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Gender Differences, Work Stressors and Musculoskeletal Disorders in Weaving Industries

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Abstract: A study was undertaken to identify the work stressors among male and female weavers (N=516) in powerloom and handloom and examine the association of work stressors with the prevalence of work related musculo-skeletal disorders (MSDs). Physical and psychosocial stresses of work, job diagnostics, hazards of workplace, working environment and MSDs prevalence were assessed. There is high prevalence of MSDs among weavers. Female weavers in powerloom and handloom were more prone to developing MSDs in upper back (OR 1.8; $p<0.05$ and OR 2.1; $p<0.01$) and lower back (OR 1.9; $p<0.05$ and OR 1.8; $p<0.05$). Male weavers were more prone to developing pain in the knee (OR 2.9; $p<0.001$), and hand (OR 2.2; $p<0.05$). Multivariate analysis indicated that job duration >10 yr (OR 3.7, $p<0.05$), manual material handling (OR 3, $p<0.05$), and poor machinery safety (OR 11, $p<0.05$), contributed to occurrence of MSDs amongst powerloom weavers. Among the handloom weavers, age >25 yr (OR 3.2, $p<0.05$), poor machinery design (OR 2.2, $p<0.01$), mental overload (OR 5.7, $p<0.001$), skill requirement to perform jobs (OR 20.7, $p<0.05$) had significant influence in the occurrence of pain. Gender differences exist in the prevalence of MSDs and the perception of work and psycho-social stresses among the weavers.

Key words: MSDs, Weaving industry, Work stressors, Psychosocial stresses, Gender differences

Introduction

Powerloom and handloom industries are the largest economic sector after agriculture, in India. Nearly 3.8 million handlooms provide employment to 6.5 million workers, who are engaged in producing natural fiber fabrics like cotton, silk and woolen, as well as man-made and mixed fiber fabrics. Besides, 4.75 million weavers work in 1.7 million powerlooms in the country. Females constitute 65% of the total workforce in rural and semi-urban settings.

Work-related musculoskeletal disorders (WMSDs) have emerged as major health problem among workers in both industrialized and industrially developing countries[1, 2]. Several work place factors, such as repetitive work, awkward and static postures, have been identified as being associated with upper extremity pain and discomfort[3–5]. Studies in Iranian hand woven carpet industry have reported high prevalence of musculoskeletal problem among weavers due to constraints of working postures, poor design of loom, working time, repetitive work and seat type[6, 7]. Physical and psychosocial load, poor climatic conditions, and vibrations have been identified as risk factors that contribute to developing MSDs among agricultural workers[8]. In machine manufacturing plant[9] and textile weavers[10], high physical demands, poor postures and insufficient recovery time are the contributing factors to develop low back pain. In spite of apparently similar occupational pattern of work, gender differences do exist in the prevalence and severity of MSDs and perception of work as stressors. The present study focuses on identification of different dimensions of work stressors among the weavers in handloom and powerloom and explores its association with the prevalence of MSDs among male and female weavers and existence of any gender difference.

Job description

Power loom

Weaving in powerloom units involves working with

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warping and weaving machines (Fig. 1A). The workers are exposed to vibration, cotton dust and noise. Standing work posture is maintained throughout the shift in operating 3 looms simultaneously. After raw materials are warped, the workers push and move iron beams weighing 75–100 kg for a distance of about 2 m and this kind of materials handling are performed 6–7 times per day. The job demands high attention in observing threads do not break off, mending the breaks and then change the beam after one is completed.

Handloom

Handloom weaving encompasses a wide range of tasks such as manual sorting of raw materials, carding and spinning in cord machine, dyeing by acid and chrome dyes preceding the actual weaving. The workers are exposed to noise and dust. The job demands high attention in making designs. Fibers are boiled in a vat containing acetic acid and dye solution, washed in running water and dried, and spindles are made out of fibers. Weaving processes are done on two types of hand operated looms e.g., (i) desk-bench type workstation and (ii) sitting on floor with their legs hanging to operate the pedals at a lower level (Fig. 1B–D). The task of weaving demands repeated movement of upper and lower limbs to operate pedals and shuttles, with arms raised away from the body. The post weaving operations involve materials woven to be clipped, embossed and carved into art designs, mending, edge bending and finally a chemical wash being given to get a finished product.

Methods

The manually operated handlooms and electric operated power looms are either home based or are operated in isolated sheds. Within the radius of about 200 km of Ahmedabad district there are clusters of handloom and powerloom units. Five hundred and sixteen weavers participated in the study, that covered nearly eighty percent of the workers in those units in the year 2007. The remaining 20% were either not available during the survey or did not want to participate in the study. The weavers were divided into four groups: Powerloom workers, Males (N=150), Females (N=75) and Handloom workers, Males (N=103), Females (N=188). Keeping in mind the linguistic problem, the questionnaire was explained to the workers in local language by the interviewer. The weavers belonged to the poor socio economic group, having annual income ranging between Rs. 20,000 to 30,000 (approx. US$400–500). They get the jobs through the contractors and are often insufficiently paid.

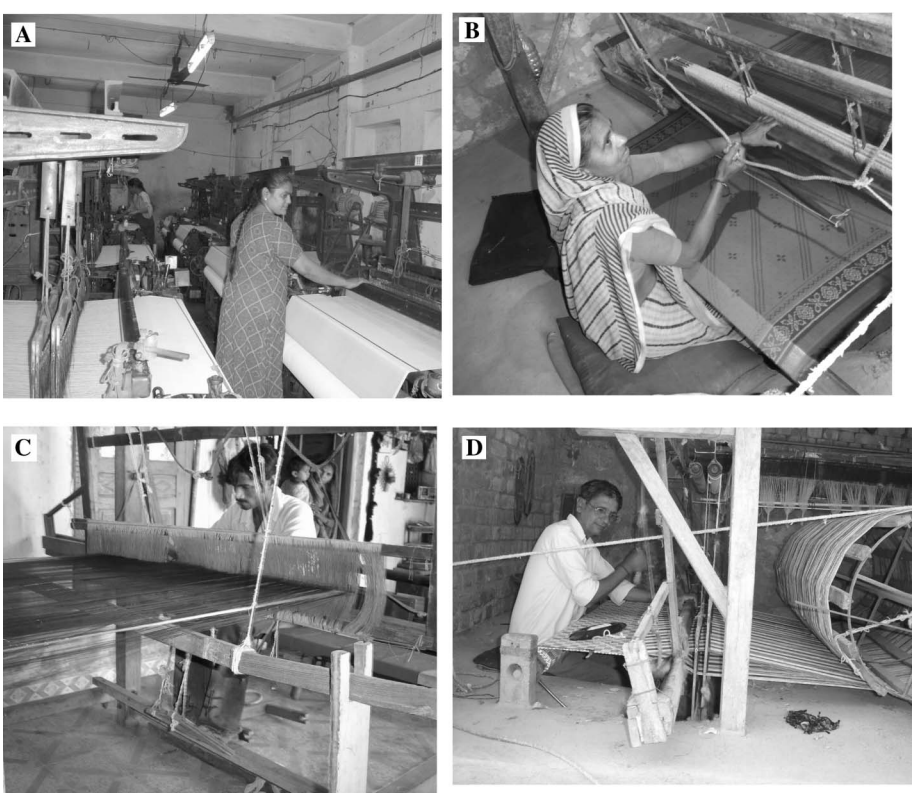

Fig. 1. Female weavers in powerlooms (A) and handlooms (B); Male weavers in Handloom (C & D).

The survey

The study was conducted by introducing interviewer-administered questionnaires. The prevalence of self reported MSDs among the weavers was evaluated using NIOSH checklist[11]. The weaver's responses regarding severity of pain in the last twelve months, work-day lost due to pain, their perception on the causation of pain and the remedial measures taken to mitigate pain were recorded. Severity of pain was scored on the scale of mild, moderate, severe and unbearable (1–4) and loss of productivity was measured in terms of loss of working days and restricted duties. The study was conducted in compliance with the ICMR ethical guidelines. The Institutional Ethical Committee clearance was obtained to conduct the study and the informed consent was obtained from each participant.

To identify the aspects of work and stressors, the weavers were interviewed by a multi-method ergonomic checklist[12]. The ergonomics checkpoints (Table 1) pertaining to this study include the enquiry on work system analysis, such as job characteristics, physical and psychosocial stresses of work, job diagnostic dimensions, constraints of workplace and tools, and hazards of physical environment. The checklist entries were responded by a single digit on a five-point Likert's scale where strong disagreement to the statement (1) to strong agreement to the statement (5), were scored. The low value is the positive indicator of the perception of absence of the stress. The relative loading of scores for each section of the checkpoints was arrived at from the ratio of the summated score value to that of maximum cumulative scores possible under that section. The values greater than mid value of maximum possible score were considered as the positive indicator of the stressors. In other words, for each of the work stressors, the relative loadings would range within 0 to 1 and the loading of each aspect of work equal to or more than 0.5 was considered as a stressor.

Table 1. Details of ergonomics checklist

Work aspects	Details
Job specialization	Specific job, production volume, quality of work and multiple task
Skill requirement	Training, knowledge, skill required for job, frequent mistakes at work, job rotation and machine paced work
Physical work	Target oriented pace, repetitive movements, muscular exertion and working position
MMH	Load handling mode, load weight, distance, height, etc.
Task situation	Material package, handle position, unsafe practices and mechanical aids
Workplace design	Work distance away from normal reach, non-adjustable work desk height, poor clearance space, presence of obstacles
Seating arrangement	Mismatched dimensions, poor adjustability, absence of vibration damping and absence of hold-support
Auxiliary support	Storage space, restricted passage, design mismatches of staircase, awkward positioning of limbs for hand-foot hold, poor supports
Work posture	Arm stretch, wrist extension, neck/shoulder angle, bent and twisted, hips and legs not supported, one sided body movement
Noise	Noise at work area, absence of sound isolation and emergence measures
Climate	Temperature, humidity, ventilation device at workplace
Lighting	Illumination intensity, presence of shadows, etc.
Dust	Presence of dust, poor ventilation, absence of protective measures
Vibration	Transmission of vibration by feet, hand-arm and seat, prolong and continuous exposures and possibility to eliminate or isolate
Work schedule	Working at night and overtime, uneven distribution of work tasks, incorporation of work rest and working at a predetermined pace
Machinery Control	Awkward positioning, mismatched dimensions with body parts, force, speed and precision required in operation, and unpleasant feelings while operation
Machine characteristics	Instability, maintenance, speed, handle operation, guarding, warning signal, absence of vibration damping, high noise level and poor visibility of machine
Tools	Using with alternate hands, weight, handle form and position, sharp edged
Machinery safety	Removal and fastening of accessories, poor positioning, contact with body parts, difficult to inspect and lack of instruction for safe operation
Job autonomy	Time schedules, absence of assistance and insufficient people for assistance of work, rigid methods of work
Job feedback	Role in decision making, increased attention demand for machine operation, assessment by others on job performance
Task clarity	Unambiguous goal, job restrictiveness, work conflict, restricted stimulation, boredom, poor scope
Mental overload	Information load, high information handling, high workload, repetitive act, superficial attention, multiple choice and simple motor act
Training	Advancement to higher levels, lack of opportunities, poor training and incentives

Table 2. Personal characteristics of the weavers

Characteristics	Powerloom		Handloom	
	Male (n=150)	Female (n=75)	Male (n=103)	Female (n=188)
Age (yr)	50.4 ± 9.3	30.8 ± 9.3	40.5 ± 11.5	36.7 ± 11.5
Job tenure (yr)	26.6 ± 10.2	12.6 ± 8.9	22 ± 11.5	13.2 ± 10.8
Working hours/day	10.3 ± 3.5	11.7 ± 2.2	9.7 ± 2.3	7.6 ± 2.5
Literacy (%)	77	73	79	66
Smokers (%)	25	0	42	0
Tobacco chewers (%)	54	4	24	2

Values are means ± SD.

In addition, other stress dimensions, such as the somatic and cognitive anxiety[13] (physiological and psychological state of anxiety), the extent of social and domestic disruption[14] (impairment in domestic and social activities), and the personality inventory for neuroticism and extroversion[15] (a mental state of depression, anxiety, anger, phobias attitude, etc. that orient a person towards the external objective world) and the chronic fatigue (characterized by exhaustion, impaired sleep, lethargic and feeling of drained) were assessed[16].

Data analysis was performed using SPSS statistical software, version 16.0. The descriptive statistics, including prevalence percentage and the odd ratios of the test measures were obtained with reference to work groups, physical characteristics, physiological and psycho-social stressors. The normality of data was checked by Kolmogorov-Smirnov Test with Lilliefor's correction and the distribution of the data for most variables was found to be normal ($p<0.05$) in both handloom and powerloom workers. The relationship of the work stressors to MSDs was examined by Pearson correlation. Multivariate analysis was done using binary logistic regression model with backward elimination method in order to understand the effects of work stressors and worker characteristics on the occurrence of MSDs. The reliability co-efficients for internal consistencies (Cronobach's alpha) of the ergonomics checklists were examined and in case of handloom and powerloom workers, the alpha values ranged from 0.684 to 0.833 indicating moderate to adequate reliability. The responses of the weavers to different work stressors were compared by ANOVA (adjusted for age and gender).

Results

Mean age and job tenure of males were significantly higher ($p<0.001$) than those of females in both powerloom and handloom respectively (Table 2). Workers in powerloom spend longer working hours per day to those in handlooms ($p<0.001$) which also varied significantly with genders.

MSDs among weavers

About 88% males and 79% females in powerloom reported work related MSDs (Fig. 2). Co-morbidity among the workers was high and workers with elevated co-morbidity (pain in two or more regions) reported severe pain. Only 17% of the total workers reported MSDs in only one region, 33% in two regions, 35% in three regions and 15% in all the four regions. Males in both powerloom (OR 5.8) and handloom (OR 2.9) had greater loss of productivity in terms of loss of working days. The weavers had mixed responses about their perception to the cause of pain and discomfort and were generally indifferent to remedial measures (Table 3).

In handlooms females having age >25 yr (OR 2.9, $p<0.05$), the marital status (OR 2.1, $p<0.05$) and job involvement >10 yr (OR 2.2, $p<0.05$) had significant influence on the occurrence of MSDs (Table 4). Female weavers in powerloom and handloom were more prone to developing pain and discomfort in upper back (OR 1.8; CI 1–3.2; $p<0.05$ and OR 2.1; CI 1.3–3.3; $p<0.01$ respectively) and lower back (OR 1.9; CI 1.1–3.3; $p<0.05$ and OR 1.8; CI 1.1–3.2; $p<0.05$ respectively). Male weavers were more prone to developing pain in the knee (OR 2.9; CI 1.7–5.2; $p<0.001$), and hand (OR 2.2; CI 1–5.6; $p<0.05$).

Psychosocial variables and MSDs

About 84% females (OR 1.5) in powerloom and 48% males (OR 4.3) in handloom had poor job satisfaction, with positive association to developing MSDs in any of the four body regions (Table 5). Nearly two-third of the weavers (60–65%) had complaints of general chronic fatigue, excepting the male folks in handloom sector (29%). Job dis-satisfaction (OR 4.3; $p<0.001$) in handloom and cognitive anxiety in both powerloom (OR 4.5; $p<0.05$) and handloom (OR 5.4; $p<0.001$) among males had positive effect on MSDs occurrence.

In handlooms, lack in task clarity (OR 3.2; $p<0.001$)

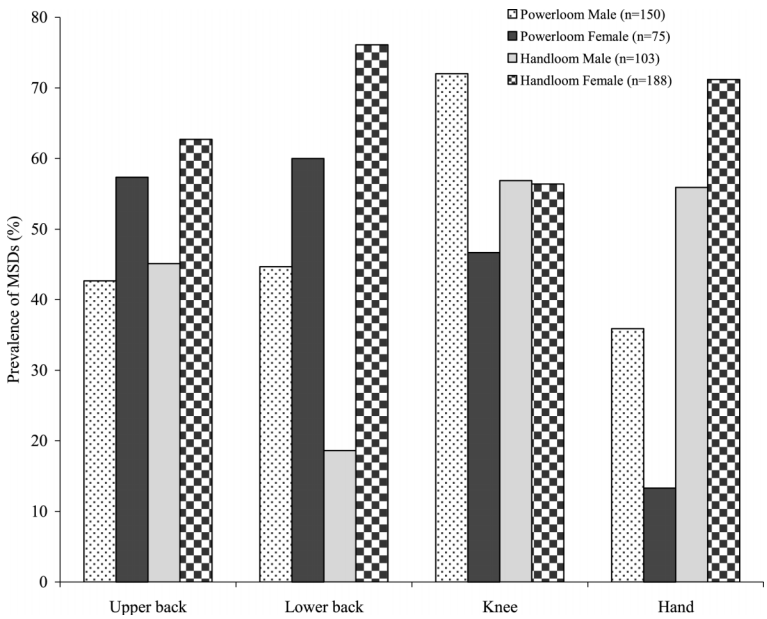

Fig. 2. Prevalence of MSDs among male and female weavers in handloom and powerloom.

Table 3. Severity of pain, remedial measures and causes of MSDs as reported by the weavers

	Powerloom					Handloom				
	Male	Female	OR	95%CI	*p*	Male	Female	OR	95%CI	*p*
Pain severity (%)										
Severe pain	24	17	1.5	(0.7–3.1)	NS	27	15	**1.9**	**(1.1–3.6)**	**0.05**
Mild pain	60	62	0.9	(0.5–1.6)	NS	57	76	0.4	(0.2–0.7)	NS
Productivity loss	29	5	**5.8**	**(1.9–17.1)**	**0.001**	23	11	**2.9**	**(1.5–6.1)**	**0.01**
Weaver's selection of remedial measures (%)										
Pain killer oral medicine (self medication)	16	5	**4.8**	**(1.4–16.5)**	**0.01**	17	28	0.5	(0.2–0.9)	NS
Medical aid (consult doctor)	7	24	0.7	(0.4–1.5)	NS	7	7	0.9	(0.3–2.5)	NS
Balm massage	9	14	0.9	(0.4–2.3)	NS	9	11	0.8	(0.3–1.7)	NS
Hot water foot bath	8	7	1.8	(0.6–5.8)	NS	8	10	0.7	(0.2–1.7)	NS
Rest	8	9	2.3	(0.8–6.3)	NS	7	11	0.5	(0.2–1.4)	NS
No remedial measures	51	42	1.4	(0.7–2.7)	NS	52	33	0.4	(0.2–0.9)	NS
Weaver's perception to the cause of pain (%)										
Posture	29	19	1.4	(0.7–2.7)	NS	27	16	**1.7**	**(1.0–3.2)**	**0.05**
Work equipment	26	15	1.6	(0.8–3.3)	NS	51	54	0.7	(0.5–1.2)	NS
Work method	20	17	0.9	(0.5–1.9)	NS	44	45	0.8	(0.5–1.3)	NS
Exhaustion and workload	22	7	**3.1**	**(1.1–8.3)**	**0.01**	4	10	0.3	(0.1–0.9)	NS
Personal reasons and others	10	15	0.5	(2.2–1.3)	NS	1	4	0.3	(0.1–2.1)	NS

OR = Odd Ratio, 95%CI = 95% Confidence Interval, NS= Not significant.

and poor job feedback (OR 4.2; $p<0.001$) also influenced the development of MSDs among males. Mental overload had significant effect on the occurrence of MSDs among male (OR 7.6; $p<0.001$) and females (OR 3.7; $p<0.001$) in handloom. The higher social and domestic disruptions among female weavers (handloom: 74% and powerloom 75%) had no significant impact on MSDs.

Aspects of work and MSDs

The use of ergonomics checklists led to elucidation of multiple aspects of work of the weavers. Responses of the weavers to the work stressors as a function of gender

Table 4. Personal characteristics and their association with MSDs as indicated by risk estimate

	Powerloom						Handloom					
	Male			Female			Male			Female		
	OR	95%CI	*p*	OR	95%CI	*p*	OR	95%CI	*p*	OR	95%CI	*p*
Age>25 yr (compared against ≤25 yr)	**1.3**	**(1.2–1.4)**	0.8	1.5	(0.5–4.4)	0.2	0.9	(0.1–4.5)	0.6	**2.9**	**(1.2–7.4)**	**0.04**
Working hour>5 h (compared against≤5 h)	**1.3**	**(1.1–1.4)**	0.8	0.7	(0.2–3.6)	0.6	**11**	**(10–13.5)**	0.1	2.3	(0.7–4.9)	0.6
Marital Status (married compared against unmarried)	2.3	(0.3–14.7)	0.3	1.6	(0.5–4.4)	0.2	0.7	(0.2–5.1)	0.6	**2.1**	**(1.1–4.6)**	**0.04**
Job tenure>10 yr (compared against≤10 yr)	0.4	(0.04–3.3)	0.4	1.4	(0.5–3.8)	0.4	1.2	(0.5–3.3)	0.6	**2.2**	**(1.2–3.9)**	**0.04**
Literacy: Literate (compared against illiterate)	1.8	(0.7–5.2)	0.2	2.2	(0.6–5.2)	0.09	0.9	(0.3–2.8)	0.5	2.1	(0.7–6.1)	0.06

OR = Odd Ratio, 95%CI = 95% Confidence Interval.

Table 5. Psycho-social variables and their association with MSDs as indicated by risk estimate

Psycho-social variables	Powerloom								Handloom							
	Male				Female				Male				Female			
	%	OR	95%CI	*p*	%	OR	95%CI	*p*	%	OR	95%CI	*p*	%	OR	95%CI	*p*
Chronic fatigue	66	1.2	(0.5–2.6)	0.40	62	0.8	(0.3–2.7)	0.5	29	1.9	(0.8–4.1)	0.2	65	0.6	(0.2–1.8)	0.3
Job dissatisfaction	40	0.8	(0.4–1.9)	0.15	84	1.5	(0.3–7.2)	0.5	48	**4.3**	**(1.2–14.9)**	**0.01**	21	1.4	(0.4–4.6)	0.4
Cognitive anxiety	57	**4.5**	**(1.5–11.1)**	**0.02**	34	1	(0.2–4.1)	0.6	21	**5.4**	**(1.9–15.1)**	**0.01**	19	3.5	(0.7–16.2)	0.06
Somatic anxiety	37	2.8	(0.8–9.7)	0.29	20	1	(0.1–5)	0.6	9	3.4	(1.1–10.3)	0.1	12	3.8	(0.5–29.9)	0.09
Job autonomy	83	1.2	(0.4–3.2)	0.47	78	0.6	(0.1–3.2)	0.4	79	1.2	(1.1–1.4)	0.6	75	2.1	(0.7–6.2)	0.2
Job feedback	84	5.7	(1.1–30.2)	0.06	96	1.3	(0.3–5.4)	0.5	96	**4.2**	**(1.5–12.4)**	**0.004**	69	2.8	(1.1–8.2)	0.1
Task clarity	80	1.8	(0.7–4.7)	0.11	78	0.5	(0.1–2.5)	0.3	78	**3.2**	**(1.1–9.5)**	**0.02**	51	2.2	(0.6–6.6)	0.13
Mental overload	66	0.9	(0.4–2.4)	0.06	67	0.5	(0.1–3.8)	0.4	67	**7.6**	**(2.1–28.5)**	**0.001**	46	**3.7**	**(1.0–13.8)**	**0.03**
Socio-domestic disruption	61	0.8	(0.3–1.9)	0.5	75	1	(0.3–3.7)	0.6	69	1.7	(0.5–5.7)	0.3	74	0.9	(0.3–3.2)	0.6
Neuroticism	42.6	1.7	(0.7–4.3)	0.10	44	1	(0.3–3.1)	0.6	8.7	2	(0.2–16.9)	0.4	25	1.4	(0.4–5.1)	0.4
Extroversion	84	1	(0.3–3.2)	0.60	82.7	1.1	(0.3–4.7)	0.6	49.5	2.2	(0.5–9.6)	0.2	94.7	3.2	(0.6–16.5)	0.2

OR = Odd Ratio, 95%CI = 95% Confidence Interval.

are shown in Figs. 3 and 4 in powerlooms and handlooms respectively.

In powerloom, male weavers identified noisy workplace ($p<0.01$), work schedules ($p<0.01$), mental overload ($p<0.001$), work methods and tools ($p<0.001$), postural constraints ($p<0.05$) and skill acquisition ($p<0.05$), as more stressful, as compared to the responses of the female weavers, who identified demand of job specialization ($p<0.01$), workplace designs ($p<0.05$), dusty work environment ($p<0.001$) as significantly stressful. In contrast to the situation in powerloom, male weavers in handloom identified job autonomy ($p<0.001$), dusty work environment ($p<0.01$), workplace designs ($p<0.001$), task situations ($p<0.001$), manual material handling ($p<0.001$) and job specialization ($p<0.001$) as more stressful. Females perceived noisy work environment ($p<0.001$) and auxillary support as more stressful.

Multivariate analysis indicated that amongst powerloom weavers, job experience <10 yr (OR 3.7, $p<0.05$), manual material handling (OR 3, $p<0.05$), poor machinery safety (OR 11. $p<0.05$), literacy (OR 3.75, $p<0.01$), marriage (OR 5.5, $p<0.05$) contributed to the occurrence of pain. Amongst the handloom weavers, age >25 yr (OR 3.2, $p<0.05$), poor machinery design (OR 2.2, $p<0.002$), high mental overload (OR 5.7, $p<0.001$), performing specialized job (OR 20.7, $p<0.05$) had significant impact on occurrence of pain. Correlation coefficient was calculated among the work stressors and the occurrence of MSDs and the statistically significant ones are marked (Table 6).

Discussion

The study reiterates that high prevalence of self-reported MSDs among the powerloom and handloom weavers are influenced by multiple work stress dimensions. The powerloom and handloom are spread over different corners of this country. The present data represent the sample population of predominant clusters of selected districts of western India. Self-reporting of morbidity has its limitations with regard to memory recall. However, the detailed comparison of multiple dimensions of work aspects and its relationship with MSDs, provided indications and directions of overall work stresses of the weavers. In this cross sectional study, the associations presented are observed relations.

Reports from Thailand[17] and India[10, 18] confirm the

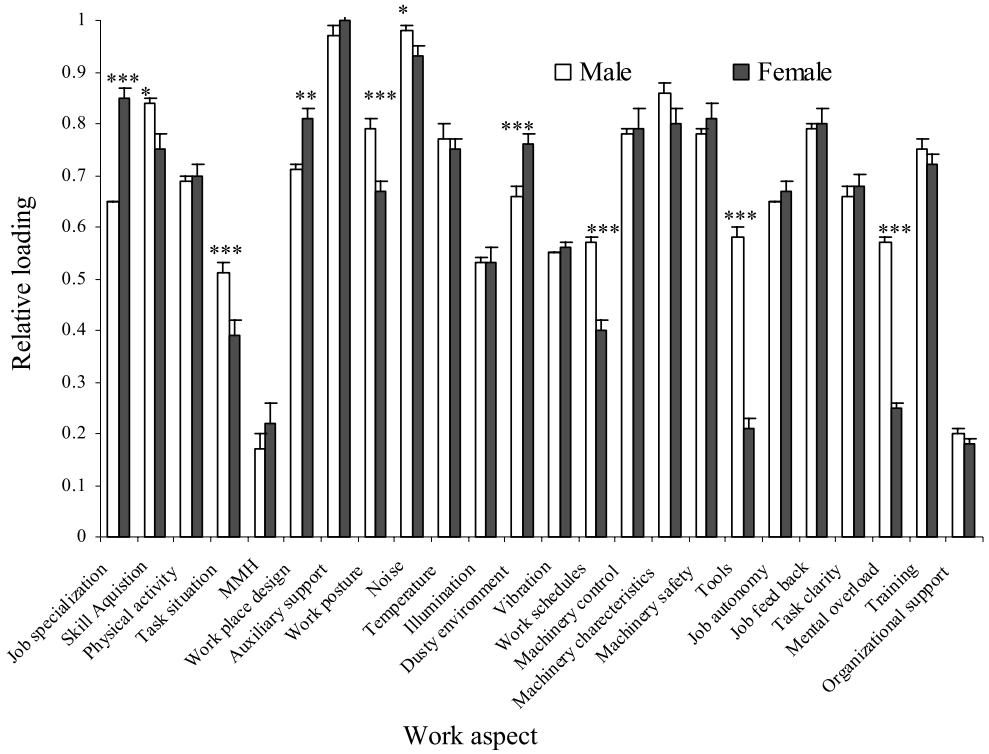

Fig. 3. Responses of male and female weavers in poweroom.
(*p<0.05; **p<0.01; ***p<0.001)

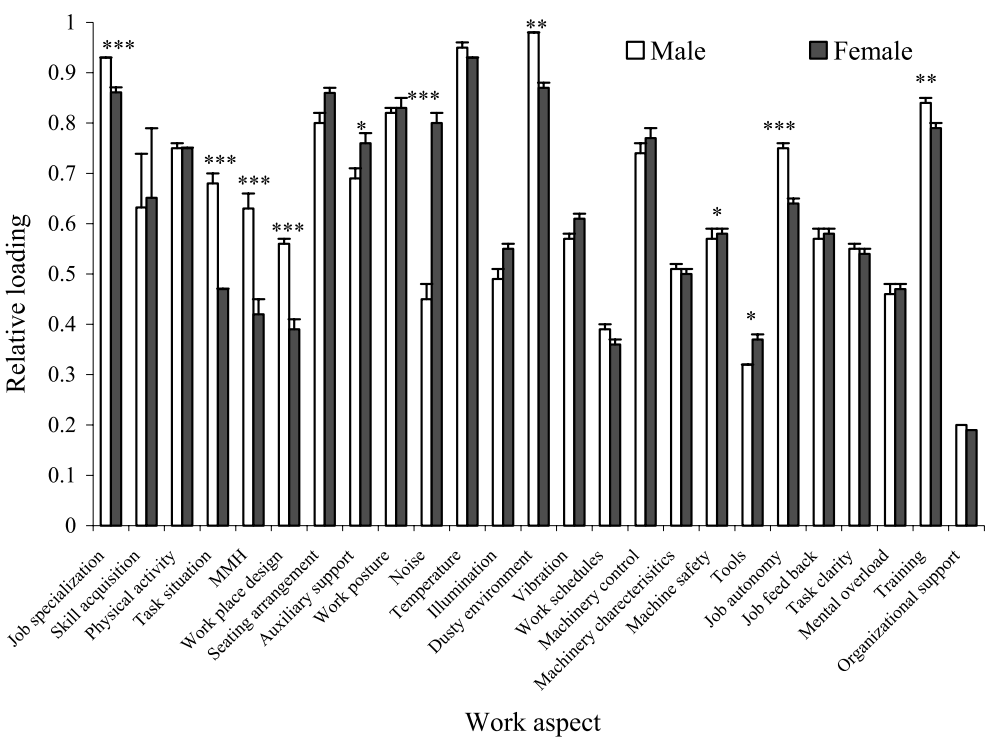

Fig. 4. Responses of male and female weavers in handloom.
(*p<0.05; **p<0.01; ***p<0.001)

Table 6. Relationship (Correlation) between work aspects and MSDs

	Powerloom					Handloom				
	Male			Female		Male			Female	
Work Aspects	Upper Back	Lower Back	Knee	Upper Back	Knee	Upper Back	Lower Back	Knee	Upper Back	Lower Back	Knee
Skill requirement			¤			•					
Manual materials handling	•	¤	•								
Task situation						•	¤	•			
Workplace design						¤		¤	¤		•
Auxiliary support	•	¤									
Strenuous work posture						•		•			•
Hot environment									•		
Noise at workplace								•		•	
Less Illumination					¤					•	
Dusty work environment	•	•							•		
Work schedules							¤				
Machine characteristics						•		•	¤		•
Machinery control				•		¤	•	¤			
Tool mis-match									¤		•
Machinery safety						¤		¤			♣
Poor job autonomy						¤	¤	¤	•		
Poor job feedback						•		•	•		♣
Task clarity						•	•	•	♣		¤
Mental overload				•	•	•	•	•	♣		•

Correlation Coefficients • $p<0.05$, ¤ $p< 0.01$, ♣ $p<0.001$.

prevalence of MSDs among weavers but the back pain observed in the present study was much higher (76% among handloom women) than those reported studies. Forced back bent sitting work posture due to positioning of loom, workspace constraints, high muscle exertion and repetitive movement of limbs to operate the looms might be attributed to high prevalence of MSDs among handloom weavers in the present study. High prevalence of back and knee pain among the female weavers in handloom (fixed work station) might be due to the fact that either they had to stretch their legs maximally or had to sit with minimal hip support in a constrained posture to operate the pedals. Non-adjustability of workstations of the looms had distinct constraints on workers due to anthropometrics and physiologic characteristics[19] and contributed to the MSDs.

Female reported higher incidences of back pain in comparison to males in this study and the same has been reported by other researchers[20, 21]. Though we did not study the non-work related social factors, the incidences of higher MSDs among women might possibly be due to the physiological demand to perform the household activities, including fetching of water from far off places, raring of cattle, taking care of the children and elderly at home. This reduces their physical recovery throughout the day. The study observed that long hours (>5 h) and long duration (>10 yr) of job involvement had positive impact on the occurrence of MSDs among women as observed in the previous study[22]. Weaving activities involve repetitive work, causing strain on the musculoskeletal system increasing the likelihood of fatigue and decreasing the opportunity for tissue to recover leading to pain and discomfort[23]. Standing for long hours influences centre of pressure points of the body and lumbar extensor muscle fatigue[24], suggesting that the occurrence of pain in knees among powerloom male weavers might attribute to their standing work for long hours.

To these poor workers, mitigation of pain is not their priority. Often they take it for granted as the part of their life process and avoid spending money for medication for themselves in the face of other family priorities. This indifferent attitude often makes the situation aggravated in terms of overuse of muscle and tendons without being recovered. The workers' chosen perception, like constrained work posture, work equipment/tools/method and work load, as the causes of pain and discomfort signify the necessity of involving workers' representation while taking into account the intervention measures to minimize the MSDs among weavers in handloom and powerloom sector.

Since majority of the female weavers (66%) had only the primary level of education and remaining were illit-

erate, this made them vulnerable to psychosocial stress, in terms of exploitation, less bargain power for wages[25]. Evidences[26, 27] indicate that the psychosocial stresses related to the job and work environment have bearing on the development of MSDs. Pain has often been associated with physical and psychosocial co-morbid features such as low levels of job satisfaction and high levels of boredom in work[28]. Though the etiologic mechanisms are poorly understood, studies indicate that the perception of intensified workload, monotonous and repetitive work, limited job control and clarity and low social support might be associated with the occurrence of MSDs[3]. Harkness *et al*.[29] reported that the workers who perceived their work to be monotonous or boring were at an increased risk of developing shoulder pain. The present study is in confirmation of those reports and substantiates the risk of developing MSDs among weavers who had poor job satisfaction and poor job autonomy.

Psychosocial characteristics might also influence biomechanical strain, through changes in posture, movement and exerted forces[30]. Association may well be confounded by the effect of physical factors at work[31]. Any trigger of the work and working condition to physiological mechanism may initiate organic changes for intensification of musculoskeletal symptoms and/or influence pain perception[32]. Our multivariate analysis showed that job experience, literacy, marital status (married), MMH tasks, poor machinery design superseded the potential impact of psychosocial load on the occurrence of pain in powerloom sector. However the high mental overload and performance of specialized job had highly significant impact on pain and discomfort in handloom weavers. The present study in weaving industry is one of its first kind exploring the gender differences in perceptions of work aspects for apparently similar tasks and unique in the fact that the multiple dimensions of work aspects were examined in a single study. ANOVA indicated that the perception to work aspects as stressors differed significantly between male and female weavers. Correlation analysis showed significant relationship of dimensions of work aspects (Table 6) with pain and discomfort, substantiating that the work related MSDs are the results of interaction of multiple stressors associated with work and work environment, and other personal factors. Differences in prevalence of MSDs among male and female weavers call for attention that the intervention strategies must be developed considering the gender differences amongst the weavers in powerloom and handloom.

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