

Ergonomic analysis of physiological problems due to inadequate postures adopted by rice mill workers

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■ **ABSTRACT** : Food grains are processed in rice mills and stored in several organizations such as the Food Corporation of India, Central Warehouse Corporation, State Warehouse Corporation etc. In the present investigation, work on physiological examination of rice mill workers in the ergonomic background was taken into consideration with intent to determine the magnitude of physiological strain of the workers in actual situation of work. This study has undertaken to evaluate the food grain-handling workers with respect to their workload, energy expenditure rate (EER) and musculo-skeletal disorders (MSDs), discomfort resulting out of work practice. The subjective assessment of respondents showed that mild to moderate pain was experienced by rice-mill workers in upper and lower extremities. The results also revealed that selected respondents adopting standing, forward bending (half bending), full bending posture and frequency of postural change varied from approx. 2-8 times (standing), 6-12 (forward bending) and 7-11 times (full bending) for almost all activities performed by workers in rice mill.

■ **KEY WORDS** : Work-physiological examination, Musculo-skeletal disorders, Energy expenditure rate (EER), Posture and frequency of postural change

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Food grains are processed in rice mills and stored in several organizations such as the Food Corporation of India, Central Warehouse Corporation, State Warehouse Corporation etc. It has been reported earlier that the workers exposed to grain dust in storage air suffer from respiratory, allergic and patho-physiological disorder. Load handling *i.e.*, lifting and carrying heavy load of grain filled sacs is the major job component in these organizations. Often, the workers have to adopt awkward postures leading to physiological strain and musculo-skeletal problem (Aaras and Westgaard, 1988; ROHC, 2004).

Ergonomics involves equipment, adjusting workstations, job rotation, and other changes in the way work performed (Berger, 1995). Application of force is required for handling load (lifting, holding, carrying loads, pushing and pulling weights etc). Awkward body posture also causes the work to become strenuous and the physiological costs are higher in non-erect postures giving rise to musculo-skeletal strains and low back signs and symptoms. Turning, twisting and bending

are also associated with increased incidence of low back disorder like pain, ache and discomfort (Braton, 1992). It was observed during work that the workers had to bend and twist their neck and back for putting the load on the shoulder. Therefore, the present study was based with the following objectives to know the Physiological responses of the workers during various activities of the rice mill workers, to recognize the environmental parameters and related health problems and to envisage the subjective feeling and body pain of the rice mill workers.

■ RESEARCH METHODS

Descriptive research design was chosen to find out the existing working conditions, faulty postures and physical discomfort of the workers and experimental research with 15 respondents, planned to find out physiological cost of work in terms of heart rate, and postural stress while loading the rice bags, related discomfort and health hazards caused. The

data were collected through a structured interview schedule. Pain experienced by respondents in different body parts were measured with the help of suitable body map (Corlett and Bishop, 1976) and in order to ascertain the degree of severity of pain, on a five point scale (Verghese *et al.*, 1996).

Activities taken:

- Loading / uploading of food grain sac on and from vehicles.
- Spreading paddy on the un-shaded floor with a wooden spreader for drying.
- Carrying paddy filled sac, climbing ladder and emptying sac in the processing machine.
- Filling sacs with rice in black-bent posture with the help of a cylindrical vessel.
- Lifting and keeping the rice filled sacs on and from weighing machine.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

Physiological responses of the workers during various activities (Mean ±SD):

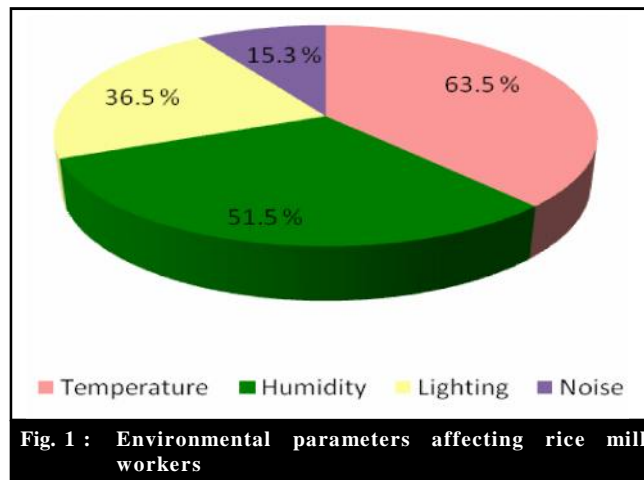
Mean value of peak working heart rate and energy expenditure of the subjects carrying out various activities in rice mills have been presented in Table 1. The workload of workers engaged in various types of activities performed by the rice mill workers ranged from “moderate” to “extremely heavy”, depending on the basis of classification. The mean value of peak working heart rate varied from 115.2±4.38 (spreading) to 151.0±18.58 beats/min (carrying/climbing/emptying).

The energy expenditure value for the activities were 3.76±0.20 and 5.37±0.84 kcal min for the spreading and carrying/climbing/emptying activities, respectively. When the workload was classified based on the energy expenditure values, the jobs were found to be “moderate” and “heavy”, regardless of the basis of classification.

Environmental parameters and related problems:

The environmental parameters observed during the study showed that most affecting parameters was temperature

(63.5%) followed by humidity (51.5%), lighting (36.5%) and noise (15.0%) created by the plant of rice mill. These parameters were creating the adverse affect on the health of the workers as they were suffering from the health problems like eye weakness, body pain, joint problems etc. These may lead to risk like slip and fall injuries etc.



Frequency of postural change of related respondents:

The results revealed that selected respondents adopting standing, forward bending (half bending), full bending posture and frequency of changing posture, and frequency of changing postures varied from approx 2-8 times(standing), 6-12 (forward bending) and 7-11 times (full bending) for almost all activities performed by workers in rice mill (Table 2).

As the frequency of changing revealed that the workers were feeling uncomfortable and were finding to fit themselves to the task rather than fitting the task to them and this in turn affecting heart rate and energy expenditure adversely.

Postural deviation (angle of deviation in lumber region) of selected rice mill workers:

It was observed from Table 3 that angle of deviation of selected rice mill workers as compared to the normal curve was 3.62, 5.06, 4.11, 4.51 and 1.82 degree when forward bending (half bending) posture was adopted for selected activities in rice mill and 10.57 and 14.71 were adopted when full bending posture were adopted in activities.

Angle of deviation indicates the extent of bend of the

Activity	Peak working heart rate(b/m)	Energy exp(kcal/m)
Loading/uploading	145.1±13.2	5.11±.49
Spreading	115.2±4.4	3.76±0.20
Carrying/climbing/emptying	151.0±18.6	5.37±0.84
Filling	140.7±23.7	4.91±1.07
Lifting and taking off	116.9±11.8	3.84±0.53

Table 2 : Frequency of postural change of related respondents

Sr. No.	Activities	Postures	Frequency of change
1.	Loading / uploading of food grain sac on and from vehicles.	Standing	3-5
		Forward bending (half bending)	6-8
		Full bending	5-10
2.	Spreading paddy on the un-shaded floor	Standing	2-8
		Forward bending	6-11
3.	Carrying paddy filled sac	Standing	2-3
		Forward bending	3-5
4.	Climbing ladder	Forward bending	3-8
5.	Emptying sac in the processing machine	Standing	3-8
		Forward bending	5-8
		Full bending	7-11

Table 3 : Postural deviation (angle of deviation in lumber region) of selected rice mill workers

Sr. No.	Activities	Variables	Angle of deviation
1.	Loading /uploading	Angle of normal curve(standing)	193.81
		Angle of forward bending	197.43
		Angle of deviation(B-A)	3.62
		Angle of full bending	204.38
		Angle of deviation(D-A)	10.57
2.	Spreading paddy on the un-shaded floor	Angle of forward bending	198.87
		Angle of deviation(F-A)	5.06
3.	Carrying paddy filled Sac	Angle of forward bending	197.92
		Angle of deviation(H-A)	4.11
4.	Climbing ladder	Angle of forward bending	198.32
		Angle of deviation (J-A)	4.51
5.	Emptying Sac	Angle of forward bending	195.63
		Angle of deviation(L-A)	1,82
		Angle of full bending	208.52
		Angle of deviation(N-A)	14.71

Table 4: Subjective assessment of the workload of the worker

Sr. No.	Workload	Percentage
1.	Light	-
2.	Moderate	76.9%
3.	Heavy	23.1%
4.	Very heavy	-
5.	Extremely heavy	-

Table 5 : Subjective feeling of pain or discomfort reported by the workers

Body part	Percentage
Shoulder	15.4%
Elbow	nil
Chest	30.8%
Abdomen	61.5%
Low back	61.5%
Leg	30.8%
Knee	61.5%
Ankle	61.5%

back. More the angle of deviation of the back more is the intensity of back pain. It is inferred from Table 3 that the angle of spinal curve increased to the maximum in full bending posture.

The results of subjective assessment of workloads are shown in Table 4. The workers of the rice mills expressed that their work was in the categories. The highest percentage of the workers expressed that workload was moderate and rest of the workers expressed that their work was in the category of heavy (23.1%). It is interesting to note that nobody had expressed his workload as very heavy.

The percentage value does not add to 100 because of multiple responses. The subjects had multiple responses regarding pain or discomfort in various parts of the body. Results of the assessment of the subjective feeling of body pain or discomfort of the workers are reflected in Table 5. The rice mill workers reported maximum pain in knee and low back (61.5%) each followed by chest and leg (30.8%) each.

Conclusion:

On the basis of the study it was concluded that environmental parameters were creating the adverse affect on the health of the workers as they were suffering from the health problems like eye weakness, body pain and joint problems etc. and the angle of spinal curve increased to the maximum in full bending posture. A highest percentage of the workers expressed that workload was moderate and rest of the workers expressed that their work was in the category of heavy and the maximum pain was felt in knee and low back.

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