

# ASSESSMENT OF WORK-RELATED MUSCULOSKELETAL DISORDERS OF FORGING WORKERS BY STANDARDIZED NORDIC QUESTIONNAIRE

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## ABSTRACT

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. Despite being such an important part of the society their working condition is really poor it contain use of heavy tools and furnaces; which involve heat, noise, vibration, and dusty environments. Therefore, forge smith's are especially prone to occupational health problems and experience more sickness absenteeism. This paper presents a study on various working postures of forging workers who are involved in different activities like hammering, striking and cooling. The study was conducted on 120 workers who are engaged in forging work. To determine the prevalence of self-reported musculoskeletal pain/discomfort body map and standardized NORDIC musculoskeletal questionnaire were used. The result revealed that forging workers were exposed to repetitive work for long time, and the occurrence of back pain and body ache was found very high among them Thus the workers are under high risk of work-related musculoskeletal disorders which need to be taken care of through ergonomic intervention and medical treatment.

**Keywords:** forge smith's, ergonomic, musculoskeletal disorder, occupational health issue

## INTRODUCTION

The labour forces in developing economy consist of two sectors, the unorganized and organized sectors . According to the report of the (**Economic Survey released in 2019**) 93% of the total workforce of the country is from the unorganized sector. One of such unorganised sector in which the conditions of workers are very miserable is forge smiths. 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 which is defined as the plastic deformation of metals by applying compressive forces by manual or power hammers, presses, or special forging machines (**DeGarmo et.al. ,1988**). Therefore, iron and steel workers are especially prone to occupational health problems and experience more sickness absenteeism (**Manjunatha. R et.al.,2011**).

## 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 i.e. table 1.

**Table 1. categories of workers according to activities**

		ACTIVITY	POSITION	NO. OF WORKERS
<b>Group I</b>		Hammering	Sitting	40
<b>Group II</b>		Striking	bending	40

Group III		Cooling	squatting	40
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To determine the prevalence of self-reported musculoskeletal pain/discomfort body map and standardized NORDIC musculoskeletal questionnaire were used. NORDIC questionnaire was developed by **Kuorinka et al. (1987)** and validated by **Dickinson et al.(1992)** and **Chaffin and Anderson (1991)**. NORDIC questionnaire is a multiple page questionnaire and used for evaluation of musculoskeletal problems.

## RESULT AND DISCUSSION

The work-related morbidity and mortality not only results in suffering and hardship for the worker and his or her family, but it also adds to the overall cost to society through lost productivity and increased use of medical and welfare services (**Mikheev M. 1994.**). All the selected workers had given their responses based on standardised NORDIC questionnaire. The data clearly revealed (**Table 2.1**) that none of the workers in different groups were having knowledge about musculoskeletal pain/discomfort. Among all groups, maximum of group II workers i.e.80 percent were prevented from normal work activity due to pain/discomfort followed by 70 percent workers from group I and least i.e. 42.5 percent workers from group III. And Nearly 45 percent of the total workers reported that they stay away from normal activities because of pain/discomfort.

**Table 2.1 Pain and Discomfort with the locomotive organ among workers**

**N=120**

S.No		Group I		Group II		Group III		TOTAL	
		Yes	No	Yes	No	Yes	No	Yes	No
1.	Do you know about musculoskeletal pain/discomfort?	-	40(100)	-	40(100)	-	40(100)	-	120(100)
2.	Have you ever been prevented from normal work activities because of musculoskeletal pain/ discomfort?	28(70)	12(30)	32(80)	8(20)	17(42.5)	23(57.5)	77(64.16)	43(35.83)
3.	Do you stay away from your normal activities because of pain/discomfort?	22(55)	18(45)	19(47.5)	21(52.5)	12(30)	28(70)	53(44.16)	67(55.83)
4.	Activities cause the pain and discomfort								
	• Hammering	35(87.5)	5(12.5)	-	-	-	-	35(29.16)	5(4.16)
	• Striking	-	-	38(95)	2(5)	-	-	38(31.66)	2(1.66)
	• Cooling	-	-	-	-	12(30)	28(70)	12(10)	28(90)

Figures in parentheses indicate the percentage values

From the finding, it can be concluded that almost equal pain / discomfort were reported by group I and group II workers who were performing hammering striking operation respectively . The finding can be supported by the study of **Bernard, B.P.(1997)** who reported that a task with high repetition and poor postures may result in a significant number of complaints or injuries .

## 2.2 Perceived body discomfort

Workers were asked few questions about perceived pain/discomfort, which lasted, for at least 24 hours. Pain was measured for past 12 months, one month and for 7 days. Majority of the workers were feeling pain and discomfort in different body parts.

### 2.2.1 Prevalence of musculoskeletal pain/discomfort among workers in last 12 months

The data envisaged in table 2.2 revealed that during the last 12 month majority of the workers i.e. 81.66 had reported pain in low back, followed by upper back pain which was reported by more than 75 percent of workers and only 35 percent of workers had reported pain/discomfort in both elbow. The result was supported by **Muggleton et al. (1999)**, who found that the workers, who were exposed to repetitive work for long time, the occurrence of back pain was found very high among them. In the present study also, it was observed that all workers in different groups were performing repetitive task of hammering, striking and cooling for long duration which might be the reason for back problem.

**Table: 2.2 Prevalence of musculoskeletal pain/discomfort among workers in last 12 months**

Body part	Group I (Hammering) (n=40)	Group II (Striking) (n=40)	Group III (Cooling) (n=40)	TOTAL (N=120)
Neck	32(80)	28(70)	15(37.5)	75(62.5)
<b>Shoulder</b>				
• Right	26(65)	-	-	26(21.66)
• Left	-	-	-	-
• Both	10(25)	40(100)	20(50)	70(58.33)
<b>Elbow</b>				
• Right	14(35)	-	6(15)	20(16.66)
• Left	-	-	-	-
• Both	20(50)	22(55)	-	42(35)
<b>Wrist/hands</b>				
• Right	12(30)		10(25)	22(18.33)
• Left	-	-	4(10)	4(3.33)
• Both	20(50)	32(80)	18(45)	70(58.33)
<b>Upper back</b>	40(100)	40(100)	12(30)	92(76.66)
<b>Low back</b>	40(100)	40(100)	18(45)	98(81.66)
<b>Hips/thighs</b>	40(100)	32(80)	-	72(60)
<b>Knees</b>	24(60)	11(27.5)	6(15)	41(34.16)
<b>Ankles/feet</b>	27(67.5)	10(25)	5(12.5)	42(35)

Values in parentheses indicate percentage.

### 2.2.2 Prevalence of musculoskeletal pain/discomfort among workers in last one month

From the table 2.3 it can be clearly said that in totality most of the workers i.e. more than 70 percent had complained for lower and upper back pain and nearly 25 percent of workers were least affected by elbow and wrist/hand pain in last one month.

While comparing the data among different groups it was observed that among group I who were involved in hammering tasks the majority of the workers i.e. 100 percent had reported pain/discomfort in upper and low back, whereas group II workers who were performing striking task had reported problem in upper back (i.e. by 100 percent of workers). However in group III workers the majorly affected body part were shoulders, neck, both wrist/hand and upper back in last one month.

Table: 2.3 Prevalence of musculoskeletal pain/discomfort among workers in last one month

Body part	Group I (Hammering) (n=40)	Group II (Striking) (n=40)	Group III (Cooling) (n=40)	TOTAL (N=120)
Neck	26(65)	14(35)	10(25)	50(41.66)
Shoulder				
• Right	-	-	-	
• Left	-	-	-	
• Both	11(27.5)	22(55)	25(62.5)	58(48.33)
Elbow				
• Right	20(50)	-	-	20(16.66)
• Left	-	-	-	-
• Both	10(25)	20(50)	-	30(25)
Wrist/hands				
• Right	12(30)	-	8(20)	20(16.66)
• Left	-	-	-	-
• Both	20(50)	22(55)	10(25)	52(43.33)
Upper back	40(100)	40(100)	10(25)	90(75)
Low back	40(100)	40(100)	6(15)	86(71.6)
Hips/thighs	40(100)	35(87.5)	-	75(62.5)
Knees	18(45)	20(50)	-	38(31.66)
Ankles/feet	22(55)	10(25)	-	32(26.66)

Values in parentheses indicate percentage

### 2.2.3 Prevalence of musculoskeletal pain/discomfort among workers at any time during last 7 days

When enquired about the pain and discomfort occurs/felt during last 7 days as showed in table 2.4 it was found that majority of the total workers i.e. nearly 80 percent had reported maximum pain/discomfort in lower back and only 3.33 percent of total workers had reported pain/discomfort in right wrist/hand.

In comparing the data among different group it was further found that among group I majority of the workers i.e. 100 percent had reported pain/discomfort in lower back, whereas among group II workers majority i.e. 100 percent had reported pain/discomfort in both lower back and hips/thighs. However among group III workers maximum affected body part were both shoulders, both wrists and low back. In other study also (Yerpude P.N.2010), prevalence of overall morbidity vary for different activities. This might be due to different working conditions, different health facilities, assessment methods, etc.

**Table 2.4. Prevalence of musculoskeletal pain/discomfort among workers at any time during last 7 days**

Body part	Group I (Hammering) (n=40)	Group II (Striking) (n=40)	Group III (Cooling) (n=40)	TOTAL (N=120)
<b>Neck</b>	20(50)	10(25)	5(12.5)	35(29.16)
<b>Shoulder</b>				
• Right	15(37.5)	-	-	15(12.5)
• Left	-	-	-	-
• Both	10(25)	20(50)	10(25)	40(33.33)
<b>Elbow</b>				
• Right	-	-	-	-
• Left	-	-	-	-
• Both	16(40)	20(50)	-	36(30)
<b>Wrist/hands</b>				
• Right	-	-	4(10)	4(3.33)
• Left	-	-	-	-
• Both	20(50)	20(50)	10(25)	50(41.66)
<b>Upper back</b>	40(100)	40(100)	10(25)	90(75)
<b>Low back</b>	40(100)	40(100)	15(37.5)	95(79.16)
<b>Hips/thighs</b>	40(100)	30(75)	-	50(41.66)
<b>Knees</b>	23(57.5)	10(25)	3(7.5)	36(30)
<b>Ankles/feet</b>	17(42.5)	10(25)	5(12.5)	32(26.66)

Figures in parentheses indicate the percentage values

### 2.3 Health surveillance of workers

It was found from the finding as showed in table 2.5 that more than 70 percent of total workers had first notice the problem while working in which all workers were from group I, 70 percent were from group II and 50 percent were from group III. Whereas only 12.5 out of total sample, had first notice the problem before working.

With regard to medical treatment 76.66 percent of total workers took medical treatment among which 100 percent from group I, 75 percent from group II and 55 percent from group III were taking medical treatment when needed. Majority of the workers from all groups were taking self treatment. Only 16.66 percent of total workers were taking treatment from doctor or directly from dispensaries.

**Table 2.5 : Health surveillance of workers**

Question	Group I (Hammering) (n=40)	Group II (Striking) (n=40)	Group III (Cooling) (n=40)	TOTAL (N=120)
<b>First notice the problem</b>				
• Before working	-	10(25)	5(12.5)	15(12.5)
• While working	40(100)	28(70)	20(50)	88(73.33)

<b>You take the medical treatment</b>	40(100)	30(75)	22(55)	92(76.66)
<b>Take the treatment from</b>				
• Personal doctor	-	-	-	-
• Self	30(75)	22(55)	20(50)	72(60)
• Others	10(25)	8(20)	2(5)	20(16.66)
<b>Take the treatment for</b>				
• Headache	20(50)	10(25)	10(25)	40(33.33)
• Body ache	32(80)	30(75)	3(7.5)	65(54.16)
• Irritation on eyes	-	-	20(50)	16(13.33)
• Stiffness in hand joints	-	-	-	-
• Burning sensation in fingers	-	-	-	-
• Pain in palm	10(25)	10(25)	-	20(16.66)
• Numbness in fingers	-	10(25)	-	10(8.33)
• Cuts and wounds	34(85)	20(50)	12(30)	66(55)
• Fractures	-	-	-	-
• Cough/cold	10(25)	-	16(40)	26(21.66)
• Pain in trunk	-	-	-	-
• Back ache	30(75)	25(62.5)	10(25)	65(54.16)
• Shoulder pain	-	16(40)	-	16(13.33)
<b>Did the treatment help?</b>	10(25)	12(30)	10(25)	32(26.66)

Figures in parentheses indicate the percentage values

Regarding the problem for which they take the treatment as showed in table 2.5, it was observed that on the whole maximum workers i.e. nearly 55 percent were taking treatment for body ache, cuts/wound and backache respectively. The study was supported by **Bihari et al., (2011)** which showed that overall prevalence of musculoskeletal pain was found and more than 50% of the subjects complained of backache.

While comparing the data among the groups, it was further observed that majority of the group I workers i.e. 85 percent were taking treatment for cuts/ wounds followed by body ache and back ache which was reported by 80 percent and 75 percent of workers respectively. Whereas among group II most of the workers i.e. 75 percent were taking the treatment of body ache followed by back ache, cuts/ wounds and very few i.e. 25 percent of workers were taking treatment for headache, pain in palm, numbness in fingers. However the workers who were involved in cooling operations (i.e. group III) were mostly taking the treatment for irritation on eye (i.e.50 percent) as showed in table 2.5

It was further found that only 26.66 percent of total workers had reported that treatment helped them in overcoming their problem among which maximum i.e. 30 percent were from group II, and almost equal number of workers i.e. 25 percent were from both group I and group III.

## CONCLUSION

The majority of forge workers live in poor areas, lack basic health, welfare services ,social protection and work in an unhealthy and unsafe working environment. It was found through NORDIC questionnaire that none of the forge smith's had knowledge regarding MSDs ,and most of the total workers had first notice the problem like back ache, cuts, wounds etc while working. Workers in group I i.e. hammering and group II i.e. striking had reported mostly body ache, cuts/wounds and group III i.e. cooling workers had reported eye irritation as their major common illness. It was further found very few of the workers were taking treatment for their illness and those who are taking treatment had reported that treatment helped them in overcoming their problem. So, the study recommended a proper implementation of ergonomics interventions program with awareness and training among workers and use of personal protective equipments (PPE) to reduce the risks of WMSD.

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