Academic and Law Serials
ISSN : 0973-2608
e-ISSSN : 2454-3608

KNOWLEDGE ASSESSMENT OF STUDENTS REGARDING SEWING MACHINE AND CLOTHING CONSTRUCTION

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International Journal of Family and Home Science, Vol.13 (3) (Sep.-Dec., 2017) (451-460)

Abstract

In ancient time, women hold a place of considerable respect and power. A woman is the embodiment of shakti, even more so in present times, as she is the binding force that keeps families and society together. Indian women are almost 50% of the Indian population and they directly as well as indirectly contribute to the economic parameters of the nation. Women, who now represent 48.2% of the population, are getting access to education, and then employment. From 5.4 million girls enrolled at the primary level in 1950-51 to 61.1 million girls in 2004-05. At the upper primary level, the enrolment increased from 0.5 million girls to 22.7 million girls. In this study knowledge were assessed of students regarding Sewing machine and clothing construction. Sewing is the craft of fastening or attaching objects using stitches made with a needle and thread. Sewing is one of the oldest of the textile arts, arising in the Paleolithic era. In this study data were collected from college going girl students of B.A. second year and B.A. third year (age group 18-24) of V.K.M. and Arya Mahila P.G. college of Varanasi district. There was multi stage sampling method. Selection of college was purposive sampling method. Total 237 respondents were selected for this study. Data were collected through self structured questionnaire. Result clearly shows that no significant difference is observed regarding knowledge about sewing machine between students of B.A. II year and III year, students of V.K.M. and Arya Mahila between students of urban and rural community as well as among different caste category in the present study.

Key words: Empowerment, Sewing and Stitching, Paleolithic era, Purposive sampling.

Introduction

In ancient time, women hold a place of considerable respect and power. A woman is the embodiment of shakti, even more so in present times, as she is the binding force that keeps families and society together. Empowering one woman may result in empowering an entire household including the health and wellbeing of the family. A self- reliant woman is more likely to ensure fewer children dropping out from schools ensuring a higher literacy rate and will contribute towards better income that may result in improved standard of living. Empowering women not only helps their families, but their communities and the country at large. . Women's development has always remained a central issue in the development process although there have been various shifts in women's development policy approaches. These shifts in development policies reflect the changes that took place in the overall development programmes of the developing world. Based on these shifts of women development Moser has classified women's development approaches into five categories. These are termed as "Welfare" to "Equity", to "Anti poverty" to "Efficiency" to "Empowerment". This is true to Indian context also. Indian women are almost 50% of the Indian population and they directly as well as indirectly contribute to the economic parameters of the nation. Generally it has been observed that females are more involved into small scale business activities as entrepreneurs but with time change has been noticed and they are moving towards IT/ITES, Apparel/accessories and Food & Beverages. 'Development' assumes a greater significance in the specific context of woman with the secondary position at all levels, in spite of her inherent strengths and capabilities. It signifies a state of evolvement, maturity completeness, improvement and positive change transiting to a desirable higher level of quality of life. Women's development can become a reality only when an environment is created which will influence her thinking and life style to evolve as an improved personality Women empowerment means that women should take part on an equal basis with men in economic, social, cultural and political decision-making at all levels and in all spheres of public and private life.

Women, who now represent 48.2% of the population, are getting access to education, and then employment. From 5.4 million girls enrolled at the primary level in 1950-51 to 61.1 million girls in 2004-05. At the upper primary level, the enrolment increased from 0.5 million girls to 22.7 million girls. In this study knowledge were assessed of students among sewing and stitching. Sewing is the craft of fastening or attaching objects using stitches made with a needle and thread. Sewing is one of the oldest of the textile arts, arising in the Paleolithic era. For thousands of years, all sewing was done by hand. The invention of the sewing machine in the 19th century and the rise of computerization in the 20th century led to mass production and export of sewn objects, but hand sewing is still practiced around the world. Fine hand sewing is a characteristic of high-quality tailoring. If we give formal or non formal education, communication technologies and its uses are more important to know everyone. Non formal education is an organized educational activity carried on outside the four walls of the institution. It is related to life and is environment oriented (Pillai, 1996). According to Veeranjaneyulu (2014) Observed that through this training program there about 151.6% gain in knowledge among the Apparel making & Embroidery Trainees. It is evident that in Apparel making & Embroidery Training given by KVK, Kampasagar every trainee is an earner. Ward and lee (2005) Concluded that the clothing laboratory was beneficial in helping students improve their clothing construction skills and should be included in their university program of study. Malleshwari (2014) Revealed that through apparel making and embroidery training programme that there was about 142.5 per cent gain in knowledge among the trainees.

Methodology

In this study data were collected from college going girl students of B.A. second year and B.A. third year (age group 18-24) of V.K.M. and Arya Mahila P. G. college of Varanasi district. There was multi stage sampling method. Selection of college was purposive sampling method. Total 237 respondents were selected for this study. Data were collected through self structured questionnaire.

Table 1: Distribution of Respondent's Knowledge about Sewing Machine

S.n.	Year of study	Knowledge about sewing machine					
		Yes		No		Total	
		No.	%	No.	%	No.	%
1.	B.A.2nd year	130	82.8	27	17.2	157	100.0
2.	B.A.3rd year	73	91.2	07	8.8	80	100.0
3.	Total	203	85.7	34	14.3	237	100.0
		$\chi 2 = 3.08, df = 1, P > 0.05$					
	College						
1.	V.K.M.	97	89.0	12	11.0	109	100.0
2.	Arya Mahila	106	82.8	22	17.2	128	100.0
		$\chi 2 = 1.83, df = 1, P > 0.05$					
	Caste						
1.	SC/ST	39	78.0	11	22.0	50	100.0
2.	OBC	118	87.4	17	12.6	135	100.0
3.	General	46	88.5	6	11.5	52	100.0
		$\chi 2 = 3.06, df = 2, P > 0.05$					
	Region						
1.	Urban	117	84.8	21	15.2	138	100.0
2.	Rural	86	86.9	13	13.1	99	100.0
		$\chi 2 = .21, df = 1, P > 0.05$					

Information about respondent's knowledge for sewing machine is collected and distributed in table 1 in relation to the independent variables like as year of study. College of study, religion and cost. It demonstrates that out of total selected students majority 85.7% had knowledge about sewing machine where as only 14.3% of student had no knowledge regarding it. Those students who had knowledge about sewing machine, majority 82.8% where from B.A. II year and 91.2% were of the B.A. III year. Although the student of B.A. III year had knowledge in more proportion than the student, of B.A. II year. But statistically, this difference in proportion is not significant.

Similarly 89.0% of respondents of V.K.M. as well as 82.8% students of Arya Mahila accepted to have knowledge about sewing machine. But difference is also not statistically not significant. It is also observed that 88.5% of students belong to general caste category, 87.4% of students

related to OBC while 78.0% of SC/ST students had knowledge about sewing machine but statistically, there is no significant difference in knowledge about among sewing machine students of different caste groups. Majority 86.9% of students belong to rural area and 84.8% of students belong to urban area had knowledge about sewing machine. Although rural students have knowledge about sewing machine in higher proportion than students of urban area but statistically, this difference is not found to be significant.

Table 2: Distribution of Respondent's Knowledge about availability of Sewing Machine in the Home on the basis of their, Caste and Region

S. No.	Caste	Availability of sewing machine					
		Yes		No		Total	
		No.	%	No.	%	No.	%
1.	SC/ST	28	56.0	22	44.0	50	100.0
2.	OBC	100	74.1	35	25.9	135	100.0
3.	General	36	69.2	16	30.8	52	100.0
	Total	164	69.2	73	13.8	237	100.0
		$\chi 2 = 13.48, df = 2, P < 0.001$					
	Region						
1.	Urban	99	71.7	39	28.3	139	100.0
2.	Rural	65	65.7	34	34.3	99	100.0
		$\chi 2 = 2.47, df = 1, P > 0.05$					

The table 2 shows the distribution of respondents on the basis availability of sewing machine in their family. In relation to caste and place of residence it depicts that majority 69.2% of students family had sewing machine while among 13.8% of student family the sewing was not available. It is noticed that out of OBC students, more than three fourth 75.6% student family and 73.1% of students family belong to general caste category had sewing machine where as availability of sewing machine among students family of SC/ST were found to be minimum 48.0% respectively. Statistical chi – square test shows that there is highly significance difference in proportion of student's family having sewing machine among various caste group. Majority 73.2% and 63.6% students belong to urban and rural community reported about availability of sewing machine in family but this difference is not statistically significant.

Table 3: Distribution of Respondent's Knowledge about use of Sewing Machine According to their Year, Caste and Availability of Sewing Machine

Sn.	Year of study	Use of sewing machine					
		Yes		No		Total	
		No.	%	No.	%	No.	%
1.	B.A.2nd year	101	64.3	56	35.7	157	100.0
2.	B.A.3rd year	63	78.8	17	21.2	80	100.0
3.	Total	164	69.2	73	30.8	237	100.0
		$\chi 2 = 5.17, df = 1, P < 0.05$					
	Caste						
1.	SC/ST	28	56.0	22	44.0	50	100.0
2.	OBC	100	74.1	35	25.9	135	100.0
3.	General	36	69.2	16	30.8	52	100.0
		$\chi 2 = 5.59, df = 2, P > 0.05$					
	Region						
1.	Urban	99	71.7	39	28.3	139	100.0
2.	Rural	65	65.7	34	34.3	99	100.0
		$\chi 2 = 1.01, df = 1, P > 0.05$					
	Availability of sewing machine						
1.	Yes	1.	Yes	1.	Yes	1.	Yes
2.	No	2.	No	2.	No	2.	No
		$\chi 2 = 39.09, df = 1, P > 0.001$					

It is observed from the table 3 that more than two third of students 69.2% were using sewing machine while remaining 30.8% did not use sewing machine at the time of survey period year of study wise distribution projects that 78.8% of B.A. III year students and 64.3% of B.A. II year students admitted to use sewing machine statistical chi-square test proves the fact that there is significance difference in proportion of B.A. II year and III year students regarding using of sewing machine. Caste wise status analysis reveals that out of total OBC students, majority 74.1% and out of general caste group students 69.2% were using sewing machine were as it was maximum 56.0% among SC/ST students. Although the proportion of OBC students were using sewing

machine in high proportion in comparison to the students of general and SC/ST caste category but statistically. This increase in proportion in proportion is not found to be significant. It is also noticed that majority 71.7% of urban students and 65.7% of rural students used sewing machine but statistically, this difference in proportion is not significant that is students belong to either urban community or rural community both are using sewing machine significantly in same proportion.

Table 4: Distribution of Respondent's Knowledge about use of Sewing Machine According to their Year, Caste and Availability of Sewing Machine

S.N.	Year of study	Taking stitching training					
		Yes		No		Total	
		No.	%	No.	%	No.	%
1.	B.A.2nd year	28	17.8	129	82.2	157	100.0
2.	B.A.3rd year	18	22.5	62	77.5	80	100.0
3.	Total	46	19.4	191	80.6	237	100.0
		$\chi 2 = .74, df = 1, P > 0.05$					
College							
1.	V.K.M.	20	18.3	89	81.7	109	100.0
2.	Arya Mahila	26	20.3	102	79.7	128	100.0
		$\chi 2 = .15, df = 1, P > 0.05$					
	Caste						
1.	SC/ST	10	20.0	40	80.0	50	100.0
2.	OBC	28	20.7	107	79.3	135	100.0
3.	General	08	15.4	44	84.6	52	100.0
		$\chi 2 = .70, df = 2, P > 0.05$					
Region							
1.	Urban	26	18.8	112	81.2	138	100.0
2.	Rural	20	20.2	79	79.8	99	100.0
		$\chi 2 = .07, df = 1, P > 0.05$					
Availability of sewing machine							
1.	Yes	39	23.8	125	76.2	164	100.0
2.	No	7	9.6	66	90.4	73	100.0
		$\chi 2 = 6.15, df = 1, P > 0.05$					

The table 4 determines the fact that only 19.4% of total selected students had taken stitching training were as remaining 18.6% had not taken any type of stitching training. Those students reported to take stitching training 22.5% where of B.A. III year students. Although the proportion of B.A. I year students is comparatively more than the students of B.A. II year students regarding taking stitching training but statistically is not significant. Similarly 20.3% students of Arya Mahila College and 18.3% of V.K.M. students admitted to adopt stitching training but this difference is not obtained to be statistically significant. Caste wise distribution elaborates that maximum 20.7% of OBC students followed by 20.0% of SC/ST students reported to take stitching training where as it was noted to be 15.4% among of general caste category. Statistically test shows that there is no significance difference in proportion of students belongs to different caste category regarding taking of stitching training. Out of total students belong to rural community out of which 20.2% reported to take stitching training while it was 18.8% among the students belong to urban community but statistically. This difference in proportion is not significant. It is also noticed that 23.8% of students admitted to participate in stitching training programme whose family had sewing machine but in which students family, the sewing machine was not present, only 9.6% got stitching training which is about one third of the above proportion. Statistical chi square test also signifies the fact that the proportion of the students is significantly higher than those who did not have sewing machine.

Table 5: Distribution of Respondent's Knowledge regarding Stitching of different Garments

S.No.	knowledge of stitch garments	Yes		No		Total	
		No.	%	No.	%	No.	%
1.	Frock	57	24.1	180	75.9	237	100.0
2.	Blouse	35	40.8	202	85.2	237	100.0
3.	Petticoat	98	41.4	139	58.6	237	100.0
4.	Kurta	45	19.0	192	81.0	237	100.0
5.	Salwar	47	19.8	190	80.2	237	100.0

In the table 5 respondents knowledge regarding stitching of different garment is assessed. The students had knowledge about stitching of more than one garments therefore information is gathered each garment separately. It depicts that majority 41.4% and 40.8% of students had knowledge about stitching of petticoat and blouse respectively. It is also observed that about one fourth of the students (24.1%) had knowledge about stitching of Kurta and salwar respectively.

Conclusion

It may be concluded that majority 86.0%of students have knowledge about sewing machine but no significant difference is observed regarding knowledge about sewing machine between students of B.A. II year and III year, students of V.K.M. and Arya Mahila between students of urban and rural community as well as among different caste category in the present study. Result clearly shows that majority of student's family were having sewing machine, out of which the proportion of SC/ST student's is found to be significantly lesser in comparison the OBC and general caste category but no significant difference is observed between students of rural and urban community in the present study. Out of total students in which family sewing machine are available, majority 81.77% were using sewing machine but in which family sewing was not present, among those only 41.1% were in position to use sewing machine in. It means availability of sewing machine in the family affects the utilization of it statistical chi square test also signifies the fact that there is highly significance difference in proportion of students. About using of sewing machine between availability and using of sewing machine in their family.

Only 19.4% of students have been taken stitching training in the study area. There is no significance association of year of study, college of study caste and region with taking of stitching training. Availability of sewing machine contributes the significant effect among on participation in stitching training programme among the students of study area. Result clearly projects that majority of students have knowledge about stitching of blouse and petticoat while minimum students reported to have knowledge about stitching of frock, salwar and Kurta. Therefore training for such purpose or needed in the present study. Similar types of findings have been reported by semathi (2005) zarapkar& zarapkar (1933) and verma (2015) in their studies.

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Received on 15.3.2017 and accepted on 22.3.2017

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UGC Approved Journal No. 49321 Impact Factor : 2.591 ISSN : 0976-6650

Shodh Drishti

An International Peer Reviewed Refereed Research Journal

Vol. 9, No. 3 Year - 9 February, 2018

Published by
SRIJAN SAMITI PUBLICATION
Varanasi

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UGC Approved Journal No. 49321 Impact Factor : 2.591
Shodh Drishti (An International Peer Reviewed Refereed Research Journal), Vol. 9, No. 3, February, 2018 ISSN : 0976-6650

Sustainability of "Lambani" Craft in the Era of Modernization

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Lambani Embroidery is a unique needle craft made specifically by the nomadic women of the Lambani tribe in and around the sandur region of Karnataka. This embroidery is basically linked to the rituals & rutes followed by the Lambani Community which they call as 'khilen' and 'toon'. The Lambanis have preserved their rich cultural heritage through their oral tradition expressed in proverbs, folk tales and songs. This unique embroidery style has been handed down from mother to daughter through many generations.

A method of using small bits of cloth material & attaching them to make up the whole garment was unique to the Lambanis which is called as 'Patch work'. The patchwork was intricate and beautifully executed. At each point, the patchwork ended in a series of tiny triangles along the seam made by folding the material. These were called 'Katta', which are basically fragrant flowers used for worship. Sometimes at the peak of the triangle, a stitch called as 'nakra' was embroidered. This embroidery is used on garments worn or used mostly by women such as for daily wear, for marriage, items for daily use, household items such as bedcovers, cushion-covers, bags, wall hangings etc.

Lambani embroidery, is a very distinctive style of embroidery hand done by the *lambani* women of north Karnataka. It is a fusion of cross stitch, pattern darning, mirror work and quilting stitches. The uniqueness of the *lambani* embroidery comes from the random, yet geometric designs and the bright colors that are typical to this tribe.

Lambani embroidery is usually combined with mirror work to produce the glitter and color that are integral parts of the Lambani costume. The cloths of the Lambanis reflect their love of life and evolved across the centuries to suit local climatic and social condition.

History of Lambani Community

Banjaras/Lambanis are innumerable nomadic tribes found in Andhra Pradesh, Bihar, Madhya Pradesh, Himachal Pradesh, Gujarat, Tamil Nadu, Karnataka, Odisa, and West Bengal wondering from one place to another and leading a life in its own terms and conditions. The Banjara tribes are believed to be descendants of the Roman gypsies of Europe who migrated through the rugged mountains of Afghanistan, to settle down in the deserts of

Rajasthan and many other states in India as they occupy most of the states in India. Their way of living is quite thrilling and full of adventures. They are known for their colorful costumes vibrant colors of cloths with lots of accessories. They are the enthusiastic tribe of India.

It is believed that Lambani do not have any official language, as they travel from place to place, they learn and add new words in to their vocabulary. They have their own political system which is known as Goar Panchayat. The lead of the Panchayat is known as Nayak (Headman), their political system follows Goar Boli (language of Gaur). Goddess Shakti and her various incarnations are being worshiped by the Lambanis. Their social get together consist of Rick folk Dance, which are generally known as teej, lengi, kikli, rain dances they are performed at the time of marriage. Lambani community which posses very rich culture have a major contribution in keeping the rich cultural craft alive through their costume, which could be considered as one of the most colorful and elaborate of any other tribal group found in India.

Lambani embroidery is practiced in Karnataka, and different parts of India including Punjab, Rajasthan, and Maharashtra. Some of the villages around Hampi, where this craft is being practiced are Kadirampur, Keri tanda, etc. Lambani embroidery has now reached all over the world with the export of bed sheet and cushion covers in subtle colors, but the heavily embroidered bags in flamboyant colors remain a favourite among tourists.

A Lambani woman's garments-

A Lambani women's costume is a compilation of bright colors & patterns in different shapes & sizes.

Lahanga- Traditionally, women wore a coarse cotton skirt called a lehenga. The lehenga was stitched with strips of vibrant colors making it a colorful vibrant attire. Patches of cloth called phool are appliqued on to the skirt & in turn interspersed with mirrors & beads. At the lower edge of the skirt, a narrow border called 'leavan' was attached. This was made of thin strips of colored cloths attached together &again decorated with beads &mirrors.

Choli- The blouse worn by the Lambani women is called as choli or "Kaalli". The blouse was short with a bore back tied together by two pairs of cords- one attached at the shoulder & the other at the waist. The array of beads & mirrors was repeated in the blouse. A distinct feature of the blouse was the use of large square mirrors stitched as a strip edged with metal bells & coins. This piece was called a taagli.

Special care was taken to decorate the area between the chest & the shoulders. It was embroidered with a variety of stitches to fill the gap between the mirrors & the beads & was called a Kadapa.

Odhni- The veil is called as odhni. This covered the head and its ends were tucked in to the skirt in front. The part of the odhni which covered the forehead, was attached with a border of large mirrors, beads, ghungroos and coins.

Garments of daily use-

Pulia and gala- The Lambani women had to walk a great distance from habitation to bring water for their requirements. They carried water in brass pots placed once above the other on the head. To support the weight of the water pots, a circular padded cloth covered with knotted rope was placed on the head. This was called a gala. At times, the rope was interwoven with

bits of colored material. Under the gala, a small square patch of embroidery called gaadi was placed. At the back of the head, a long rectangular piece was hung from the gala and extended below the shoulder. This was called pulia. The gaadi and pulia were seldom plain. The skill of the artisan women was displayed on them. The gaadi was always replete with embroidery; whereas, the pulia had a combination of beads and mirrors or embroidery. The outer edges of the plulia were lined with a series of shells. Zigzag lines of vele in varied hues filled the pulia.

Garments used during wedding ceremonies-

Sandiya and Singdi- The bullock was an important animal in the tribal life of lambanis. It was decorated for special occasions with its own garments such as sandiya and singdi. The sandiya was designed to fit on the forehead of the bullock. It was made of four rectangular pieces attached together by a large square mirror which formed the centre piece. A horizontal rectangular piece lies between the two horns from which hung two vertical pieces. The Sandiya was essentially embellished with shells and mirrors.

The singdi was a conical or cylindrical embroidered piece which was fitted on to the edge of the bullock's horns. Bunches of shells dangled from the fully embroidered singdi.

During wedding times, the bullock was adorned with sandiya and singdi and bride was made to sit on it, with a stick in her hand called as dandiya and sing a song of adiew before she departed from her maternal home.

Kalchi- This was an envelope- shaped quilted bag attached with a dori or chord/ string, to tie it up. Though its use was multifarious, it had two main purposes-one was to carry roti or bread, in it to the fields and secondly, a larger kalchi was made to contain the trousseau of a bride.

Tope- This is an elaborately worked square piece converted in to a bag by tying together the doris, which were attached to its 4 corners. A tope was carried by the bridegroom while going to the bride's house for the wedding. In it, were kept 5 bone bangles called balia to be worn by the bride between the elbow and the shoulder. Unmarried girls and widows do not wear bangles on the upper arm.

Geometric patterns of vele were closely stitched on the top. A shell phool was a series of shells arranged in a circle to form a flower. It was attached to the bottom of the tope and its doris were bunched together also with the phool.

Toperghaler Kotli- This is a bag used for nuptial ceremonies. The bride carried the auspicious coconut in it to the groom's house. It had a square base and short handle which were embroidered with kalchi pattern.

Sarafer Kotli- This is the groom's bag which was filled with tobacco, betelnuts and presented to the headman of the bride's village.

Kotli/paisaghaler kotli- This is a rectangular pouch which was tucked at the waist of the lehenga. The attached front which was tucked at the waist of the lehenga. The attached front which was visible had embroidered patch of mirrors with beads dangling from its ends. Having 2 compartment, it served the purpose of a money purse and a tobacco pouch.

Dantni- This is a rectangular pouch with opening at both the narrow ends. It was used to keep neem sticks which are traditionally used to clean teeth. A dantni filled with neem sticks was sent with the bride to the groom's house.

Tools and Raw Materials-

Fabric- Usually loosely woven dark blue or red handloom base fabric is used. The base cloth used is either cotton khadi or power loom fabric.

Dyes- Although most of the fabric is dyed using chemical colors, vegetables dyes made from kattha, ratanjot, chawal kudi, pomengranate, peel etc. are gaining popularity.

Thread- Embroidery is worked with different colored threads such as yellow, orange, white, maroon, blue and green that make work stand out on the base fabrics well as create a colorful textile. Woollen and linen threads are used create Banjara embroidery motifs on cloths.

Appliques- added to the embroidery are colorful pieces of appliqué, colorful tassels of different colors, shells, beads and other embellishments that enhance the vibrant appearance.

Mirror/ coins/sea shells- Accessories used for embroidery.

Needles- Needles are used to penetrate the material.

Making Process of Lambani Embroidery-

Lambanis use a variety of stitches to embroidery. The 14 types of stitches used in Lambani embroidery are kilan, vele, bakkya, maki, kans, teradora, kavdi, relo, gadri, bhuriya, pote, jollya, nakra. These include the running stitch, which often appears as small dashes, the running stitch lends itself to creating a variety of patterns on cloth. It is worked in parallel lines and a thread of contrasting color is intertwined between the stitches in a line to create a neat horizontal pattern. Similarly a thread may be intertwined between lines to form a criss- cross pattern.

Other than that there is chain stitch that is sometimes tightly and densely worked, almost covering the ground fabric, small loops that look like grains, satin stitch, herringbone stitch, and buttonhole stitch. The chain stitch may be worked in different directions such as zigzag to create patterns.

Designs/ Patterns used in Embroidery-

- The distinctiveness of the Lambani embroidery is the random designs and bright colors that is so traditional to this tribe.
- Usually all over patterns are created, which covers the base of the fabric.
- Sometimes, geometrical patterns like circles, rectangles, and squares are made which are heavily embroidered with colorful threads and decorated with embellishments like shells, coins, mirrors and beads etc.

- Patchwork or Applique technique is other form of technique used by them to create patterns. In these small pieces of cloth are cut in to triangles and stitched on to the base cloth, with sides being nearly turned in.These appliqué triangles specially feature as borders and create a charming pattern.
- Lambani embroidery also to a large extent comprises of the quilting technique which is done on the edge of the garment and is called “Katta”.

Lambani embroidery is usually combined with mirror work to produce glitter and color that are integral parts of the Lambani costume. The clothes of Lambanis reflect their love of life and evolved across the centuries to suit local climatic and social conditions.

The difference between Lambani and Kutchi Embroidery

Lambani embroidery is commonly mistaken as kutch (Kachhi) embroidery because of mirror work, but shells and coins are unique to this type of embroidery. Also the stitches used are different.

Role of Sandur Kushala Kala Kendra in promoting Lambani Embroidery-

Sandur kushala kala Kendra was promoted and sponsored by Shri M.Y. Ghorpade in 1984. It is a non- profit centre which works towards uplifting and introducing traditional crafts of village to national and international level. The institute also provides infrastructure to the artisan and help them sell their product by providing market support, consistency of quality, innovative designs and working with market expectations has been a key factor that has contributed to the success of the Sandur project indigenously.

At present the range of the products include-

- Embroidery and Mirror work.
- Cane and Bamboo products.
- Karnataka Kasuti.
- Stone sculptures and wood carvings.
- Cotton Khadi, spinning and weaving.

Sandur Kushala Kala Kendra employ both women and men. One of the most of popular handicraft work carried out at institute is mirror and embroidery work which is commonly done by women. Currently the institute has employed over 500 artisan, these artisan are also given the exposure to the latest trend and fashion through government training institution and Dastkar (A society for crafts and craftspeople) is a private not- for- profit NGO established in 1981, working to support traditional Indian craftspeople, many of them women and village based, with the objective of helping crafts people regain their place in the economic mainstream, in a country where the craft sector only to agriculture is providing employment.

Currently the institute funded by Sandur Manganese and Iron Ore Company to preserve the traditional craft of Lambani. Artisan are given Rs. 500 ration per month and they are also equipped with sewing machine.

Sandur Lambani Embroidery gets GI tag- "It is the 28th product in the state to gets the distinction"-

Karnataka's famous Sandur Lambani Embroidery has now found a place in the products with geographical indication (GI) tag in country.

With this registration, about 300 craftswomen of Lambani tribe located in and around Sandur in Bellary district will benefit from the GI tag as they can utilize this tag as a unique selling proposition in various marketing and advertising activities across the globe, with this no other organization or individual can sell the embroidery products under this name without registering them as authorized users.

The GI tag for the art comes with the join effort of the Sandur Kushala Kala Kendra, a non- governmental organization, and the Karnataka state Handicrafts Development Corporation which sells handicrafts products under the brand "Carvery".

The Sandur Lambani embroidery is unique with its combination of darning, cross stitch, mirror work, and because of the natural dyeing and printing done by Lambani craftswomen.

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Asian Journal of Agricultural Extension, Economics & Sociology

38(3): 27-32, 2020; Article no.AJAEES.55534
ISSN: 2320-7027

Diverse Role of Women for Natural Resource Management in India

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Authors' contributions

This work was carried out in collaboration between both authors. Author SS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SD managed the literature searches. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2020/v38i330320
Editor(s):
(1) Dr. Nguyen Khac Minh, Thang Long University, Vietnam.
Reviewers:
(1) Jicenta Nchangnwie Foncha, University of Applied Sciences, Pan African Institute For Development West Africa, Cameroon.
(2) Susetyo Darmanto, University of 17 Agustus 1945 Semarang, Indonesia.
(3) Mustafa Hakki Aydogdu, Harran University, Turkey.
Complete Peer review History: http://www.sdiarticle4.com/review-history/55534

Review Article

Received 24 January 2020
Accepted 31 March 2020
Published 09 April 2020

ABSTRACT

Natural resources are means to satisfy human wants which exist in natural environment and which are available without any type of human endeavour. The degradation of natural resources such as land, water, forest etc. may have an adverse impact on livelihood of rural people. The present review paper determines diverse roles of women for management of various natural resources in India. Vigorous participation of women in decisions and activities related to conservation and well-organized utilization of renewable and non-renewable natural resources is solution of this world wide issue i.e., natural resource degradation. Over exploitation and botched utilization of natural resources can be protected in India through involvement of women in policies and programs made for natural resource management. They will also serve as a treasure of indigenous information for conserving natural resources.

Keywords: Women empowerment; natural resource management; overexploitation.

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1. INTRODUCTION

Natural resources are means to satisfy human wants which exist in nature and which are available without any type of human endeavour. These natural resources are elementary for human life and have economic value also. Resources supplied by the nature such as land, water, forest, fisheries etc. have utmost significance for human survival and livelihood. The pressure on these natural resources is continuously increasing due to various factors such as rapid economic growth, over population, industrialization and climate change. Sufficient natural resource has an impact on the growth of any country if it is appropriately managed/ exploited.

Natural resources for population should be in sufficient amount for growth of any country. Due to uneven consumption and over population, it will be difficult to fulfil demand of future generation with the available natural resources. The untenable and irregular consumption levels had resulted in a progressively strained environment and there is challenge of protecting degradation of natural resources to meet continuously increasing demands [1]. India is known for its bio diversity and jewels of distinct natural sources and it has four identified bio-hotspots, viz. the Himalaya hotspot, the North East of India, the rainforests of the Western Ghats and the Andaman & Nicobar Island chain [2]. In spite of that, country is facing various issues related to natural resources such as water scarcity, degradation of soil and deforestation.

Natural Resource Management (NRM) refers to the viable exploitation of major natural resources, such as land, water, air, minerals, forests, fisheries and wild flora and fauna. It has been seen since centuries that women have greater role in managing natural resources as they exploit these resources for fulfilling their family needs [3]. Participation of women and their knowledge enhancement regarding sustainable natural resource utilization and management can be only way to resolve the issues related to natural resource degradation. There is an urgent need to modify policies and programmes in this direction.

2. MAIN CONCERNS IN NATURAL RESOURCES MANAGEMENT

A major portion of population in India lives in rural environment and depends on natural resources for their livelihood such as farmers, fishermen and agricultural wage workers (more than 1.3 billion people). They rely on the availability of cultivable soil, water and livestock for their source of revenue [4].

Degradation of these natural resources may have an adverse impact on livelihood of rural people. Climate change, improper management of natural resources, increasing demand and scarcity are the major causes of natural resource deprivation. Other than that gender issues are essential to address for proper management and conservation of natural resources, in particular-

i. Lack of knowledge and awareness of managing resources amongst women
ii. Gender differences regarding rights and access to natural resources
iii. Gender differences in decision making
iv. Gender differences regarding use of technologies

Women are mainly responsible for collecting food, fuel and water while men have their control over land use, agriculture, irrigation, fisheries etc. Besides, in most of the communities women have lesser rights than men. Men use natural resources for commercial purpose while women play role in managing natural resources for households. Gender equality in policy decision making for natural resource management will widen the scope for better and sustainable use of natural resources. Role of women in managing and conserving natural resources is very significant. This paper will review the roles of women in managing various natural resources.

3. WOMEN AND WATER RESOURCE MANAGEMENT

Water management has been a matter of concern in India and poor management of water led to water scarcity. Ground water level is decreasing at an alarming rate in many parts of the country. Government policies and institutional framework is unable to deal with the current problem. Following table shows the per capita annual water availability. A per capita availability of less than 1700 cubic meters (m^3) is termed as a water-stressed condition while per capita availability below 1000 m^3 is termed as a water scarcity condition. It can be seen in the table that projected water availability till the year 2050 is scarce. While currently it is under stressed condition. Hence, it is indispensable to save

Table 1. Per capita water availability

Year	Population (Million)	Per capita average annual availability (m3/year)
2001	1029 (2001 census))	1816
2011	1210 (2011 census	1545
2025	1394 (Projected)	1340
2050	1640 (Projected)	1140

Source: Water in India - situation and prospects [5]

water otherwise water scarcity will be immense to cope up with.

Role of women is exemplary in this direction. A research was conducted based on participatory approach in 10 villages situated in the arid region of Vidarbha in the state of Maharashtra, India which had a persistent problem of adequate and safe drinking water. The street plays and protests organized by the women and their consistent efforts for creating awareness about water management, sufficient safe drinking water was available in seven villages during the summer months of 1997. Women of these villages also initiated programmes for social forestry and rain water harvesting to protect the environment [6].

Women play crucial role in utilizing and conserving natural resources such as forests, water, land and wildlife in Himalayas to fulfil basic needs for their families [7]. The close association between women and natural resources was found in rural context especially among women of rural areas. Women performed social and economic role over many generations to acquire food, water, fuel, fodder and income from surroundings resource base [8].

The extent and nature of the involvement of women in participatory institutions in eastern India showed that their inclusion was very low and the concerns of women are usually not being taken into account. Women were taking decisions related to agriculture and water jointly with men. Research was further indicating the fact that if women participate formally in water user associations, it would expand their awareness and contribution for water management [9].

It has been concluded in another study that policies and reform should be formulated to increase women's participation in water management which would benefit ultimately to the society and conservation of resources because women are primary users of water [10].

Women's role is important for the success of water projects through changing the negative social traditions to protect effective participation of women, raising their self-confidence and improving their participation and volunteering [11].

Considering the findings of these studies, it can be inferred that women participation is must for water management. They should take active participation in decision making for sustainable use of water and formulation of water management projects at community level.

4. WOMEN AND FOREST MANAGEMENT

About one billion population (with more than 68 million tribal) of India are partially or wholly dependent on forest resources for their livelihoods that cover almost one fifth of the national land area of India [12].

Women in hilly areas of India perform various day to day activities which are related to forestry. They collect fuel, fodder and herbs from the woods. Forests have been called as mother's home for women who are living in hilly counties of Himalaya [7]. Women's engrossment in forest management schemes is utmost important. Men were mostly engaged in planting, maintaining and harvesting trees for commercial purposes, while women mainly used to take care of products for subsistence use, such as food, medicines, fuelwood, fodder, and those for soil fertility improvement [4].

Women were more aware about joint forest management programme in areas of Chattisgarh with good forest cover. It was revealed in the research that more than 70 percent women were aware about the forest management programmes while hundred per cent women were dependent on forest for collection of fuel, fodder and other forest products [3].

So, women can be ambassador of forest management and proper utilization of forest resources, if their knowledge and services are used properly. They should have key role in making strategies for forest management and resource conservation.

5. WOMEN AND AGRICULTURAL LAND RESOURCE MANAGEMENT

About two-third of Indian population depends on agriculture for their livelihood. Hence, land can be categorized as one of the most important natural resource for human survival along with water. According to International Labour Organization (2019), almost fifty six per cent women are employed in agriculture. Hence, women have an obligatory role for agricultural land management [12].

It is evident from researches that women are major workforce in agriculture; still they are lagging behind land owing rights, crucial decision making and marketing of agricultural produce. It was indicated in a study that women's involvement was more than 90 per cent in most of the agricultural operations but they were not involved in decision making as well as lacking technical guidance [13]. Mostly agricultural extension and information on new technologies are designed exclusively for men, even when women are increasingly responsible for farm work [14]. As a result, women are not aware about new technologies and developments in agriculture such as improved dry land farming techniques and new varieties suitable for unfavourable soil and moisture conditions [15]. This is the need of hour to strengthen the capabilities of rural women in agriculture production through their active participation agriculture related decision making and technical training programmes.

Indigenous knowledge also has an overwhelming effect on appropriate land resource management. There is a need to explore indigenous knowledge base of women for land management [16].

6. WOMEN AND FISHERIES

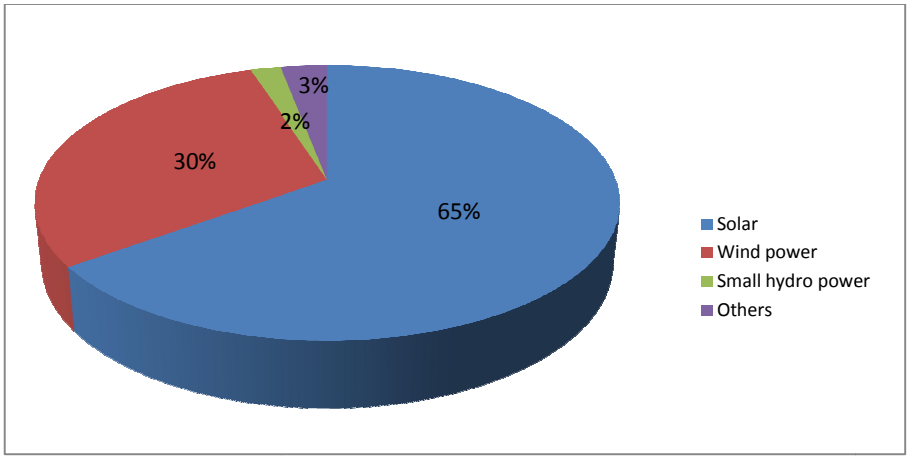
There are 5.4 million people fully engaged in fisheries activities, and in this population, 3.8 million are fishermen and 1.6 million are fisherwomen. However, there is a significant difference between the incomes earned by them as the former one gets high income as compared to their counterpart [17].

Mainly women are involved in the activities before and after fishing. Their role is more prominent in marketing of fish. There is a need of gender equality in fisheries sector.

7. WOMEN AND RENEWABLE ENERGY SECTOR

India has huge potential for renewable energy. Use of renewable energy sources has become only alternative to save depleting non-renewable natural sources. Renewable energy is a dynamic sector with ample of opportunities such as reducing adverse health effects of conventional energy sources, meeting increasing energy demands, employment generation and livelihood security. Following graph shows various renewable energy sources-

Employment generation in renewable energy has reached 10.3 million in 2017 and expected to reach many folds till 2050. Gender equality is an important concern in growing renewable energy sector in India. Women are major user of renewable energy at household level and



Graph 1. Estimated potential of renewable energy sources in India

renewable energy sources improve their quality of life. Their drudgery at household and farm level can be reduced by using solar, wind and other renewable energy equipment. Other than that, women also play role as producers and managers in renewable energy sector [18]. Keeping in mind women's role as primary energy consumers, their preferences should be given priority and they should be part of planning and implementing policies related to renewable energy policies.

8. WOMEN'S INVOLVEMENT: AN APPROACH FOR ECOLOGICAL NATURAL RESOURCE MANAGE-MENT

Vigorous participation of women in decisions and activities related to conservation and well-organized utilization of renewable and non-renewable natural resources is solution of this world wide issue. Following approaches are needed in this regard-

- Gender equality should be maintained in every sphere of natural resource management such as programme planning, implementing, policy making and in work force.
- Conducting training programmes for creating awareness and skill development especially for women related to technical and non-technical aspects will be a way forward towards sustainable natural resource management.
- Efforts should be made to explore livelihood opportunities for women in untouched areas such as finances and marketing.
- Role of women in natural resource conservation and management should be well recognized and they should be projected as representatives of social and economic development through their active involvement in natural resource management and other related employment.

9. CONCLUSION

Women are closely related to utilization and management of natural resources. They are active in getting water, food, energy for meeting their family demands. Their workforce in various sectors is regularly increasing such as agriculture, livestock and fisheries also. Despite this, women remain largely excluded from owning land, benefiting from resource wealth or participating in decision-making about resource management. This exclusion of women is worsening the condition of natural resources. Over exploitation and botched utilization of natural resources can be protected in India through involvement of women in policies and programs made for natural resource management. They will also serve as a treasure of indigenous information for conserving these resources.

10. RECOMMENDATION

- Women should be trained in sustainable management of water and they should be imparted knowledge about methods of conserving and reutilizing water.
- Women might be game changer to protect land degradation if their involvement and awareness regarding land management will be increased.
- Advanced technologies should be easily accessible to women and equipment should be designed keeping in mind women's requirement.
- Women should be trained to conserve and manage forest resources. Promotion of agro forestry, farm forestry, eco-restoration etc. is one of the alternatives to preserve resources and guard forest deprivation.
- Modern technologies should be accessible to women and they should also be trained. Women may also bear noteworthy responsibility in fisheries management and administration.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/55534

Textile Trends

63RD YEAR OF PUBLICATION, NO. 05 AUGUST 24, 2020, ISSN 0040 - 5205, Rs. 35/-

DEVELOPMENT OF WOMEN ENTREPRENEURS IN INDIAN TEXTILE INDUSTRY

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Abstract

Women entrepreneurs may be defined as a "woman or a group of women who initiate, organize and run a business enterprise ".

"Male entrepreneurs are motivated by the potential to earn lots of money, while women start their own companies because they seek greater control over their personal and professional lives". (Connie Glaser)

Women in business are not a recent phenomenon in India, small business and tiny cottage industries are the business where they have confided themselves with the growing sensitivity in the society. Today women entrepreneurs represent a group of women who have broken away from the beaten track and are exploring new avenues of economic participation.

Textile sector of India is one of the largest and is as old as world textile industry. The Indian technical textile industry offers vast opportunities for small and medium enterprises which plays an important role in growth. Textile industry in India is also the only industry that has employed women since a very long time. In India, from beginning garment manufacturing has always been one of the most women oriented sectors. But over the decades, women have been replaced by men in the mills and the reduction in women employment in textile sector has been quite abrupt.

Even after so many opportunities and option available for Indian women for their entrepreneurial ventures there are various constraints such as: lack of confidence, socio-cultural background, lack of awareness about financial assistance that stop women in India from becoming successful entrepreneurs. There is a need to explore & identify the talents of young women for various types of industries in order to increase the productivity in the industrial sector.

In this paper development of women entrepreneur in Indian textile industry and the problem of women entrepreneur were discussed.

Keyword : women entrepreneur, textile industry etc.

Introduction

Entrepreneurs are the people who have the courage to take the risks and make important engagements to get a new or an existing business going, where as a woman entrepreneur is someone who is willing to pass all the hurdles of economic uncertainty and society to create something new. Entrepreneurship is a global phenomenon that has been on boost since a quite a long time. Economic development of any country is not complete only by its physical resources but also by the proper advancement and application of its human resources as well. [Sherly Thomas (2011)]

Since entrepreneurship is simulates as gender-neutral and its definition has never been based on a particular gender, therefore it can be extended to females without any restrictions. Entry of women in an organized business or women starting a new business is quite a new phenomenon. In past, women were considered inappropriate for entrepreneurship because there was a general feeling that women lack confidence and organizational skills for starting a new venture. [Dr. Kumar Prabhakar (2012)] By entering into various professions and industries, women have proved themselves capable enough and to be on par to their men counterparts in businesses by breaking the constraints within the four walls of their houses. [G. Palaniappan, C. S. Ramanigopal, A. Mani (2012)]

For a country like India, its quite important to promote entrepreneurship and self-employment, since India is troubled by the twin problems; one of increasing unemployment and the other of growing population. [Dr. Chandrashekhar (2012)] The approach of women entrepreneurship in India is a recent sensation. For instance, according to Forbes (2012) "India is a great place for women entrepreneurs, business polling and for studies. "According to the study commissioned by Dell, it was found that the ideal country for a woman starting a business in 2012 could well be India" [IBNLive (2012)]. In order to put their talents and capabilities to maximum use, women entrepreneurs should stay aware about the opportunities and chances available to them. In India, changing economic situations like liberalization and globalization have given women opportunities to become professional and take up jobs in order to secure a downright source of income. Even though women have played an important and distinctive role in Indian society but still their entrepreneurial

skills have not been given enough consideration because of the lack of education, societal pressure, low status in society and mainly because of old traditional values. [Meenu Goyal, Jai Prakash (2011)]

Well established and wise firms try to put focus on 2 major problems for professional women in emerging economies; first, taking care of their aging parents and commuting. Many major companies make it flexible for their women employees to work from home. Ernst and Young, organizes family days in an attempt to show the parents what their daughters have achieved and also offer medical cover for parents. Many big companies in India, the UAE and Brazil provide services like late-night shuttle buses; female-only taxi companies etc. for their female staff members in order to avoid any inconveniences for them. [The Economist (2011)] In a nutshell, it is essential to broaden the role of women which is not only limited to her household responsibility. There are many areas which are unexplored where women can prove to be successful entrepreneurs.

Textile Industry in India and scope for Women Entrepreneurs in the industry

Textile sector of India is one of the largest and is as old as world textile industry. The Indian technical textile industry offers vast opportunities for small and medium enterprises which plays an important role in Indian economy in terms of development, employment and growth. Small scale sector has enormous opportunities since it requires less capital, adding more to its benefits are factors like government support, reservation for exclusive manufacture by small scale sector & exclusive purchase by the government, finance & subsidies, raw material & machinery procurement, manpower training, export promotion etc. [Uma Ramaswamy and SarathDavala (1992)] Textile industry in India is also the only industry that has employed women since a very long time. Women have also enjoyed the benefits like sickness benefits, security of employment, bonus, etc. while working in this industry. The gender gap in wages in manufacturing industry is one of the main reasons of the contrasting distribution of men and women workers of various branches. Moreover, in India, from beginning garment manufacturing has always been one of the most women oriented sectors. But over the decades, women have been replaced by men in the mills and the reduction in women employment in textile sector has been quite abrupt. [Sherly Thomas (2011)]

Government schemes for motivating Women Entrepreneurs

Scheme	Beneficiary	Amount	Requirement of security	Bank provide the Loan
Annapurna scheme	Food catering business	Up to 50,000	Guarantor is required	State bank of India
Stree shakti package for women Entrepre-neurs	Women who have majority ownership in a small business -Have to be enrolled in the EDP	More than 5 lakh	No security is required up to 5 lakh	SBI- run scheme
Cant kalyani scheme	Agriculture, cottage industry, small medium enterprises, government sponsored and retail trade	Up to 1 Crore	No security is required	Central bank of India
Mudra Yojana Scheme	General scheme for all who runs small units	Up to 50 lakh	No guarantors are required for loans below 10 lakh	Any Nationalised bank
Mahila Udyam Nidhi Scheme	Women who start new small scale venture	Up to 10 lakh	—	By PNB and SIDBI
Dena Shakti Scheme	In agriculture, manufac-turing, micro-credit, retail stores, & small enterprises	Up to 20 lakh	Up to 50,000 are offered under the microcredit category	
Orient Mahila Vikas Yojana Scheme	Women who hold a 51% share capital individually or jointly in a proprietary	More than 25 lakh	No security is required for loans between 10-25 lakh	Oriental bank of Commerce

DEVELOPMENT OF WOMEN ENTREPRENEURS IN INDIAN TEXTILE INDUSTRY

Bhartiya Mahila Bank Business Loan	For meeting working capital requirement, business expension, or manufacturing enterprises	Up to 20 Crore	—	Bhartiya Mahila Bank which was later merged with SBI in 2017

Even after so many opportunities and options available for Indian women for their entrepreneurial ventures, there are various constraints such as; lack of confidence, motivational factors, market oriented risks, socio-cultural backgrounds, lack of awareness about financial assistance, administration knowledge & experience and lack of knowledge about available resources that stop women in India from becoming successful entrepreneurs. There is a need for encouragement for educated, technically sound and professionally qualified women to manage their own business, rather than depending on wage employment outlets. There is also a need to explore & identify the talents of young women for various types of industries in order to increase the productivity in the industrial sector. There is also a longing for a desirable environment for woman entrepreneurs in India to develop their entrepreneurial values and encourage them to involve more in business dealings. [Asghar Afshar Jahanshahi, Prof. Dr. BairagiKachardas Pitamber, Khaled Nawaser (2010)]

The Indian Ministry of Textiles has launched special schemes to empower the women engaged in the textile industry (handloom, handicrafts, silk, and power loom sectors).

The schemes were formulated on the occasion of International Women's Day.

Ministry of Textiles conducts special marketing events for women artisans on International Women's Day.

There are about 43.31 lakh handloom weavers and allied workers (third handloom census 2009-10) in the country of which 77 percent are women.

- The four schemes launched for the handloom workers are: National Handloom Development Programme, Handloom Weavers' Comprehensive Welfare Scheme, Yarn Supply Scheme and Comprehensive Handloom Cluster Development Scheme.
- 100 percent subsidy is provided to Scheduled Caste (SC), Scheduled Tribe (ST) and Below Poverty Line (BPL) women for construction of worksheds under National Handloom Development Programme.
- SC, ST and BPL women weavers are provided 75 percent subsidy for enrolment under Indira Gandhi National Open University (IGNOU) and National Institute of Open Schooling (NIOS).

In the Handicrafts sector, there are around 7 million artisans, of which 56.07 percent are women.

- The schemes in this sector include 75 percent subsidized fee for women in SC, ST and BPL categories in NIOS and IGNOU.
- A provision of financial support to artisans in impoverished circumstances for awardee crafts persons below 60 years of age is also there.

In the silk sector, the Ministry estimates that the number of women employers is expected to increase from 43.20 lakh to 55 lakh in 2020.

- In order to reduce the toil of the women tasar silk reelers, the Ministry is supplying 4956 Buniyaad Reeling Machines by March 2019 and 10,000 machines by 2020.
- The Textiles Ministry is implementing 32 projects under its North East Region Textile Promotion Scheme (NERTPS) for the silk industry workers in northeast India to create livelihood opportunities.

This scheme is estimated to be benefitting 45,000 women beneficiaries in the silk industry of India.

- Under the Powerloom sector, 'Stand-up India' scheme is launched wherein women entrepreneurs belonging to SC, ST and BPL categories are given financial assistance of 25 percent margin money of maximum Rs. 25 lakh on the machinery cost.
- Under this scheme, the borrower has to bear 10 percent of the project cost and allows reimbursement of credit guarantee fee up to 1 percent of the loan amount.
- In order to bridge the skill gap in the textile sector, the Ministry launched Integrated Skill Development Scheme (ISDS) under which 6,41,983 women were trained since 2014-15 to 2018-19. Moreover, as many as 6,17,915 women were assessed of which 5,32,600 women were placed in the respective sectors.

There has been an addition to the number of women entrepreneurship in more developed countries and it has been growing in less developed economies as well as an apparatus for women to survive, help and support their families [Gordon (2000). Initially, the Mumbai city of India was considered to be "Manchester of East" but now due to growing urbanization there, it is becoming more of a land market. Textile industry slowly has been now pushed to other states of India, specially Gujarat and Madras which are now attracting world textile buyers. Even though India is showing a good growth of women entrepreneurs in terms of other industries but when compared with other developing countries, women entrepreneurship in India does not seems to grow in terms of textile industry. [M.Gurusamy; P.Umamaheswari; DR.N.Rajasekar (2012)]

From psychological, educational and business point of view, the development of women entrepreneur in small scale textile manufacturing industries is still at early stage. Female participation in the textile industry in Surat (Gujarat, India) has not reached an impressive amount due to lack of proper education and support. Successful women entrepreneurs are not very readily seen in the textile industry because of absence of basic understanding of the industry which is influenced by proper channeling of information and support.

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Spinning mill to move to inventory pile-up : ICRA

The cotton spinning sector is in for a tough year ahead with an expected 25-30 per cent fall in revenue and 3-4 per cent drop in operating margins this fiscal amid Covid-induced disruptions in manufacturing activities.

This apart, weak demand in downstream segments such as fabrics and apparels will ake a further toll on the sector. The disturbing rend in the sector follows an estimated 5-7 per ent slide in revenue and 2.50 per cent dip in perating margins last fiscal.

As per an ICRA note, the business outlook pears adverse due to an inventory pile- across the value chain, which is likely to p demand from the downstream segments

Senior Vice-President, ICRA Ratings, said the trend has been weak in the domestic market, where consumer discretionary spending and consumer footfalls in markets remain abysmal.

A month after the natianal lockdown was lifted, spinning mills' operations have not yet fully ramped up. This is despite the fact that several companies outside the containment zones had already commenced operations in April and May. Capacity utilisation for most players across the sector was at 30-40 per cent in the June quarter.

In contrast, better demand for cotton yarn in the international markets, with competitive

Vol.33, No. 2 July 2021 ISSN 0970 2733 IHMSF-33 (1-258)2021

The Indian Journal of HOME SCIENCE

An Official Publication of

THE HOME SCIENCE ASSOCIATION OF INDIA

CARE Listed, Peer Reviewed

Published by

THE HOME SCIENCE ASSOCIATION OF INDIA

The Indian Journal of

HOME SCIENCE

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Vol.33, No. 2 July 2021 ISSN 0970 2733 IHMSF-33 (1-258)2021

CARE Listed, Peer Reviewed

Published by

THE HOME SCIENCE ASSOCIATION OF INDIA

Website: www.homescienceassociationofindia.com

THE INDIAN JOURNAL OF HOME SCIENCE

An official publication of THE HOME SCIENCE ASSOCIATION OF INDIA

CARE Listed, Peer Reviewed

Vol. 33 **No.2** **July, 2021**

The Indian Journal of Home Science 2021: 33(2)

INFLUENCE OF ORGANIC COTTON/ SILK FIBRE BLENDING ON THE PHYSICAL PROPERTIES OF THE YARN

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ABSTRACT

Cotton and silk both are natural fibers. Both the fibers have different characteristics. Nowadays organic fiber is in focus in relevance with nature. In the present study organic cotton and silk waste fibers have been taken for blending and developing the yarn. Silk has maximum properties but because of high price customers can't afford the pure silk fabric. In the present study it was tried to develop the yarn or fabric with minimum cost and maximum environmental value. To achieve the objective ,5 samples of blended yarns (100% silk waste, 100% organic cotton, 67/33% silk waste+ organic cotton, 33/67% silk waste+ organic cotton, 50/50% silk waste +organic cotton) were prepared under the identical processing condition as blending, carding, drawing, roving, and last spinning and subsequently blended yarns were developed. Physical properties such as single yarn strength, lea strength, breaking force, elongation, twist per inch, hairiness properties of the developed yarns have been analyzed and compared with each other. The results reflect that the blend ratio of 67/33% silk waste and organic cotton yarns showed good result in maximum properties respectively. By blending of these fibers cost effective fabric can be developed and customers can wear the clothes with maximum characteristics and adorable appearance with an effective cost.

Key words: Blending, Organic Cotton, Physical properties, Silk waste

INTRODUCTION

During the early days of existence people were dependent upon animal skins and furs to keep them warm. But as the years passed, human's susceptibilities became more tender. By the time, man found that the long thin fibres produced by plants and animals could be twisted together to form a thread. These threads could then be interlaced to provide a flexible, warm and more comfortable material. He had never known before that natural fibre, any hair like raw material directly obtainable from an animal, vegetable, or mineral source were convertible in to nonwoven fabrics such as felt or paper or, after spinning in to yarns, in to woven cloth.

Nowadays demand of environment friendly and hygienic product is increasing and natural fibre is expected to be the potential contender to consume the majority of the market share. Natural fibre-based textiles are constantly increasing their acceptance among global consumers due to growing awareness towards sustainability. However, global production of textile grade natural fibre is limited and preferential use of these fibres in respective applications can lead to equilibrium between demand and supply. Kilinc et al., (2017) have stated that natural fibers are used for hundreds of years in clothing and sheltering. Excess use of synthetic fiber has reduced the importance of natural fibers towards the end of the 1990s.

But the increasing environmental concerns and depletion of petroleum resources have increased the importance of natural fiber once again. Natural fibers have many mechanical and physical properties and these properties of natural fibers can be used as natural fiber reinforced composite products in various industries such as automotive, building, and furniture.

Blending is the process of combining fibres of different origins, length, thickness, or colour to make yarn. Blending is accomplished before spinning and is performed to impart such desirable characteristics as strength or durability, to reduce cost by combining expensive fibres with less costly types, or to achieve special colour or texture effects.

Few studies on blending of natural fibre with other natural or synthetic fibres have been reported earlier. Saika, S., stated in the paper entitled "A study on blending of regenerated Bamboo with Silk" (2016) that nowadays demand for fabric is not only related with style & durability but it requires hygiene and many other properties as well. It has been observed in the paper that all the blend proportion of bamboo & silk showed better performance required for clothing materials. Organic cotton is grown using methods and materials that have a low impact on the environment. It leaves the soil, air and water free from contaminates that cause the harm. It produces around 46% less CO2e as compared to conventional cotton whereas Silk is an animal fibre. It is based on one insect- the silkworm- as a handy material with which they build their webs, cocoons, and climbing ropes. This insect spins the silk and wraps the fibre round itself in the form of a cocoon in which it can settle down in comfort. Although the silkworm spins its cocoon from a continuous filament of silk, it is fortunate if half of the available silk filament can be used. The rest of the silk is unsuitable for reeling, and it is known as 'Waste Silk'. Waste silk consists of the silk brushed from the outside of the cocoon during reeling, the useless inner portions of the cocoon, broken filaments from damaged cocoons such as those from which the moth has been allowed to emerge, and waste material from the reeling and throwing generally.

Justification of the Study-

Nowadays the desire of the consumer is to buy an eco- friendly product. In the study natural fibres has been used to fulfil the eco-friendly purpose of the product. Also, through the blending of different types of fibres fabric cost can be reduced and the properties of the prepared fabric can be enhanced as well.

OBJECTIVES

- To blend the organic cotton and silk waste fibre
- To develop the yarn by spinning method
- To analyse the physical properties of the prepared yarn

MATERIAL AND METHODS

The research work was based on experimental Research Method. Experimental research is any research conducted with a scientific approach where a set of variables are being measured as the subject of experiment. The main aim of the present research work was to prepare a yarn by the blending of

different fibers and to determine the mechanical and physical properties of the yarn. Two fibers silk waste and organic cotton were taken for the present study.

Materials:

Mulberry silk waste was procured from Silk Trader, Mahalaxmi Traders, Bangalore and the other fiber was organic cotton, which was collected from Chandra Mauli Fiber, Vijayawada, Andhra Pradesh, India. The properties of the fibers were tested in the lab. Properties of both the fibers are shown in the following table:

Table 1. Physical properties of the fibers used in the study

Sr.No.	Test Parameter	Test Method	Test Results	
			Organic Cotton	Silk Waste
1-	Strength	IS 3675	18.59	24.34
2	Elongation	IS 3675	5.20	8.06
3	Moisture Content	IS 199:1989 (RA 2010) Hot Air Method	5.55	3.59

Methods-

1 Blending of Organic Cotton and Silk Waste Fibers:

There is a difficulty in directly blending different fibers in a machine due to variation in fiber characteristics such as length, fineness, elongation etc. To avoid these variations both the fibers were blended by hand. After hand blending fiber lubricant was sprayed over the hand blended fiber and left for 24 hours so that electrical charges in the fiber would not be created. After 24 hours hand blended fiber was passed through the blow room machine. Air was blowing in the machine. With the help of air, fibers were mixed with each other equally. The equally blended fibers came out of the machine in the form of lap that was rolled on the iron rod as shown in the picture.

Figure 1. Blending (lap formation)

Figure 2. Blended Fiber rolled on the rod

2 Development of Yarn:

2.1. Carding:

Prepared lap was passed through the carding machine. After carding of the blended fibers, the fibers mixed equally and became more uniform and straighter and came out as a thick sliver as shown in fig.3.

Figure 3. Carding (thick sliver)

2.2. Drawing:

The thick sliver was then passed through the drawing machine. In drawing machine sliver was passed through the two processes- first was breaker and second was finisher. First slivers were through breaker process in which thick slivers became thin and became more uniform. After that thin sliver were passed through finisher process. By this process thin sliver became more uniform and thinner and very little twist was given to them in this process. In drawing frame there were total 8 dumbles to make the sliver more uniform. In this experiment 6 dumbles were used for making the slivers more uniform.

Figure 4. Drawing Process

2.3. Roving or Speed Frame:

The sliver came from draw frame subsequently gone through roving machine or speed frame machine (brand name of machine). In this process slivers were drawn by using drafting and twisting. Drafting is a process of stretching and twisting the sliver. After roving process sliver become thinner. It looked like a thick yarn.

Figure 5. Roving Process

2.4. Spinning or Ring Frame:

Roving slivers had then undergone through spinning set up (ring frame machine- brand name). During that process again drafting process had been done and slivers were run through in process and produced the final yarn.

Figure 6. Spinning Process

2.5. Physical Analysis of the Developed Yarn:

Physical testing of the prepared yarn was done and analyzed their physical characteristics and also tried to forward that all the present properties were able to develop the unique fabric.

2.6 Methods of Characterization of Fiber and Yarn Properties:

Yarn Count (Ne), Lea Strength (lbs), CSP (IS 1671-1991) and breaking force (gF), RKM (gm/tex), CV% of RKM (IS 1670-1991) of all five types of developed yarn were measured in Lea Strength Fester-KMI and Uster Tensorapid-4 Switzerland UTM-350; SDL, UK for comparative study. For Yarn Count total 80 rounds have been taken in one sample and total 3 samples have been taken for evaluation. For RKM evaluation average 20 readings have been taken. Elongation, CV% of elongation (IS 1670-1991) and twist per inch, CV$% and twist direction (IS 832: Part 2-2011) of the prepared samples were analyzed in Uster Tensorapid-4 Switzerland UTM-350; SDL, UK and twist test was carried out in Electronic Twist Tester-Statex for their evaluation. Uster U%, CVM%, CVb% and imperfection (ISO 16549:2004) in the yarn like thin and thick places, neps and hairiness index (ASTM D 5647:2007) of the yarn has been analyzed. For observation UT-S SA 400 zellweger Uster, Switzerland machine was used. All the properties of the 5 developed yarns have been tested so that the future developed fabric properties would be according to the study and provide comfort to the ultimate consumer.

RESULT AND DISCUSSION

Table-2 Physical properties of the developed yarn

S.N.	Test parameters	Types of yarns				
		33% O.C.+67%S.W.	50% O.C.+50% S.W.	67%O.C.+ 33%S.W.	100%O.C.	100% S.W.
1-	Yarn Count	15.53s	15.59s	16.29s	15.70s	15.79s
2-	Lea Strength	115.33	99.0	84.67	60.0	128.33
3-	CSP	1791.13	1543.41	1379.22	942.0	2026.38
4-	Breaking Force	482.0	453.0	376.3	298.3	504.4
5-	Single Yarn Strength (RKM)	112.68	11.96	10.38	7.93	13.49
6-	CV% of RKM	11.7	13.0	11.3	18.1	10.5
7-	Elongation at break	10.02	8.48	7.66	7.76	13.05
8-	CV% of Elongation	9.6	11.1	8.7	15.1	15.40
9-	Twist (per inch)	19.75	19.62	21.02	26.44	21.24
10-	CV%	8.39	6.39	9.90	10.31	5.79
11-	Twist Direction	Z	Z	Z	Z	Z

1. Effect of Blending of Silk Waste and Organic Cotton on Yarn Properties

1.1. Effect of Blending on Yarn Count, Lea Strength and CSP (Breaking Strength of Yarn Skin Form):

Yarns made out of different proportion of silk waste and organic cotton (100% Silk Waste; 67-33% Silk Waste – Organic Cotton; 50-50% Organic Cotton-Silk Waste; 100% Organic Cotton) under the identical processing parameters were analyzed to observe the effect of blending of both the fibers on yarn properties. It was observed that the count of all the yarns were similar whereas Lea strength of the yarn developed from 100% silk waste was very high (128:33) in comparison to other blended yarn. In the table it was clearly shown that after 100%silk waste yarn, the Lea strength of organic cotton-silk waste and 50-50% organic cotton-silk waste (115.33 and 99.0) were good and the Lea strength of other two blends (67-33% Organic Cotton-Silk Waste) and 100% Organic Cotton were very low (84.67 and 60.00) and also the yarn CSP which was calculated as count (Ne) X breaking strength of lea (in pound). The CSP of all the blended yarns were 100% Silk Waste- 2026.38, 33-67% Organic Cotton- Silk Waste – 1791.13, 50-50% Organic Cotton- Silk Waste – 1543.41, 67-33% Organic Cotton- Silk Waste – 1379.22, 100% Organic Cotton – 942.00. The CSP of 100% Silk Waste was overall good.

1.2 Effect of Blending on Yarn Breaking Force and Single Yarn Strength (RKM):

From the table it has been observed that the breaking force (gf) of 100% Silk Waste Yarn was 504.4 which was better than other blended yarns. The breaking forces of other blended yarns were 482.0, 453.2, 376.3, 298.3 (33-67% Organic Cotton- Silk Waste, 50-50% Organic Cotton- Silk Waste, 67-33% Organic Cotton- Silk Waste, 100% Organic Cotton) and also the single yarn strength RKM (gm/tex) of 100% Silk Waste was maximum 13.49. After 100% Silk, 33-67% Organic Cotton- Silk Waste and 50-50% Organic Cotton- Silk Waste had good single yarn strength whereas 67-33% Organic Cotton- Silk Waste, 100% Organic Cotton has minimum yarn strength, but the CV% of RKM was maximum (18.1) in 100% Organic Cotton as compared to the other. According to the table the CV% of RKM of other blended yarns were 13.0, 11.7, 11.3, 10.5 in (50-50% Organic Cotton- Silk Waste, 33-67% Organic Cotton- Silk Waste, 67-33% Organic Cotton- Silk Waste, 100% Silk Waste).

1.3 Effects of blending on yarns elongation properties-

The yarn made out of 100% silk waste fiber had better elongation property (13.05) among all the blended yarn whereas the elongation property of other blended yarns were as shown in the table 33-67% Organic Cotton- Silk Waste- 10.02%, 50-50% Organic Cotton- Silk Waste- 8.48%, 100% Organic Waste- 7.76% and 67-33% Organic Cotton- Silk Waste- 7.66%. The elongation rate of 67-33% Organic Cotton- Silk Waste was minimum. Also, the CV% of elongation for 100% Silk Waste blended yarn was good (15.40) as compared to other blended yarn. The CV% of elongation for other blended yarns were 15.1 (100% Organic Cotton), 11.1 (50-50% Organic Cotton- Silk Waste), 9.6 (33-67% Organic Cotton- Silk Waste), 8.7 (67-33% Organic Cotton- Silk Waste). It has been analyzed that 67-33% Organic Cotton- Silk Waste had minimum elongation rate and also it had minimum CV% of elongation.

1.4 Effect of Blending on Twist per Inch and its CV%-

For obtaining TPI yarn tension needs to be set-up. When count is high tension should be set to low and when count is low tension should be set to high. After analyzing the table, it has been observed that the TPI of 100% organic cotton was high where as TPI of 50/50% O.C. / S.W. was minimum, which was 19.62. Also, the CV% of all the developed blended yarns were 10.31 (100% O.C.), 9.90 (67/33% O.C.+S.W.), 8.39 (33/67%O.C.+S.W.), 6, 39 (50/50% O.C.+ S.W.) and 5.79 of 100% S.W. Twist direction of all the blended yarns were ‘Z’ twist.

CONCLUSION

In this study 2 natural fibers (Silk waste & Organic cotton) have been blended with different ratios under the identical fiber processing set-up. Total three ratios of blended yarns have been developed (50/50% O.C.+S.W., 67/33% O.C.+ S.W., 33/67% O.C.+S.W.) also the 100% O.C. yarn and 100% silk waste yarn have been developed. All the blended yarns were compared with each other in terms of physical properties such as single yarn strength breaking force of single yarn, lea strength, yarn count, csp, elongation property of the blended yarn, TPI, twist direction, some imperfections of the blended yarn as hairiness index was also analyzed. It was found that count of all the blended yarns were about to similar with each other but significant improvement has been observed in single yarn strength (RKM) in

67/33% S.W./O.C. (12.68) and 50/50% S.W./O.C. (11.96). As silk was good in all the properties it displayed better result in all the related properties and the blended yarns 67/33% S.W./O.C. and 50/50% S.W./O.C. showed significant improvement in the properties respectively. Breaking force of yarn of the blend ratio of (67/33% S.W. / O.C., 50/50% S.W. / O.C.) were also increased. Lea strength and CSP of the same blended ratio yarns also showed the better improvement as compared to other blended yarns. Elongation rate was also found good in 67/33% S.W. /O.C., 50/50% S.W. /O/C. blended yarns where as TPI of all the blended yarns were observed little less than 100% O.C. & 100% S.W. 100% silk fabrics are very high in price so it is generally found that it was out of reach for common customers and there is lack of some properties in organic cotton because it is the staple fiber. Under this study it was tried to blend both the fibers to cope-up with the draw- back of both the fibers. In the study it has been clearly indicated that the blended yarns of ratio 67/33% & 50/50% S. W./O.C. were good in maximum properties which were analyzed. These yarns can be used to make a fabric which may attain the required characteristics for high value textile applications and also this type of fabric proved very fruitful for the environment point of view as well.

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ISSN: 2581-9925
Impact Factor 6.882

INTERNATIONAL JOURNAL OF EDUCATION, MODERN MANAGEMENT APPLIED SCIENCE & SOCIAL SCIENCE (IJEMMASSS)

A bi-lingual Multidisciplinary Quarterly Peer Reviewed Refereed Journal
Vol. 04 | No. 04(II) | October-December, 2022

Indexing Status: IJEMMASSS is Indexed and Included in:
COSMOS Foundation & Electronic Journal Library EZB, Germany
International Scientific Indexing (ISI) || General Impact Factor (GIF)

International Journal of Education, Modern Management Applied Science & Social Science
Vol. 04 No. 04(II), Oct.-Dec., 2022

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25, Modi Sadan, Sudama Nagar

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Published by **Prof. (Dr.) S. S. Modi**, Proprietor, INSPIRA, Jaipur, Rajasthan

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International Journal of Education, Modern Management, Applied Science & Social Science (IJEMMASSS)
ISSN : 2581-9925, Impact Factor: 6.882, Volume 04, No. 04(II), October - December, 2022, pp. 137-142

UPGRADATION IN PHYSICAL PROPERTIES OF THE YARN DEVELOPED BY THE FUSION OF ORGANIC COTTON & SILK WASTE FIBER

Pooja Kanodia*
Dr. Sunita Dixit**

ABSTRACT

Natural fibers are obtained from plants, animals, minerals and other geological processes. The aim of the study was to develop the yarn with environmental benefit as well as having cost effective material. In the present study two natural fibers have been taken regarding environmental perspective. organic cotton and silk waste have been blended and developed the yarn with different ratios as 67% silk waste + 33% organic cotton, 33% silk waste + 67% organic cotton, 50% silk waste + 50% organic cotton, 100% silk waste and 100% organic cotton. The fiber was blended to achieve better quality of the fabric with the effective cost management. The yarn was prepared following the process blowing, carding, drawing, roving, and spinning. The yarns were assessed on the basis of yarn count, tenacity, unevenness, thin and thick places and hairiness properties. Study reflects that the yarn with the ratio of 67% silk waste and 33% organic cotton found best result following other ratios of the yarn. The yarn made from blended fiber will be of inexpensive having good properties and environmental welfare as well.

Keywords: *Blending, Fusion, Organic Cotton, Silk Waste Fibre.*

Introduction

Natural fibers are fibers that are produced by plants, animals, and geological processes. Natural fibers have good sweat absorbents characteristics and it is found in variety of textures. Cellulosic fibers are decomposed by aerobic bacteria and fungi. Wool and silk are also subject to microbial decomposition by bacteria and molds. A textile is a flexible material consisting of a network of natural or synthetic fibers. Yarn is developed by spinning of raw fibers of wool, flax, cotton, hemp or other materials. Textiles are prepared by different methods such as weaving, knitting, crocheting, knotting, felting or braiding.

Blending of fibers is usually made with different fibers having dissimilarity in their properties, with a view to achieving certain characters of the yarn or its processing performances. Fiber blending can achieve quality products that cannot be realized using one fiber type alone, blending can also reduced the cost of the product by substituting a less expensive fiber for a more costly one.

According to Nandi, K.A., et.al (2015) Blending of jute and ramie fibre which bears superior fibre qualities compared to jute can produce high quality blended fabrics with improved aesthetic properties like texture, feel, resiliency, drapability and durability which add values for consumers' adoration.

According to Rajalakshmi,M., et.al, (March 2018) They found in their paper that when the ratio of micro polyester had been increased in micropolyester: cotton blended yarn, the properties of prepared yarn as their evenness, imperfections and mechanical properties such as strength, elongation had a significant influence. It was also observed that quality of 65:35 micropolyester/ cotton blend ratio showed better improvement than the 100% cotton yarn in which a small proportion of micro polyester in there.

As quoted by Kalita, B., et.al. in their paper, "properties of Ramie and its Blends (2013) Ramie is the strongest fibre of all natural bast fibres in the world. The fibre materials were capable of producing excellent blended fabrics and it worked as a substitute for cotton. Ramie blended with different types of silk showed good results, but 50:50 blends showed the best result. Blending of ramie with different silk with different blend proportions offers excellent scope for producing a variety of materials for different uses.

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As quoted by saika, s., in her paper "a study on Blending of regenerated Bamboo with silk (2016)" that blending of different fibres can achieve quality products. Now the demand for fabric is not only related with style &durability but it required hygienic and many other properties also. In her paper she found that all the blend proportion of bamboo & silk showed better result which is required for clothing materials.

In the study organic cotton and silk waste fibers will be blended together to develop environment friendly product or fabric. Organic cotton is grown using methods and materials that have a low impact on the environment. Organic cotton is generally defined as the product that is grown organically in subtropical countries such as Turkey, China, &parts of the USA from non- genetically modified plants, and without the use of any synthetic agricultural chemicals such as fertilizers or pesticides Organic cotton can be found in everything from clothing, footwear and home furnishings (towels, bathrobes, sheats, blanket, bedding), children's products (clothing, toys, diapers), personal care items (sanitary products, make-up removal pads, cotton puffs and ear swabs) and even stationery and note cards.

Silk is a natural protein fiber, some forms of which can be woven in to textiles. The protein fiber of silk is composed mainly of fibroin and is produced by certain insects larvae to form cocoons. The best known silk is obtained from the cocoons of the larvae of the mulberry silkworm Bombyx mori reared in captivity (sericulture). Silk has a smooth, soft texture that is not slippery, unlike many synthetic fibers. One example of the durable nature of silk over other fabrics is demonstrated by the recovery in 1840 of silk garments from a wreck of 1782. The most durable article found has been silk.

Materials and Methods

The research work was based on experimental Research Method. Experimental research is any research conducted with a scientific approach where a set of variables are being measured as the subject of experiment. The objective of the present research work was to prepare a yarn by the blending of different fibers and to analyze the mechanical and physical characteristics of the yarn. Two fibers silk waste and organic cotton were taken for the present study.

Materials

Silk waste was procured from Silk Trader, Mahalaxmi Traders, Bangalore and the other fiber was organic cotton, which was assembled from Chandra Mauli Fiber, Vijaywada, Andhrapradesh, India. The properties of the fibers were assessed in the lab.

Methods

- **Blending of Organic Cotton and Silk Waste Fibers**

At the initial stage fibers were blended by hand. After hand blending fiber lubricant was sprayed over the hand blended fiber and leave them for 24 hours so that electrical charges in the fiber would not be create. After 24 hours hand blended fibers were passed through the blow room machine. Air was blowing in the machine. With the help of air, fibers were mixed with each other equally. The equally blended fibers come out of the machine in the form of lap that was rolled on the iron rod as shown in the picture.

Blending (Lap Formation)

- **Development of Yarn**
  - **Carding:** Developed lap was passed through the carding machine. After carding of the blended fibers, the fibers mixed equally and became more uniform and straight and came out as a thick sliver as shown in the picture.

Carding (Thick Sliver)

  - **Drawing:** The thick silver was then passed through the drawing machine. In drawing machine silver passed through the two processes first was breaker and second was finisher. First silvers were through breaker process in which thick silvers became thin silver and become more uniform and after that thin silver were passing through finisher process. By this process thin silver became more uniform and thinner and very little twist was given to them in this process. In drawing frame there were total 8 dumbles to make the silver more uniform. In this experiment 6 dumbles were used for making the silvers more uniform.

Drawing Process

  - **Roving or Speed Frame:** The silver came from draw frame subsequently gone through roving machine or speed frame machine (brand name of machine). In this process silvers were drawn by using drafting and twisting. Drafting is a process of stretching and twisting the silver. After roving process silver become thin. It was look like a thick yarn.

Roving Process

- **Spinning or Ring Frame:** Roving silvers were then undergone through spinning set up (ring frame machine- brand name). During that process again drafting process had been done and silvers were run through in process and produced the final yarn.

Spinning Process

- **Physical Analysis of the Developed Yarn:** Physical testing of the prepared yarn had been tested and analyzed their physical characteristics and also tried to forward that all the present properties were able to develop the unique fabric.
- **Methods of Characterization of Fiber and Yarn Properties:** Yarn Count (Ne), Tanacity (IS 1670-1991) and uniformity of all five types of developed yarns were measured in Lea Strength tester-KMI and Uster Tensorapid-4 Swizerland UTM-350; SDL, UK for comparative study. For Yarn Count total 80 rounds has been taken in one sample and total 3 samples have been taken for evaluation. For tanacity evaluation average 20 readings have been taken. Uster U%, CVM%, CVb% and imperfection (ISO 16549:2004) in the yarn like thin and thick places, neps and hairiness index (ASTM D 5647:2007) of the yarn has been analyzed. For observation UT-S SA 400 zellweger Uster, Switzerland machine was used. All the properties of the 5 developed yarns have been tested for providing comfort to the ultimate consumer.

Result and Discussion

Table 1: Yarn Count of Developed Yarn (IS 1671-1991)

S. No.	Blending Ratios of the Fibre	Yarn Count (Ne)
1	67% (O.C.)+33% (S.W.)	16.29s
2	33% (O.C.)+ 67% (S.W.)	15.53s
3	50% (O.C.)+50% (S.W.)	15.59s
4	100% (S.W.)	15.79s
5	100% (O.C.)	15.70s

O.C. = Organic Cotton, S.W.= Silk Waste

From the above table it was observed that the yarn count of all five samples were about to similar. The maximum yarn count was 16.29 which was found in 67% (O. C.)+33% (S.W.), 100% (S.W.) had 15.79 yarn count and 100% (O.C.) had 15.70 yarn count whereas 50% (O.C.) + 50% (S.W.) and 33% (O.C) + 67% (S.W.) had the least yarn count that is 15.59 and 15.53. The more yarn count the more coarser yarn is developed. Hence to prepare the fine yarn it was trying to develop yarn with minimum yarn count.

Table 2: Tenacity of the Yarn (IS 1670-1991)

S. No.	Blending Ratios of the Fibre	Tenacity/RKM (gm/tex)
1	67% (O.C.)+33% (S.W.)	10.38
2	33% (O.C.)+ 67% (S.W.)	12.68
3	50% (O.C.)+ 50% (S.W.)	11.96
4	100% (S.W.)	13.49
5	100% (O.C.)	7.93

O.C. = Organic Cotton, S.W. = Silk Waste

It was observed in the table that the tenacity of the yarn ratio (33% O.C. + 67% S.W.) had high tenacity 12.68 followed by 11.96 and 10.38 tenacity found in (50% O.C. + 50% S.W. and 67% O.C. + 33% S.W.) ratio of yarn. 100% (O.C.) had the least tenacity 7.93.

Table 3: Unevenness (U%) 0f the Yarn

S. No.	Blending Ratios of the Fibre	Uster U %
1	67% (O.C.)+ 33% (S.W.)	20.85
2	33% (O.C.)+ 67% (S.W.)	17.42
3	50% (O.C.)+ 50% (S.W.)	20.12
4	100% (S.W.)	14.73
5	100% (O.C.)	25.13

O.C. = Organic Cotton, S.W. = Silk Waste, U%= unevenness

It was noticed from the table that the yarn ratio (100% O.C. and 67% O.C. + 33% S.W.) had the maximum unevenness 25.13 and 20.85 whereas (50% O.C. + 50% S.W.) yarn had 20.12 unevenness and (33% O.C. + 67% S.W. and 100% S.W.) ratio of yarn had minimum unevenness which was 17.42 and 14.73.

Table 4: Imperfections in the Yarn

S. No.	Blending Ratios of the Fibre	Imperfection/ Km as Thin Places (-50%)	Imperfections/ Km as Thick Places (+50%)
1	67% (O.C.)+ 33% (S.W.)	1057.0	1124.0
2	33% (O.C.)+ 67% (S.W.)	283.3	625.0
3	50% (O.C.)+ 50% (S.W.)	851.0	1201.0
4	100% (S.W.)	60.8	362.5
5	100% (O.C.)	2721.0	2294.0

O.C. = Organic Cotton, S.W. = Silk Waste

From the above table it was recorded that the yarn prepared from (100% O.C.) and the ratio of (67%O.C. + 33%S.W.) had the maximum imperfection as thin places was (-2721 and -1057) and thick places was (+2294) followed by (+1201.0) thick places found in (50% O.C. + 50% S.W.) ratio of yarn and it had few thin places as (-851.0) whereas the yarn composite from (67% O.C. +33% S.W.) had (+1124.0) thick places. From the analysis it was also observed that the yarn developed from (100% S.W. & 67% S.W. +33% O.C.) had minimum thin and thick places as (-60.0 & -283.3) and (+362.5 & + 625.0).

Table 5: Hairiness of the Yarn

S. No.	Blending Ratios of the Fibre	Hairiness Index (H)
1	67% (O.C.)+ 33% (S.W.)	7.06
2	33% (O.C.)+ 67% (S.W.)	6.78
3	50% (O.C.)+ 50% (S.W.)	7.07
4	100% (S.W.)	6.65
5	100% (O.C.)	6.89

O.C. = Organic Cotton, S.W. = Silk Waste, H= Hairiness Index

It was noticed from the table that (50% O.C.+50% S.W.) had highest hairiness index 7.07 followed by 7.06 hairiness found in (67% O.C.+33% S.W.) and (100% O.C.) had 6.89 hairiness index whereas the fabric made from (33%O.C.+67%S.W. and 100% S.W.) had minimum hairiness index (6.78 and 6.65).

Conclusion

In the present paper two natural fibers (Silk waste & Organic cotton) have been blended with different ratios under the controlled fiber processing set-up. Total three ratios of blended yarns have been developed (50/50% O.C.+S.W., 67/33% O.C.+ S.W., 33/67% O.C.+S.W.) 100% O.C. yarn and 100% silk waste yarn have also been developed. All the blended yarns were compared with each other in terms of physical properties such as single yarn strength or tenacity, yarn count of the blended yarns was tested and imperfections like thin and thick places, hairiness index and unevenness of the blended yarns were also analyzed. It was found that count of all the blended yarns were about too similar with each other but notable improvement have been observed in single yarn strength (RKM) as (12.68 & 11.96) of the yarn ratio of 67/33% S.W./O.C. and 50/50% S.W./O.C. As silk shows satisfactory properties it displays better result in all the related characteristics and the blended yarns of the following ratios (67/33% S.W./O.C. and 50/50% S.W./O.C.) revealed significant improvement in the properties respectively. Unevenness of the yarn of following ratios (100% S.W. and 67%S.W.+33%O.C.) were found minimum of the same blended ratio yarns were also showed the better improvement as compared to other blended yarns. Elongation rate was also found good in 67/33% S.W. /O.C., 50/50% S.W./O/C. blended yarns whereas TPI of all the blended yarns were observed little less than 100% O.C. & 100% S.W. 100% silk fabrics are

very high in price so it is generally found that it was out of reach for common customers and there is lack of some properties in organic cotton because it is the staple fiber. Under this study it was trying to blend both the fibers to cope-up with the draw- back of both the fibers. In the study it has been clearly indicated that the blended yarns of ratio 67/33% & 50/50% S. W./O.C. were good in maximum properties which were analyzed. These yarns can be used to make a fabric which may attain the required characteristics for high value textile applications and also this type of fabric proved very fruitful for the environment point of view as well.

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SKILL DEVELOPMENT OF GIRLS THROUGH COMPUTER BASED TRAINING ON APPAREL CONSTRUCTION

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Abstract

Computer has become a universal tool of any modern man (or woman). Literacy today is not defined only in terms of the ability to read and/ or write but in addition, it includes the ability to use and communicate with the aid of computer. The main objective of this study to find out the impact of computer based training about apparel construction to enhance the skill of girl students. To enable employment ready workforce in the future, the youth need to be equipped with necessary skills and education. In this study 106 respondents were selected from B.A. second year and B.A. third year (age group 18-24) of V.K.M. and Arya Mahila P.G. college of Varanasi district. There was multi stage sampling method. Selection of college was purposive sampling method. Total Data were collected through self structured questionnaire. the average knowledge score about parts and its function of sewing machine, sewing tools, problem arises in sewing machine during stitching, taking body measurements is found to be statistically highly significant between pre & follow up first, follow up first & second and between pre and follow up second respectively.

Key words : computer based training, apparel, construction, purposive sampling,

Computer has become a universal tool of any modern man (or woman). Literacy today is not defined only in terms of the ability to read and/ or write but in addition, it includes the ability to use and communicate with the aid of computer. In the education sector, computers are being used to promote teaching and learning.

Computer is defined as an electronic equipment which can store information and data which can be retrieved from it as and when required. In recent years computers have permeated our lives. Computers are transforming the ways we work and learn. Computer is fast becoming the universal machine of the 21st century. Early computers were large in size and too expensive to be owned by individuals. , early computers were designed to accept numeric data but over the years computers have been developed to accept not only numeric data, computers can now process multimedia data text, audio and video. The combination of computer technology and communications technology gave birth to what is now widely known as Information and Communication Technologies (ICT). ICT has changed the face of virtually, all fields of human endeavor, ranging from science to engineering, commerce and industry, international trade, transportation, culture and tourism, education and research, among others. Nowadays, literacy is not only measured by the ability to read and write, but also include computer literacy. The wave of globalization which has been largely propelled by the collapse of barriers of distance between nations and peoples in the world as result of ICT, makes it imperative for the modern man to have at least the basic knowledge of computers.

In this study knowledge were assessed of computer based training about apparel construction to enhance the skill of girl students. Skill development is critical for economic growth and social development. The demographic transition of India makes it imperative to ensure employment opportunities for more than 12 million youths entering working age annually. It is estimated that during the seven-year period of 2005-2012, only 2.7 million net additional jobs were created in the country. To enable employment ready workforce in the future, the youth need to be equipped with necessary skills and education. According to International Labour Organisation "Education, vocational training and lifelong learning are central pillars of employability, employment of workers and sustainable enterprise development."

Moradnezhad (2014) Investigated the effect of Computer-Assisted Instruction (CAI) on, creativity and academic performance of the students at the sixth grade elementary schools in Kerman. Research findings obtained by using (t-independent test) for measuring academic performance between two groups and Covariance analyzing method for measuring the effectiveness of the components of creativity and meta cognition showed that computer-assisted instruction in creativity and meta-cognition has a significant impact on students' academic performance, but a significant difference could not be seen. Mishra (2013) Assessed the impact of E-education on school going children between the age group of 6-13 years. Result shows that the impact of E-Education may not vary according to age. Impact of E-Education was equal for both boys and girls & had positive impact on them but impact of E-Education may vary according to gender; Boys

Sunayana Kushwaha

have positive impact of E-Education rather than girls. Subrahmanyam (2001) Studied that teenagers use the computer more than younger children or adults. Use is also greater for boys compared to girls, for Whites compared to Black or Hispanic children, and for children in households with higher parental income and education. Children still seem to be spending more time watching television than using computers, although computer users watch less television than non computer users.Yunus et al. (2013) Observed the awareness of students towards the e-learning system because today most students use e-learning system. The result shows that most of participants have positive attitude towards the e-learning security. The strength of positive attitude is slightly different within male and female students. Findings of this study provide an enriched understanding about e-learning users and the security awareness of the system. Rajendra Nath, (2013) Founded the awareness among ICT and CCE among secondary school students. 60 secondary school students were selected for the study. Mean, S.D. and t-test were used for the analysis of the data. The teacher education system empowered by ICT driven infrastructure can have a great opportunity to come up to the centre stage and ensure academic excellence, quality in¬struction and leadership in a knowledge-based a society. Isman et al. (2006) Concluded that students give importance to the computers as a part of their life. In addition to this, research results represent that high percentages concentrated on that there are positive attitudes towards computers because of being tool to organize life efficiently. Amutha, (2015) Explored the awareness of technology based education by the student teachers. Survey method was adopted in this study. 91 student teachers in the B.Ed College have been selected as sample by simple random sampling technique. Founded that there is no significant difference in intellectual domain of student teachers based on gender. There is significant difference in emotional domain of student teachers based on gender.

The main objective of this study to find out the impact of computer based training about apparel construction to enhance the skill of girl students. In this study 106 respondents were selected from B.A. second year and B.A. third year (age group 18-24) of V.K.M. and Arya Mahila P.G. college of Varanasi district. There was multi stage sampling method. Selection of college was purposive sampling method. Total Data were collected through self structured questionnaire.

The above table reveals that the average knowledge score about parts and its function of sewing machine during pre-invention is obtained to be 3.28 but after giving educational material, the average knowledge score increased to 3.78 and after providing practical training, the average knowledge increase to 4.57 and this increase in knowledge score among student is found to be statistically highly significant between pre & follow up first, follow up first and second between pre and follow up second respectively. The total students average knowledge score about sewing tool is found to be 2.29 at the time of pre invention where as it significantly increase to 3.27 and 3.95 after supply educational materials and training programme during first and second follow up respectively. The average knowledge score about sewing machine

Sl. No.	Type of training	Pre	Follow up Ist	Follow up IInd	T-test between		
		Mean ±SD	Mean ±SD	Mean ±SD	Pre & Ist Follow up	Ist & IInd Follow up	Pre & IIst Follow up
1.	Parts of sewing Machine and its function	3.28 ± 1.20	3.78 ± .95	4.57 ± .66	t = 4.22 P<0.001	t = 10.17 P<0.001	t = 9.94 P<0.001
2.	Sewing tools	2.17 ± 1.05	3.20 ± .88	3.84 ± .91	t = 9.34 P<0.001	t = 5.84 P<0.001	t = 13.61 P<0.001
3.	Sewing machine problems	1.98 ± 0.98	2.89 ± 1.09	3.41 ± 1.15	t = 6.84 P<0.001	t = 4.65 P<0.001	t = 11.08 P<0.001
4.	Taking body measurement	1.80 ± 1.03	2.66 ± 1.01	3.51 ± 1.08	t = 6.52 P<0.001	t = 7.37 P<0.001	t = 11.99 P<0.001

problems was 1.98 during pre, after providing related educational, it increase to 2.89 and after going practical training, it re-increase up to 3.41 statistically, this increase in average language score is obtained to be highly significant.

The overall knowledge regarding taking body measurement of garments is assessed during pre and post intervention on the basis of different independent variable, It depicts that the mean knowledge score is found to be very less (1.80) regarding this matter at the time of survey but after supply necessary educational material and practical training programme it increased to 2.66 and 3.51 respectively. The statistical test shows that there is highly significant increase in average knowledge score about this fact after invention.

Counclusion

In present time computer awareness and training is must for every person. the assessment of the impact of computer based training programme and supplying necessary educational material and practical training programme about apparel construction among girls, the average knowledge score about parts and its function of sewing machine, sewing tools, sewing machine problems, taking body measurements is found to be statistically highly significant between pre & follow up first follow up first and second and between pre and follow up second respectively.

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Sircilla's indigent weavers working round the clock to meet the demand of festival

In a first of its land move, about 10,000 weavers in the textile town of Siricilla are working round the clock.

Their mission: To make one crore saris to cater to an order from the Telangana government for the flagship cultural event of the state, Bathukamma festival.

The saris are meant to be distributed free of cost to over 97 lakh women who are holding Food Security Cards (white ration cards) and is costing the state exchequer Rs. 200 crore, according to the State Handlooms Development Commissioner, Shailaja Ramayyar.

"An order worth Rs. 200 crore for saris is the first of its kind from the government," P Yadgiri, Joint Director, Telangana State Handloom Weavers Society told Hyderabad recently.

A team of officials had already met the members of the Mutually Aided Co-operative Societies (MACS), owners of small-scale powerloom industries and other stakeholders in the town to appraise them of the order.

"The process is on and 10,000 weavers are currently engaged in the production of saris," Yadgiri said.

Though the state government had sought the participation of weavers from other locations such as Warangal, Karimnagar, Nalgonda and Aler, the response was lukewarm compared to the great excitement shown by Siricila weavers.

Earnings

The deadline is August 15 and about 20,000 powerlooms will have to work round-the-clock to meet this. The order is for two varieties of polyester saris, one for the elderly and another printed variety for the young.

Each weaver will be paid a wage of Rs. 5 per metre of cloth produced. "The earnings of a weaver out of this order will be almost 70 per cent higher than what they earn in private production," Yadgiri said.

This is expected to give a boost to many weavers who are facing financial challenges in the recent past. Bathukamma is a colourful and vibrant festival of Telangana and celebrated by women, with flowers that grow exclusively in each region. This festival is a symbol of Telangana's cultural identity. ■

Since - 1940

ISSN 0368-4636
e-ISSN 2347-2537

Journal of the TEXTILE Association

VOL. 84 NO.2 July-August, 2023

Anthropometric Measurement & Assessment of Occupational Ergonomic Risks of Handloom Weaving in Varanasi District

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Abstract

Handloom weaving is one of the oldest surviving traditional crafts in Varanasi and generates a large number of employments. Poor posture is a risk for musculoskeletal problems of the neck, shoulders, and lower back and lengthy hours of static work with awkward posture at traditionally designed looms can lead to a high prevalence of musculoskeletal problems. Keeping in view these facts the present research was planned and a survey was conducted to select four handloom weavers' clusters. The survey was conducted in different handloom clusters of Varanasi. The four selected areas after the survey were selected and Fifty (50) weavers from each cluster were randomly taken for the study. Thus the total sample size was 200. This study was aimed at evaluating the anthropometric measurement of handloom weavers to assess their Body Mass Index to evaluate their physical fitness and Risk Assessment for Musculoskeletal Disorder by Rapid Entire Body Assessment (REBA).The 5th, 50th, and 95th percentile of the various recorded anthropometric dimensions of the handloom weavers were also evaluated. The observations regarding the above anthropometric measurements can be used for redesigning the traditional handloom which will minimize the musculoskeletal disorders of the weavers. The working postures of the handloom weavers during weaving were observed and the score was assigned to each body part by using the REBA score sheet. It was observed during the REBA score assessment that sitting with slight forward bending flexion at the neck and the back with the movement of both hands and legs was acquired by the majority of the handloom weavers while performing the weaving activity.

Keywords: *Environmental factors, Ergonomics, Handloom weavers, Health problems, musculoskeletal problems, Socio-economic conditions*

Citation: Sunita Dixit, "Anthropometric Measurement & Assessment of Occupational Ergonomic Risks of Handloom Weaving in Varanasi District", *Journal of the Textile Association*, **84/2** (93-98), (July-August'23),

Article Received: 12-04-2023, Revised: 17-07-2023, Accepted: 26-07-2023

1. Introduction

The ergonomic approach of evaluating the present handloom employment status and ergonomic intervention will help in finding some effective solutions. The financial misfortune due to such disorders influences not only the individual but moreover to society also. It is necessary to assess & control occupational health hazards at the workplace of weavers which may cause injury, illness, weakened health, discomfort, and inefficiency in workers of the community. Because of incompatible working circumstances, handloom weavers in textile industries are facing challenges with many work-related musculoskeletal issues related to torment and distress. Many ergonomic problems arise from poorly designed tools, work areas, and repetitive motions. The handloom sector is aimed to generate and provides direct and indirect employment to over 4.3 million people all over India [13]. The predominance of the problems are due to poor ergonomics and designing of workstation and prolonged hours of constant working atmosphere in the carpet industry [2].

The research will focus on how occupational health hazards at the worksite affect handloom weavers and based on findings future recommendations for the corrective measure can be proposed. As occupational health is affordable, accessible, follows equity and contributes to the national economy, the finding of research will help in strategy formulations for handloom weavers; thus the handloom weavers' society can be benefited.

The findings explored through research will be applied for making weavers compatible systems, strengthening the application of high-quality ergonomics, strengthening the demands for high-quality ergonomics by enhancing awareness. Handloom weavers do physical labor beyond their capacity. Hence, Ergonomic interventions will be made in the study regarding the multifactorial genesis of work-related muscular disorders, health problems, and physical conditions of the workplace for sustainable employability to prolong working life. Ergonomics points to ensure that tasks, tools and equipment, facts, figures, content and information, and the conditions and circumstances suit each worker.

The textile and apparel industry is one of the foremost driving sections in the Indian economy. Ergonomics is the scientific and logical application of the standards and strategies that can draw data from several disciplines for the advancement of the system in which an individual plays a significant role. In the garment industry, numerous operations are repetitive in nature and continuous repetition of the work causes musculoskeletal problems and disorders. It has been broadly recognized that awkward and constrained postures result in musculoskeletal disorder on distinctive body locales of seated workers and are a significant component in the emergence of the development of

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musculoskeletal disorders. Destitute postures have also been found to be related to diminished effectiveness of performance, which is caused by body discomfort resulting from confined and restricted body postures.

Musculoskeletal disorder related to work is a major problem in most occupations. The prevalence, characteristics, and impacts of WMSDs in certain anatomical areas of the body among handloom industry workers in Kerala was determined.. This research was conducted with a modified Nordic Musculoskeletal Questionnaire (NMQ) to assess the prevalence of disorders that occurred. A self-administered questionnaire in regional language was prepared and distributed among 380 full-time handloom workers [19]. The research was conducted to study the dietary status, socio-economic status, and occupational health hazards of the Baluchari Saree weavers of Bishnupur. Sixty-two handloom weavers in the age group between 17-75 years willingly co-operated for the study and thus were selected by the convenient sampling procedure. The evaluation of their nutritional condition exhibited notable pervasiveness of malnutrition (53.22 %) in the weavers of Baluchari Sari [11].

A total of 60 workers were taken for the study from the Lakhimpur district of Assam. The assessment of the working posture of women workers involved in various handloom activities was performed. Data were collected by interview method, photography, video recording, and observation of work practices. The postural assessment was done by using ergonomic tools: RULA and Strain Index. Awkward postures were observed in the handloom workers. The mean RULA score was found highest in weaving activity with 6. 41±0.49 followed by warping, spinning. Strain Index was found highest in the right hand and left hand of weaving activity. The high occupational risk was found in the handloom activities. Therefore, the application of ergonomics would help in reducing postural exertion [4]. The lengthy hours of constant work with inappropriate posture at old designed looms causes the extreme presence of musculoskeletal disorders among carpet weavers. The backrest minimizes some of the trunk or torso loads and assists in impeding vertebral strain. The distinctive sitting postures acquired by the handloom weavers while performing weaving tasks are upright, forward flexed, and side bending. Extended flexion of the spine leads to expansion of intervertebral joint laxity and loss of fluid in the intervertebral discs [5, 8].

Forty women weavers of Samarinda sarongs were investigated to ascertain the widespread and risk component of musculoskeletal disorders (MSDs). In this study, a Nordic body map, anthropometric equipment, and rapid upper limb assessment (RULA) were used to intrigue the MSD extremity, work posture, and anthropometric dimensions of the weavers, respectively [16]. In the present era of advancement and commercialization, the handloom sector is also indicating the changes that the large numbers of women are adopting the weaving activity as their profession. The activity they performed previously during their spare time, has now been transformed to an eight hour job. But, in spite of the increased weaving time spent on weaving looms, the workstation design remains unaltered [16].

In traditional old looms, normally there is no workstation adjustability and adjustment of weaving height is difficult that causes the awkward postures of the upper body. Inappropriately designed hand tools and the kind of the task are the chief causes of awkward postures of wrists and fingers [6]. Handloom is one of the long-established cottage industries in India, especially in West Bengal, where a significant number of rural people are engaged in weaving. The outcome of the present investigation revealed that highly repetitive works carried out for a long time could increase the intensity of the pain felt and would lead to repetitive strain injuries [3, 9].

The Finnish Institute of Occupational Health (FIOH) identified musculoskeletal disorders as one of the most widespread work-related frailty, emphasizing that despite several parts of the body being involved, the back experiences most of the discomfort [12, 15]. The postures of workers also need to be modified, and corrective measures need to be introduced to minimize the risk of musculoskeletal disorders in the long term [18]. The weaver has often been forced to adopt squatting posture to operate the traditional carpet looms and as the width of the carpet increases and they have to lean forward to complete the task [3].

2. Methodology

2.1 Selection of Sample

The survey was conducted in different handloom clusters i.e. Madanpura, Badi bazaar, Alaipura, Nati Imli, Lallapura, Ramnagar, Lohta, Baragaon, Basani, Ashapur, Bajardiha, Ausanganj, Golgada, Basani, and Saraiya. The four selected areas after the survey were Lallapura, Bajardiha, Ausnganj and Saraiya. Fifty weavers from each cluster were randomly taken for the study. Thus the total sample size was 200.

2.2 Development of the tool

The socio-economic questionnaire was administered to the weavers for the evaluation of their socio-economic status. A thorough investigation of the review of literature helped and enabled the researcher to develop the tool. Care was taken to incorporate all the needed information as decided and a suitable interview schedule was prepared to get relevant information based on the interview.

2.3 Collection of Anthropometric Data

Various anthropometric measurements of handloom weavers such as sitting height, sitting eye height, sitting shoulder height, sitting elbow height, sitting mid-shoulder height, waist height, popliteal height, buttock popliteal height, shoulder breadth, hip breadth, arm reach forward, elbow to elbow, upper limb length, forearm hand length were taken. All subjects were told to wear light clothing without footwear. For taking standing measurements, the subjects were informed and asked to stand upright and facing forward

and arms hanging adjacent to the body. To take measurements in sitting position, subjects were asked to sit upright on a chair without the support of armrests, with knees bent on 90 degrees, and the feet kept flat on the surface, facing forward and arms hanging adjacent to the body. The measurements of each handloom weaver were taken three times for maintaining the accuracy in results. The analysis of the data obtained in the present study was done precisely. The 5th, 50th, and 95th percentile values were also calculated to understand and interpret the data. The statistical analysis of each group of data was conducted for the elucidation of the results.

2.4 Risk Assessment for Musculo-skeletal Disorder by Rapid Entire Body Assessment (REBA)

REBA is an ergonomic tool for the assessment of musculoskeletal disorders which uses a structured and organized procedure to assess the whole body postural MSD and risks related to the performance of the tasks. REBA is a single-page worksheet that is used to assess the required or selected body posture, intense and forceful exertions, type of movement, motions, and action, reiteration, and coupling of the body parts during the performance of an activity or task.

Posture for risk of work-related musculoskeletal disorder among handloom weavers in Varanasi was assessed by using REBA Scale [14].

Table 1 - REBA Decision Score

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

3. Results and Discussion

3.1 Risk Assessment for Musculo-skeletal Disorder by Rapid Entire Body Assessment (REBA)

The working postures of the handloom weavers during weaving were observed and the score was assigned to each body part by using the REBA score sheet. The position of the wrist, neck, lower arm, upper arm, and trunk during the handloom weaving activities was also critically observed for analysis of the posture.

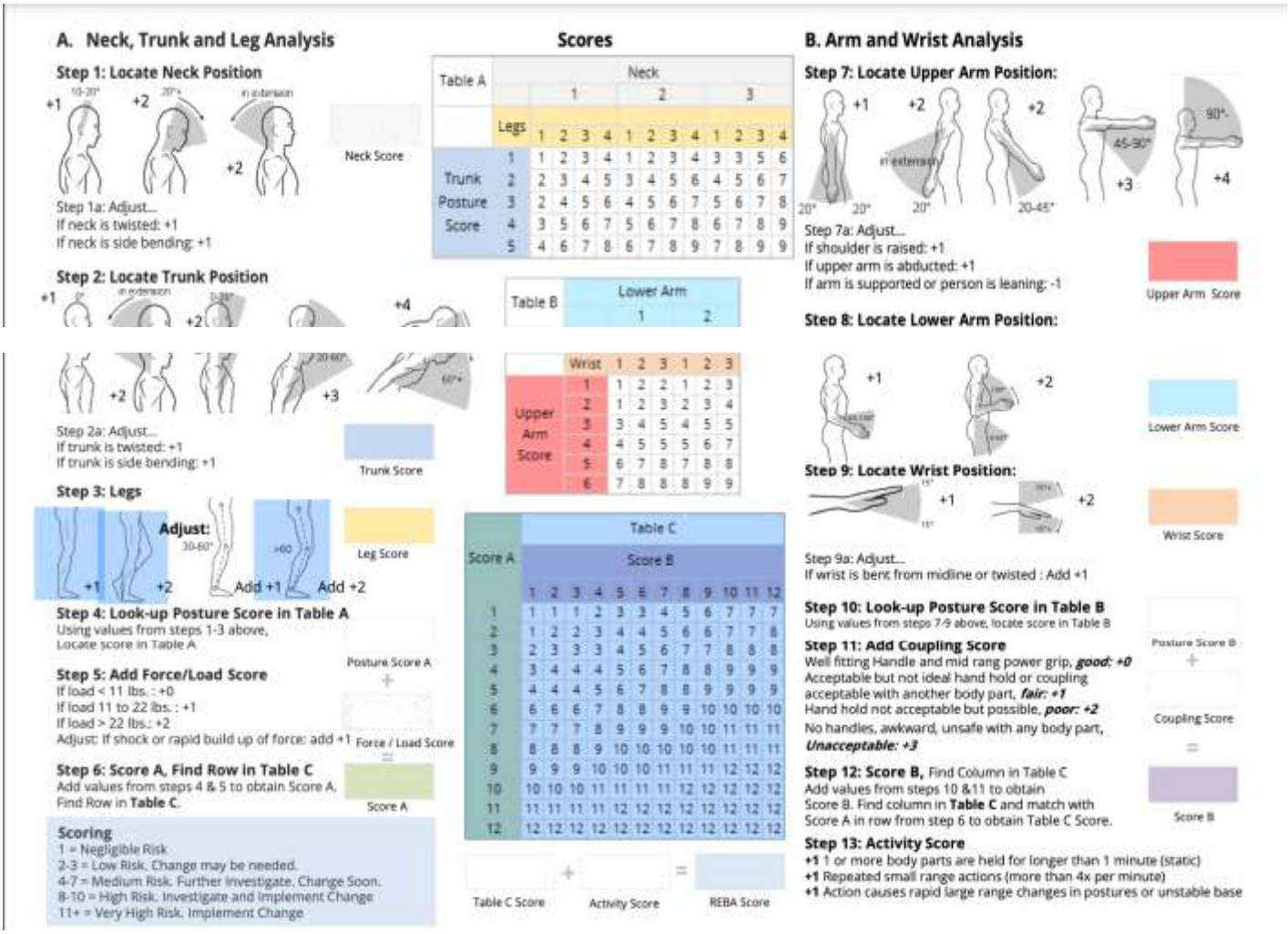

Table 2 - Employee Assessment Worksheet

Body parts	Mean	Standard deviation	Maximum score
Neck	2.60	0.3648	3
Trunk	4.80	0.3678	5
Upper arm	3.40	0.4356	6
Lower arm	1.00	0.0000	2
Wrist	2.00	0.0000	2
Coupling	2.00	0.0000	2
Score B	7.8	0.3657	12
Score C	9.8	0.4323	9
Activity score	1.00	0.0000	1
REBA score	10.8	0.4566	11

Table 2 reveals the REBA score assigned to different body parts of handloom weavers in Varanasi handloom clusters. It showed that in the score a maximum mean score of 4.80 was for the trunk and in the score, B maximum mean score of 3.40 was for the upper arm. The mean for score B which included wrist, lower arm, upper arm, and coupling was higher (mean score 7.80) when compared to score A (mean score 6.74) which included neck, trunk, leg, and force /load score. The mean for score C was 9.80 which after adding the mean of activity score (mean score 1.00) turned to REBA mean score (mean score 10.6.). It was observed during the REBA score assessment that sitting with slight forward bending flexion at the neck and the back with the movement of both hands and legs was acquired by the majority of the handloom weavers while performing the weaving activity.

Postures with elbow flexion of the right hand, abduction, and adduction of the hands, flexion of wrist and pronation of the legs and feet during treadling operations, pronation of hands during beating action and passing shuttle, raised shoulder abduction, and shoulder flexion while weaving were found among the handloom weavers. These all significantly contributed to the musculoskeletal disorders and health hazards of weavers.

A study was conducted to assess the risk of musculoskeletal disorder in handloom weavers of the Durrie unit. The data in their study revealed that the mean REBA score was 11 which indicated a very high level of risk and the mean QEC score for neck, back, and wrist/hand was 17, 31, and 43 respectively were in the very high-risk category and shoulder/arm with mean score 37 in the high-risk category. REBA reported 56.25 percent of weavers were at elevated risk level and 43.75 percent at extremely elevated risk level. QEC also reports 61.25 percent weavers at high and 38.75 percent at the very high-risk category [20].

Table 3: Percentage-wise distribution of the handloom weavers based on REBA score (N = 200)

Action Category	Interpretation	REBA Score (Frequency)	REBA Score (Percentage)
1- Negligible	No change is required	-	-
2-3- Low risk	Change may be needed	-	-
4-7- Medium risk	Further investigation and changes needed	28	14
8-10- High risk	Investigation and implementation of changes	95	47.5
11- Very high risk	Implementation of changes	77	38.5

The REBA action category presented in Table 3 reveals that a maximum of 47.5 percent of weavers was in action category 4 which ranged between score 8-10 i.e. high risk which signifies directions for investigation and implementation of changes wherever needed, whereas, 38.5 percent of handloom weavers were in action category 5. The score of action category 5 is above 11 i.e. very high risks and this signifies directions to implement change immediately. 28 percent of handloom weavers were found to be in action category 3 which ranged between 4 - 7 i.e medium risk and required further investigation and needed changes.

3.2 Anthropometric measurements of handloom weavers

Various anthropometric measurements of handloom weavers were taken for ergonomic interventions. The observations were analyzed and mean, standard deviation was calculated. The 5th, 50th, and 95th percentile of the various recorded anthropometric dimensions of the handloom weavers was also evaluated.

The mean sitting height and sitting eye height were 82.13 and 68.43 respectively, whereas the 5th percentile of sitting height and sitting eye height was 73.00 and 61.23 respectively. The mean sitting shoulder height and sitting mid-shoulder height were 51.64 and 39.12 respectively. The mean popliteal height was 46.85 whereas the mean buttock popliteal height was found to be 54.38. The mean hip breadth, elbow to elbow, forearm hand length, waist breadth, and upper limb length were 33.53, 36.34, 34.78, 33.16, and 34.73 respectively. The observations regarding the above anthropometric measurements can be used for redesigning the traditional handloom which will minimize the musculoskeletal disorders of the weavers.

Table 4 - Anthropometric measurements of handloom weavers in Varanasi District

	Mean	Standard deviation	5th percentile	50th percentile	95th percentile
Sitting height	82.13	3.52	73.00	84.31	88.45
Sitting eye height	68.43	2.98	61.23	72.44	76.90
Sitting shoulder height	51.64	3.76	48.32	55.12	59.89
Sitting mid-shoulder height	39.12	4.12	29.00	42.54	46.97
Sitting elbow height	32.34	3.94	26.12	35.89	38.00
Popliteal height	46.85	4.24	36.89	48.66	56.66
Waist height	24.54	2.25	21.21	25.65	29.90
Shoulder breadth	22.57	3.87	18.00	22.44	26.88
Buttock popliteal height	54.38	3.26	49.54	55.43	63.33
Hip breadth	33.53	4.34	31.00	35.00	43.79
Elbow to elbow	36.34	4.12	30.76	37.54	44.00
Forearm hand length	34.78	2.65	32.00	36.67	38.88
Waist breadth	33.16	3.96	25.43	29.90	38.44
Upper limb length	34.73	2.27	64.56	73.00	75.55

The mean sitting height and sitting eye height were 82.13 and 68.43 respectively, whereas the 5th percentile of sitting height and sitting eye height was 73.00 and 61.23 respectively. The mean sitting shoulder height and sitting mid-shoulder height were 51.64 and 39.12 respectively. The mean popliteal height was 46.85 whereas the mean buttock popliteal height was found to be 54.38. The mean hip breadth, elbow to elbow, forearm hand length, waist breadth, and upper limb length were 33.53, 36.34, 34.78, 33.16, and 34.73 respectively. The observations regarding the above anthropometric measurements can be used for redesigning the traditional handloom which will minimize the musculoskeletal disorders of the weavers.

4. Conclusion

The hand-woven textiles of India have been recognized and mentioned since ancient times and it is deeply rooted in our lives and traditions. In spite of the fact that it provides and creates employment opportunities for a large number of people, the handloom segment is contemplating as a dusk industry, and there are unavoidable circumstances and discuss of certainty which has given the continual stepping towards the motorization, advancement, and refinement. Still, there are many supporters of handloom for reasons including their logical justifications, beliefs, ethics and principles, sheer affection for handloom products, and economic viewpoint. Many policies and programs were prepared by the government to increase the production, productivity, and GDP through this sector but no attention has been paid to the human component of this sector. Workers, an integral part of this sector, suffer from many health-related hazards due to the nature of this work. Handloom weaving requires long hours of work in static and awkward posture which gradually leads to the risk of work-related musculoskeletal disorder. It has been broadly accepted that inappropriate and severely restricted postures result in musculoskeletal pressure on various body parts of workers in sitting positions and it is the crucial component in the evolution and growth of musculoskeletal problems. Poor postures have also been closely linked with diminished productivity of execution, which is predominantly caused by bodily discomfort which occurs due to limited and restricted postures.

Based on the subjective assessment and responses obtained from the handloom weavers, the major concerning criteria found were related to the following:

- Designing of plank, adjustable height of the seat, depth of the seat and the forward slope/inclination at a different angle and the width of the plank, and the requirement of the backrest.
- The different adjustable seat heights can be prescribed and made based on the data obtained of the popliteal height of the handloom weavers. There should also be an adjustable backrest at the time of weaving as well as at the time of rest during weaving.
- The slope angle of the seat should be adjustable according to the need of the handloom weaver.
- The seat depth should also be modified according to the anthropometric measurements.
- An ergonomically equipped workstation for the weaving allied activities would also be helpful in reducing the exertions which are found during different handloom weaving-related activities.

5. Acknowledgement

I am highly thankful to ICSSR for the sponsorship of the project scheme, IMPRESS under the domain Health and Environment.

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Man Made Textiles in India

July 2023 I Volume LI No. 7 I Annual Subscription ₹ 2000.00 I Single Copy ₹ 200.00

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TECHNICAL ARTICLE

An ergonomic study on prevalence of musculoskeletal disorders among handloom weavers of varanasi

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Abstract

Handloom is one of the oldest and widely established industry in Varanasi and it employs a large number of people also.It has been broadly recognized that awkward and con-strained postures result in musculoskeletal disorder on distinctive body locales of seated workers and are a significant component in the emergence of the development of muscu-loskeletal disorders. Destitute postures have also been found to be related to diminished effectiveness of performance, which is caused by body discomfort resulting from con-fined and restricted body postures. Keeping in view these facts the present The primary findings from this study showed that there are several causes for severe and frequent musculoskeletal disorders like hard seating surfaces, poor seat design, seat height, non-adjustability of parts of loom according to weaver's physical structure, no backrest for relaxing, less gap between two treadles, leaning forward for cloth rolling process, hand-loom material, etc. It was revealed during the investigation that the maximal number of handloom weavers complained against the intense and frequent pain in the neck, shoul-der, lower back, and upper arm.

Keywords: Ergonomics, Handloom weavers, Health problems, Socio-economic conditions, Musculoskeletal problems, Environmental factors

Introduction

The textile and apparel industry is one of the foremost driving sections in the Indian economy. Ergonomics is the scientific and logical application of the standards and strate-gies that can draw data from several disciplines for the advancement of the system in which an individual plays a significant role. In the garment industry, numerous operations are repetitive in nature and continuous repetition of the work causes musculoskeletal problems and disorders. According to census 2009-10, there are 43.31 lakhs weavers in the country. 36.33 lakhs are in rural areas and 6.98 lakhs in urban areas. There are around 11 weavers clusters in Varanasi. Varanasi incorporates a wealthy social legacy of the handloom industry and workmanship of hand-woven materials. During the weaving workers adopt awkward postures, which is imperative to calculate their destitute working proficiency and predominance of musculoskeletal problems. Keeping in view these facts the present research is planned. In the present research, the Anthropometric data and Body Mass Index of the weavers were analyzed. Identification of physical (parameters related to the work environment are noise, temperature, humidity, and light), chemical and ergonomic (assessment of postural discomfort, musculoskeletal problems) occupa-tional health hazards of hand-loom weavers. research was planned and survey was con-ducted to select four handloom weavers' clusters. The survey was conducted in different handloom clusters of Varanasi. The four selected areas after the survey were selected and fifty (50) weavers from each cluster were randomly taken for the study. Thus the total sample size was 200.

The purpose of this study was to evaluate the prevalence of musculoskeletal disorder among handloom weavers in Varanasi. The ergonomic approach of evaluating the present

handloom employment status and ergonomic intervention will help in finding some effec-tive solutions. The financial misfortune due to such disorders influences not only the individual but moreover to society also. It is necessary to assess and control occupational health hazards at the workplace of weavers which may cause injury, illness, weakened health, discomfort, and inefficiency in workers of the community. Because of incompati-ble working circumstances, handloom weavers in textile industries are facing challenges with many work-related musculoskeletal issues related to torment and distress. Many er-gonomic problems arise from poorly designed tools, work areas, and repetitive motions.

The research will focus on how occupational health hazards at the worksite affect hand-loom weavers and based on findings future recommendations for the corrective measure can be proposed. The occupational danger of risk as a term indicates both long-term and short-term risks amalgamated with the conditions of the workplace and is a field of study for occupational security and public health-being. Short-term risks may incorporate phys-ical damage, while long-term risks may expand the chance of developing cancer and heart diseases. Physical prerequisites such as the rise of arms for long periods, static contrac-tions, and repetitive movements that cause neck and shoulder problems and issues more-over include the wellbeing harm or injury related to weaving [1 – 3]. Alireza Choobineh et.al reported that carpet weavers experienced musculoskeletal disorders mostly due to poor working postures [4]. The postures were mostly restricted due to the poor design of workstations. Choobineh A. et.al explained that lengthy hours of constant work with in-appropriate posture at old designed looms causes the extreme presence of musculoskeletal disorders among carpet weavers [5]. The carpet industry possesses a central position in the economic strength of different countries. The weavers performing in the carpet indus-try agonize from a different kind of health risk component. The hazards in the carpet in-dustry are exorbitant and the potential to control them is lower and more threatening. The predominance of the problems are due to poor ergonomics and designing of work station and prolonged hours of constant working atmosphere in the carpet industry [6].

Keeping in view these facts the present research was planned and the survey was con-ducted to select four handloom weavers' clusters. Fifty weavers from each cluster were randomly taken for the study. Thus the total sample size was 200. An ergonomic ques-tionnaire was formulated and administered to the selected handloom weavers. It consists of a series of questions with several preferred responses and is administered to assess their socioeconomic status, health problems, and working conditions. The anthropometric measurement of the weavers was taken to assess the Body Mass Index to evaluate their physical fitness. This research work is aimed at evaluating the ergonomic issues related to the present handloom sector.

Methodology

Selection of sample

The survey was conducted in different handloom clusters of Varanasi. The four selected areas after the survey were selected and fifty (50) weavers from each cluster were randomly taken for the study. Thus the total sample size was 2.

Assessment of postural discomfort

A good posture is said to be, which allows the subject to accomplish the prescribed task more effectually and with minimal muscular discomfort and can undergo a minimum of static effort. The body part discomfort scale was used to assess the discomfort of hand-loom weavers at their different body parts after performing weaving activity which was related to treadling, seating, flying shuttle, beating up, warp winding, cloth rolling opera-tions on beam, etc. It is a psycho-physical 10 point scale rating scale, 0 being considered the lowest point which shows no discomfort, and 10 being the uppermost point which shows the extreme discomfort of different body parts. A picture of the body with several points was shown to the subjects after/during performing any activity and they were asked to respond on the ten-point scale. This scale assists in determining the experience of body discomfort during the performance of the task.

Results and Discussion

Assessment of postural discomfort by body parts discomfort scale

Postural discomfort by body parts discomfort scale

The distress level of handloom weavers during the performance of weaving tasks was documented at a ten-point discomfort scale. It is a scale that represents pain level, in this scale zero interprets that there is no pain, one shows a very small amount of discomfort, and two is the possibility of a score level of discomfort.

Pain: An uncomfortable sensation that can extend from mild, localized, discomfort to ex-cruciation. Pain constitutes both physical and emotional factors. The physical part of pain results from nerve stimulation. Pain may be contained to distinct sections, as in an injury, or it can be much diffusive, as in disorders like fibromyalgia. Pain is conciliated by specified nerve fibers that carry the pain impulses to the brain where responsive recognition may be modified by numerous variables.

The body part discomfort scale is a subjective indicator survey tool that assesses the re-spondent's direct experience of discomfort at different body parts.

Table 1: Assessment of Postural Discomfort by Body Parts Discomfort scale

Discomfort in different parts of the body during weaving operations	Handloom weavers N = 200 (%)
Head	126 (63)
Neck	181 (90.5)
Shoulder	158 (79)
Chest	107 (53.5)
Upper arm	153 (76.5)
Elbow	126 (63)
Forearm	120 (63)
Wrist	134 (67)
Hand	140 (70)
Lower back	174 (87)
Thigh	124 (62)
Knee	125 (62.5)
Lower leg	154 (77)
Foot	157 (78.5)

Assessment of pain in body parts of handloom weavers by Body Parts Discomfort (BPD) Scale

Assessment of pain and discomfort in various body parts was done by Body parts Dis-comfort scale, of 200 handloom weavers of Varanasi. It was observed from Table 1 that the pain reported by handloom weavers in different parts of the body were head (63%), neck (90.5%), shoulder (79%), upper arm (76.5), Elbow (63%), forearm (60%), wrist (67%), hand (70%), lower back (87%), thigh (62%), knee (62.5%), lower leg (77%) and foot (78.5%). It was analyzed from the data obtained that the maximum number of weav-ers were having pain in the neck, shoulder, lower back, upper arm, and foot followed by pain in other parts of the body. The discomfort was closely associated with the seating, flying shuttle, and cloth rolling operations. It was revealed during the investigation that the maximal number of handloom weavers complained against the intense and frequent pain in the neck, shoulder, lower back, and upper arm.

The primary findings from this study showed that there are several causes for severe and frequent musculoskeletal disorders like hard seating surfaces, poor seat design, seat height, non-adjustability of parts of loom according to weaver's physical structure, no backrest for relaxing, less gap between two treadles, leaning forward for cloth rolling process, handloom material, etc. Rooser et al. also reported that the poor design of the seat in the present workstation connected with the repetitive treadling operation affects both the anterior and posterior side of the thigh muscles [7]. It was also explained that there was no thigh clearance space in the handloom units which exacerbate with oscillato-ry treadle operation. The solid and hard edge of the plank, with raised plank height, leads to the enhancement and instigation of pressure on the posterior thigh muscle. Muscle pressure, as well as localized pressure, occurs in a relatively short period of time, physio-logical reaction of muscle fatigue, obstructive blood circulation, and venous blood collec-tion results in edema in the feet and ankle.

According to Adams et al. distinctive sitting postures acquired by the handloom weavers while performing weaving tasks are upright, forward flexed, and side bending [8]. Ex-tended flexion of the spine leads to expansion of intervertebral joint laxity and loss of flu-id in the intervertebral discs.

Durlov et al. also concluded in their research concerning the occupational health risks that lead to the prominent widespread of musculoskeletal disorders among handloom weavers includes a bent back due to low loom position, inadequate and restricted workspace for proper movement and accomplishing the weaving activity, workspace limitation, exertion of muscle and the repetitive movement of limbs for operating the loom [9].

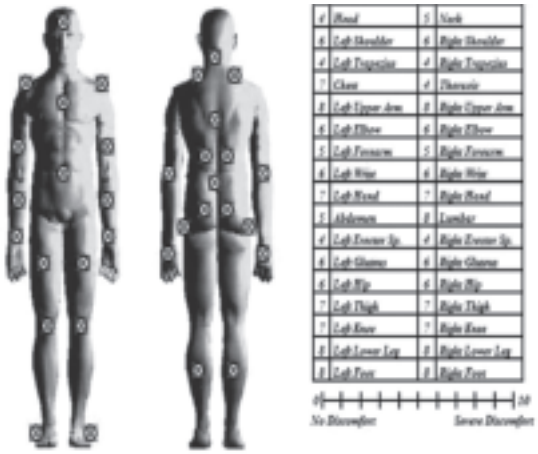
Table 2: Discomfort Mean Score of various body parts during the performance of handloom weaving activities

Body parts	Discomfort mean score during handloom weaving activities
Head	4.5
Neck	6.68
Shoulder	4.5
Chest	4.2
Upper arm	7.12
Elbow	4.11
Forearm	5.50
Wrist	7.33
Hand	5.68
Lower back	8.98
Thigh	5.32
Knee	5.5
Lower Leg	7.54
Foot	6.72

Table 2 indicates that the most affected body part during weaving operations was the lumbar. The major discomfort reported by the handloom weavers was in the lower region of the spine. The handloom weavers also experienced extensive discomfort on different regions of the body such as the upper arm, neck, wrist lower leg, foot, and lower back. Many of the weaving activities like spinning, winding and twisting, warping, threading the healds, threading the reeds, setting the warp on the loom, preparing the loom for weaving, etc. also require bending posture. Bending is explained as flexion/bending of the trunk commonly in the forward or lateral directions. Numerous researchers have also documented the lower back pain and sciatic pain indication as health outcomes due to bending posture for performing different weaving operations. Many times handloom weavers adapt squatting posture also during many weaving related activities like spin-ning, winding and twisting, warping, threading the healds, setting the warp on the loom, this type of posture invariably severely affects the lumbar, feet, knee, hand, and legs. Due to these reasons, there are more risk factors of having musculoskeletal disorders mainly in lower body parts related to the spine.

This result suggests that an ergonomically equipped workstation for the weaving allied activities would also be helpful in reducing the exertion which is found during different handloom weaving-related activities.

Case Studies



Various cases were discussed in detail which can explain more clearly about the body dis-comfort after performing handloom weaving activity. The different cases are explained below:

Case 1

Subject : Ashfaq Sex : Male
Age : 50 yrs Activity : Handloom Weaving

The study of case 1 showed various body parts of the subject where he felt discomfort after performing activities. Intense discomfort was experienced by the subject in different regions of their body i.e. lower legs, feet, arms, and lower back. He also explained dis-comfort in various other regions of the body such as hands, knees, and thigh. He felt dis-comfort in performing handloom activities for awkward posture and long working hours. The subject was also found to be underweight. Therefore, working while he is not physi-cally fit also increased his discomfort level.

The association of pain and discomfort related to different work postures forced static exertions, repetition, and frequency of movement is a widely recognized criterion of poor job design [9, 10]. Hence, a body part discomfort study is an imperative part of the job analysis. By the responses of the employee to the discomfort survey, an employer can recognize body parts that may be experiencing raised levels of discomfort. The responses can also facilitate the employer with prioritizing and emphasizing control strategies by concentrating on the body parts influenced by current job design.

Case 2

Subject : Babulal Sex : Male
Age : 40 yrs Activity : Handloom Weaving

Case 2 revealed various body parts of the subject where he felt discomfort after perform-ing handloom activity. This subject reported severe pain in left and right lower legs but moderate pain in other regions of the body which were used during carrying out hand-loom weaving activity such as elbows, arms, hands, and knees. This discomfort can be reduced by improving and adopting correct posture during weaving. It is better to have a proper sitting posture than bending and squatting postures while conducting various handloom weaving operations.

Case 3

Subject : Abdul Sex : Male
Age : 38 yrs Activity : Handloom Weaving

The subject reported discomfort in various body parts in Case 3. The weaver described extreme pain in the wrist, hands, legs, and lower back. He also delineated slight pain in the upper portion of the body such as the trapezius, head, thoracic, etc. The risk factors of musculoskeletal diseases while working in a bending position with extended forearms set forth as epicondylitis (painful inflammation of tendons), hand and wrist disorders, lower back pain, etc. The subject also reported severe back pain. It can be concluded that there should be a backrest for supporting the back muscles during the rest pauses by the weav-er. Choobineh et al also revealed in their study that the backrest minimizes the load on the seat which eventually reduces stress on the paraspinal and spinal structure [4]. According to Corlett in his study suggested that the backrest minimizes some of the trunk or torso loads and assist in impeding vertebral strain [11, 12].

Case 4

Subject : Aadil Sex : Male

Age : 35 yrs Activity : Handloom Weaving

It showed discomfort of various body parts felt by the subject after performing weaving activity. This subject experienced extreme distress in lower regions of the body such as lower legs, lumbar, cleared left and right feet, gluteus, hips, and wrists. This discomfort was felt due to adopting an awkward posture for a long time and also due to repeated movements of the limbs.

Case 5

Subject : Ajay Kumar Sex : Male

Age : 45 yrs Activity : Handloom Weaving

It focussed discomfort level of various body parts reported by the subject after complet-ing handloom weaving activities. The weaver reported extreme discomfort in the lower region of the spine, lower back, hand and legs during the performance of weaving activi-ty. He described slight discomfort in the upper region/torso of his body. It was observed that the weaver was not having good physical health and poor body mechanics was also observed. Poor body mechanics is basically due to back problems in which the spine is subjected to unhealthy and undesirable stresses, and over time it leads to degeneration of spinal anatomy and system. During the analysis, it was outlined that there was a higher risk for musculoskeletal disorders of the arm, lower back disorders hand, and wrist disor-ders.

Conclusion

During the study, it was found that lower back and lower limb discomfort was highly prevalent in the handloom weavers and

it was attributed to the inappropriate ergonomi-cally designing of the seat. It was also observed that there is a prominent widespread of ergonomic threat components. However the sitting posture during handloom weaving cannot be altered, but the customization of the seat can be efficacious in minimizing the hazardous effect of the prolonged hours of sitting in an awkward position. The forced forward bent sitting during the beating operation is also attributed to the high musculo-skeletal disorders. Based on the subjective assessment and responses obtained from the handloom weavers, the major concerning criteria found were related to the designing of plank, adjustable height of the seat, depth of the seat and the forward slope/inclination at a different angle and the width of the plank, and the requirement of the backrest.

(ICSSR sponsored IMPRESS project under the domain Health and Environment)

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Textile Trends

66TH YEAR OF PUBLICATION, NO. 01 APRIL 24, 2023, ISSN 0040 - 5205, Rs. 60/-

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Textile Trends
R NI No. 2815/58
APRIL 2023

AN ERGONOMIC SURVEY OF OCCUPATIONAL HEALTH HAZARDS PREVALENT IN HANDLOOM CLUSTER OF VARANASI

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Abstract

The handloom industry is perhaps the most established in Varanasi where a significant number of individuals are occupied in handloom weaving. Long hours of static work with awkward posture at traditionally designed looms can lead high prevalence of musculoskeletal problems. A healthy economy, high quality of products, and long-term productivity are difficult to achieve in poor working conditions where workers are exposed to health and safety hazards. Keeping in view these facts the present research was planned and the survey was conducted to select four handloom weavers' clusters. This study was aimed at evaluating the different health problems, socio-economic conditions of the handloom weavers, and environmental factors i.e. noise, temperature, humidity in handloom clusters. The survey was conducted in different handloom clusters of Varanasi. The four selected areas after the survey were selected and Fifty (50) weavers from each cluster were randomly taken for the study. Thus the total sample size was 200. An ergonomic questionnaire was formulated and administered to the selected handloom weavers. It consists of a series of questions with several preferred responses and was administered to assess their socioeconomic status, health problems, and working conditions. It was observed that all types of weavers belong to low socio-economic conditions and suffered from health problems like pain in body parts (neck, shoulder, elbow, wrist, upper back, lower back, hips, knees, ankle, etc), poor vision, hearing problems, respiratory problem, allergy, eye irritation, etc.

Keywords : Ergonomics, Handloom weavers, Health problems, Socio-economic conditions Muscu-loskeletal problems, Environmental factors

I. INTRODUCTION

The handloom industry is perhaps the most established in Varanasi where a significant number of individuals are occupied in handloom weaving. Varanasi has rich customs, beliefs, and heritage of handloom industry & fine workmanship of hand-woven textiles. Throughout the weaving process, weavers adopt awkward postures, which is a crucial component of their poor working efficiency and skill effectiveness as well as the emergence and development of musculoskeletal disorders. Extended duration of static work with awkward posture at old traditionally designed looms can lead to elevated existence of musculoskeletal problems. A flourishing economy, premier quality of products, and long-term productivity are strenuous to attain in poor working conditions where weavers are vulnerable to health and safety hazards. Ergonomics aims to make sure that tasks, equipment, documentation, information, and the en-vironment suit each worker. It is absolutely a significant interdisciplinary field that assists the weaver to attain higher productivity due to less fatigue, a safer working environment (fewer mishappenings), lesser absenteeism, and reduced labor turnover. The ergonomic intervention comprises the human-machine interface, environmental surroundings, hardware, and work posture. Some of the factors that influence ergonomic attentiveness are Climate (Temperature, Humidity, and Airflow – Ventilation); Noise, Illumination, Vibration, and Radiation; besides Work Time/Shift, Work Overload, Ageing, Material Handling, Stress or Strain, and Load.

In the present era of advancement and commercialization, the handloom sector is also indicating the changes that a large number of women are adopting the weaving activity as their profession. The activity they performed previously during their spare time, has now been transformed into eight hours job. But, despite the increased weaving time spent on the weaving loom, the workstation design remains unaltered. [3]. In traditional old looms, normally there is no workstation adjustability and adjustment of weaving height is difficult that causes the awkward postures of the upper body. Inappropriately designed hand tools and the kind of task are the chief causes of awkward postures of wrists and fingers [9]. The handloom sector is aimed to generate and provide direct and indirect employment to over 4.3 million people all over India [4].

An amended Nordic Musculoskeletal Disorder Questionnaire and Oswestry Low Back Pain Disability Questionnaire along with a body part discomfort scale were administered to handloom weavers of Bengal. The working posture of the

respondents was evaluated by using the Ovako Working Posture Analysis System (OWAS). The study outlines the need for further research about the postural strain of weavers and also suggests the implementation of the ergonomic design into weaver workstations to minimize the adverse effect of their current working postures. By improving the weaver's work-posture would improve their quality of life. Handloom is one of the long-established cottage industries in India, especially in West Bengal, where a significant number of rural people are engaged in weaving. The outcome of the present investigation revealed that highly repetitive works carried out for a long time could increase the intensity of the pain felt and would lead to repetitive strain injuries.[1, 2].

The social and physical well-being of the weavers has not been much considered a priority in government policy. Musculoskeletal disorders (MSDs) are typically common to almost all the occupations and segments related to weaving, which leads to serious physical and economic aftermath for weavers, and their dependents. The Finnish Institute of Occupational Health (FIOH) identified musculoskeletal disorders as one of the most widespread work-related frailty, emphasizing that despite several parts of the body being involved; the back experiences most of the discomfort [5, 6].

Weaving is considered to be a highly labor-intensive task, with the labor cost ac-counting for up to an average of 65% of the production cost. Some of the MSDs that commonly occur are carpal-tunnel syndrome (CTS), tendonitis, and lower-back pain, which are generally caused by repetitive motions, awkward and non-neutral postures, poor working conditions, among other things [7]. There is a correlation between MSDs and occupation. Therefore, there is a critical need to evaluate the occupational risk factors among the unorganized sector, particularly the weaving industry in India. The postures of workers also need to be modified, and corrective measures need to be introduced to minimize the risk of musculoskeletal disorders in the long term [8]. The weaver has often been forced to adopt a squatting posture to operate the traditional carpet looms and as the width of the carpet increase and they have to lean forward to complete the task [10]. The present survey was aimed at the assessment of physical characteristics, health problems, socio-economic conditions, and environmental factors.

II. METHODOLOGY

Selection of Sample

The survey was conducted in different handloom clusters of Varanasi. The four selected areas after the survey were selected and fifty (50) weavers from each cluster were randomly taken for the study. Thus the total sample size was 200.

Development of tool

The socio-economic questionnaire was administered to the weavers for the evaluation of their socio-economic status. An exhaustive review of the literature assisted and enabled the investigator in the development of the tool. Care was taken to incorporate all the needed information as decided in the formulated objectives of the study. An interview schedule was prepared to get relevant information. It consists of a series of questions with several preferred responses. The questions sought information about the socio-economic background, educational status, knowledge, marital status, family member, attitude, experience, monthly income, working hours, work-related aspects, etc. The questions related to health problems were pains in body parts (neck, shoulder, elbow, wrist, upper back, lower back, hips, knees, ankle, etc), poor vision, hear-ing problems, respiratory problems, allergy, eye irritation, etc. [11].

Measurement of Physical characteristics

The basic physical parameters, such as height and the bodyweight of the weavers were measured using an anthropometric rod and a properly calibrated weighing machine respectively to assess body mass index (BMI). Most of the weavers were both semi-literate and illiterate, so interviews were carried out verbally and responses were noted. The questions were prepared in Hindi and communicated to them during working hours or either before or after work hours [12].

III. RESULTS AND DISCUSSION

Physical characteristics of handloom weavers of Varanasi

The primary survey was conducted in different handloom clusters i.e. Madanpura, Badi bazaar, Alaipura, Nati Imli, Lallapura, Ramnagar, Lohta, Baragaon, Basani, Ashapur, Bajardiha, Ausanganj, Golgada, Basani, and Saraiya. The selected areas after the survey were Lallapura, Bajardiha,

Ausnganj and Saraiya. Fifty weavers from each selected cluster were randomly taken for the study. Thus the total sample size was 200.

Table 1: Physical characteristics of handloom weavers of Varanasi

Physical parameters	Handloom weavers N=200
Age (years)	19-58
Height (cm)	142.5-179.0
Weight (kg)	42-87
BMI (Kg/m2)	16.5-32.4
Working hours per day	10-12

Table 1 shows the age, height, weight, BMI, and working hours per day of the handloom weavers.

Socio-economic status of handloom weavers in Varanasi

Table 2 : Socio-economic status of handloom weavers in Varanasi

Demographic parameters	Parameters	Handloom weavers, N=200 (%)
Educational level	Illiterate	92 (46)
	High school	73 (36.5)
	Intermediate	30 (15)
	Degree/Diploma	05 (2.5)
Marital Status	Married	160 (80)
	Unmarried	34 (17)
	Widow	06 (3)
Family members	1-3	28 (14)
	4	34 (17)
	5	55 (27.5)
	More than 5	83 (41.5)
Number of children	1	23 (11.5)
	2	38 (19)
	More than 3	139 (69.5)
Experience in weaving (years)	1-5	32 (16)
	5-10	40 (20)
	More than 10	128 (64)

The socio-economic status of the handloom weavers is given in Table 2. The economic condition of the handloom weavers was poor; therefore they did not have better educational opportunities. It was found that 46% of weavers were illiterate, 36.5% were high school, 30% were Intermediate and only 2.5% were having a Degree or Diploma. It was found that 80% of the weavers were married, 17% were unmarried and 3% were a widow. It is also evident from the table that 41.5% of weavers had more than five family members and 69.5% weavers had more than three members. It was found that that 64% of weavers had more than 10 years of weaving experience whereas 20% weavers had weaving experience between 5 to 10 years and 16% had weaving experience between 1to 5 years.

Health problems of handloom weavers of Varanasi

Table 3 : Health problems of handloom weavers of Varanasi

Health problems	Handloom weavers N = 200 (%)	
	Yes	No
Cardiovascular problems	103 (51.5)	97 (48.5)
Respiratory problems	137 (68.5)	63 (31.5)
Digestive problems	117(58.5)	83 (41.5)
Eye irritation	145 (72.5)	55 (27.5)
Hearing problem	134 (67)	66 (33)
Skin disease	108 (54)	92 (46)
Pain in body parts	176 (88)	24 (12)

It was observed during the survey that the weavers were exposed to different stressed working condition and hazardous environment. They have reported various occupational health-related problems and complaints which are given in Table 3. It was found that 51.5% weavers had cardiovascular problem, 68.5 had respiratory problem, 58.5% showed digestive problem, 72.5% reported eye irritation, 67% had hearing problem, 54% reported skin problem and 88% weavers complained about pain in body parts which ranged from moderate to severity. It is clear from the data obtained that eye irritation, respiratory problems, hearing problems and pain in body parts are the most common health problems in maximum number of weaver.

It can be concluded that these health problems are due to bad postures for long hours, use of hazardous dyes and chemicals, unsafe environment and working conditions. Therefore it is necessary to find the best ways and methods for the proper

health conditions of handloom weavers. It was found that the traditional handloom weavers and jacquard loom weavers were suffering from pain in body part and it was more prevalent than other health problems. The percentage of pain was much higher in case of jacquard loom weavers than the traditional handloom weavers. In the same way different health problems i.e., respiratory problems, cardiovascular problems, digestive problems, skin diseases etc were also more prevalent among the jacquard loom weavers [13]. The reasons identified include unnatural work postures, use of hazardous chemicals, unsafe working practices, long working hours and high risks of accidents at work place, caused by unsafe conditions [14].

Assessment of environmental factors (Noise, Temperature, Humidity, and Light)

Table 4: Measurement of Illumination level (Lux) at handloom workstation during four times a day in two months

Time	Lux (Mean) Month of January	Lux (Mean) Month of October	Standard Level of Illumination recommended for conducting fine & me-dium type of work
10: a.m	114.26	143.53	BIS: 300 Lux - 700 Lux
1:00 p.m	129.34	178.74	ISO: 300 Lux
4:00 p.m	73.22	86.38	CIE: 300 Lux
6:00 p.m	52.26	65.24	IES: 400 Lux - 750 Lux

The mean values of the illumination of the handloom cluster are given in Table 4. According to the data obtained, it was found that during daytime there was a considerable variation in the illumination value at handloom clusters. It was also observed that the illumination value was maximum at 1:00 p.m i.e 129.34 and it was minimum at 6:00 p.m i.e 52.26 in January. The illumination value was found to be maximum at 1:00 p.m i.e 143.53 and it was minimum at 6:00 p.m i.e 65.24 in October. It can also be concluded from the data that the illumination reading value was more in October as compared to January.

Table: 5 Noise level at the handloom cluster

Examination Attributes	Sound level dBA (mean score)	Standard Level of Noise recommended at workplace
Maximum Value of Noise	82.29	Bureau of Indian Standard (BIS)
Minimum Value of Noise	48.37	45 to 75 dBA

The noise level at the handloom cluster is shown in Table 5. The mean score of the maximum value of noise was 82.29 dBA which is elevated than the standard of BIS i.e 45 - 75 dBA. A high deviation and fluctuation were also experienced in the noise level at the handloom cluster.

This objective aimed to analyze the influence of prevailing illumination and sound level on the occupational health of the handloom weavers and recommend possible and attainable suggestions to reduce the problems. It was observed that there was a high influence of existing sound levels and illumination levels on the physiological, physical characteristics as well as cognitive attributes of the weavers' well-being. The results of this objective also showed that the weavers were also confronted with different types of problems, obstacles, and challenges which leads to the development of serious occupational health obstructions and an inadequate working environment.

It was found that the weavers were not aware of the effect of such environmental components at their workplace as well as about the personal protective devices and their uses. It is a fact which is to be considered that the weavers of a small scale cottage industries and unorganized segments experience and undergo different types of musculoskeletal disorders as well as psycho-physiological issues which leads to poor occupational working conditions. Based on the literature reviewed, it was found that the influence of illumination level and sound level on occupational health in the context of the handloom weavers has not been much reported.

The noise and illumination level are the significant criteria that possibly affect the accomplishment of the task, productive capacity, psychological and physiological well-being of the handloom weavers engaged in handloom sectors. Noise and illumination level were two main components among other environmental factors which were found to be constant throughout the year irrespective of the variation in season. The illumination level in the handloom cluster was remarkably poor and much below the standards which are recommended for proper working environmental conditions. [13].

IV. CONCLUSION

The hand-woven textiles of India have been recognized and mentioned since ancient times

and it is deeply rooted in our lives and traditions. In spite of the fact that it provides and creates employment opportunities for a large number of people, the handloom segment is contemplating asa dusk industry, and there are unavoidable circumstances and discuss of certainty which has given the continual stepping towards the motorization, advancement, and refinement. Still, there are many supporters of handloom for reasons including their logical justifications, beliefs, ethics and principles, sheer affection for handloom products, and economic viewpoint. Worker an integral part of this sector suffers from many health-related hazards due to nature of this work. Handloom weaving requires long hours of work in static and awkward posture which gradually leads to the risk of work-related musculoskeletal disorder. It has been broadly accepted that inappropriate and severely restricted postures result in musculoskeletal pressure on various body parts of workers in sitting positions and it is the crucial component in the evolution and growth of musculoskeletal problems. The type of work included in handloom necessitates high levels of workers, focussed and precise lighting condition also assures fewer errors and faults transferred to the next stage of work and which affects the quality of production.

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