

Ergonomic Evaluation of Female Working in Small Scale Handicraft Industries of Patiala District of Punjab

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Abstract: The study was undertaken in Patiala district of Punjab state. Study was conducted on 150 women (dari weavers, naale weavers, pakhi makers) working in organized and unorganized or home based small scale handicraft industries. An interview and observational schedule was used to gather the relevant information regarding respondents Anthropometric measurements, rating of perceived exertion (RPE), Musculoskeletal disorders (MSD), Postural analysis. Finding of study highlight that dari weavers and naale weavers exertion and body pain are more due to their poor posture. In pakhi making exertion is less but neck pain is prominent. Poor and prolonged awkward posture leads to pain and increase exertion that leads to musculoskeletal disorders and decrease productivity.

Keywords: Musculoskeletal Disorders (MSD), Rating of Perceived Exertion (RPE), Posture, Handicraft

INTRODUCTION

Handicraft is an important industry in developing countries. Handicraft sector is a part of small manufacturing industries in rural Punjab. Significant part of rural women of Punjab depends on handicraft industry for their livelihood. Handicraft is a highly labor intensive task. Work is normally organized around families and done in home. Handicraft products such as daari, phulkari, naale, pakhi, pranda are produced in home based workshops known as informal small scale industries. These industries do not require resource beyond basic infrastructural facilities to make these products i.e. loom, basic weaving tools, threads. In rural Patiala, it has become a cottage industry where these products are made mainly by women folk. Women workers work in traditional manner, they often adopt awkward posture which leads to MSD.

Ergonomic is a scientific discipline that deals with interactions among human and their work environment in order to optimize human well-being and overall performance of work. Physical factors in work environment that harm musculoskeletal system (muscles, joints, bones and related structures) of workers is known as ergonomic hazards. Poor work place design, awkward body posture, repetitive movements and other ergonomic hazards leads to cumulative trauma that can affect hands, wrist, elbows, shoulder, neck, lower back. These disorders are termed as work related musculoskeletal disorders. These could be prevented by evaluating risk factors of work environment and by introducing new effective tools and techniques to increase productivity and decrease ergonomic hazards.

REVIEW OF LITERATURE

There are several studies that reveal health related problems in handicraft industries. Metgud et al. (2008) studied on women workers in a woolen textile factor to identify health related problems. He found musculoskeletal problems within 95% of the subjects. Body mapping reveal that 47% low back pain and 19% neck pain with general fatigue. Results reveal that major ergonomic factors associated with musculoskeletal system were awkward posture, daily working time and seat type. Mukhopadhyaya et al (2010) studied on evaluating ergonomic risk factors in non regulating stone carving units of Jaipur. He identified different ergonomic risk factors related with this profession. Arphorn et al (2008) studied on sculpture workstation in pottery handicraft to reduce

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fatigue and discomfort. Workstation was redesigned that can lead in reduction of muscular discomfort and fatigue. Tiwari et al (2003) studied on cotton textile workers .his study revealed that low back pain was found and he suggested that ergonomic principles should be used to control occupational risk factors. there are many studies that done on male workers engaged in handicraft industries such as daari making and hand embroidery but limited studies has been done on females. hence in view of above an attempt has been made to ergonomically evaluate females working in handicraft industry.

METHODOLOGY

The study was carried out on 90 females (18-42 years) who are involved in handicraft industry of Patiala district. Sample was categorized based on their work 30 subjects of each categories were selected i.e. naale weavers, daari weavers, pakhi makers. Samples were randomly selected from organized and unorganized sectors. Subjects having more than 3 years working experience were included .subjects with acute illness and any having any musculoskeletal deformity were excluded from the study.

Musculoskeletal problems were evaluated by body mapping chart (corlett and bishop,1976) and Nordic questionnaire (Kuorinka et al 1987) these are self-reported questionnaire which we evaluated the area of pain and discomfort of the subjects.

Posture analysis of all subjects were done in anterior view, posterior view, lateral view by using plumb line. subject stood on indicated footprints with their foot in position of footprints. Plumb line were hanged from overhead bar. Plum bob was in line with the point on footprints on floor that is standard base point (anterior to the lateral malleolus in lateral view, midway between heels in side view

Rating of Perceived exertion: Borg's 10 point scale were used to rate exertion. After completion of 30 minute work set subjects were asked to rate their perceived exertion on 10 point scale by choosing any number on the scale where 0 was no exertion and 10 was maximum exertion.

RESULTS

Table1. *physical Characteristics of Subjects*

Variables	Daari weavers(n-30) (Mean ± SD)	Naale weavers(n-30) (Mean ± SD)	Pakhi makers(n-30) (Mean ± SD)
Age(yrs)	34.4±7.6	35.7±6.3	36.6±7.5
Height(cms)	153.4±3.8	155.3±5.7	153±5.5
Weight(kgs)	57.7±12.5	61.3±10.7	61.3±11.6

Table 1 shows 90 subjects were studied.30 were daari weavers.30 were naale weavers and 30 were pakhi makers .Mean age, height and weight were calculated

Table2. *Rating of perceived exertion*

Work type	PRE ±SD	Borg rating
Dari weavers	6.73±1.96	Somewhat hard
Naale weavers	4.58±1.95	Somewhat easy
Pakhi makers	4.53±1.96	Somewhat easy

Table 2 shows PRE calculated in daari weavers PRE was calculated more than naale weavers and pakhi makers i.e daari weaver's PRE (6.73±1.96) were more than naale weavers (4.58±1.95) and pakhi makers (4.53±1.96). Daari weaving is more exerting work than naale and pakhi. naale weaving is more exerting than pakhi making

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Table3. *Body pain indicator chart (Front view)*

	Dari	Naalee	Pakhi
Head	0	0	0
Shoulder			
<i>Both shoulders</i>	15 (50)	3 (10)	8 (26.7)
<i>Left side</i>	0	1 (3.3)	0
<i>Right side</i>	6 (20)	5 (16.7)	0
Elbow			
<i>Both sides</i>	2 (6.7)	9 (30)	5 (16.7)
<i>Left side</i>	0	0	0
<i>Right side</i>	0	1 (3.3)	0
Wrist	0	11 (36.7)	5 (16.7)
Palm and fingers	0	1 (3.3)	0
Chest	0	1 (3.3)	0
Upper abdomen	0	0	0
Lower abdomen	0	0	0
Hip	0	0	0
Knee			
<i>Both sides</i>	8 (26.7)	7 (23.3)	9 (30)
<i>Left sides</i>	0	2 (6.7)	0
Ankle			
Both sides	1 (3.3)	4 (13.3)	1 (3.3)
Left side	0	0	0
Dorsal aspect of foot	0	0	1 (3.3)

Table 3 shows front view of body chart shows both shoulder pain is more in daari weavers (50%) than pakhi makers (26.5%) than naale weavers (10%). elbow pain is more in naale weavers (30%) than pakhi makers (16.7%) than daari weavers (6.7%)wrist pain is more in naale weavers(36.7%)than pakhi makers (16.7%). palm and fingers pain are present in naale weavers.knee pain is more in pakhi (30%) than daari weavers (26.7%) than naale weavers (23.3%) ankle pain is more in naale weavers (13%) than pakhi and daari weavers.

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Table4. *Body pain indicator chart (Back view)*

	Dari	Naalee	Pakhi
Head	0	0	0
Neck	11 (36.7)	13 (43.3)	24 (80)
Scapular region			
Both sides	0	2 (6.7)	3 (10)
Left side	0	1 (3.3)	0
Right side	1 (3.3)	4 (13.3)	0
Upper back	0	0	0
Lower back	17 (56.7)	24 (80)	17 (56.7)
Pelvis	1 (3.3)	0	0
Tail bone	0	0	0
Thigh	0	0	0
Calf	4 (13.3)	8 (26.7)	5 (16.7)
Plantar aspect of foot	1 (3.3)	0	1 (3.3)

Table 4 shows back view of body chart. neck pain is more in pakhi makers (80%) than naale weavers (43.3%) than daari weaving (36.7%) scapular region of both side are more painful in pakhi makers (10%) than naale weavers (6.7%). lower back pain is more in naale weavers (80%) than pakhi and daari weavers (56.7%). calf pain is more in naale makers (26.7%) than pakhi makers (16.7%) than daari weavers (13.3%). planter aspect of foot are painful in both daari and pakhi makers.

Table5. *Postural analysis checklist: Side view*

	Dari	Naalee	Pakhi
Ankle joint Right			
Neutral	30 (100)	30 (100)	30 (100)
Ankle joint Left			
Neutral	30 (100)	30 (100)	30 (100)
Knees Right			
Neutral	29 (96.7)	29 (96.7)	30 (100)
Flexed	1 (3.3)	1 (3.3)	0
Knees Left			
Neutral	29 (96.7)	29 (96.7)	30 (100)
Hyperextended	0	0	0
Flexed	1 (3.3)	1 (3.3)	0
Hip joint Right			
Neutral	30 (100)	30 (100)	30 (100)

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Hip joint Left			
Neutral	30 (100)	30 (100)	30 (100)
Pelvis Right			
Neutral	30 (100)	29 (96.7)	30 (100)
Anterior Pelvic tilt	0	1 (3.3)	0
Pelvis Left			
Neutral	30 (100)	29 (96.7)	29 (96.7)
Anterior Pelvic tilt	0	1 (3.3)	1 (3.3)
Lumbar spine			
Neutral	7 (23.3)	6 (20)	6 (20)
Flat	6 (20)	5 (16.7)	9 (30)
Excessive Extension	17 (56.7)	19 (63.3)	15 (50)
Lower Thoracic spine			
Neutral	10 (33.3)	8 (26.7)	8 (26.7)
Flat	8 (26.7)	8 (26.7)	9 (30)
Excessive Flexion	12 (40)	14 (46.7)	13 (43.3)
Upper Thoracic spine			
Neutral	12 (40)	8 (26.7)	8 (26.7)
Flat	7 (23.3)	8 (26.7)	9 (30)
Excessive Flexion	11 (36.7)	14 (46.7)	13 (43.3)
Cervical spine			
Neutral	10 (33.3)	5 (16.7)	4 (13.3)
Flat	13 (43.3)	19 (63.30)	17 (56.7)
Excessive extension	7 (23.3)	6 (20)	9 (30)
Head			
Neutral	13 (43.3)	7 (23.3)	6 (20)
Forward	16 (53.3)	23 (76.7)	20 (66.7)
Retracted	1 (3.3)	0	4 (13.3)

Table 5 shows side view of posture flexed knee is found in dari and naale(3%) makers. anterior pelvic tilt is found in naale makers(3%). lumbar spine flattened more in pakhi makers(30%) than daari makers(20%) than naale weavers(16.7%). Excessive flexion of lumbar spine is found in naale weavers(63.3%) than daari weavers(56.7%) than pakhi makers(50%). lower thoracic spine is flat in pakhi(30%) than naale weavers and daari weavers(26.6%) excessive flexion of lower thoracic spine is more in naale(46.7%) than pakhi makers(43.3%) than daari makers(40%). cervical spine flat in naale weavers more than pakhi and daari weavers. head is forward more in naale weavers than pakhi makers than daari weavers

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Table6. Postural analysis checklist: Front view

	Dari	Naalee	Pakhi
Feet Right			
Neutral	30 (100)	30 (100)	30 (100)
Feet Left			
Neutral	30 (100)	30 (100)	30 (100)
Knees			
Neutral	28 (93.3)	29 (96.7)	30 (100)
Knock knees			
Bow knees	2 (6.7)	1 (3.3)	0
Pelvis			
Level	30 (100)	29 (96.7)	30 (100)
Elevated right	0	0	0
Elevated left	0	1 (3.3)	0
Rib cage			
Neutral	30 (100)	30 (100)	30 (100)
Shoulder Right			
Level	19 (63.3)	23 (76.7)	26 (86.7)
Elevated	4 (13.3)	2 (6.7)	1 (3.3)
Depressed	7 (23.3)	5 (16.7)	3 (10)
Shoulder Left			
Level	29 (96.7)	25 (83.3)	24 (80)
Elevated	1 (3.3)	2 (6.7)	4 (13.3)
Depressed	0	3 (10)	2 (6.7)
Head			
Neutral	30 (100)	30 (100)	30 (100)

Table 6 shows: Postural analysis of front view shows that bow knees are found in dari weavers(6.7%) than naale weavers(3.3%).left pelvis is elevated in naale weavers(3.3%).shoulder elevated in dari weavers(13.3%) than naale weavers and pakhi makers

Table7. Postural Analysis Checklist: Back View

	Dari	Naalee	Pakhi
Feet Right			
Neutral	30 (100)	30 (100)	30 (100)
Feet Left			
Neutral	30 (100)	30 (100)	30 (100)
Femur Right			
Neutral	30 (100)	30 (100)	30 (100)
Femur Left			

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<i>Neutral</i>	30 (100)	30 (100)	30 (100)
Pelvis			
<i>Neutral</i>	29 (96.7)	29 (96.7)	30 (100)
<i>Elevated left</i>	1 (3.3)	1 (3.3)	0
Scapula Right			
<i>Neutral</i>	7 (23.3)	6 (20)	18 (60)
<i>Protracted</i>	12 (40)	21 (70)	8 (26.7)
<i>Retracted</i>	0	0	0
<i>Elevated</i>	3 (10)	1 (3.3)	1 (3.3)
<i>Depressed</i>	8 (26.7)	2 (6.7)	3 (10)
Scapula Left			
<i>Neutral</i>	15 (50)	8 (26.7)	18 (60)
<i>Protracted</i>	11 (36.7)	21 (70)	8 (26.7)
<i>Elevated</i>	2 (6.7)	1 (3.3)	3 (10)
<i>Depressed</i>	2 (6.7)	0	1 (3.3)
Humeri Right			
<i>Neutral</i>	30 (100)	27 (90)	30 (100)
<i>Medially rotated</i>	0	3 (10)	0
Humeri Left			
<i>Neutral</i>	30 (100)	30 (100)	30 (100)

Table 7 shows: Postural analysis of back view shows that's protracted scapula is more in naale weavers(70%), daari weavers(40%) than pakhi makers(26.7%). Elevated shoulder is more in dari weaver,(10%) than pakhi n naale weavers. Depressed shoulder are more in daari weavers(26.6%) than pakhi and naale weavers.

DISCUSSION

Result of study revealed that handicraft workers are engaged in long sitting, prolonged forward posture, unorganized work place and repetitive movement of wrist and hand that causes Work related health problems. Our study showed that subjects discomfort level and pain cause due to prolong working hours in order to increase productivity. Postural changes are shown due to awkward posture during work. exertion rate is increased at the end of day because of short recovery periods .In our study all the subjects had muscular pain, postural changes, rate of exertion increases because of traditional methods and tools are used in handicraft industries.

Postural changes shown due to muscular fatigue .Workers were in long sitting posture for at least 8 hours without backrest. Each worker in our study were involved in two jobs one is as worker in handicraft industry doing for income and other is as homemakers doing all household work. Rest time between work and household activity are reduced so fatigue is induced which cause residual muscular pain and ultimately leads to Work Related Disorders.

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