ISSN No:-2456-2165

Risk Assesment of Handloom Weavers in Kerala

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Abstract:- The goal of this study is to evaluate the likelihood that Keralan handloom weavers may develop a musculoskeletal condition. Among the weaving units in Kerala's Balaramapuram, Kothampally, and Chemdamangalam, 80 male handloom weavers were chosen. The likelihood of musculoskeletal problem was evaluated. In order to analyse working posture using REBA, working postures were documented using still photography. For the Rapid Exposure Checklist, assessments of postural issues connected to work in several body areas, such as the back, neck, shoulder/arm, and hand/wrist, were made by observers and workers. The data shows that the mean REBA score is 11, indicating a very high level of risk, and that the mean QEC scores for the neck, back, wrist/hand, and shoulder/arm are, respectively, 17, 31, and 43, indicating high and very high levels of risk. According to REBA, 56.25 percent of weavers were at high risk and 43.75 percent were at extremely high risk. Also, according to QEC, 38.75 percent of weavers are in the very high-risk group, while 61.25 percent are in the high-risk category.

I. INTRODUCTION

The vast traditional, historical, and cultural diversity that sets India apart from the rest of the world is embodied in the handlooms and handicrafts. The kashida embroidery of Kashmir, Naga morungs, paitkar artwork from Jharkhand, or the bhandhej and toran from Gujarat, among other well-known handicrafts, have all undergone careful refinement over the years. Each has a distinctive tale to tell. India has been doing weaving for more than 5000 years. Almost 23% of the nation's fabric is produced on handlooms. As a result of the possibility for employment in the rural areas, it is important to the Indian economy.

In addition to being the greatest source of non-farm rural employment, the handloom sector holds a particular and distinctive position in the Indian economy. The handloom industry is primarily home-based, and the entire family contributes work to it. It is strewn throughout the nation's thousands of villages and municipalities. Around 11% of the nation's total cloth output originates from this sector, which also helps the nation's export earnings. Moreover, 95% of all hand-woven fabric in the world is produced in India.

The industry is a continuation of the long-standing history of hand weaving in India and reflects the sociocultural practises of the weaving communities. Weaving is one of the most tiresome jobs since it requires prolonged periods of stationary work and has a significant potential for MSD risk factors such as improper posture, repetitive motions, and contact stress. The postures that employees take at work rely on the kind of work they do, how the workspace is designed, their individual features, the equipment needed to do the task at hand, as well as the length and frequency of work cycles. Weavers occasionally have to adopt positions at work without taking into account their unique capabilities and limits, which causes stress and trauma for the workers. Over time, this causes both productivity and the calibre of the job to degrade. As a result of one's everyday activity, certain muscles frequently shorten or tense while others lengthen and weaken, which leads to poor posture. There are a variety of factors that might affect posture, including work-related activities and biomechanical elements like force and repetition. Psychosocial variables like occupational stress and strain are also risk factors for bad posture. Neck and shoulder pains are more likely to appear in those who are under more stress at work. Poor working conditions and uncomfortable postures were prevalent in a study on carpet repair operations. They noted a significant incidence of musculoskeletal issues in the shoulders, back, and knees of the carpet fixers. According to Alireza Choobineh, poor working postures are a major cause of the musculoskeletal issues that weavers have. Their posture is primarily restricted by the way workstations are made. indicated that a significant frequency of musculoskeletal disorders (MSDs) among carpet weavers can be caused by lengthy hours of static labour with uncomfortable posture at conventionally constructed looms. The carpet business plays a significant role in the economic vitality of numerous nations. The carpet industry's weavers experience a variety of health risk issues. In the carpet industry, the risk is greater and the controllability is less. The majority of issues in the weaving business are caused by inadequate ergonomics, poorly designed workstations, and prolonged periods of static work. In India, handloom weaving is an inherited craft that weavers learn from their ancestors. As a result, this craft is widely used in rural regions and employs a large number of rural artisans. Despite the fact that Indian handlooms have established themselves in the globalised globe, this industry still lacks appropriate awareness of the health issues and dangers associated with weaving.

Shedding, Picking, and Beating are the three primary processes (motions) used in handloom weaving. To enable weft insertions or picking before beating, a shearing motion divides the warp threads in accordance with the pattern [1]. Picking is the process of inserting the length of weft through the shed after it has been made. The reed pushes or beats up the weft to the fall of the cloth as soon as a weft yarn is placed. The weaver manually performs all three movements to weave the fabric by interlacing the warp and weft. The essential tool for hand weaving is a loom. The handlooms can be broadly divided into four classes based on their construction and method of operation: primitive looms, pit looms, frame looms, and semi-automatic looms. Ikat from Odisha, Kalamkari from Andhra Pradesh, Bandhani or tie-dye from

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Gujarat, Patan Patola from Gujarat, Brocades from Uttar Pradesh, Zari work from Madhya Pradesh, and Balaramapuram sarees from Kerala are some of the major handloom types.

B. Handlooms Throughout Kerala's History

The origins of Kerala handloom items are localised. Each of these weaving centres has distinctive qualities that mark them as distinct from the others. The three principal weaving hubs in the State are Kuthampully, Balaramapuram, and Chendamangalam.

In the Thrissur district's Kuthampully village, traditional handloom remains an integral component of daily life. The ancestors of Kuthampully left Mysore some 500 years ago to weave clothing for the former Cochin dynasty, and they never went back. At the beginning, they took the conventional route, and the many types of clothing they developed, such as the kasavu double dhoti, veshti, and set mundu, gained popularity. Eventually, traditional Kuthampully sarees were skillfully embellished with embroidery techniques to create designer versions.

Balaramapuram in Thiruvananthapuram has a handloom weaving tradition that dates back to than 300 years. Balaramavarma, the former king of Travancore, ordered the introduction of handloom weaving in Balaramapuram. To create fabrics for the royal household, seven weaver families from Tamil Nadu were brought and installed there. The fabled Balaramapuram handloom fabrics have only ever been produced using traditional techniques and tools up until this point.

Every piece is a tribute to the skill of the Chendamangalam weavers from Ernakulam and is renowned for its outstanding quality. Today, the designs created utilising traditional methods still have an unmatched allure that may draw in even the most affluent clientele. In addition to Kuthumpally, Balaramapuram, and Chendamangalam, the public also appreciates and is familiar with the furniture from Kannur and the sarees from Kasaragod.

Every yarn used in the warp and weft of the handlooms produced in Kerala is soaked in centuries-old history. This traditional stamp contributes significantly to Kerala's rich cultural history.

Table 1 State-wise handloom details

NUM	STATE	NUMBER OF HANDLOOMS
1	Assam	12,83,881
2	West Bengal	6,31,447
3	Tamil Nadu	2,43,575
4	Manipur	2,24,684
5	Uttar Pradesh	1,90,957
6	Andhra Pradesh	177,447
7	Tripura	1,37,639
8	Arunachal Pradesh	94,616
9	Kerala	30,200

Source: Handloom Census report 2021

II. LITERATURE REVIEW

A. Handlooms and Powerlooms

The term "handloom" refers to a weaving frame made of wood that is powered solely by human labour. The artisans utilise this instrument to provide various types of fabrics.

Electricity powers a power loom, which is also used to weave clothing. As it is mechanical, no manual labour is required.

B. Kerala's handicrafts

Traditional Balaramapuram textiles are normally woven from natural cotton yarn and feature a gold zari border and typically a simple zari stripe at the end. Latest experimentation with the patterns include weaving the same designs using coloured yarn for the weft and the steadily growing popularity of sarees decorated with murals.

With relatively minor kasavu decoration, Chendamangalam mundu or settu mundu has coloured borders and a corresponding colour stripe. Weavers in Chendamangalam, like in other regions of Kerala, were officially supported by the aristocratic dynasty of Paliam, who acted as the chief ministers for the Rajas of Cochin. In terms of the actual weaving procedure, textiles from Chendamangalam are produced on frame looms and have a little thicker texture than comparable textiles from Balaramapuram.

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Kuthampully sarees are the most well-known design outside the state, despite the fact that Balaramapuram and Chendamangalam are famed for their traditional designs for mundus and sarees. Given the variety of jacquard patterns that are often used to decorate them, these sarees stand out from those woven in other parts of the state and are highly popular in Kerala. Although half-fine zari is commonly used in the weaving process, Kuthampully sarees are less expensive and more widely worn as a result. Another distinguishing feature of this pattern is the gap of white where the kasavu border ends and the border begins.

Table 2 Safety Innovations in Loom Industry

SL No	Authors	Safety Innovations			Outcomes	Powerlooms/ Handlooms
		Design	Process	Marketing		
1	Varghese and Salim (2015) [12]	Yes	Yes	Yes	Will help double the current profits and also in establishing a brand	Handloom
2	Department of Planning and innovations govt of Odisha[2]	No	No	Yes	Helped connect handloom weavers to potential customers and still being adopted in Odisha	Handloom
3	Roa and Rao (2015) [8]	Yes	No	No	Suggested the non-viability of government schemes and suggests direct financial and institutional support to the handlooms	Handloom
4	Basu (2016)[2]	Yes	Yes	No	Garments can be encouraged for earning more revenue and employment and initiative should be taken by the state Govt to provide infrastructural development and more refined textile schemes	Powerloom
5	Sekar and Vignesh (2014) [10]	No	No	Yes	It emphasizes on cottage industries to perform detailed market analysis before making financial investments	Handloom

Table 2 displays the results of studies done by the following authors during the previous decade: Varghese and Salim (2015), who have conducted a study titled "Handloom Industry in Kerala: A study of the problems and challenges", Roa and Rao (2015), who have conducted a study titled "An Analysis of Handloom Industry in Andhra Pradesh – Challenges vs. Government schemes", Department of Planning and Coordination, Govt.Odisha, who had prepared a report on "Marketing Study in the area of Handloom Project", and Basu (2016),"Textile, Garment, and Fashion Industry in Odisha, Prospects and Challenges", Sekar and Vignesh (2014) who conducted a research entitled "A Study on customer perception and marketing issues of cottage industry products in Madurai district".

III. MEATHODOLOGY

The present study was carried out to determine the postural stress among handloom weavers in Balaramapuram weaving unit Trivandrum , Kerala.. Eighty male weavers engaged in durrie weaving were selected randomly from Balaramapuram and Kothampally of trivandrum district in Kerala. Posture for risk of work related musculoskeletal disorder among handloom weavers was assessed by using REBA Scale developed by Hignett and McAtamney (2000) [5] and risk was assessed by using Quick Exposure Checklist.

How to evaluate the REBA Scale;

- Evaluate a job's essential task.
- To evaluate the postural aspects for each job, give each region a score.
- Postures for Group A (Trunk, Neck, and Legs)
- Group B 4. (Upper Arms, Lower Arms, and Wrists)
- There is a posture score scale for each location as well as correction notes for further considerations.
- Next, grade the factors for load/force and coupling.
- At last, grade the activity.
- Determine the results for the Group A posture scores from Table A and the Group B posture scores from Table B.
- There is a posture score scale for each location as well as correction notes for further considerations.
- Next, grade the coupling and load/force variables.
- At last, grade the activity.
- There is a posture score scale for each location as well as correction notes for further considerations.
- Next, grade the coupling and load/force variables.
- At last, grade the activity.
- Determine the results for the Group A posture scores (Table A) and the Group B posture scores (Table B).
- Score A is the result of adding the scores from Table A and Load/Force. The Coupling score for each hand is added to the Table B score to determine Score B.

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- Enter the score from Table C along with the scores A and B. The Score C and the Activity score are added to create the REBA score.
- The REBA Decision table contains the risk level.

Table 3 – REBA Decision

Reba Score	Risk Level
1	Negligible
2-3	Low
4-7	Medium
8-10	High
11-15	Very High

➢ *Risk Risk assessment (Quick Exposure Checklist):*

- An observational checklist on postures and other physical requirements aimed for rapid assessment of task with minimal training of observers.
- Posture of back, shoulder/arm, wrist/hand and neck are observed and rated with two and three step scales using: fuzzy logic" (natural language without exact borders between the classes)
- The workers are asked to rate the weights handled, daily time in the observed task, level of hand force, visual demands, driving of vehicles, use of vibrating tools, and difficulties to keep up with the work as well as stress fullness of this work.
- The ratings are weighted to scores added to summery scores for body parts and other items (driving, vibration, work pace and stress).
- Based on these scores, priority level for intervention has been proposed to provide a basis for decision- making and communication within organisations.
- Worker's perception and observers assessment was taken into account by QEC checklists.

Table 4- Recommended QEC percentage score
The Action level from QEC

Action level	Intervention recommended	Recommended QEC % Score
Acceptable risk	Acceptable posture	<40%
Moderate risk	Further investigation needed; Change may be required	40-49%
High risk	Investigation and changes may be needed soon	50-69%
Very high risk	Investigation and changes needed immediately	>70%

IV. RESULTS AND DISCUSSIONS

The working postures of the respondents while durrie weaving through handloom was observed and score was assigned to each body parts by using the REBA score sheet. The position of neck, trunk, leg as well as load/force, upper arm, lower arm and wrist used in carrying out activities were considered for analysis of postures.

Table 5- Distribution of the respondent according to REBA Employee Assessment Worksheet

S. No.	Body parts	MEAN	S.D	Maximum Score
1	Neck	2.40	0.4928	3
2	Trunk	4.60	0.4928	5
3	Leg	3.20	0.9859	4
4	Force/load score	1.00	0.0000	2
Score A	6.60		0.4928	12
1	Upper arm	3.60	0.4928	6
2	Lower arm	1.00	0.0000	2
3	Wrist	2.00	0.0000	2
4	Coupling	2.00	0.0000	2
Score B	7.60		0.4929	12
Score C	9.60		0.48989	9
Activity Score	1.00		0.0000	1
REBA Score	10.6		0.48989	11

Analysis of data in table 5 regarding REBA score to different body parts of handloom weavers in durrie unit reveals that in score A maximum mean score 4.60 was for trunk and in score B maximum mean score 3.60 was for upper arm. Mean for score B which includes upper arm, lower arm, wrist and coupling was higher (m s 7.60) as compare to score A (m s 6.60) which include neck, trunk, leg and force /load score. Mean for score C was 9.60 which after adding mean of activity score (m.s 1.00) turn to REBA mean score (m.s10.6.)

Table 6 -Percentage distribution of the respondent on the basis of REBA score N =80

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S. No.	Action category	Interpretation	Score	
			Frequency	Percentage
1	1-Negligible risk	No change is required	-	-
2	2-3 low risk change	Change may be needed	-	-
3	4-7 medium risk	Further investigate change soon	-	-
4	8-10 high risk	Investigate & implement change	45	56.25
5	11+ very high risk	Implement Change	35	43.75

REBA action category presented in table 4 reveals that maximum 56.25 percent weavers were in action category 4 which ranges between score 8-10 i.e. high risk which directs for investigation and implementation of change, whereas, 43.75 percent weavers were in action category 5 which scores above 11 i.e. very high risk and directs to implement change immediately.

Table-7 -Comparison of QEC score of weavers with recommended priority scores N = 80

S. No	Body Area	QEC Score for weaving activity				
		Low	Moderate	High	Very High	Weaver's Score
1	Back (static)	8-14	16-22	24-28	30-40	31
2	Shoulder/ Arm	10-20	22-30	32-40	42-56	37
3	Wrist/ hand	10-20	22-30	32-40	42-56	43
4	Neck	4-6	8-10	12-14	16-18	17

Analysis of data in table 7 regarding assessment of risk factor in different body parts while weaving through Quick Exposure Checklist reveals that QEC mean score for Durrie weaving was 31 for back (static) which belongs to very high exposure to hazard in back, mean QEC score for shoulder was 37 which shows high exposure to hazard in shoulders, wrist / hand with mean QEC score 43 was exposed to very high health hazard and neck with QEC mean score 17 is highly exposed to health hazard. Table clearly depicts that while weaving back, wrist/hand and neck were exposed to very high risk of health hazard and shoulder /arm only to high risk. This might be due to the improper design of work station, hand tools or long working hour.

Table 8- Percentage distribution of weavers on the basis of recommended action level in QEC N = 80

S. N0.	Action level	Intervention recommended	Recommended QEC % Score	Frequency	Percentage
1	Acceptable risk	Acceptable posture	<40%	-	-
2	Moderate risk	Further investigation needed; Change may be required	40-49%	-	-
3	High risk	Investigation and changes may be needed soon	50-69%	49	61.25
4	Very high risk	Investigation and changes needed immediately	>70%	31	38.75

Analysis of weaving operation using QEC gives exposure score to specific body parts including the back, shoulder/ arm, wrist / hand, and neck. The percentage of total QEC score for weaving operation of each individual was calculated. Data presented in table 6 shows that out of total weavers 61.25 percent were in 50-69percent range which mean they are exposed to high risk so investigation and changes may be needed soon, whereas, 38.75 percent weavers who were above 70 percent QEC score were exposed to very high risk so for them investigation and change is needed immediately.

V. CONCLUSIONS

Throughout the beginning of time, people have known about Indian hand-woven cloths. Although though it employs the most people, the handloom industry is seen as a sunset one, and given the unrelenting march of mechanisation, modernization, and sophistication, there is a sense of inevitability. Even Nevertheless, there are many people who support handlooming for a variety of reasons, including ideology, philosophy, a genuine appreciation of handcrafted goods, and economic justifications. The government developed several laws and programmes to boost GDP, productivity, and output through this industry, but the human element of this industry received little consideration. Due to the nature of their employment, workers in this industry face several health risks. Long hours spent weaving on a handloom in a hunched-over position increase the chance of developing a musculoskeletal illness connected to the job over time. According to a study done by REBA and QEC, there is a high risk for 56.25 percent of weavers and a very high risk for 43.75 percent of weavers, respectively. So, their work station and working environment need to be examined and changed in order to increase output without placing the weavers in a physically demanding situation.

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