

Prevalence of Musculoskeletal Disorders among Stone Polishing Workers using Stone Polishing Devices in Unorganized Sector of Guwahati (India)



Susmita Nath, Rajiv Tiwari, Sougata Karmakar

Abstract: Stone polishing is one of the prominent informal sector in India (and world as well), where a large number of stone polisher works for long duration. Stone polishing workers manually operate the polishing machine either in standing or sitting position to carry out polishing activities, and are quite prone to various MSDs (repetitive strain induced) and thereby injuries and accidents. The present research therefore intends to explore the occurrences of WMSDs among the stone-polishing workers, and with utmost attempt to put forward some recommendations regarding corrective measures. Thirty (30) male stone polishing workers were selected from the Guwahati city of Assam. A comprehensive study on discomfort feeling was carried out by the modified Nordic questionnaire which considered the information about work nature and job stress. Rapid Entire Body Assessment (REBA) method was followed to evaluate whole body postural load and risks associated with the job. The finding of the study contributes to the understanding of the working conditions of the stone polishing workers and their physical discomforts at various body parts (mainly the lower back, knees and shoulder) due to awkward posture, repetitive motion, force exertion and sustained load handling during polishing activities. To overcome the problem arisen from aforesaid ergonomic stressors associated with stone-polishing work, ergonomic design intervention pertaining to modification of the equipment / hand tool like handle design, easy manoeuvrability, avoiding hand-holding of weight etc. have been proposed

Keywords: Informal sector, MSDs, Design intervention, Ergonomics, Occupational health

I. INTRODUCTION

Stone polishing is one of the prominent informal sector in India (and world as well), where a large number of stone polisher works for long working hours. The stone polishing workers manually operates the polishing machine either in standing or sitting position to carry out polishing activities, and are thus quite prone to work-related musculoskeletal disorders (WMSDs) (specially of repetitive strain induced ones) and thereby injuries and accidents. Sustained sitting or standing posture for long duration increases the demand on the muscles, ligaments and other soft tissues of the

musculoskeletal system, which causes overall discomfort and pain in the back, neck and shoulders of the workers [1, 2]. Moreover, polishing activities involve repetitive actions that stand with a greater chance (and incidence, often) of WMSDs as the work requires manual task, frequent monotonous repetitive movements and lifting (manual handling) of the polishing machine. WMSDs have recorded a global impact (and concern, therefore) on both individual health and the organization [3]. Literature review revealed that various research work has been carried out in Indian scenario to assess ergonomic stressors and to report on occurrence of WMSDs associated with different formal and informal occupational setups to propose or implement ergonomic design interventions [4, 5, 6]. As far as stone polishing workers are concerned, there had been no literature available assessing the occupational health issues and ergonomic risk factors and thereby ergonomic interventions. Therefore, the current research intended to explore the occurrences of WMSDs among the stone-polishing workers, and with utmost attempt to put forward some recommendations regarding corrective measures.

II. METHODOLOGY

The study sample consisted of 30 male stone polishing workers across Guwahati city, Assam. The workers were selected purposively from the different places of the city namely Lokhra, Ambari Fatasil, Ganesguri and Amingaon. A comprehensive study on discomfort feeling was carried out by the modified Nordic questionnaire [7], which considered the information about work nature, job stress and discomfort feeling. The reliability and validity of the questionnaire was assessed statistically and Cronbach's Alpha (α) ≥ 0.80 was accepted for reliability. Analysis of body posture was done by Rapid Entire Body Assessment (REBA) method [8] to evaluate the postural stress while on the job. In this study polishing activities mainly for the wall, floor and staircase were considered.

III. RESULT AND DISCUSSION

Following analysis of the collected data on job characteristic and demographic profile of the polishing workers, it was observed that participants' age varied from 18-46 years (Mean= 30.5; SD=7.9 years) with job experience between 1-15 years (mean= 5.4 years; SD= 3.2 years).

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The workers were mostly married (80%) and their educational level varied as illiterate (33.3%), primary school (53.3%) and secondary school (3.33%). The daily duration of work per day was 6.4 ± 1.5 hours. The average duration of break in a day was $\frac{1}{2}$ to 1 hour and the average daily working hours without break was about 5 hours (SD = 2hours). The workers worked at a stretch of 2 ± 1 hours. The majority of the workers found their work to be stressful to the extent of high (26.7%) to extremely high (56.7%). A large section of the workers reported a high extent of job responsibility (53.3%) with comparatively low job satisfaction.

The incidence of musculoskeletal symptoms of different body regions of the stone polishing workers caused disruption in carrying out regular work due to pain. 93.3% of the stone polishing worker reported pain in the neck region during the last 12 months, 90% in the wrists, 80% in the shoulder, 90% in the elbow, 83.3% in the ankle and 66.7% had knee trouble during the last 12 months. Disturbances in carrying out regular activities because of musculoskeletal pain were reported by all of the stone polishing workers, and this resulted in pain in the neck, shoulders, wrist/hand, elbow, ankles and knee. There was significant correlation between duration of working hours per day with the development of body part discomfort. Duration of working hours was significantly correlated with wrist pain ($r=0.41, p \leq 0.05$), elbow ($r=0.46, p \leq 0.01$) and knee pain ($r=0.46, p \leq 0.01$). Severity of vibrational discomfort was found significantly correlated with number of breaks ($r=0.41, p \leq 0.05$) and duration of break ($r=0.61, p \leq 0.05$). There was significant correlation between wrist trouble and visit to a physician ($r=0.49, p \leq 0.05$). The workers reported their visit to physician for elbow trouble ($r=0.95, p \leq 0.05$) and knee pain ($r=0.42, p \leq 0.05$). There was no significant correlation of visiting physician for personal habits (drinking, smoking etc.).

Table 1. Factors influencing the occurrence of pain in different body parts of the stone polishing workers (n=30)

Pain in body parts	Variable	p-value
Shoulder	Height	0.050
	Working days in a week	0.030
	Work done during break	0.020
Wrist	Weight	0.015
	Height	0.012
	Job experience	0.009
	Duration of working hours in a day	0.007
	Number of break taken	0.009
	Work done during break time	0.011
	Vibration discomfort	0.01
Elbow	Smoking	0.002
	Job experience	0.003
	Work done during break	0.027
Ankle	Smoking	0.012
	Age	0.004
	Weight	0.004
	Height	0.004
	Daily work duration	0.003

	Work done during break	0.003
	Working days in a week	0.003
	Work done during break	0.000
Knee	Number of breaks a day	0.001

Ordinal regression

As shown in the Table1, the results of ordinal regression analysis showed that individual factors including age, weight, height as well as others factors i.e. daily duration, job experience, work done in break, working days a week, number of break taken in a day, duration of break, hours spent in polishing job were associated with musculoskeletal symptoms. All these factors influenced on occurrence of pain in different body parts. The occurrence of pain in the mentioned body regions was higher for the workers who worked for prolonged duration (≥ 5 hours) and took less frequent breaks. Vibration discomfort was found to be associated with the occurrence of wrist pain. This might be due to transmission of vibration from polishing tool to hand. Higher occurrence of pain was also observed among the less experienced workers than the more experienced. Similarly, age was also found to be one of the influencing factors for pain among the stone polishing workers. The older workers were found to be suffering more than the younger workers. Height and weight of the workers were found to be associated with prevalence of pain. However, there no significant relation was found in case of pain in neck with any of the factors under consideration.

Postural Analysis

The REBA score (score A, score B and final score) of stone polishing worker during carrying out different types of polishing work (floor polishing, wall polishing, and staircase polishing) are shown in Table 3. Percentages of workers with the final REBA grand score of 5 and 6 was 66.7% in floor polishing, 86.7% in wall polishing and 73.3% in staircase polishing. It is observed that the mean value of final/ grand scores for floor, wall and staircase polishing were 5.9, 5.1 and 5.2 respectively. It indicates that the overall postural load was of medium risk and further investigation is required to identify intervention strategies to correct the awkward posture soon. Among many of the causative factors of body parts discomfort of the workers, one might the awkward posture of different body segments adopted during polishing work.

Table 2. REBA scoring for stone polishing worker during different polishing activities (n=30)

REBA Score	Floor Polishing		Wall Polishing		Staircase Polishing	
	Final Score	n(%)	Final Score	n(%)	Final Score	n(%)
1						
2						
3						
4	3(10.0)		2(6.7)		4(13.3)	
5	3(10.0)		26(86.7)		22(73.3)	
6	20(66.7)					
7	3(10.0)				1(3.3)	



8		2(6.7)	3(10.0)
9	1(3.3)		
10			
Mean (SD)	4.6(0.93)	5.1(0.81)	5.2(10.7)

IV. DISCUSSION AND CONCLUSION

The crucial part of the findings was that the occurrence of the musculoskeletal pain for one or more number of body parts was common among all (100%) the stone polishing workers under study. This WMSD related issues affected their normal activities as reported by the workers. Majority (93.3%) of the workers were having high wrist pain which hindered their normal activities both at home and at work. Apart from awkward wrist posture, holding of vibrating polishing machine by hand might be the main reason for occurrence of wrist pain. Wrist pain was found to be significantly associated with vibrational discomfort reported by the participants. The significant positive correlation of vibrational discomfort with number and duration of break revealed that workers used to take more number of breaks for longer duration as their severity of vibrational discomfort was high during use of polishing tool. The prevailing of WMSDs in various body regions were found to be significantly correlated with the daily working hours. The severity of pain was excessive at shoulder, wrist, ankle and knee than other body-parts. Following postural load evaluation (using REBA technique), it was noticed that majority of the workers adopt awkward posture with medium risk of developing musculoskeletal ailments. This suggests the need of systematic inquiry and implementation of corrective measure to ensure better working posture. Various researchers have pointed out that the prevalence of musculoskeletal ailments among Indian workers are mainly due to limited infrastructure to support ergonomic activities and interventions, lack of appropriate anthropometric data, ineffective working tools, improper working condition etc. [9,10]. Stone polishing job in unorganized sector is generally repetitive in nature with awkward postures and long working hours. These result in prevalence of WMSDs which is aggravated due to transmission of vibrations from the polishing tools to the hands, arms and shoulders. Therefore, there is need of more research aiming at intervention strategies to ameliorate the drudgery of the stone polishing workers. Such intervention strategies may include (1) ergonomic design of the polishing tool for easy and sustained holding (2) use of vibration dampening material as coating material on handle to reduce impact of vibration (3) providing additional supportive mechanism for avoiding the load holding of the vibrating tool for prolonged duration, (4) workers are to be encouraged to take frequent rest breaks of shorter duration to lessen the consequences of body parts discomfort due to the long duration of polishing activities, (5) awareness generation among workers to avoid sustained awkward postures, etc.

With the case study from Guwahati city, present research has outlined the scenario of prevalence of WMSDs among workers engaged in stone polishing work. It has highlighted various ergonomic stressors associated with this activity by establishing relationship of these causative factors with the occurrence and severity of pain/ discomforts at different body parts. The outcome of present research would ignite future researchers to carry out further research towards

implementing ergonomic design interventions to protect the stone polishing workers from WMSDs.

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