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Comparison of ergonomics parameters while mahua decortications by traditional method and by mahua seed decorticator

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Abstract

Farm women are mainly involved in tedious, monotonous, time consuming task in agriculture, the result of which they are subjected to drudgery. The farm women are been compelled to long static postures resulting in physical drudgery to their body. In spite of current scenario of agricultural advancements, the drudgery of Farm women remains the same with non friendly technologies and implements (Singh, S.P. 2012). Thus for the benefit of farm women and to aid in ease of Farm women involved in Mahua seed Decortication the mahua seed decorticator was evaluated. The result revealed that the use of mahua seed decorticator reduces the drudgery of farm women by 68.33%. The decorticator increased the efficiency by nearly more than six times as compare to traditional decortication method.

Keywords: Monotonous, drudgery, efficiency, productivity, decorticator

Introduction

The Indian butter tree, mahua (*Madhuca longifolia*), is a tree that has been known since prehistoric times and is a member of the Sapotaceae family (Singh *et al.*, 2000) ^[14]. According to Patel *et al.* (2011) ^[8], mahua is one of those multipurpose tree species that is primarily grown or harvested for the three Fs: food, fodder, and fuel. Numerous everyday utility products are produced by the tree. The fact that its fruits, seeds, and flowers are widely used makes it valuable in India (Ramadan *et al.*, 2006) ^[9]. When mature, mahua fruits are green, but when ripe, they turn reddish-yellow. The seed has two kernels and is very susceptible to freezing and desiccation, indicating that it is a stubborn seed. After 45 to 60 days of flowering, the fruits open, and the seeds develop by June and are available until the middle of July. When the fruits ripen, they fall to the ground. Once the fruit falls off the tree shortly after it ripens, tribal people typically gather it and manually press the fruit wall to separate the seeds (Patel *et al.*, 2011; Gupta *et al.*, 2012) ^[8, 3]. Mature fruits that have been harvested from the tree can also be stored for further ripening and seed extraction by depulping the fruit (Hegde *et al.*, 1993) ^[5]. Mahua trees are also known as Indian butter nut trees because mahua seeds are the main source of natural hard fat that is used in commercial products under the names mahua butter and mowrah butter. When fresh Mahua oil is extracted from properly preserved seeds, it has a golden color and a mild flavor. Tribal peoples of Madhya Pradesh, Chhattisgarh, Gujarat, Maharashtra, and Odisha, use mahua oil for cooking. The seeds are gathered in June or July, coinciding with the start of the wet season. According to Jha and Vaibhav (2013) ^[6], this makes it one of the most significant sources of tree seed oil in India's tribal areas.

Farm women usually collect these mahua seeds from forest and decorated them by hand using stones. According to Bhushan *et al.* (2016) ^[1], the women farmers have been using conventional tools and implements for a sizable period of time. These equipments and methods expose women farmers to several health issues and also they are ignorant to them. A decrease in the labor force available for agriculture, low labor productivity, difficult work, and education all have an effect on the health of farm women (Patel *et al.*, 2015) ^[7]. The lack of knowledge, insufficient training, and poverty may all be contributing reasons to the delay in treating occupational health problems.

Therefore, KVK Shahdol District worked to lessen the drudgery and enhance the productivity of farm women engaged in mahua seed decortications by Heart Rate Response Method. Hasalkar *et al.* (2004) ^[4] reported that heart rate is typically utilized as an ergonomic metric to assess the physiological or functional demands of labor. Chauhan (1999) ^[2], stated that the energy cost and cardiac cost of work determine the work load, which is defined as the demands made on the cardio-respiratory system from a physiological perspective.

Methodology

Thirty farm women without any physical deformities, aged between 20 and 55, participated in the work on mahua seed decortication in the Shahdol district. The trial was run from June to July. The characteristics, such as the profile and physiological stress, were examined throughout the trial. For both traditional and seed decorticator practices, the amount of mahua seed decorated per hour was recorded. Physical attributes like height and weight were measured using an anthropometric rod and weighing balance. The time was

recorded using a stop watch. The heart rate monitor was used to record the heart rate. The average heart rate during work and rest, as well as the energy expenditure per minute, were computed using the heart rate records.

The following parameters were computed using the heart rate records: * Average heart rate at rest and during work was calculated. Varghese *et al.* (1994) [15] provided formulas to estimate the energy consumption per minute based on heart rate.

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

- DHR (beats/min) = Average working heart rate – average heart rate during rest
- Output (kg/hr) = weight of mahua seed decorticator x duration / average time
- Cardiac cost of worker per unit of output (beats/ kg of mahua) = DHR x duration / output.

Results and Discussion

The ergonomic evaluation of mahua seed decortication activity was done. For this purpose, 30 respondents of the age group 20 to 55 years were randomly selected. The mean age count, average height and weight of FW were 36.29 years, 151.92. cm and 51.33 Kg respectively (Table 1).

Table 1: Anthropometric measurements

Physical characteristics	Mean ± S.D.
Age (yrs)	36.29 ± 9.65
Height (cm)	151.92 ± 2.95
Weight (kg)	51.33 ± 3.32

Table 2 revealed that decortication of mahua seed was 1.63 Kg and 9.94 Kg per hour by traditional stone decortication and mahua seed decorticator respectively. Thus, it is very clear that mahua seed decorticator increases the efficiency by 509.81 percent against the traditional (stone decortication) and increases the output more than six times as measured by the mahua decorticated seeds. During stone decortications of mahua the average HR was 10.54 beats/ min., while by mahua seed decorticator it was recorded as 20.23 beats/ min. Sharma *et al.*, (2014) [11] reported that working heart rate, energy expenditure and cardiac cost was more for plain sickle as compare to serrated sickle. Also Sharma *et al.*, (2021) [10] reported that the okra ring cutter increased the efficiency by nearly two times as compared to traditional hand harvesting method. Further Sharma *et al.*, (2019) [12] reported that Hanging Type Grain cleaner not only saves the time of farm women but also enhances the efficiency more than twelve times with a saving of 84.20 per cent cardiac.

Table 2: Comparative Ergonomic evaluation of Mahua seed decortications

Parameters	Mean values	
	Stone Decortication (By seive)	Mahua seed decorticator
Output (Kg/hr)	1.63±1.63	9.94±0.474
Increase in efficiency (%)	-	509.81
Average working heart rate (beats/min)	84.17±3.16	95.47±2.80
Average heart rate during rest (beats/min)	73.63±2.45	75.23±3.16
ΔHR (beats/min)	10.54 ±3.85	20.23 ±2.65
Cardiac cost (beats/kg)	386.64 ±141.71	122.46 ±17.41
Saving in cardiac cost/kg (%)	-	68.33
Drudgery Reduction (%)	-	68.33

Table 3: Distribution of sample by age

Age in years farmwomen	Frequency (N=30)	Percentages (%)
Below 30 years	4	13.33
Between 31-40 years	19	63.33
Between 41-50 years	2	6.67
Above 51 years	5	16.67

Table 3 revealed that the majority of the respondents are in between age group of between 31-40 years (63.33%),

followed by respondents of above 51 year age groups (16.67%). Data given in Table 4 revealed that maximum output was given by the age group in between 31-40 years i.e. 1.78 kg in stone decortications and 10.8 in mahua seed decorticator. It was also revealed that the majority of the respondents faced wounds and accidents during the traditional method. Vishwakarma *et al.* (2020) [16] reported that majority of the farm women involved in okra picking activity had itching and wound problem.

Table 4: Performance and feedback of farm women during mahua decortications

Subject Age Group	Traditional stone decortications		Mahua seed decorticator	
	Av. Quantity Harvested kg/hr	Remarks from subject	Av. Quantity Harvested kg/hr	Remarks from subject
Below 30 years	1.54	Health hazards and accidents while performing mahua seed decortication by stone	9.8	Easy to operate, feeling presser to wrist.
Between 31-40 years	1.78	Pain in arms and shoulders	10.8	Moderate pain in wrist, arm and shoulder
Between 41-50 years	1.68	Wounds and accident prone	10.4	No risk
Above 51 years	1.65	Wounds and accident prone	9.2	No risk but more time required to practicing

Conclusion

The mahua seed decortication activity is a very monotonous, repetitive, lengthy and time consuming activity. Moreover mahua decortications by stone lead to wounds and injuries on the fingers of farm women. The mahua seed decorticator proved to be useful in decortications activity. It saves time, labour and energy. The mahua seed decorticator increases the efficiency by 509.81 percent and with a more than six times increase in output. It further reduces the drudgery by 68.33 percent. The chances of the wounds and injuries are eliminated and it is safe to use mahua seed decorticator. The technology could be adopted by the farm women. More efforts are needed for further availability of tools at village level.

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