



## Prevalence of musculoskeletal disorders among handloom weavers of Uttarakhand : an ergonomic study

Heena Naz, Seema Kwatra and Pragya Ojha\*

Department of Family Resource Management, College of Home Science, G. B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand), INDIA

\*Corresponding author. E-mail: ojha.pragya063@gmail.com

Received: September 22, 2014; Revised received: February 6, 2015; Accepted: March 12, 2015

**Abstract:** Long hours of static work with awkward working postures at traditionally designed looms can cause high prevalence of musculoskeletal disorders (MSDs) among handloom weavers. Because of incompatible working situations handloom weaver in textile industries are confronting with many work related musculoskeletal problems related to pain and discomfort in upper and lower extremities. Keeping this in view, the present study was planned to assess the prevalence of musculoskeletal disorders and postural discomfort among handloom weavers. For this study, 64 (male and female) handloom weavers aged 20-55 years were selected randomly from Almora and Nainital districts of Uttarakhand state. To collect the information, standardized Nordic questionnaire was used to assess pain and discomfort in different body regions of handloom weavers. It was observed that those workers worked continuously in awkward postures during weaving activities. Consequently they suffered from high discomfort in their different body parts. High rate of pain and musculoskeletal disorder was most prevalent in right wrist, left wrist, hip/thigh, neck and lower back of the workers. The data revealed that since last 12 months, total 76.56 percent workers were suffered with pain and discomfort in right hand and 73.44 percent workers had pain and discomfort in both elbows. During last month, 73.44 percent workers were suffered with pain and discomfort in upper back because of awkward working postures whereas during 7 days, total 59.38 percent workers had pain in lower back. The study indicates that the traditional handloom weaving demands immediate ergonomic intervention in the workstation and process design.

**Keywords:** Ergonomics, Handloom weavers, Musculoskeletal discomfort, Textile industry, Working posture

### INTRODUCTION

Handloom is an important cottage industry among developing countries like India, Pakistan, Bangladesh, Iran, Turkey and China, where traditional ways of weaving is still significantly practiced. The vast majority of workforce in South Asia is engaged in the informal sectors which also embraces the cottage industries. Weaving is acknowledged to be one of the oldest surviving crafts in the world (Pandit *et al.*, 2013). During the weaving operation handloom workers adopt awkward postures, which is one of the most important factor of their poor working efficiency and prevalence of musculoskeletal disorders. Musculoskeletal disorders (MSDs) are a common health problem and a major cause of disability throughout the world. The economic loss due to such disorders affects, not only the individual level but also the organization level and the society as a whole (Kemmlert, 1994). At present, MSDs are one of the most important problems ergonomists encounter in the workplace all over the world (Vanwonderghem, 1996). In many countries, prevention of work-related musculoskeletal disorders (WMSDs) has become a national priority (Spielholz *et al.*, 2001). The nature of

the work of the female handloom weavers of Uttarakhand is also consisted of several occupation related risk factors. For example, most of the workers had to work in static and awkward body postures and work with contact pressure at the hand and wrist areas. Keeping this in view, an attempt was made to analyze the prevalence of musculoskeletal disorders and postural discomfort in various body regions of male and female handloom weavers of Uttarakhand.

### MATERIALS AND METHODS

**Selection of subject and field:** Purposive and random sampling without replacement was used to select the study area and sample size of 64 respondents from two districts i.e. Almora and Nainital of Uttarakhand state. Most of the male and female workers were from the 20 -55 years of age and they were performing the handloom weaving operation more than 10 hours per day which is not permissible.

**Assessment of postural discomfort and musculoskeletal disorders:** Standardized Nordic musculoskeletal questionnaire was used to determine the prevalence of self-reported musculoskeletal pain/discomfort. Standardized Nordic Musculoskeletal Questionnaire was developed by

Kuorinka *et al.* (1987) and it is a multiple page questionnaire which is used for evaluation of musculoskeletal problems in body regions. Work-related pain/discomfort was reported in 12 month, last month and prevalence in 7 days during month of May 2012 to June 2013. The questionnaire consisted of a series of objective questions with yes or no response and some were in multiple choice questions.

## RESULTS AND DISCUSSION

The work-related musculoskeletal problems and the body pain perceived by the workers were determined by administering of standardized Nordic questionnaire. All the selected workers had given their responses, which were analyzed. Workers were asked few questions about perceived pain/discomfort. Pain was measured for past 12 months, last month and for 7 days. Majority of the respondents were feeling pain and discomfort in different body parts. Handloom weavers generally adopt sitting posture while working. Different sitting postures that is forward flexed, upright and side bending, are adopted by the weavers while performing weaving task. Prolonged flexion of the spine leads to increase intervertebral joint laxity and fluid loss in the intervertebral discs (Adams, 1987). Studies suggest that flexed sitting posture results in extension of upper cervical and flexion of lower cervical spine (Black *et al.*, 1996). Due to motif formation and for inspection work, the weavers develop flexed posture while for constant weaving they maintain upright posture which results in isometric contraction of Hamstring muscle (Pheasant and Haslegrave, 2006). The condition of flexed forward leaning posture is aggravated with poor rolling mechanism of cloth and warp beam. In order to avoid the effort needed for rolling operation, the weavers lean forward and maintain this

posture as long as it is possible to weave which leads to the development of severe back pain.

Table 1 clearly envisages that since last 12 months, 67.86 percent male and 72.22 percent female who were involved in handloom weaving operations had pain and discomfort in neck. When asked about pain in shoulders 32.14 percent of male workers and 47.22 percent female respondents reported discomfort during the activity. Total 67.86 percent male and 77.78 percent female population reported pain in elbows and 40 percent of the total population of male and female respondents was suffering from wrist/ hands pain and discomfort. When asked about the pain in upper back total 60.71 percent male and 75 percent female handloom weavers were reported discomfort whereas 75 percent male and 61.11 percent female reported pain and discomfort in lower back. Majority of female workers (80.56 percent) reported pain in hip/ thighs but only 64.29 percent male workers were suffering from pain and discomfort in the same region. Total 35.94 percent of male and female population reported pain in knee whereas 45.31 percent population had pain and discomfort in ankles/ feet. Choobineh *et al.* (2004) reported that an awkward leg posture could be a reason for injury, swelling, and pain in weavers' lower extremities. Further they analyzed that musculoskeletal symptoms in thighs, knees and legs were significantly more prevalent among those who worked in those non-neutral or dangling leg postures as compared to those with well-supported legs. In addition, insufficient legroom causes weavers to be in a constrained position without the possibility to move and results in posture fixation. Posture fixation causes the worker not to be able to vary posture and reduce fatigue and can be very uncomfortable and fatiguing (Clark, 1996; Kroemer *et al.*, 1999).

They were also asked about their prevalence of pain

**Table 1.** Distribution of respondents on the basis of prevalence of MSD in weavers during May 2012 to April 2013 (n=64).

Pain in body parts	Male (n=28)		Female (n=36)		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Neck	19	67.86	26	72.22	45	70.31
Shoulders						
Right	14	50.00	21	58.33	35	54.69
Left	-	-	-	-	-	-
Both	9	32.14	17	47.22	26	40.63
Elbow						
Right	11	39.29	19	52.78	30	46.88
Left	-	-	-	-	-	-
Both	19	67.86	28	77.78	47	73.44
Wrist/hands						
Right	18	64.29	31	86.11	49	76.56
Left	13	46.43	29	80.56	42	65.63
Both	7	25.00	19	52.78	26	40.63
Upper back	17	60.71	27	75.00	44	68.75
Lower back	21	75.00	22	61.11	43	67.19
Hip/thighs	18	64.29	29	80.56	47	73.44
Knees	12	42.86	11	30.56	23	35.94
Ankles/feet	15	53.57	14	38.89	29	45.31

**Table 2.** Distribution of respondents on the basis of prevalence of MSD in weavers during the month of May 2013 (n=64).

Pain in body parts	Male (n=28)		Female (n=36)		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Neck	14	50.00	23	63.89	37	57.81
Shoulders						
Right	5	17.86	22	61.11	27	42.19
Left	-	-	-	-	-	-
Both	17	60.71	27	75	44	68.75
Elbow						
Right	1	3.57	18	50	19	29.69
Left	-	-	-	-	-	-
Both	16	57.14	26	72.22	42	65.63
Wrist/hands						
Right	15	53.57	30	83.33	45	70.31
Left	9	32.14	28	77.78	37	57.81
Both	17	60.71	19	52.78	36	56.25
Upper back	16	57.14	31	86.11	47	73.44
Lower back	19	67.86	29	80.56	48	75
Hip/thighs	8	28.57	11	30.56	19	29.69
Knees	5	17.86	26	72.22	31	48.44
Ankles/feet	8	28.57	17	47.22	25	39.06

since last month (Table 2) and it was revealed that maximum of them i.e. 75 percent were having pain in their lower back. From the total sample 73.44 percent respondents were suffering from pain in upper back 70.31 percent were suffering from pain in their right wrist/hand. 68.5 percent were having pain in their both shoulders. Only 57.81 percent male and female handloom weavers reported pain in neck whereas 65.63 percent of the total respondents were suffering with pain and discomfort in elbow. When asked about pain in hips/thighs total 28.57 percent male and 30.56 percent female respondents reported pain and discomfort during the activity. From the total population 48.44 percent male

and female workers had discomfort in knees whereas 39.06 percent respondents were suffering with pain in ankles/ feet.

Regarding pain and discomfort during last 7 days less than half i.e. 37.5 percent of the respondents were having pain in wrists and 28.13 percent were suffering pain and discomfort in both shoulders. From the male population 32.14 percent respondents were suffering from neck pain whereas 41.67 percent female workers revealed that they were also suffering with the same. Only 29.69 percent handloom weavers were suffering from elbow pain and discomfort since last 7 days. More than half of the population i.e. 59.38 percent had pain and

**Table 3.** Distribution of respondents on the basis of prevalence of MSD in weavers during the first week of June 2013 (n=64).

Pain in body parts	Male (n=28)		Female (n=36)		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Neck	9	32.14	15	41.67	24	37.50
Shoulders						
Right	15	53.57	13	36.11	28	43.75
Left	-	-	-	-	-	-
Both	9	32.14	9	25	18	28.13
Elbow						
Right	7	25	18	50	25	39.06
Left	9	32.14	11	30.56	20	31.25
Both	12	42.86	7	19.44	19	29.69
Wrist/hands						
Right	15	53.57	14	38.89	29	45.31
Left	5	17.86	19	52.78	24	37.50
Both	18	64.29	6	16.67	24	37.50
Upper back	6	21.43	10	27.78	16	25
Lower back	16	57.14	22	61.11	38	59.38
Hip/thighs	8	28.57	11	30.56	19	29.69
Knees	10	35.71	18	50.00	28	43.75
Ankles/feet	7	25.00	19	52.78	26	40.63

discomfort in lower back region whereas only 25 percent respondents were suffering from pain in upper back. When asked about pain in hips/ thighs only 28.57 percent male workers reported pain and discomfort but 30.56 percent female respondents were suffering from pain in hips/ thighs. On the other hand total 43.75 percent respondents had pain in knees whereas 40.63 percent handloom weavers were suffering from pain and discomfort in ankles/ feet region. In addition, Chavalitsakulchai and Shahnavaz (1993) also reported that there is positive association between deviant working postures and musculoskeletal signs and symptoms. Lack of workstation adjustability in a weaving operation can be the main cause of constrained, awkward postures, as it is in the case of visual terminal display (VDT) (De, 1993) and sewing operations (Chan et al., 1998).

### Conclusion

The present investigation showed that there was a high rate of poor working postures and musculoskeletal problems among handloom weavers. Therefore, control of musculoskeletal disorders risk factors and up gradation of working environment seem essential. Type of handloom, rest, working postures, daily working hours etc. are the most important and considerable factors which are directly associated with prevalence of musculoskeletal disorders among handloom weavers. The majority of ergonomic shortcomings and important factors for musculoskeletal symptoms in weaving operations originated from ill-designed weaving workstations. Therefore, it can be concluded that any working conditions improvement program in this industry can be regulated and should be focused on designing of ergonomic-oriented weaving workstations. This would minimize the fatigue and drudgery among weavers and significantly enhance their productivity and working efficiency.

### REFERENCES

- Adams, M.A. (1987). Dolan P, Hutton WC: Diurnal variations in the stresses of the lumbar spine. *Spine*, 12:130-137.
- Black, K.M., Mc, C.P. and Polansky, M. (1996). The influence of different sitting positions on cervical and lumbar posture. *Spine*, 21(1): 65–70.
- Chan, C.K., Tsang, B. and Wong, K.P. (1998). Ergonomic investigation on posture problem in a garment manufacturing factory in China. In: Bishu R, Karwowski W, Goonetilleke R, editors. Proceeding of the first world congress on ergonomics for global quantity and productivity. Hong Kong: HKUST. pp 251–254.
- Chavalitsakulchai, P. and Shahnavaz, H. (1993). Ergonomics method for prevention of the musculoskeletal discomforts among female industrial workers: physical characteristics and work factors. *J. Hum. Ergol.*, 22:95–113.
- Choobineh, A., Lahmi, M., Shahnavaz, H., Jazani, R.K. and Hosseini, M. (2004). Musculoskeletal Symptoms as Related to Ergonomic Factors in Iranian Hand-Woven Carpet Industry and General Guidelines for Workstation Design. *International Journal of Occupational Safety and Ergonomics (JOSE)*, 10 (2): 157–168.
- Clark, D.R. (1996). Workstation evaluation and design. In: Bhattacharya, A, McGlothlin JD, editors. Occupational ergonomics: theory and practice. New York, NY, USA: Dekker. 279–301.
- De, K.T. (1993). Ergonomics in computer workstation design. *Ergonomics SA*, 5(1):16–20.
- Kemmlert, K. (1994). Labor inspectorate investigation for the prevention of occupational musculoskeletal injuries (licentiate thesis). Solna, Sweden: National Institute of Occupational Health.
- Kroemer, K.H.E., Kroemer, H.B. and Kroemer, E.K.E. (1999). Ergonomics; how to design for ease and efficiency. Upper Saddle Hill, NJ, USA: Prentice Hall.
- Kuorinka, I., Jonson, B., Kilbom, A., Vinterberg, H., Biering, S.F., Anderson, G. and Jorgensen, K. (1987). Standardized Nordic Questionnaire for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18:233-237.
- Pandit, S. Kumar, P. and Chakrabarti, D. (2013). Ergonomic Problems Prevalent in Handloom Units of North East India. *International Journal of Scientific and Research Publications* 3 (1):1-7.
- Pheasant, S. and Haslegrave, M.C. (2006). Body space, Anthropometry Ergonomics and the design of Work, 3rd edition, pp126, CRC Press, New York,
- Spielholz, P., Silverstein, B., Morgan, M., Checkoway, H. and Kaufman, J. (2001). Comparison of self-report, video observation and direct measurement methods for upper extremity musculoskeletal disorder physical risk factors. *Ergonomics*, 44(6):588–613.
- Vanwonterghem, K. (1996). Work-related musculoskeletal problems: Some ergonomics considerations. *J. Hum. Ergol.*, 25(1):5–13.