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## REBA technique in forge smith's workers

**Kavita Narwal and Neha Mishra****Abstract**

A forge smith is a person who forges, or shapes, metal by first heating it until it is red-hot, then uses tools like chisels and hammers to force the metal into the shape he desires, and the process is known as Forging. Combined with a heavy physical workload, it results in a high frequency of work-related musculoskeletal disorders. Work related musculoskeletal disorders are series of painful disorders of muscles, tendons and nerves. The present study was aimed to evaluate the musculoskeletal disorder (MSD) of 120 workers who are engaged in forging work using the posture analysis tool REBA Method. A video showing the different activities of the workers was shot and the snapshots were taken from it for the analysis. The final score of REBA during various working activities of maximum workers were found to be very high which need immediate action to be taken. Further to check whether action categories of REBA has some relation with different activities performed by the workers, test of significance is used and it was found that action categories of REBA postural analysis technique are dependent on various activities performed by forge smiths. The present Study recommended the awareness and proper ergonomics training to the workers.

**Keywords:** REBA, Postural analysis, work related musculoskeletal disorder, forge smith's**Introduction**

A forge smith is a person who forges, or shapes, metal by first heating it until it is red-hot, then uses tools like chisels and hammers to force the metal into the shape he desires, and the process is known as Forging. Forge smith's have been the most important group and enjoyed utmost respect in the traditional rural setup. No agriculture and no rural industry could sustain without them. As per the survey conducted by AIFI (association of Indian forging industry) in 2016, the estimated turnover of the 384 forging units operating in FY 2014-15 was Rs 27,835 crore including Rs 6,100 crore contributed from exports, providing employment to approximately 100,000 people in the country.

Despite this, the majority of forge workers live in poor areas, lack basic health and welfare services and social protection and work in an unhealthy and unsafe working environment. The Periodic Labour Force Survey 2017-18 report, released last year, states that 71% of the regular/salaried employees in the informal sector (non-agriculture) are those who do not have a written job contract. There is 54.2 percent who do not get paid leave. Not only this, but 49.6 percent of them do not even qualify for any social security scheme. It is clear that the scope of the such sector is not only wide but also completely unsafe. Absence of occupational and safety training, and their compulsive exposures to hazardous substances increases work related accidents, injuries and death rates (Santana and Loomis, 2004) [4] Therefore, the study recommended that there is dire need of implementation of Rapid entire body assessment (REBA) technique with proper awareness among forge worker to check whether various activities and postures adopted by forging workers has any dependency with work related musculoskeletal disorder(WMSDs).

**Hypothesis**

Action categories of REBA are independent of activities performed by forge smith's.

**Materials and Methods**

In the present study 120 workers were taken through snowball technique from Uttarakhand state and for the in-depth analysis of data the forge smith is categories under 3 categories as showed in table 1.

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**Table 1:** Categorization of forging workers on the basis of their task

Occupational details	Group I (Hammering)	Group II (Striking)	Group III (cooling)
Tools used	Hand hammer, anvil, shovel and tongs	Sledge hammer and anvil	Tongs
Position adopted	Sitting and squatting	Bending	Squatting
Duration of task	Long	Long	Medium

To determine the prevalence of level of risk REBA (Rapid Entire Body Assessment) technique is used, which was developed by Higne, and McAtamney (2000) <sup>[2]</sup>, to provide a quick and easy observational postural analysis tool for whole body activities (static and dynamic) giving musculoskeletal

risk action level Patrick G. Dempsey (2003) <sup>[3]</sup>. A video and photos of different sections like hammering, striking, and cooling, showing different movements of the workers during an activity was recorded. The snapshots were analysed to fill the scores in REBA as shown in table 2.

**Table 2:** Action categories of REBA technique


Reba Score	Risk Level	Action Level
AL <sub>0</sub> (1)	Negligible	Corrective action including further assessment is not necessary
AL <sub>1</sub> (2 to 3)	Low	Corrective action including further assessment may be necessary
AL <sub>2</sub> (4 to 7)	Medium	Corrective action including further assessment is necessary
AL <sub>3</sub> (8 to 10)	High	Corrective action including further assessment is necessary soon
AL <sub>4</sub> (11 to 15)	Very high	Very high Corrective action including further assessment is necessary now



## Results

The result regarding subjective assessment of postural risk with the help of REBA and observation technique furnished information of risk factors and work postures were assessed and enclosed in table 3 and figure 1. Various postures of neck, trunk and leg in group A (plus load/force), upper arms, lower arms and wrists in group B (plus coupling) along with activity score were observed and analysed. It was found that sum total of 30 percent of workers were in AL<sub>3</sub> which interprets high risk and action necessary now followed by 28.33 percent workers in AL<sub>4</sub> (very high risk, action necessary now), 15 percent in AL<sub>1</sub> (low risk, further action may be needed). However, only 1.66 percent of workers were found to be in AL<sub>0</sub> indicating 'negligible' risk level, means no action was necessary i.e., acceptable posture.

When the activities were analysed individually, it was observed that majority of the hammering workers involved in hammering operation (60 percent) were in the zone of AL<sub>3</sub> (high risk and action was necessary now) followed by 25 percent of workers in AL<sub>2</sub> (medium risk level and change was required soon), 15 percent in AL<sub>4</sub> (very high risk, action was necessary now). In group II workers (involved in striking operation) majority of the workers i.e 70 percent were under the AL<sub>4</sub> (very high risk, action was necessary now) zone and 30 percent under AL<sub>3</sub> (high risk and action was necessary now). Whereas in group III workers (cooling) 50 percent of the workers were under AL<sub>2</sub> zone (medium risk level and change was required soon) followed by 45 percent of workers in AL<sub>1</sub> indicating low risk level, further action may be needed, only 5 percent of workers in AL<sub>0</sub> (negligible risk, no action was necessary).

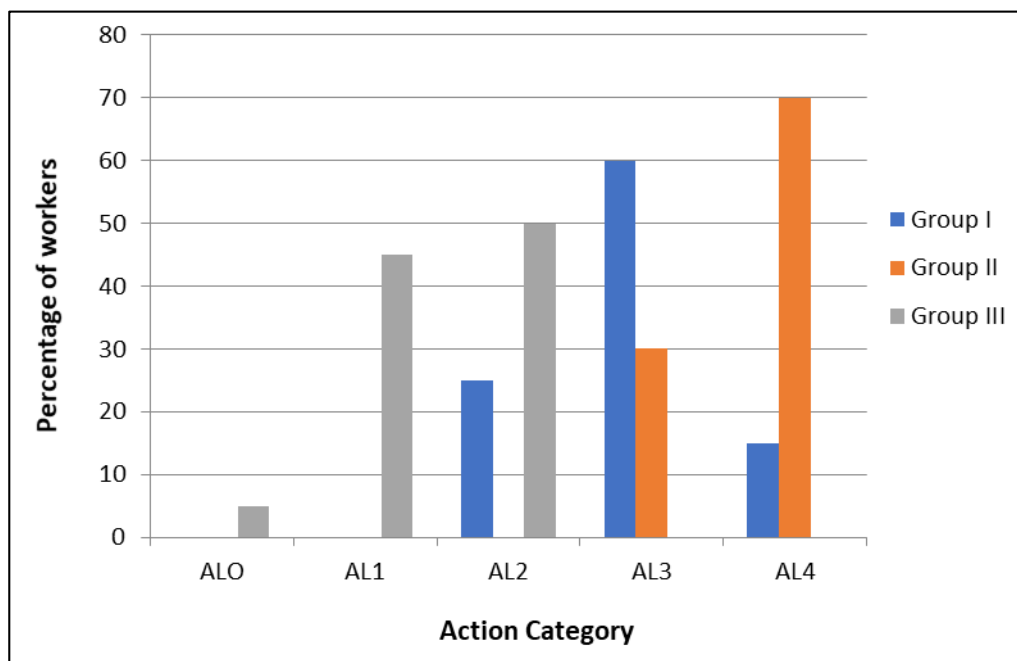
**Table 3:** REBA analysis for postural assessment of forge smiths

Forging activities	Posture	Posture analysis		
		REBA		
		REBA Score	Risk level	Action category
<b>Hammering (n=40)</b> 	Back bent forward, one arms below shoulder level and one above, sitting and squatting, weight handed over 5 kg but less than 10 kg.	8 -10	High	Corrective action including further assessment is necessary soon
<b>Striking (n=40)</b>	Back bent forward/backward, both knees bent, static position, weight handed over 7 kg but less than 15 kg.	11-15	Very high	Very high Corrective action including further assessment is necessary now

				
<p><b>Cooling (n=40)</b></p> 	<p>Squatting posture, knees bent, both arms below shoulder level, static position, weight needed over 5 kg or less.</p>	<p>4-7</p>	<p>Medium</p>	<p>Corrective action including further assessment is necessary</p>

Results was supported by study of Varghese M.A. (1999) [5] good working posture reduces the physiological cost of work and fatigue to a minimum; whereas static muscular efforts and incorrect postures for long period can damage the inter-

vertebral, cause tiredness and may increase the energy expenditure in proportion to the physical effort involved, leading to irreparable damage to the body.



**Fig 1:** REBA analyses for postural assessment of workers

As the result revealed that maximum risk has been faced by workers who are engaged in striking operation i.e. Group II workers followed by hammering workers and last but not the least by cooling workers. This may be due to poor posture as well as due to use of heavy operation tools during striking operation.

So in order to check it further that action categories of REBA postural analysis technique are dependent or not on various activities performed by forge smiths, test of significance is done as showed in (table 4) and it was found that action categories of REBA postural analysis technique are dependent on various activities performed by forge smiths. Result is supported by study of (Yerpude P.N. 2010) [6] that prevalence

of overall morbidity vary for different activities. This might be due to different working conditions, different health facilities, assessment methods, etc.

**Table 4:** Test of significance for REBA analysis

Activity profile	REBA Action Category					Chi-square value
	AL <sub>0</sub>	AL <sub>1</sub>	AL <sub>2</sub>	AL <sub>3</sub>	AL <sub>4</sub>	
Hammering Group I (n=40)	-	-	10	24	6	152.35*
Striking Group II (n=40)	-	-	-	12	28	
Cooling Group III (n=40)	18	20	2	-	-	

Significant at 5% level of significance

### Discussion/ Conclusion

The study clearly indicates that the forging workers who are continuously engaged in hammering, striking and cooling operations have been categorized as having high to very high-risk level as they are performing the operations under great difficulties and bear stress on their various part of body. This is due to several reasons as justified by the photographs taken of the workers performing the operations. By using REBA technique, it was observed that in every operation taken into consideration, each worker is under muscular stress. In hammering task, workers has to work in a static position with in close contact with furnace for long period. As in striking operation, workers has to bend and lift heavy tools which leads to stress in back, shoulders and neck. Whereas in cooling operation, workers has to work in squatting position which leads stress on back. Methods of postural analysis closely co-relate with the awkward postures adopted by the workers. Hence the necessary and requisite improvement should be done in every operation. Proper training of workers and awareness may reduce the risk of musculoskeletal disorders.

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