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AN ANALYSIS OF ERGONOMIC RISK FACTORS ASSOCIATED WITH THE WOOD BLOCK MAKING CRAFT OF PETHAPUR, GUJARAT, INDIA

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ABSTRACT

The handicrafts sector in India provides employment to a vast number of people contributing to the country's economy; by the vary nature of woodblock making craft, the produce is made with hand- making it labour intensive; spending hours in the same place, health hazards associated occupation. Woodblock makers of Pethapur served as the focal point of the ergonomic study; to render the craft person to be more efficient and productive. The semi structured interview schedule was developed containing a detailed check list for analyzing occupational health hazards using musculoskeletal disorder scale and RULA scale.

The results showed that the senior craftsmen experienced pain at various body parts such as joint pain, neck and shoulder pain. It was also discovered that working posture has relation to the body sections that are in pain. It was concluded that there is a need for implementing change in working pattern, workspace arrangement as well as creating awareness amongst the craftsmen about the ergonomic risk factors. The craftsmen need to undergo some physical exercises before performing work which would help in reducing pains.

Keywords: Woodblock Making Craft, Ergonomic Approach, Musculoskeletal Disorders, Posture Analysis, Work Environment, Working Pattern, Workshop Arrangement, Ergonomic Awareness, Efficiency

1. INTRODUCTION AND BACKGROUND OF THE STUDY

The handicrafts sector in India occupies an important position in the country's economy. There are a vast number of people employed in this sector. It is still unorganised, and due to this, craftsmen face a number of difficulties in their craft practices, such as designing, marketing, sourcing raw materials, finance, communication skills, work efficiency, and occupational health hazards. Pethapur, situated 10 km from the capital city of Gujarat, Gandhinagar, is one such centre of

wood block-making craft. It has been famous all over the world for its finely carved wooden blocks since the 16th century BC Posrithong (2013).

Woodblock is a prerequisite for hand block printing. It is made up of seasoned teakwood. It requires skill, precision, concentration, and continuous effort to prepare a perfect block for seamless printing. It is tedious and labour-intensive. It takes a minimum of three years of training to acquire the craft skills. The woodblock maker sits for hours in a static position and in complete focus to achieve accurate and desired results. It was found during the pilot study that, at present, only a handful of craftsmen practice this craft. The number of craftsmen presently engaged in this craft is less than twenty. In addition to this, it was also identified that there is enough work but, due to the lack of manpower (a smaller number of craftsmen practicing), they are unable to achieve the target in a given time frame. Therefore, increasing work efficiency could be one of the possible ways for the craftsmen to perform at a higher level. From the literature review, it was found that ergonomic studies helped increase the productivity of the craftsmen in various ways.

As stated above, making wood blocks is a tedious job, and craftsmen have to sit for hours in a static position, which causes damage to various body parts, which affects health and results in work fatigue. Hence, a study was undertaken to ascertain the occurrence of work-related bodily complaints, identify ergonomic risks and musculoskeletal disorders (MSD), and examine the work patterns of the craftsmen and their workplace with an ergonomic approach.

The present paper discusses the occupational health hazards associated with wood block making and the work practices of the craftsmen by studying working posture, working conditions, and the work environment. Additionally, it focuses on possible solutions for reducing ergonomic risks in order to boost productivity and ensure the better survival of the craft.

2. LITERATURE REVIEW

A review on similar studies were taken up to understand the various aspect of ergonomic principles, the procedure of analysing risk, risk factors and measures to prevent ergonomic risks.

Qutubuddin et al. (2013) studied on Indian saw mill workers identified work-related musculoskeletal disorders and ergonomic risks, recommending immediate ergonomic interventions and proper awareness among workers.

The study by Widana et al. (2018) focused on ergonomic work station design to enhance workload quality and productivity among craftsmen. Nine samples were tested before and after treatment, and results showed improved occupational health, decreased work load, and increased productivity.

According to the study on Brass Handicraft workers found inadequate ventilation, limited workshop space, and musculoskeletal complaints at the waist, neck, and shoulder. They recommended raising awareness about occupational safety and health Dharmawan et al. (2019). Ergonomics concepts are more commonly applied in large-scale industries like steel, power, manufacturing, and automotive, but they can boost worker efficiency by improving tools, processes, and working environments, reducing pain and disorders Sain et al. (2016).

3. MATERIALS AND METHODS

3.1. SAMPLE SELECTION AND LOCALE OF THE STUDY

The study was conducted in the village of Pethapur near Gandhinagar district, the capital of Gujarat. The criteria for selecting the sample were the craftsmen who are presently practicing the craft and the residents of Pethapur village. The total number of craftsmen practicing the craft was only 15. Hence, the population selected for the study was fifteen (N = 15), and therefore the whole population was selected as a sample for the study. The sample selected for the study was 15 craftsmen from eight existing workshops of woodblock making situated in Pethapur village itself. All the participants engaged in the craft study were male artisans.

3.2. TOOL USED FOR DATA COLLECTION: QUESTIONNAIRE STUDY

The Modified Musculoskeletal Questionnaire Bisht and Khan (2019). was used to collect the required information from the respondents. It was divided into three sections.

- Demographic and work-related information, i.e., age, experience, education, marital status, health habits, working hours, job tasks, workspace-related information, etc.
- Body part experience discomfort interview, i.e., pain or discomfort at different body sites, such as the palm, wrist, and finger regions, knee, and leg (using the body part discomfort scale, developed by Corlett, E.N., and Bishop, 1976). This is a 10-point scale and is used to measure the pain experienced by the respondent to determine the degree of severity of the pain. Figure 1

Figure 1

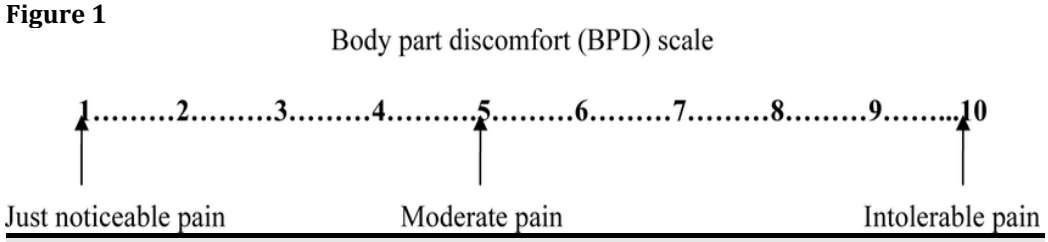

Figure 1 10 Point Body Part Discomfort Scale Corlett and Bishop (1976)
Source https://www.researchgate.net/figure/Body-part-discomfort-BPD-scale

1) Postural analysis was done using the Rapid Upper Limb Assessment [RULA] method by the existing craftsmen in Pethapur. The RULA sheet is a tool to analyse the upper limb body posture, and it helps to assess the biomechanical and postural load needs of job duties and demands on the neck, trunk, and upper extremities. A one-page worksheet is used to assess the necessary repetition, force, and body position. Scores were entered for each body region in sections; A for the arm and wrist and B for the neck and trunk based on the evaluations. Tables on the form are then utilised to assemble the risk factor variables, resulting in a single score that shows the amount of MSD risk after the data for each location has been gathered and graded. RULA is a helpful tool in screening the ergonomic risks at the workplace, as the final score also indicates whether an implantation of change is required or not. The RULA postural analysis method is considered a pen-and-paper observation method. Figure 2

Figure 2

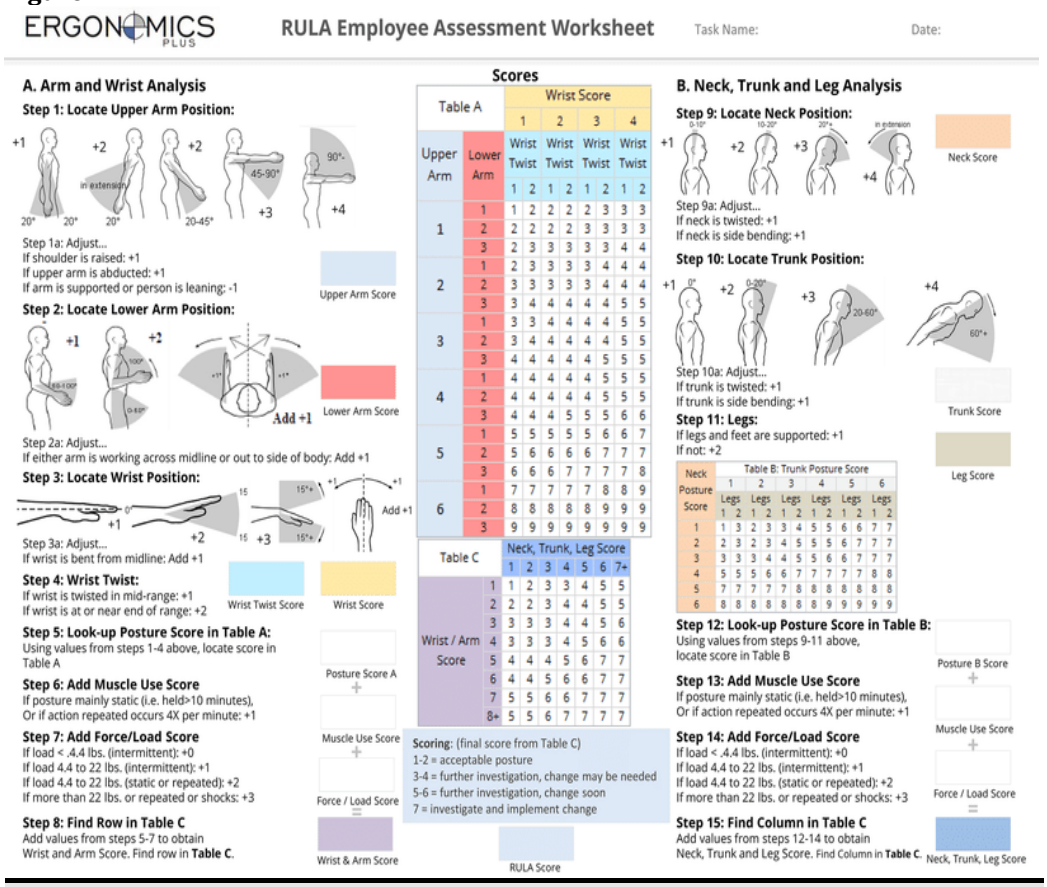

Figure 2 Rapid Upper Limb Assessment Sheet (RULA)

Source https://ergo-plus.com/wp-content/uploads/RULA-A-Step-by-Step-Guide1.pdf

The postures maintained for the long duration were considered for analysis. Postures of the upper arm, lower arm, forearm, and wrist were scored as Posture A. Force load scores were calculated. Neck, back, and leg postures were observed and scored as Posture B. All the scores were then added to get the final score, which determined the ergonomic risk associated with that posture.

The questionnaire was developed in English and validated by the expert. Each craftsman was explained about the RULA scale and Nordic questionnaire before the interview. The questions were verbally explained in local language to the respondents, and their answers were noted by the researcher. Self-enumeration was difficult due to craftsmen's lack of understanding of the subject and the lower literacy level of the majority of participants. The major advantage of the interviewer-assisted data collection method was that low literacy rates could be covered, and the response rate and quality of the data could be increased by personalising the interview.

3.3. PHYSICAL PARAMETERS

Physical parameters such as height and weight were measured using a metal measuring tape and digital weighing scale (Perfexca). The body mass index (BMI) was computed from the collected data using a standard equation.

3.4. SAMPLE SIZE AND ANALYSIS

The sample selected for the study is equal to the population because the craftsmen engaged in the craft are 15. Therefore, the whole population has been selected for the study, which is N = 15, and all the craftsmen selected were residing in Pethapur. The participants were interviewed and observed to analyse ergonomic risks associated with their age, workload, work pattern, and work area. The data collected from all the participants was then compared to find the effect of age, workload, and posture on body discomfort. As sample size was small, the comparison and analysis were done using table.

4. RESULTS AND DISCUSSIONS

It is necessary to understand the tools and techniques of woodblock making before beginning with the results.

1) An introduction to the woodblock-making craft:

For hand block printing, woodblocks are a necessary instrument. A flawless block must be prepared for seamless printing with skill, accuracy, focus, and constant work. It requires a minimum of three years of learning to acquire the craft skills. It takes three days to carve an outline block. To complete the carving duties, craftsmen must sit motionless for hours at a time. Figure 3 and Figure 4 depict the equipment needed and the steps involved in creating woodblocks, respectively.

Figure 3

Figure 3 Tools and Equipment Used in Wood Block Making
Source Image Captured by researcher during field visit, Pethapur

Figure 4

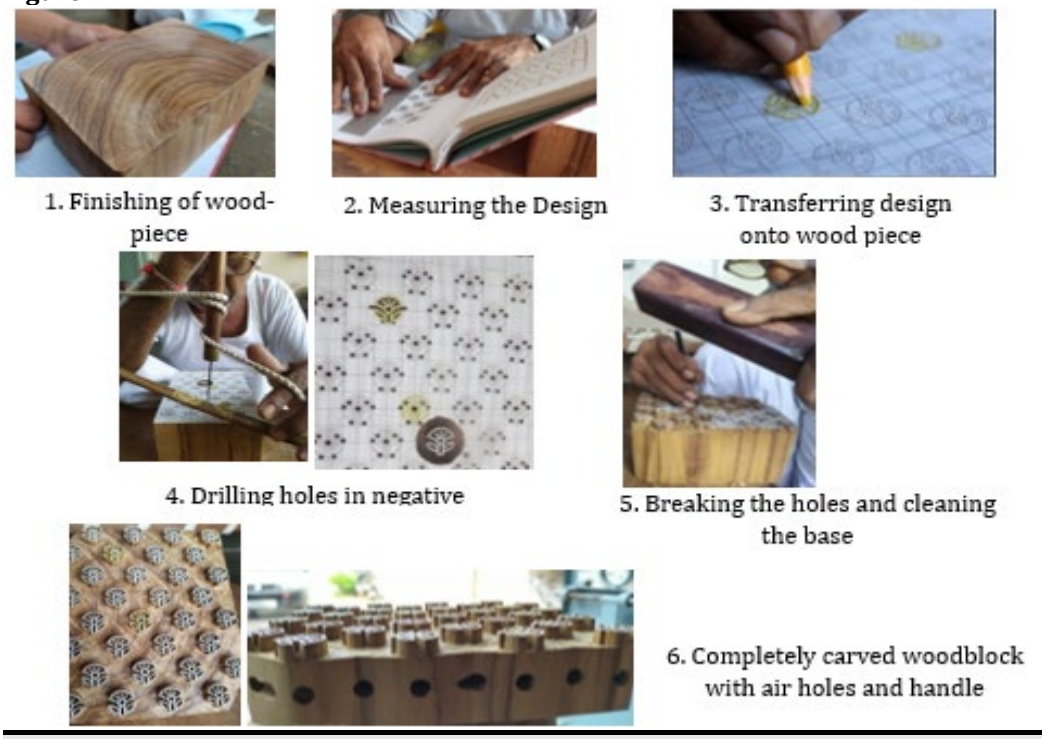

Figure 4 Process of Wood Block Making
Source Image Captured by Researcher During Field Visit, Pethapur

The results are divided into four sections: i) demographics and work-related information; ii) body part experiencing discomfort scale; iii) rapid upper limb assessments (RULA); and iv) analysis of work area and work pattern.

4.1. DEMOGRAPHICS AND WORK-TASK-RELATED INFORMATION

As discussed in the methodology, 15 craftsmen were interviewed. Table 1 shows the demographic details and work-related information. The average or mean BMI index computed was 23.64 kg/m^2, which is considered normal. The daily working hours spent in craft practice by the respondents were 10 hours, inclusive of 80–120 minutes of rest each day, and the weekly workload was 70 hours, including 14 hours of rest (7 days working).

The average age calculated for block makers was 50 years. Six of the 15 craftsmen were under the age of 40; four were between the ages of 41 and 50; and three were above the age of 50. It was observed that 80 percent of participants had education up to the secondary level. From Table 1, it has been observed that six out of 15 craftsmen have limited work space in their workshop. It was reported that 50% (four workshops out of eight) of the workshops were run single-handedly by the craftsmen themselves, i.e., four craftsmen were working without any assistant in their workshop. Hence, they have to complete all the tasks alone, which results in work-related fatigue and affects work efficiency.

Table 1

Table 1 Demographic and Job Task Related Information (n=15)

No.	Questions	Category	No. of Respondents (n=15)
1	Age	31-40	5
		41-50	4
		51 & above	5
2	Education	Illiterate	1
		Primary	4
		Secondary	9
		Graduate	1
3	Experience	5-20 years	7
		21-40 years	4
		41 years & above	4
4	Working hours	**08 hrs**	13
		10 hrs	2
5	Breaking time	2-5 time	8
		> 5 time	7
6	Resting time	**1 hour**	
		2 hour	15
7	Working pattern	**Alone**	6
		With Assistant	9
8	Do you carry your work monthly at same workplace?	**Yes**	15
		No	
9	Work rotation with colleagues	**Yes**	8
		No	7
10	Repetitive work	**Yes**	9
		No	6
11	Workshop having sufficient space	**Yes**	9
		No	6
12	Enough sunlight and air circulation/ proper ventilation	**Yes**	13
		No	2
13	Use of any mechanized tools to reduce physical activity/ reduce load	**Yes**	13
		No	2
14	Environmental or other factors that affects work production/ create disturbance?		
		Temperature	3
		Humidity	15
		Noise	

		Other than this please specify	
14	Use of back rest for supporting upper back	**Yes**	6
		No	9
15	Use of cushion while working sitting on floor	**Yes**	15
		No	
16	Job tasks	a) Finishing of wood piece	8
		b) Transferring design on to wood piece	8
		c) carving process	9
		d) Finishing of carved wooden block	10

The craft is practiced by sitting on the floor continuously in the same posture. All of them use cushions for sitting, but nine craftsmen work without back support. It was also reported that, according to the work pattern, craftsmen undergo repetitive and continuous work. This caused musculoskeletal disorders as well as pain and discomfort. There was no significant problem with eyesight observed among the participants, as they preferred to work in sunlight. It might be stated that in this case, long-term eye problems would be developed.

All the craftsmen face disturbances in their work due to humidity during the rainy season, as wood dust clumps to the wood and doesn't come out easily from the drilled part. In addition to this, less sunlight during the monsoon season also creates work hindrances. 13 out of 15 craftsmen use mechanised tools such as a trimmer, grinder, and hand drill for the finishing of wood pieces, i.e., the preparatory process. This resulted in saving time and energy and increasing productivity by maintaining quality. At the same time, it was reported that many of them faced the problem of breathing. The wood dust produced from grinding applications may cause a range of health hazards since grinding dust tends to affect the respiratory system as well as spread throughout the work area and environment quickly Mahmood et al. (2021). To address the lighting and wood dust issues, this requires immediate attention and action.

4.2. BODY PART EXPERIENCING DISCOMFORT

Table 2

Table 2 Most Affected Body Part Experience Discomfort

Age			**Level of Discomfort**					
			ND (n)	**LD (n)**	**MD (n)**	**SD (n)**	**DD (n)**	**UBD (n)**
31-40	**Most affected body parts**							
(n=5)		Neck	2	3				
		lower back	2	3				

	lower leg	4	1			
	knee	3	2			
	Vision	5				
	Breathing problem	3	1			1
	Neck		4	3		
41-50	lower back	3	2			
(n=5)	lower leg	4	2			
	knee	3	2			
	Vision	4	1			
	Breathing problem	3	2			
	Neck			**3**		
51 & above	lower back	1	2	1	1	
(n=5)	lower leg	2	1	1	1	
	knee	1		2	2	
	Vision	3	2			
	Breathing problem	3	2			

*(n)= No. of respondents facing discomfort, ND- No Discomfort, LD- Light Discomfort, MD- derate discomfort, SD- Strong Discomfort, DD- Disruptive Discomfort

The results from the body part experiencing discomfort scale were used to measure the level of discomfort experienced at various regions of the body Mrunalini and Logeswari (2016). The light (LD)to moderate (MD) pain in neck was reported amongst the 9 craftsmen. From Table 2, it is observed that most of the senior artisans experienced this kind of pain regularly. The amount of disorder and pain increases in the young generation at times of severe work load. Most of the senior artisans (n = 5) experienced moderate (MD) to strong discomfort (SD) in neck, lower back, lower leg and knee. Therefore, it can be said that the amount of pain increased with the exertion at work as well as increased with the growing age. There is an association with age as well as work exertion to the Musculoskeletal Disorders (MSDs).

4.3. POSTURAL ANALYSIS

The rapid upper limb analysis scale was 4 and 5. The postural score of nine craftsmen was 4. The results indicated that discomfort was more likely to occur in the neck and trunk. Based on the results of the RULA assessment, the majority of participants needed more research before making any changes Table 3.

The results from Nordic questionnaire discovered that body part most affected by pain were the neck, lower back, lower leg and knee.

Table 3

Table 3 Frequency Distribution of Exposure to Ergonomic Risk Factors in Woodblock Makers RULA Score

Score	Statement	Frequency
1-2	Acceptable posture	0

3-4	**Further investigation and change may be needed**	**9**
5-6	Further investigation, change soon	6
7	Investigate and implement change	0

The study was undertaken by observing the postures and work space arrangement. The postural analysis and the work space arrangement presented below are supported with photographs and analyzed with descriptions.

4.3.1. WORKING POSTURE

There are different stages of the block-making process, as shown in Figure 2. The postures differ according to the process or stage of block-making. The craftsmen need to sit continuously for hours for the carving process. There are four stages of woodblock making: a) finishing of the wood piece; b) transferring design to the wood piece; c) actual carving; d) handle attachment; and e) finishing of the carved woodblock. The process of finishing a rough wood piece takes immense physical exertion and time. Although the use of mechanised tools has reduced physical exertion by saving time and energy and increasing the productivity of craftsmen.

The process of carving is tedious, and craftsmen have to sit continuously in the same posture for hours. It takes a minimum of three days to carve an outline block. The body parts involved and affected in the carving process were the eye, neck, lower back, hand, and arm, and the craftsmen worked in the same static position while carving. Thus, the degree of stress associated with this position was examined. The majority of responders were found to work and sit without back support. It was noted that artisans would adjust their seating positions based on what was most comfortable for them (Figure 5 and Figure 6).

Position A: It has been observed, based on Figure 5, that some craftsmen used to sit in a folded-leg posture. Due to this, pain in the lower leg and knee has been reported.

Position B: Some of the craftsmen used to sit on their paws or by keeping one leg half-folded so that the elbows and arms got support from the knee and the arm stayed in the rest position (Figure 6).

During the carving process, one hand was used to hold the chisel while the other held the mallet, which was used to repeatedly tap on the chisel. Two different kinds of mallets were employed. One weighs 800 g, which is heavier and was used to break the wood piece; the other weighs 500 g, which is lighter and was used for carving and tracing. The mallet used is about a foot long, allowing the craftsmen to handle it properly and conveniently (Figure 7).

Figure 5

Figure 5 Craftsmen at Work: Working Position A
Source Image Captured by Researcher During Field Visit, Pethapur

Figure 6

Figure 6 Craftsmen at Work: Working Position B
Source Image Captured by Researcher During Field Visit, Pethapur

Figure 7

Figure 7 A Mallet Used in Carving (weight: 500 gm)
Source Image Captured by Researcher During Field Visit, Pethapur

Figure 8

a. Arrangement of wood piece, tools and equipment in limited space

b. Due to less sunlight and ventilation inside the workshop, craftsman works outside

c. Craftsman sit and work in a corner of balcony

d. Craftsman sit and work in a *warandha*

Figure 8 Work Area and Workshop Arrangement
Source Image Captured by Researcher During Field Visit, Pethapur

4.3.2. WORK SPACE AND WORK ENVIRONMENT

All the workshops were visited, and each workshop was observed and analysed on the basis of ergonomic principles to suggest interventions that need to be implemented.

Most of the workshops were attached to their dwellings, such as the *warandha* or balcony, or on a separate floor or a separate room used for the workshops, except for one that was rented and a mile away from the residence. Due to this, craftsmen have to attend to guests and do some household work, which interrupts the continuity of the work. It was observed that, out of eight workshops, six needed rearrangements of tools and space. It was observed that, due to the limited work space, they used to keep tools in a wooden box or metal trunk. This has made work more difficult and reduced productivity as craftsmen had to place things aside, then

take out their equipment and rearrange the table when they returned to their jobs. Due to the time and energy consumed on repetitive tasks led to work-related fatigue and a decrease in concentration, focus, and interest (Figure 8).

It was found that four out of eight workshops were well maintained and in good condition. The rest of the four workshops need improvement by reorganising the tools and other stuff to create a better working area and avoid interruptions during work. There was enough sunlight and ventilation in the workshops. It was observed that most of the craftsmen used to mount the cutting and finishing tools with hooks on the wall. The small tools, such as chisels, punches, and dies, were used to be put in a drawer of table, sides of the table or in a separate box. Although all the respondents used to keep the required tools within their reach, it would save time and energy as we reduce physical activity during work.

It was reported that during the monsoon season, work efficiency is affected due to less sunlight, and wood gets affected by the moisture, so it becomes tricky for the craftsmen to remove wood dust from the drilled part because when wood is moist, wood dust clumps together and forms an impermeable barrier that does not allow air or heat to pass through.

4.3.2.1. WORK PATTERN

Based on observations and interviews, it was found that in three of the nine workshops, there were two or three artisans working as assistants. The other artisans all labour on their own, without help. As a result, the craftsmen's workload increased, and they were unable to meet the deadline. Despite the fact that using mechanised equipment has decreased workload by conserving energy and time, there are still other tedious tasks to be taken into consideration (starting from procuring wood to packaging and shipping woodblocks). Hence, it is important to educate the craftsmen about an organised workspace and systematic working patterns.

It was discovered that most artisans were forced to work at random due to the limited workspace, low labour force, and large order list. As a result, there was fatigue and reduced work efficiency.

The way a workplace is designed has a significant effect on employee productivity. Making the best use of space through optimum placement of equipment, integrating human factors into workplace design, and effectively aligning the workplace with the surrounding environment are important aspects of ergonomics Thomas (2012). Hence it was apparent that reorganizing the workspace by following ergonomic principles will help to improve productivity.

4.3.2.2. ERGONOMIC ANALYSIS OF TABLE USED FOR BLOCK MAKING

A table is the most essential and basic piece of equipment used in block making. Two types of tables were used: one with three inclined legs is called *tarbaiyo* in the local language, and the other is a desk called *mez.* (Figure 9) The specification of the table used is shown in the table below. It was observed that the tables used by the craftsmen were in different sizes, with minor variations.

Figure 9

a) A desk with drawers (*Mez*) b) A table with three inclined legs

Figure 9 Tables Used in Wood Block Making
Source Image Captured by Researcher During Field Visit, Pethapur

A table with three inclined legs (*tarbaiyo*): This type of table is used mainly for carving. It has been used by the craftsmen for many years since the origin of the block-making craft. By observation and interview, it can be said that *Tarbaiyo* has been designed keeping in mind the following details:

- Due to its three inclined legs, it doesn't move while carving.
- Three legs allow easy movement of the leg.
- The board (surface of the table) can withstand weight or pressure exerted with a mallet since it is sturdy and thick enough.
- To keep the dies and chisels steady and from collapsing off the table, one side of the table features 1 cm-high edges (Figure 9b).

Desk (Mez): A desk is generally used for drawing or tracing the design. It was made up of four legs and had two or three drawers to keep the drawing tools within reach. The base of a desk had a flat surface and was used for drawing. Some of the craftsmen are also comfortable using a desk to perform all types of work, including drawing, tracing, and carving.

- Drawers make the tools easily accessible, such as different chisels, dies, and drawing tools such scales, compass, colour pencils, paint, mallets, and design papers, within reach of the craftsmen.
- There is a limited amount of space for comfortable leg movement because of the drawers (Figure 9a).

At each workshop, the length, width, height, and thickness of both types of tables were measured. A small amount of variance between dimensions was noted between the tables each artist utilised in his various workshops. The average dimension was then measured after that. Table 3 indicates that the average height of the three-legged Tarbaiyo table was 14.5" x 17.5" x 11" (L x B x H), and the average size of a desk was 11.5" x 14.5" x 13.5" (L x B x H). It has been estimated that the height of the table was nearly one foot based on average size (Table 4).

Table 4

Table 4 Specifications of Table Used in Wood Block Making

Dimensions	L	B	H	L	B	H
	11.5"	14"	13.5"	14.5"	17.5"	11"
Thickness of board/base	1"			1.5"		

Wood used in making	Teakwood	Teakwood
Drawers	Yes, two or three	No
Legs	four	Three
Use	Used in drawing and tracing of design	Used in carving process
limitations	Restricted leg movement	Less space for keeping tools.

Height of table:

It was noted during the interview that the height of the tables was adjusted in accordance with the user's height; craftsmen would either place a wood piece under the actual wood block to increase height or keep a stone or wood piece under the table leg to adjust the height of the table (Figure 10). Since doing otherwise might affect work posture and raise the risk of ergonomic hazards, it can be said that the height of the table should be proportionate to the height of the craftsman.

Figure 10

Figure 10 Craftsmen Used to Place Wood Piece or Stone to Make the Table
Source Images Captured by the Researcher During the Field Visit at Pethapur

The results of current study are supported with related literature. The study by Mahmood et al. (2021) found that upper extremity musculoskeletal disorders and ergonomic risk exposure among Pakistani handicraft workers, particularly the neck and shoulder, necessitate changes in working conditions. Musculoskeletal problems were identified as a serious issue among craftsmen by Mrunalini and Logeswari (2016) in their review, which emphasised the necessity for corrective actions to decrease ergonomic risks. A study found that workers in saw mills face moderate to high risk of musculoskeletal disorders due to manual work and lack of awareness about ergonomics and proper postures. Small scale industries and handicraft sectors were lacking with the awareness about ergonomics, good work environment, right postures etc Sain and Meena (2016). According to the study conducted by Caballer (2016) on school desk suggests that school desks should be adjustable in height to accommodate students of varying heights, ensuring comfort and ease of use.

5. CONCLUSIONS AND RECOMMENDED REMEDIES

After Significant ergonomic risks and hazards have been identified after an ergonomic assessment. These were classified in order of urgency, and possible

solutions were given to overcome the ergonomic risks and increase productivity. The proposed suggestive measures were derived from research on related issues that applied and assessed ergonomic principles. The ergonomic risks associated with the craft and its possible solutions have been discussed in detail below and supported by the related literature.

Factors identified: Natural light provision and use of artificial lighting	
Some workshops were found to have less sunlight hence craftsmen had to work outside the workshop	Skylights can be incorporated to get maximum amount of sunlight
During monsoon season, due to cloudy weather less sunlight observed and that creates work hinderance	Appropriate artificial lighting and lamps with efficient light output such as T5 tube-light or LED lighting systems can be used with less maintenance and do not produce any glare.[1]
Factors identified: Exposure to wood dust Shavings should always be vacuumed up at the source wherever possible	
• **wood dust produced from grinding applications may cause a range of health hazards since grinding dust tends to affect the respiratory system**	• OSHA recommends an eight-hour exposure limit of 5 mg/m^3 for hard wood and soft wood. • Wearing masks and apron can minimize the risk [6] • Suction devices must be used to keep dust and shavings from accumulating in the workspace. Shavings should always be vacuumed up at the source[16]
• **Factors identified: Adjustable desk**	
Desk/table used for carving	
Craftsmen need to do adjustment in the existing table to adjust height Need to overcome the limitations of both kind of tables.	• By maintaining the traditional design of the table with adjustable height, side drawers or panels to store tools, and additional space, it is possible to remodel it in accordance with ergonomic principles and the necessary specifications.
The craftsmen were not aware of ergonomic risks and occupational health hazards.	• There is a need to familiarize young craftsmen by means of training with the term 'ergonomics' and impart knowledge of some physical exercises to reduce the level of pain and for relaxation.
• **Factors identified:**	
• **Handicraft sectors given least attention to ergonomic work place and its risk factors**	• The government needs to take initiatives to develop ergonomic workplaces in the craft sector by providing financial support or subsidies to develop ergonomic infrastructure • Create and implement policies governing the ergonomic risks associated with craft industries to help artisans [14].
Factors identified: Work pattern	
It was observed that craftsmen used to take one long break of two hours in noon and working hours were 8 in the morning to 6 in the evening	• The two-hour lunch break could be split up into two or three shorter ones. One hour of relaxing and one hour of lunch break, for instance, can be split up into little intervals of fifteen or thirty minutes each. It might save time, and additional time could be spent on bodily relaxation by increasing work efficiency. • Increasing the number of working hours per day and modifying work schedules have been recommended to increase productivity. • Dividing work according to the environment would benefit the craftsmen by boosting output

	and eliminating fatigue. For example, intricate work like drawing and carving should be done during daylight, while attaching handles and packaging can be done in the evening.
Factors identified: Work area and work space	
• Less manpower, pending orders, and limited work space resulted in work fatigue and affected the work efficiency. • Most of the workshops were located in the residence or were part of the dwellings. The interruptions faced during work were due to family members, household work, attending guests, children playing around, etc.	• **Rearranging the workspace:** Arranging tools and equipment in a more systematic manner will help the workplace overcome fatigue and increase productivity. • **Workstation design:** Create a workspace or corner where artisans can focus better and work without distractions.

6. CONCLUSION

Craftsmen spent hours at a time in a static position at the same place, according to observations and research findings. Age and work exertion were found to have significant associations with musculoskeletal disorders. Senior artisans reportedly complained of severe to crippling lower back and knee pain. With higher exertion and longer work in the same posture, discomfort increases. The paper states that the RULA score indicated the need for further investigation on postural analysis and the implementation of change. There is need to aware young craftsmen about the ergonomic risks and its importance.

It was found that during the monsoon, work efficiency was affected due to less sunlight. An adequate artificial light source in workshops is needed to work smoothly in cloudy weather.

Wood dust produced with the use of a grinder and trimmer can cause serious damage to the health of the craftsmen. It would affect the respiratory system and cause skin allergies. It is intended to remove wood dust in an appropriate manner. Vacuum suction can be used to accomplish this. Floor chair with adjustable back support can be useful.

Further research needs to be done by designing a workstation, applying ergonomic principles, and analysing its impact.

CONFLICT OF INTERESTS

None.

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