING INTEREST

The author declares no conflict of interest.

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