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Ergonomic evaluation of the farm women involved in brinjal harvesting activity

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Abstract

Harvesting of brinjal activities are not only drudgeries but time-consuming also. Hence, the present study was undertaken to introduce the ring cutter and assessing its acceptability among farm women in the adopted village of Krishi Vigyan Kendra, Narsinghpur to performing harvesting of brinjal.. Reduction of women's drudgery with the use of ring cutter was asses in the terms of ergonomic cost. The ergonomic cost was calculated by measuring heart rate, energy expenditure, and total cardiac cost of the work. The results indicate that the ring cutter harvest 42 kg/hr brinjal as compare to bare hand 34.2 kg/hr with 33% labour saving.

Keywords: Ring cutter, drudgery, ergonomics, health hazards, brinjal

Introduction

Farm women are the backbone of the agricultural workforce. As per the 2011 census, the women workforce in agriculture and allied sectors is 98 million, which is 37 percent of total wage workers. Farm women are much more overburdened than men owing to their multiple occupations, but worldwide their hard work has mostly unpaid. As per the previous study by Bhople and Pathai (1998) [4] the daily work schedule of farm women is very demanding and arduous. It is estimated that 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. Drudgery or workload is normally conceived as physical and mental strain, fatigue, monotony and hardship experienced by the worker while doing any work. Analyzing the workload of any person the heart rate is a simple and reliable method with correlated to oxygen consumption this method to assess the physiological cost of work in agriculture (Badiger *et al.* 2006) [2]. Generally 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) [5].

Brinjal or eggplant (*Solanum melongena* L.) commonly known as baigan in hindi, belongs to the family solanaceae. It is a perennial plant, but in India, it grows, according to the season by transplantation of seedlings. The height of the plant reaches about 3-4 feet tall in quick and bears many bright fruits. Size, weight, and colour of fruits depend on the variety in which you grow. The fruits are harvested when they reach maturity. Brinjal harvesting is performed, only by the farm women through the bare hand, this may cause wounds, skin irritation and rashes. These were the reasons affecting the work efficiency of farm women. Harvesting of brinjal by traditional method affect the yield. During plucking of brinjal, the force has been placed by hand cause damage of roots and flowers. Therefore the present study was aimed to ensure better health and safety and to improve work efficiency, reduce the drudgery of farm women by introducing a ring cutter.

Materials and Methods

The harvesting of brinjal by ring cutter i.e. field experiment were conducted in the farmer's field during February 2018 in brinjal producing block Narsinghpur of District Narsinghpur, Madhya Pradesh. The study was carried out on 15 farm women involved in a brinjal harvesting activity. The age of selected farm women between 30-45 years with normal health, without any major illness. Harvesting of brinjal with a ring cutter was compared with indigenous method i.e. bare hand. Manually operated ring cutter is the newest tool for harvesting brinjal in the field. The ring cutter can be worn on any finger, generally, the index finger wears this small ring on the tip of a finger to turn the hand into a plucking tool. It's

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operated by a women working in standing posture in (Fig. 1).



Fig 1: Harvesting of brinjal with a ring cutter

During the experiment, the anthropometric rod and weighing balance were used to measure the physical characteristics like height and weight of farm women. One hour was given for both the treatments, i.e. hand and ring cutter. Each trial was of 60 minutes duration. Various parameters viz., time, profile, % efficiency, field capacity (output Kg/hr) was measured.

Assessment of Physiological Stress

1. Heart Rate: Heart rate was recorded using a Digital Heart Rate Monitor. In the morning resting heart rate (RHR) of the respondent was recorded and after completion of the activity working heart rate (WHR) was recorded.
2. Energy Expenditure Rate and Cardiac Cost : From the average values of heart rate and energy, expenditure was calculated with the help of formulae given by Varghese *et al.* (1994) [7] which is as follows

$$EER (KJ/min) = 0.159 \times HR (beats/min) - 8.72$$
 Where,
 EER = Energy Expenditure Rate (KJ/min)
 HR = Heart rate (beats/min)
3. Cardiac cost of work can be calculated as per the formula given by Varghese *et al.* 1994 $CCW = \Delta \text{ heart rate} \times \text{duration of activity/output}$

$$\Delta \text{ heart rate (beats/min)} = \text{Average working heart rate} - \text{average heart rate during rest}$$
 Physiological cardiac cost of work = $\Delta \text{ Heart rate} \times \text{duration of activity /output}$
4. After performing the activity respondent were asked to rate the perceived exertion on a five-point scale every time.
5. The incidence of health hazards: After performing the

activity respondent was asked to identify the region in the body where the pain is occurring.

Results and Discussion

To evaluate the harvesting of brinjal through the ergonomic point of view, 15 farm women in the age group 25-45 years were selected at random and the average age was counted 42.5 years. The basic body dimensions were measured an average was worked out as the height (156.50 cm) and weight (52.50 kg) respectively (Table 1).

As per comparison with the traditional practice of harvesting by bare hand with improved practice, i.e. ring cutter the results indicated that the farm women harvested 34.2 kg/hr and 42.0 Kg/hr with bare hand and use of ring cutter respectively. The efficiency of farm women was increased by 18.60% and 33% in terms of labour saving from Table 2. There is no reference is available to correlate the present results. Whereas the use of ring cutter for the harvesting of flowers increase 28% harvesting activity (Lakshmi V and Deepika J 2019) [6]. The results presented in Table 3 depict ergonomic assessment of the harvesting of brinjal. The average working heart rate observed in the harvesting of brinjal by bare hand and ring cutter was 105.2 beats/min and 98.4 beats/min respectively. The change in heart rate was 8.8 and 6.2 beats/min, respectively. During the use of the bare hand, Δ heart rate was 8.8 beats/min, whereas in the case of ring cutter Δ heart rate was 6.20 /min. So the use of a ring cutter saves 22.0 percent cardiac cost of a worker per unit of output. With the use of improved equipment, farm women found the light rate of perceived exertion compared to the traditional method. There is no reference available to correlate the present results. Whereas Badiger *et al.* (2004) [1] use the CIAE make okra plucker and reported that the physiological workload of farm women was lower with the higher work output.

The occurrence of health hazards in any farm practice affects the working efficiency and productivity of the performance. Table 4 reveals that in traditional practice the percentage of respondents reported the occurrence of hand pain (80%), shoulder pain (20.00%), backache pain (53.33%), wrist pain (86.67), finger injury (93.33%) and irritation in the skin (100%) whereas using a ring cutter the occurrence of pain, reduces in hand (13.33%), shoulder (6.67%), Backache (13.33%), wrist pain (66.67%) whereas figure injury and skin irritation reduces 80% and 73.33% respectively. Results are in line with the study conducted by Lakshmi V. and Deepika, J. (2019) [6] and Bajpai *et al.* (2018) [3].

Table 1: Anthropometric dimension of Farm women involved in the harvesting of brinjal (N=15)

S. No.	Parameters	Mean
1	Age (Yrs)	42.5
2	Height (cm)	156.50
3	Weight (Kg)	52.50

Table 2: Comparative analysis of harvesting of brinjal by bare hand and ring cutter (N=15)

S. No.	Parameters	Harvesting of brinjal by bare hand	Harvesting of brinjal with a ring cutter
1	Output (kg/h)	34.2	42.0
2.	Efficiency (%) of farm women	-	18.60
3.	Labour required (man-hour/q)	3	2
4	Saving of labour (%)	-	33

Note: The weight of one brinjal= 125gm to 200gm

Table 3: Ergonomic parameters and perceived rate of exertion during harvesting of brinjal

S. No.	Parameters	Harvesting of brinjal by bare hand	Harvesting of brinjal with a ring cutter
1.	Average working Heart Rate (Beats/min)	105.2	98.4
2.	Average Heart Rate during rest (Beats/min)	96.4	92.2
3.	Δ Heart rate (beats/min)	8.8	6.2
4.	Average energy expenditure (kJ/min)	8.0	7.0
5.	Cardiac cost of work (Beats/Kg)	15.44	8.86
6.	Saving in cardiac cost/Kg (%)	-	22.0
7.	Rate of perceived exertion	Moderately heavy	Light

Table 4: Comparisons of health hazards in the harvesting of brinjal (N=15)

Health Hazards	Harvesting of brinjal by bare hand (%)		Harvesting of brinjal with ring cutter (%)	
	Yes	No	Yes	No
Hand Pain	80.00	20.00	66.67	33.33
Shoulder Pain	20.00	80.00	13.33	86.67
Backache Pain	53.33	46.67	40	60.00
Wrist Pain	86.67	13.33	20	80.00
Finger injury	93.33	6.67	13.33	86.67
Skin irritation	100.00	0.00	26.67	73.33

Conclusions

Harvesting of brinjal by bare hand is time and tedious operations. Farm women feel used of traditional harvesting practice it as a maximum drudgery prone activity, because of its monotony in performance, skin irritation and figure injury were severely affected. The use of the ring cutter reduces the health hazards but also increases the efficiency of workers. Use of ring cutter reduces wrist pain, avoid itching and discomfort to the skin thus reducing drudgery. Farm women convinced to use a ring cutter due to sharpened tapering edges and they could perform the activity for a longer duration. There is a greater need to provide a ring cutter to farm women.

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