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## An empirical Study of posture related discomforts in rice mill workers

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### Abstract

There are many Rice Mills in Vidharba. Gondia & Bhandara districts comprises of about 350 Rice mills. The climatic conditions and environment as well as labors negative attitude (laziness) towards working in Mills results delay in production. Lifting, carrying and depositing the sacs of paddy and rice are carried out mostly manually by the workers. The study focused on the duration of work per day, the climatic conditions and working environment as well as labors negative attitude towards working, posture related discomfort of workers in rice mills. The study reveals that posture related discomfort results in increased heart rate and blood pressure, musculoskeletal disorders (MSD) especially to the spine, and back pain. Energy expenditure values also studied, subjective assessment of the workers showed that due to labors negative attitude (laziness) particularly in Vidharbha, available manpower is less than the requirement compels most of the workers to work more than 8-10 hours per day continuously in awkward postures with the load of paddy and rice sac results in musculoskeletal pain or discomfort which was minimally reported in back pain and knee.

**Keywords:** Loading, Musculoskeletal disorders (MSD), Posture, back pain Energy expenditure.

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### 1. Introduction

In most of the Rice Mills in Vidharbha region loading and unloading the sacs of paddy and rice are carried out mostly manually by the workers. Often, the workers have to adopt awkward postures to carry sacs of paddy and rice for loading into the truck. Working with heavy load in awkward posture leads to physiological strain, back pain and musculoskeletal problem. The present study was undertaken to evaluate the Rice Mill workers with respect to their nutritional status, workload, energy expenditure and musculoskeletal pain, posture, back pain related discomfort resulting out of nature of work load in rice mills.

The environment of Vidharbha region is hot, which reduces the working efficiency of labors. They have to work more than ten hours daily, though officially they supposed to work for eight hours. This is due to posture related discomforts which leads to the shortage of manpower and delays the production, hence available labors have to work more than ten hours. Till date very few report of ergonomic study on Rice Mill workers is available especially for Vidharbha region.

### 1.1. Various activities carried out by the workers in rice mills

1. Loading / unloading of paddy/rice sac on and from vehicles.
2. Spreading paddy on the unshaded floor with a wooden spreader for drying.
3. Carrying paddy-filled sac, climbing ladder and emptying sac at the Feeding centre or in the processing machine.
4. Filling sacs with rice in back-bent awkward postures manually.
5. Lifting and keeping the rice filled sac on and from weighing machine and in the stores.



**Fig: 1.** Loading / unloading of paddy/rice sac on and from Truck

## 2. Materials and Methods

### 2.1. Ergonomic Study:

This study was carried out in two major rice mills of Gondia district. The subjects may be considered to be representative of related workers of Rice Mills in Vidharbha both in terms of work method and also anthropometry. Permission from the Owner of Rice Mill was obtained for the study. Written consent was obtained before the field study. The truck is to be unloaded manually by the labors mostly in group of six-eight. The weight of the sacs filled with paddy is approximately 65-75 kg. Two persons each with a pair hook lift the sac full of paddy from the truck and place it on shoulder. The workers use their preferred shoulder-left or right.

They have to walk for 15-18 feet's with loaded paddy sac on back and neck -posture bent or twisted all the way to the store space kept for paddy sacs. Sometimes they have to climb steps made of paddy sacs or walk along an upward slope of wooden platform depending on the height of the stack. The time taken by two labors to unload the one sac from the truck 3-4minutes (Time study was done using stop watch). One truck comprises of 300-350 sacs. So it takes about Three hours and fifteen –twenty minutes, if eight workers involved for unloading the sacs from the truck. Some time requires for preparation work like laying of walkways, ladders, platforms, etc.

### 2.2. Physical Parameters:

In all 30-32 workers participated in the study some of them were women. Their age and physical parameters like standing height and body weight were recorded. Local doctors helped us for recording the data. The height and weight of the workers were measured with an anthropometer and Crown weighing machine (Raymon Surgical, India) respectively. The body surface area (BSA) and the body mass index (BMI) as per WHO of all the subjects were also computed. Percentage of body fat and lean body mass of a subject were derived from the values of skin fold thickness.

### 2.3. Analysis of Working Posture:

The different working postures of the workers were analyzed with the Ovako working posture analysis system (OWAS) and digital photography and video recording carried out. Actual Sketches of workers in awkward posture were prepared /drawn. Later stick diagrams were drawn from frozen-frame video recordings and eventually they were analyzed. The most frequent postures adopted by the workers were considered. The subjects were interviewed to obtain basic information and were assessed for subjective work load on a scale of 1 to 5 (light, moderate, heavy, very heavy and extremely heavy). The analysis of the body where they feel work related musculoskeletal pain or discomfort and back pain were done.

### 2.4. Heart rate & energy expenditure:

The maximal heart rate (HRmax) of the subjects was derived from their respective ages. With the help of doctors Physiological assessment of workload was carried out by recording the heart rate of the workers during work in rice mill. The heart rate of the subjects (beats per min) was recorded immediately after cessation of work, by counting 10 heart beats with the help of a stethoscope noting the time (sec) using digital stop-watch. The energy expenditure in terms of kcal per min. was calculated from the peak working heart rate by the doctors.

## 3. Results

The study reveals that due to workers works most of the time in awkward posture, the posture related discomfort results in increased heart rate and blood pressure, musculoskeletal disorders (MSD) especially to the spine, and back pain. We found that many workers were bent permanently to 20-30 degrees from vertical who works more than 8-10years. They were suffering from severe back pain as well as pain in knee with some bent.



**Fig.2.** Bent permanently to 20-30 degrees from vertical

The physical characteristics of the subjects have been presented. Although the subjects belonged to the two rice mills of Gondia districts, they were similar to workers working in other rice mills of Vidharbha. There was no significant difference in their main anthropometric dimensions in comparison with the basic Indian anthropometric data. The mean values of BMI of workers in rice mill workers were in normal category as per WHO. However 13% workers in rice mill were in the category of chronic energy deficiency I (BMI < 17.0 – 18.4 kg.m<sup>-2</sup>). As such majority of these workers were nutritionally balanced. The groups belonged to the category of “optimal health”. Heart rate of worker increased substantially due to load of 65-75 kg sac on back as compare to standard heart rate. And hence Blood pressure rises Mean values of peak working heart rate and

energy expenditure of the subjects carrying out various activities in Rice mill have been presented in Table 1. The mean values of peak working heart rate varied from  $110.3 \pm 3.5$  (job Spreading paddy with a wooden spreader for drying (direct solar load).) to  $144.1 \pm 15.5$  beats.min<sup>-1</sup> (job Carrying paddy-filled sac (75 kg), climbing ladder (4.5 m) and emptying sac in the processing machine.).

However, the energy expenditure values for the above-mentioned activity were  $4.39 \pm 0.97$  kcal per min, which indicated the workload as moderate). The workload of workers engaged in various types of activities performed by the rice mill workers ranged from “moderate” to “extremely heavy The energy expenditure values for the activities were  $3.22 \pm 0.20$  and  $5.28 \pm 0.13$  kcal per min for the Spreading paddy job and the carrying paddy job, respectively. The subjects had multiple responses regarding pain or discomfort in various parts of the body. Results of the assessment of subjective feeling of pain or discomfort of the workers are reflected in Table 2. In the rice mill workers reported maximum pain in knee and low back (59.8%) each followed by chest and leg (28.5%) each. Besides the weight of the sac, awkward postures like bending and twisting of trunk adopted frequently causes the problem.

Table 1: Findings of Heart Rate and Energy Expenditure of Rice Mill workers

Activity	Heart Rate (beats. per min)	Energy Expenditure (kcal. per min)
Loading / unloading of sac from truck	$138.1 \pm 10.3$	$4.87 \pm 0.55$
Spreading paddy	$110.3 \pm 3.5$	$3.22 \pm 0.20$
Carrying paddy-filled sac, climbing and emptying sac in the processing machine	$144.1 \pm 15.5$	$5.28 \pm 0.13$
Filling paddy dust powder in sac in back-bent posture	$135.8 \pm 21.5$	$4.39 \pm 0.97$

Table 2: Percentage of pain or discomfort reported by the workers

Body Part	Percentage of discomfort
Shoulder	12.4
Elbow	2.3
Chest	28.5
Low Back	59.8
Leg	27.6
Knee	59.8
Ankle	6.2
Bending and twisting of trunk (MSD)	30

#### 4. Conclusion

The study reveals that the climatic conditions and environment as well as posture related discomfort results delay in production. Lifting, carrying and depositing the sacs of paddy and rice are carried out mostly manually by the workers. The study reveals that posture related discomfort results in increased heart rate and blood pressure, musculoskeletal disorders (MSD) especially to the spine, and back pain. Energy expenditure values also studied, subjective assessment of the workers showed that due to laborers negative attitude (laziness) particularly in Vidharbha, available manpower is less than the requirement compels most of the workers to work more than 8-10 hours per day continuously in awkward postures with the load of paddy and rice sac results in musculoskeletal pain or discomfort which was minimally reported in back pain and knee. It was found that most of the activities of these workers are in the category of moderate to very heavy. The findings of present study regarding heart rate, energy expenditures were compared with the standards values specified by doctors/WHO's. It was observed during loading/unloading of sacs workers had to bend and twist their neck and back for putting the sac (load) on the shoulder. Most of the time they had to squat depending on the uneven

floor space/truck from which the sacs are placed on the shoulder. Moving the body with load on their shoulder, at a reasonably faster pace towards the place for deposition. These leads to feeling of pain in knee and low back may be due to repetitive bending at the knee to load /unload the sacs and carrying the sac (load) in awkward postures .Working continuously in awkward body posture causes the work to become strenuous and the physiological costs permanent bending of posture. The occupational work of loaded sacs on back requires high muscular effort in awkward postures giving rise to musculoskeletal strains and low back signs and symptoms. Turning, twisting and bending are also associated with increased incidence of low back disorders like pain, ache and discomfort. The overall stress of a worker is the integrated form of physical workload and postural stress. This can be explained with further studies involving more number of subjects in the rice mills, which will lead to better understanding of the problems and improvement of work design.

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