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Analysing the Prevalence of Occupational Risk Among Workers Involved in Traditional Clay Brick Manufacturing Tasks

M. K. Sain and M. L. Meena

Abstract Indian clay brick industry is very vast and unorganized in which manual work is performed with traditional methods and un-ergonomically designed tools. The clay brick manufacturing process includes various manual activities like clot preparation, moulding, carrying bricks to brick kiln and arrange them inside kiln for firing and then carrying out fired bricks from kiln. Due to lack of awareness regarding ergonomic principles and repetitive working with awkward postures, brick kiln workers suffer from MSDs and other occupational health problems. The purpose of the present study is to analyse the body posture and identify the severity of occupational risk among workers engaged in manual clay brick making task. Posture analysis was done by using REBA score method. According to the result, most of the workers were found having less than five years of experience. Workers generally leave this job due to various health issues. Average REBA scores for various tasks were very high. A significant decrement in hand grip strength was found after repetitive work. If the workers will continue working in the present situation, health problems and MSDs will become chronic after a time. To improve the health of brick kiln workers along with awareness regarding ergonomic principles, use of ergonomically designed hand tools and protective aids should be used.

Keywords Clay brick · Grip strength · Occupational health · Posture · REBA

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Table 1 Status of brick industry in various Asian countries [5]

	Bangladesh	India	Vietnam	Nepal	Pakistan	China
No. of brick units	–	1,40,000	10,000	700	>10,000	80,000
Production in billion	17.2	240–260	26.59	3.15	50	800–1000
Labour in lac	10	90–100	–	–	15	50
Population in million	149.7	1210	176.5	18.6	176.7	1334
Bricks use per capita	115	215	151	169	283	750

1 Introduction

Being an important material for construction, bricks are widely used in India and other Asian countries. Mechanized and fully automated process for brick making is used in developed countries. In developing countries particularly in Asian countries like India, brick industry is very large, unorganized and manual. India is the second-largest brick producer after China with 1.40 lac manufacturing units and 90 to 100 lac workers. Table 1 shows the status of the brick industry in various Asian countries.

About 99% brick production in India is done through hand moulding. In very few areas like clay preparation, work is done through pug mills or tractors mixers. The number of unorganized workers is significantly high in India, but the statistics regarding the actual number of people employed, occupational health and safety, their social life and other problems related to their work environment are not available. These workers neither undergo any formal training nor are they sufficiently educated. Posture and force analyses found poor working posture and undesirable wrist positions, with substantial loadings among brick kiln workers [7]. Working in an awkward posture with traditionally designed hand tools and un-ergonomic workplaces results in musculoskeletal disorders (MSDs) and other occupational health problems among workers [2].

The ergonomic intervention with properly designed hand tools and better nutrition is the best solution to work-related MSDs which improves the occupational health of the workers, so they can work safely for a longer period [1, 3, 6].

The brick making process includes a number of steps which are repetitive and continuous and performed in an awkward posture. Brick kiln workers have to work in stimulating and adverse working conditions, which have motivated for conducting the study in this field. This study was conducted to analyse the working posture of brick kiln workers and to find the occupational risk in various brick making steps.

2 Methodology

The study was conducted on workers of brick kilns in Rajasthan, India, during March to June 2016, when the work was in full swing. Observations were recorded in the form of videos and photographs. Video recordings and photographs were used to analyse the postures in various brick making tasks. For video analysis, VLC media

Table 2 Level of risk and required action based on REBA score [4]

Score	Level of risk	Action required
+1	No risk	No action required
2 or 3	Low risk	Action may be required
4 to 7	Medium risk	Further investigation and immediate change are required
8 to 10	High risk	Investigate and implement changes soon
11 to 15	Very high risk	Improve now

player software was used for each task. Body posture angles were measured by using ErgoFellow 2.0 software, and the posture analysis was done by REBA score method to find out the severity of the risk. The severity of risk according to REBA score and action required is given in Table 2.

3 Observations and Results

The lay brick manufacturing involves various manual tasks including excavation of clay, mixing and preparation of mud, clot cutting, mould filling and evacuating, stacking bricks, carrying, setting bricks in kilns, etc.

4 Posture Analysis

Working posture of workers engaged in various tasks was analysed by using REBA score sheet.

4.1 REBA Score

Spading is the initial step in the brick making process in which clay is obtained in small pieces from earth. The spading task is also used in clay preparation by mixing it after wetting. In this task, the body posture was found awkward with repetitive motion. Typical REBA scores for spading task were calculated by REBA score sheet which is shown in Table 3.

Prepared clay is converted into clots, and these clots are now filled into moulding boxes. This task was found repetitive with awkward posture. The typical calculation of REBA score for mould filling task is shown in Table 4.

At the final stage of brick moulding, filled moulding box is evacuated by inverting it on earth. This task was found repetitive with highly bending trunk and twisted wrist. Table 5 shows significative calculation of REBA score for mould evacuating task.

Table 3 REBA score for spading task

Score A	Neck	Leg	Trunk	Total	Adjusted considering load (6 kg)	Score C	Adjusted score (repetition and walking)
Score B	+1	+2	+4	5	+1 = 6	10	12
	Upper arm	Wrist	Lower arm	Total	Adjusted (shoulders raised)		
	+4 + 1 = + 5	+2	+2	8	+1 = 9		

Table 4 REBA score for mould filling task

Score A	Neck	Leg	Trunk	Total	Adjusted considering load (6 kg)	Score C	Adjusted score (repetition and posture changes frequently)
Score B	+1	+3	+4	6	+1 = 7	10	12
	Upper arm	Wrist	Lower arm	Total	Adjusted handle not acceptable but possible		
	+4	+2	+2	6	+1 = 8		

Table 5 REBA score for mould evacuating task

Score A	Neck	Leg	Trunk	Total	Adjusted considering load (6 kg)	Score C	Adjusted score (repetition and walking)
	+2	+1	+4	5	+1 = 6	9	11
Score B	Upper arm	Wrist	Lower arm	Total	Adjusted handle not acceptable but possible		
	+4 -1 (leaning body) = +3	+1 + 1 = 2 (Twisted wrist)	+2	5	+1 = 7		

For all three tasks—spading, mould filling and mould evacuating—average REBA (11.40, 10.80 and 10.40) and RULA (6.4, 5.8 and 5.30) scores were very high. The average REBA scores indicate the immediate need of ergonomic interventions.

Table 6 Hand grip strength of workers

	Right hand		Left hand		p value
	Mean (S.D)	Range	Mean (S.D)	Range	
Hand grip strength after work	63.3 (5.0)	58–74	60.8 (5.1)	56–73	0.181
Hand grip strength before work	68.2 (6.2)	49–85	65.0 (6.1)	48–83	0.163
p value	0.014*		0.024*		

5 Hand Grip Strength

The hand grip strength of workers was recorded before the work and at end of work shift. A significant decrement in hand grip strength was observed at the end of work shift which indicates the musculoskeletal risk among brick kiln workers (Table 6).

6 Conclusion and Discussion

The results of the present study indicate that the brick making is very high-risk occupation. For all three tasks—spading, mould filling and mould evacuating—REBA (11.40, 10.80 and 10.40) and RULA (6.4, 5.8 and 5.30) scores were very high. The result also shows that there was a significant decrement in hand grip strength among the workers compared to control group. The difference in hand grip strength in right and left hand shows the exposure to hand tools for prolonged period of time. Hence, ergonomic changes must be implemented immediately to avoid musculoskeletal problems. If the workers will continue working in the present way, the health problems and MSDs will increase gradually and became chronic after a time.

The causes of musculoskeletal problems among clay brick manufacturing workers are lack of training and heavy mode of manual working. Moreover, use of un-ergonomically designed hand tools, following traditional methods of working and improper workplace design, is the contributing factor for very high-risk level. Thus, to improve the occupational life of brick kiln workers, the following suggestions can be proposed:

- Awareness regarding ergonomic principles must be spread among brick kiln workers.
- Regular monitoring of health must be carried out for workers.
- Ergonomically designed hand tools and aids should be used for the workers' comfort.

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