Ergonomic evaluation during wheat cleaning through hanging type grain cleaner (HTGC)

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ABSTRACT

Farm women play a prominent role in rural households. Their role lies from managerial work to labour work. They are overburdened and extent of their role differs from household to household and with region. But in all they provide crucial labour in farm operations. They are generally assigned non-mechanized operations in home, agriculture and animal husbandry which involve a lot of monotonous repetitive work involving lots of unnoticed drudgery during the operations. Thus a study was done in Shahdol district of Madhya Pradesh to minimize the drudgery of farm women involved in wheat cleaning. Hanging type grain cleaner (HTGC) was introduced and tested on farm women. Reduction of women drudgery with the use of HTGC was assessed in the term of energy expenditure and by calculating ergonomic cost. The results indicated that the HTGC cleaned 225.13 kg/h wheat as compared to local sieve 17.90 kg/h with saving in 84.20 per cent cardiac cost.

Keywords: HTGC; drudgery: cardiac cost of work; ergonomic cost; energy expenditure

INTRODUCTION

In rural India 84 per cent women depend on agriculture for their livelihood. Women make up about 33 per cent of cultivators and about 47 per cent of agricultural laborers (Rao 2006). Thus farm women play a vital and crucial role in shaping the rural economy of the Indian society. The main work of farm women is confined to work such as sowing, transplanting, weeding, harvesting, cleaning and storing of grains. The nature and extent of participation of farm women in agricultural activities are affected by a lot of regional and socio-economical factors. This includes variations in nature of work due to region, family cultural and traditional values, socio-economic condition of the farm families, change in nature of activities due to mechanization, introduction of time and labour saving implements and variations in agro-climatic conditions (Gautam et al 2008). These works are thought to be fit well within the framework of domestic life and child-rearing work of farm women. Farm women are overburdened with dual role in both farm and households. Bhople and Pathai (1998) found that the daily work schedule of rural women is very demanding and arduous and during peak period women work every day for about 8-9 hours in agriculture and 4 hours in household activities. So a farm woman suffers a lot of drudgery while performing farming operations and household activities. The burden shared by women for the socio-economic development is two-fold, one on the domestic front and the other on the economic front (Akter et al 1996).

These farm activities are not only monotonous but consume more time and thus drudgery prone activities. Thus a farm woman undertakes a lot of unnoticed drudgery while performing farming operations. Also it is well known that due to the nature of activity the farm women are usually compelled to work in same and single posture for a large time which affects their body and causes various types of musco-skeletal problems. Grain cleaning manually through local sieves is very time consuming and highly drudgery prone activity performed by the farm women. Thus KVK,

Shahdol, Madhya Pradesh assessed the need to test the hanging type grain cleaner (HTGC) as a tool for cleaning grains.

To increase the efficiency and reduce the drudgery of farm women during wheat cleaning HTGC was introduced and tested. The work was conducted by KVK, Shahdol, Madhya Pradesh in adopted villages of Shahdol district, Madhya Pradesh. From physiological point of view Chauhan (1999) reported that work load refers to the demands placed on the cardio-respiratory system and is determined by the energy cost and cardiac cost of work. Heart rate is used as an ergonomic measure to evaluate the physiological or functional demands of work on the individual workers (Hasalkar et al 2004). Thus the heart rate response method was used that measures the change in heart rate and uses it to calculate the energy expenditure during wheat cleaning activity.

The present study was undertaken to assess the drudgery of farm women caused during wheat cleaning and assess their efficiency enhancement during wheat cleaning by the use of HTGC.

METHODOLOGY

The study was conducted in March-April on 24 farm women of Shahdol district, Madhya Pradesh aged between 25-40 years of age. Various parameters such as time required and energy expenditure were studied. Time was determined as required for cleaning of 30 kg of wheat grain by farm women. Wheat grain was cleaned manually (by sieve) and by HTSG. Anthropometric rod and weighing balance were used to measure the height and weight of the respondents. The time was recorded using stop watch. Heart rate monitor was used to measure the heart rate. All other parameters were calculated from the heart rate measurement. Average heart rate was calculated during rest and work. The energy expenditure per minute was calculated from the heart rate with the help of formula given by Varghese et al (1994).

Energy expenditure (kj/min)= 0.159 x Average heart rate (beats/min) – 8.72

ÄHR (beats/min)= Average working heart rate – Average heart rate during rest

Output (kg/h)= Weight of wheat cleaned x duration/average time

Cardiac cost of worker per unit of output (beats/kg of wheat cleaned)= ÄHR x duration/output

The results obtained were statistically analyzed using mean values and standard deviation.

RESULTS and DISCUSSION

The ergonomic evaluation of wheat grain cleaning activity was done. For this purpose 24 respondents of the age group of 25 to 40 years were randomly selected. The mean age count, average height and weight of respondents were 31.8 years, 152.18 cm and 52.81 kg respectively (Table 1).

Table 1. Anthropometic measurements

Physical characteristic	Mean ± SD
Age (years)	31.8 ± 4.67
Height (cm)	152.18 ± 3.03
Weight (kg)	52.81 ± 3.25

Data given in Table 2 reveal that cleaning of 30 kg wheat required 1.68 hours manually (hand cleaning) while HTGC required only 0.13 hours. Thus it is very clear that HTGC saved more than 92 per cent of time against the manual/hand cleaning and increased the working efficiency more than twelve

Table 2. Ergonomic evaluation during wheat cleaning

Parameter	Mean values ± SD	
	Manual cleaning (by sieve)	HTGC cleaning
Time spent to clean 30 kg of wheat grain (h)	1.68 ± 0.05	0.13 ± 0.004
Average working heart rate (beats/min)	83.96 ± 3.06	95.20 ± 2.96
Average heart rate during rest (beats/min)	73.46 ± 2.41	74.38 ± 2.65
ÄHR (beats/min)	10.5 ± 3.85	20.83 ± 2.41
Output (kg/h)	17.90 ± 0.52	225.13 ± 6.91
Cardiac cost (beats/kg)	35.07 ± 12.57	5.54 ± 0.64
Saving in cardiac cost/kg (%)	-	84.20

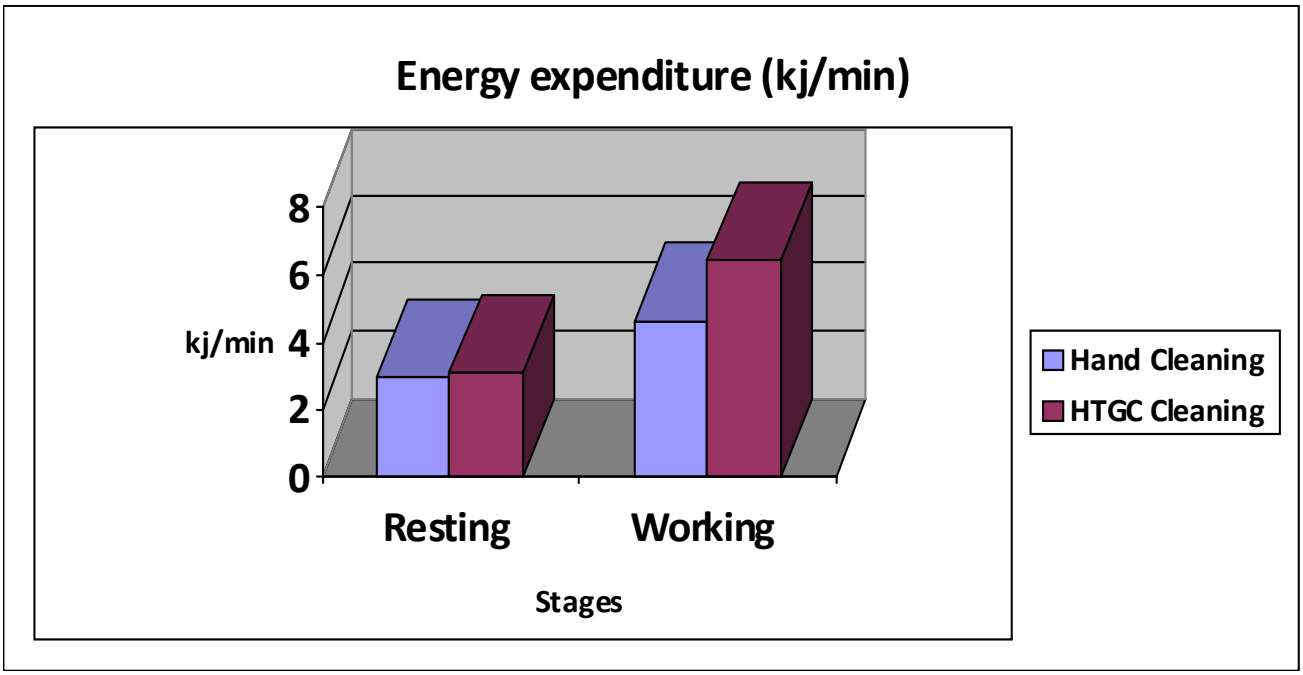

Fig 1. Energy expenditure of the farm women during hand cleaning and cleaning by HTGC

times as measured by the cleaned wheat grains output. It was recorded as 225.13 kg/h and 17.90 kg/h for HTGC and hand cleaning respectively. During hand cleaning the average ÄHR was 10.5 beats/min while by HTGC it was recorded as 20.83 beats/min.

It was found that the difference between working and resting heart rate (ÄHR) was found to differ more in HTGC. It could be due to more energy expenditure during the course of cleaning by HTGC as compared to manual cleaning (Fig 1). The resting and working energy expenditure for hand cleaning was low ie 2.96 kj/min and 4.63 kj/min respectively. In case of HTGC it was high ie 3.11 kj/min and 6.42 kj/min for resting and working period respectively. The cardiac cost of worker was 35.07 beats/kg during manual cleaning and 5.54 beats/kg by HTGC. Thus HTGC saved 84.20 per cent cardiac cost of farm women per unit of cleaned wheat grain output.

CONCLUSION

The wheat cleaning activity is a very monotonous, repetitive, time taking, drudgery prone and tedious activity. This also compels the farm women for long time continuous sitting posture and in a way affecting the skeletal make up of farm women in long run. For the farm women involved in grain cleaning operation HTGC is an appropriate tool as it not only saves the time but also enhances their efficiency more than twelve times with a saving of 84.20 per cent cardiac cost.

REFERENCES

Akter A, Mazed MA and Ahmed A 1996. Improving the rice post-harvest technology in Bangladesh. BRRI, Gajipur, Bangladesh.

Bhople RR and Pathai A 1998. Socio-economic dimensions of farm women labour. Rural India, Sep-Oct 1998, pp 192-194.

Chauhan MK 1999. Workload and health problems in some occupational activities. Paper presented in Advanced Training Course in Ergonomics, SNDT Women's University, Mumbai, Maharashtra, India.

Gautam US, Khare N, Singh A and Kant D 2008. Technological module for farm women of Madhya Pradesh. Directorate of Extension Services, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India, 222p.

Hasalkar S, Budihal R, Shivalli R and Biradar N 2004. Assessment of work load of weeding activity in crop production through heart rate. Journal of Human Ecology **14(3):** 165-167.

Rao EK 2006. Role of women in agriculture: a micro level study. Journal of Global Economy **2(2):** 107-118.

Varghese MA, Saha PN and Atreya N 1994. A rapid appraisal of occupational workload from modified scale of perceived exertion. Ergonomics **37(3):** 485-491.