Assessment of Physiological Stress of Farm Women Using Hand Operated Mechanical Winnower

B. Sharma[1] and D.N. Kalita [2]

1. SMS(H.Sc.), 2. PS cum Head, Krishi Vigyan Kendra, Kamrup, Guwahati, Assam (AAU, Jorhat)

Corresponding author e-mail: babita_s06@yahoo.co.in

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ABSTRACT

Assessment of physiological stress of farm women was evaluated in a OFT programme conducted in kamrup district of Assam, Physiological stress and musco skeletal discomfort or pain of farm women was assessed during performing winnowing both in hand operated mechanical winnower developed by ICAR, barapani and with traditional practice of winnowing by using bamboo made structure called kula or Dola. Two women workers are required for the operation of hand operated mechanical winnower, one for cracking the blower and other one for feeding the threshed materials and collecting the grain. On the other side one women can perform the activity alone in traditional practice. Average working heart rate and energy expenditure of women in using hand operated mechanical winnower is 131.1 beats/min and 12.12 kl/min respectively, which is observed 5.8 & 9.98 per cent less than traditional practice of winnowing. Physiological cost of work reduced by18.86 per cent with use of hand operated winnower. Output of winning found more in hand operated winnower which in turn saving labour cost. Musculoskeletal problem of women were assessed in terms of pain or discomfort experienced by women during performing winnowing activity. Five point likert scale was used to explore how they feel discomfort or pain.Discomfort or pain in neck and knee found almost double in performance of traditional winnowing. The equipment developed was found suitable in terms of reducing drudgery and working performance but as the equipment need two people to work at a time and high initial investment, preference of accepting the equipment at household level found minimum.

Key words: *Drudgery; Winnower; Physiological stress; Farm women; Musco-skeletal;*

In India, women play a significant and crucial role in agricultural activities. The women work force in agriculture and allied sectors is estimated to be around 92 million which amounts to 40 per cent of the total rural workers in the country (*Singh et al, 2007*). Various studies on women in agriculture point to the fact that women are generally employed in the operations which are either not mechanized or least mechanized and involve a lot of drudgery. Most of the traditional activities carried out by women are either manually (by using hand, foot or head) or by using traditional equipment with lot of drudgery and low efficiency. So a farm woman suffers a lot of drudgery while performing operations. Various tasks performed by women not only demand considerable time and energy but also sources of drudgery for rural women (*Srinath K. et. al, 2010*). The most drudgery prone activities experienced by women in various farm operations are sowing, harvesting, winnowing, weeding and intercultural operations.

Cleaning of grain or winnowing is one of the important postharvest processes where women involvement found maximum, it involves the removal of chaff and other debris from the grain. In Assam women usually used bamboo made structure called *Dola or Kula* for winnowing/cleaning of threshed paddy and other cereals. During the activity they adapt unnatural body posture due to which their physiological workload increases and also they faces many types of musco-skeletal problems as a result the efficiency of women to work decreases to a greater extent. Presently hand/paddle

operated winnowers are commercial available. Use of hand operated winnower can complete the cleaning operation quickly, saving time and labour requirement.

Present study is an attempt to assess physiological stress and musco-sketetal problems of farm women while performing winnowing activity in hand operated mechanical winnower in comparison of traditional practices.

METHODOLOGY

On Farm Trial (OFT) on hand operated winnower with fan guard developed by ICAR Research complex for NEH region, Barapani for productivity, comfort ability and as drudgery reducing tools of farm women in comparing of traditional method of winning i.e. bamboo made *Kula or Dola* by using hand were conducted in Kamrup district of Assam. In hand operated mechanical winnower two farm women were engaged during its operation. One farm women was for cranking the equipment and the other one was for feeding the material and collecting the clean material. For the purpose of the trial, 20 nos. of farm women as beneficiary of using hand operated winnower and another same numbers of farm women (i.e. 20 nos.) from same locality were taken as non beneficiary doing winnowing by using bamboo made Kula or Dola for comparing the assessment. Care has been taken to select the farm women who were healthy, non pregnant, non lactating and free from any serious health hazards and similar physical and physiological parameters. Apart from that selected farm women are involved in winnowing operation for numbers of years. Thus total sample size of the study was 40 numbers comprising 20 beneficiaries and 20 non beneficiaries.

A specially structured Performa was used to record personal data and readings during the experiment. Winnowing performance was calculated in terms of cleaning efficiency, time required for particular amount of output and cost of labour. Heart rate is one of the most accurate means of studying the energy expenditure while performing any activity. For assessing physiological parameters respondents were asked to perform the activity for 30 min. Later these readings were averaged to get mean values. Recovery heart rate was recorded for 5 mins. *Singh A. et.al. (2010)* referred 5 min for recovery heart rate in conducting studies on ergonomic evaluations.

Assessment of physiological parameters: Based on the heart rate readings the following parameters were calculated.

Average heart rate during rest, work and recovery period.

The energy expenditure per minute was estimated as-

Energy Expenditure (kl/min) = 0.159 × Average Heart rate (bmin-1) – 8.72

The Total Cardiac Cost of Work (TCCW) was estimated based on the cardiac cost of work and cardiac cost of recovery.

$TCCW = CCW + CCR$

$CCW = \Delta HR \times tA$

Where,

CCW = Cardiac cost of work

ΔHR = *Mean working heart rate – Mean resting heart rate*

tA = duration of activity

$CCR = (AHR\ recovery - AHR\ rest) \times tR$

Where,

CCR = Cardiac cost of recovery

AHR recovery = Average recovery HR

AHR rest = Average resting HR

tR = duration of recovery

$PCW = TCCW/tA$

Where,

PCW = physiological cost of work

For assessing musco-skeletal pain or discomfort level in both the practices i.e. using hand operated winnower and traditional winnowing practice by using hand, respondents were asked to put their opinion in 5 point likert scale with 5 point for heavy pain/discomfort and 1 point for no pain /discomfort during or after completion of work. musculo- skeletal problem and posture related responses like- pain in shoulder, upper and lower back pain, wrist pain, hand and finger pain, pain in lower and upper leg, irritation and pain in feet etc. were set in likert scale.

Data were collected through observation, personal interview and during field practices of the implements. Collected data were processed, tabulated, classified and analysed in terms of mean value of response.

Cleaning efficiency of grain was calculated as-

$Ec = Wg/Wtg \times 100$

Wg= weight of grain materiel in clean grained sample

Wtg= weight of total materiel in clean grained sample

Ec= percentage of cleaning efficiency

Salient features of hand operated winnower: It is a manually operated hand winnower used for cleaning of threshed paddy grains and separation of husk, dust and other light weight foreign materials from paddy and other cereals and pulses. It has a pair of sprocket and chain for increasing the speed of the fan blades to a ratio of 1:3. The use of chain and sprocket arrangement makes the operation of fan easier with less effort. Four blades each having a length of 610 mm are fitted to the fan. A fan guard is provided to prevent any accident. One person is required for the operation of this equipment while another person releases grains from height to enable the separation of dust and other unwanted light weight materials from the grain. The weight of the winnower is approximately 29 kg.

RESULTS AND DISCUSSION

Physical characteristics of respondents: Basic anthropometrics data of respondents in Table 1 revealed that mean age of selected farm women for winnowing paddy by using hand operated winnower is 36 years, with average height of 152.3 cm and weight of 51.2 kg. and 35 years mean age found among non beneficiaries with average height of 153.1 cm and weight of 50.4 kg. respectively. Mean value of both the categories of respondents shows that anthropometrics data are almost equal

Table 1. Basic anthropometric data of respondents

Parameters	Beneficiaries		Non- beneficiaries	
	Range	Mean	Range	Mean
Age (years)	34-40	36	34-40	35
Height (cm)	142-162	152.3	142-162	153.1
Weight in kg	45-55	51.2	43-56	50.4

Performance of hand operated winnower: Performance of hand operated winnower in terms of output and physiological stress of farm women were analysed in comparison with their traditional winnowing by using hand. Performance of winnowing like time requirement, labour cost and cleaning efficiency of clean grain, Ergonomic parameters like- working heart rate, resting heart rate, energy expenditure, total cardiac cost of work and physiological cost of work were calculated to find out physiological stress in both the practices.

Winnowing performance: Table 2 revealed that cleaning time for 20 kg grain immediately after threshing in hand operated mechanical winnower takes 30 min. which is 200 per cent less than manual winnowing. Less time requirement resulted more output in a day and saving of labour cost. The per cent increase in per day output was 225 per cent for hand operated mechanical winnower. Winnowing efficiency was found 85.5 and 84.3 per cent in hand operated mechanical winnower and traditional practices respectively. Improved technologies have significantly higher work output than the traditional method. *Singh and Gite (2007)* evaluated a hand operated paddy winnower ergonomically by women workers. A hand operated paddy winnower was developed by Central Rice Research Institute, Cuttack. The winnower was ergonomically evaluated using 12 subjects. The average output 242 kg grain/h was found and winnowing efficiency was found to be 88.36 per cent.

Ergonomic cost of work: Table 2 also depicts the ergonomic parameters of respondents to find out physiological stress in both hand operated mechanical winnower and traditional winnowing practice using hand. It is revealed from the Table 2 that average working heart rate and energy expenditure is more with farm women doing winnowing manually by traditional way. Mean resting heart rate found 83.9 and 84.6 beats/min of respondents with using hand operated mechanical winnower and traditional winnowing by using *kula or Dola* respectively which is very close to each other. This may be because of similar sample selection procedure with similar anthropometric data. Average working heart rate was recorded 131.1 beats/min with respondents using mechanical winnower and 138.7 beats/min with respondents using traditional practice of winnowing, which is estimated 5.8 per cent decrease with the use of mechanical winnower. Similar trend was observed in case of energy expenditure also. Energy expenditure value recorded 12.12kl/min with mechanical winnower and 13.33kl/min with traditional practice of winnowing.

Results shows that with the use of hand operated mechanical winnower TCCW reduced by 18.86 per cent. The physiological cost of work (PCW) was found as 75.6 for traditional winnowing, whereas 63.6 with the use of hand operated mechanical winnower. These findings can be concluded as physiological cost of farm women in using hand operated mechanical winnower is less with increase productivity and therefore labour saving. Less time consumption with winnower also help farm women to reduce boredom fatigue.

Musco-skeletal problem of women assessed during performing the activity: Musculoskeletal problem of

Table 2. Comparisons of winnowing output and ergonomic parameter between traditional winnowing by using bamboo *Kula or Dola* hand operated mechanical winnower

Parameters	Ttraditional winnowing by hand	Hand operated mechanical winnower	% change hand operated winnower over traditional practice
Winnowing output			
Winnowing Time for 20 kg grain cleaning	1 hr 45 min	0.30 min	200.0↓
Total output in 1 day (considering 8 working hours)	90 kg	320 kg	255 .0↑
Person involved	1 nos	2 nos	
Saving of Labour cost over traditional winnowing	-	1 day	
Cleaning efficiency	85.5%	84.3%	
Ergonomic parameters			
Av. working heart rate	138.7	131.1	5.800↓
Av. resting heart rate	84.6	83.9	0.800↓
Av. energy expenditure working kl/min	13.33kl/min	12.12kl/min	9.980↓
Total energy expenditure for same quantity of output kl/min	1399.65kl	363.6 kl/min	285.0↓
Total cardiac cost of work	2268	1908	18.86↓
Physiological cost of work	75.6	63.6	18.86↓

↓=Decreasing; ↑=Increasing;

Table 3. Assessment of Musculoskeletal problem of women

Musco-skeletal problem of women	Mean value winnowing by traditional practices	using winnower
Neck pain	4.08	2.08
Shoulder pain	3.5	2.5
hand and wrist pain	4	3.25
Back pain	3.33	2.08
Thigh muscle pain	2.92	2.17
Knee pain	3.5	1.75

women were assessed in terms of pain or discomfort experienced by women during performing winnowing activity. Mean value of Table 3 shows that musculoskeletal problem of women in all selected parameters shows higher in case of women performing winnowing by traditional practices. Regarding pain in neck and knee found almost double.

CONCLUSION

The results obtain from this research work shows that the time required to clean the rice grain in mechanical winnower are decreased, which increased performance of output and saving labour cost. Equipment was found suitable in terms of less physiological cost of work of women as well as experienced with less psycho skeletal disorder during performing the activity. Overall worker found comfortable with the equipment but as the equipment need two people to work at a time and initial investment cost of equipment, preference of accepting the equipment at household level is minimum.

REFERENCES

Singh S.P.; Gite L.P.; Agarwal, Nidhi and Majumdar, J. (2007). Women friendly improved farm tools and equipment. CIAE, Bhopal.

Singh, S. P. and Gite, L. P. (2007). Ergonomic evaluation of a hand operated paddy winnower by women workers. *J. of Agril. Engg.*, **44** (4): 67- 71

Srinath, K.; Dash, H. K.; Agarwal, S.; Tripathy, A.; Lopamudra, P. and Pattanaik, S. (2010). Drudgery reduction and women friendly farm tools and equipment. Tech. bulletin **16**. Directorate of Research on Women in Agriculture (ICAR) Bhubaneswar. pp 2.

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