

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.910.399>

## Effect of the Physiological Parameters of Different Age Group Operators on the Linseed Thresher at Different Moisture Levels of Crop

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### ABSTRACT

#### Keywords

Linseed crop,  
Physical properties,  
Physiological,  
Parameter and  
Moisture level

#### Article Info

Accepted:  
26 September 2020  
Available Online:  
10 October 2020

A study was conducted on effect of the physiological parameters of different age group operators on the linseed thresher at different moisture levels of crop. Physical properties of linseed plants were determined. Physiological parameters as heart rate, oxygen consumption rate and energy expenditure rate of age group operators of (20-24, 25-29, 30-34, 35-39 and 40-44 years) were determined during working on linseed thresher at different moisture level of sample of linseed crop. Heart rate, oxygen consumption rate and energy expenditure rate were increased during increasing of age group operators at moisture level of sample (15%, 20%, 25% MC). Heart rate, oxygen consumption rate and energy expenditure rate of 20-24 yr age groups were found minimum during working on thresher at different moisture levels. Same physiological parameters of age group operator of 40-44 yr were found maximum as same.

### Introduction

Agriculture has an important place in Indian economy and the main work force in it is human power. The population dynamics of Indian agricultural worker and it was estimated that by 2050, the population of agricultural worker will be about 202 million of which 121 will be the female workers and 81 male workers (Baruah *et al.*, 2006).

Agricultural operations are very labor intensive in India. Farming operation includes

working with biological and mechanical systems and farmer has to work in adverse climate conditions, poor infrastructure, limited implements and machines in ergonomically unsuitable postures (Kathirvel *et al.*, 2003). The word ERGONOMICS is derived from two GREEK words: ERGO (means work) and NOMOS (means rules of laws). The ergonomics is the scientific discipline mainly concerned with understanding of the interaction of humans, and the scientific design profession that applies theory, principles, data and methods

to design and improve the work system involving machine or job with human as an integral system. Ergonomics is the scientific study of relationship between man-machine and working environment (Dewangan *et al.*, 2008). The suitable well designed machine could not give the desired performance because human working was not considered as internal part of man-machine system. The significance of ergonomics was limited to military field but later applied to industrial, agricultural and consumer fields (Gite and Yadav, 1989). Generally two methods are accepted for assessing implication of ergonomics in agriculture. First is the tangible method related to cost benefit ratio and considered as the measure of the major importance. Second is an intangible method, which is dependent upon choice of importance such as human health, comfort and occupational safety. The role of ergonomics is to impress the both methods for important benefit to the farm workers. Most designers of agricultural equipment give the attention to improve the efficiency and durability but less attention is given to operators, comfort and well-being (Ram *et al.*, 2008).

With advance technology, human factor has to be given utmost priority. Hence, there is an urgent need to critically analyze these agricultural tools or equipment ergonomically in order to improve man-machine system efficiency system without compromising performance (Khogare and Borkar, 2011). Selection of subject (worker) plays an important role whenever we are conducting an ergonomic study. The subjects are required to be medically fit and represent real user population in operation of the selected machinery. The selection is made on the basis of gender, age, height and weight. In India, generally male subjects are selected for conducting ergonomic studies on agricultural machinery (Siedel *et al.*, 1980).

The present study was undertaken with the objective to find out the physical properties of linseed crop and evaluation of physiological parameters of the workers of the different age groups operating on Linseed thresher at different moisture levels of crop.

## **Materials and Methods**

The experimental set up was developed to determine the physical properties of linseed crop and evaluation of physiological parameters of the workers of the different age groups operating on Linseed thresher at different moisture levels of crop. The experiment was carried out in the farm machinery workshop, SHUATS, Prayagraj.

### **Physical properties of linseed crop**

Physical properties of kernels, grains, and seeds are necessary for the design of equipment to handle, transport, process and store the crop. The physical properties of flaxseed have been evaluated as a function of seed moisture content, varying from 6.09% to 16.81% on dry basis. The angle of repose increased linearly from 21.6° to 33.4° with the increase of moisture content (Coşkuner and Karababa, 2007). In the moisture range, average of length, width, thickness and number of each pod etc of linseed crop were determined by measuring through vernier scale and screw gauge. In order to record various data, the basic measuring instruments were used i.e. Oven dryer- (for drying of crop at desired moisture level), Measuring tape and scale- (for measuring crop and thresher's dimensions), Heart rate monitor- (for measuring heart rate), and Weighing scale- (for measuring crop weight).

Oven dryer (Fig. 4) is used for getting specific moisture level to the sample of linseed crop. Capacity, Dimensions, Heating temperature and Volume of oven dryer was 360.5 lbs./hr.,

12" W × 12" L × 12" H, 50°C to 250°C, 68 Liters respectively. Measuring tape was used for measuring crop and thresher's dimensions. All the measurement using the tape and scale was taken when the crop were in a standing mode on the field. Length, width, & weight (kg) were measured as 3m, 13,mm& 0.800 kg respectively.

Heart Rate Monitor is a digital monitor intended for measuring the heartbeat rate. Subject were allowed to take sufficient rest before starting of experiment then heart rate monitor (Fig.5) was affixed on the upper arm circumference of the subject and the heart rate was recorded on the digital screen of monitor. The subject was then asked to operate the linseed thresher at the first level (15% MC sample). All the subjects took turns to repeat the process. Weighing scale was used to crop weight. Weighing scale is the measure weight both in kilograms (KG) and in pounds (Lbs) and equipped with high precision strain gauges and load cell sensors that ensure accurate reading every time.

### **Selection of age subjects**

It was ensured that subjects were selected from particular age groups, physically fit, not suffering from any illness and had willingness to participate in undertaking experiments. The maximum aerobic capacity, heart rate, muscle strength and muscle cross-sectional area has been affected with ageing (Marsh *et al*, 1999). For this study, different age subjects were selected from the available workforce of different ages which varied from 20-44 years.

### **Selection of materials for linseed thresher**

In hand operated linseed thresher machine, the threshing of the linseed crop was done manually holding the crop over the threshing cylinder. Linseed thresher (Fig. 6) was evaluated on the basis of psychological

parameters of different ages workers at different moisture levels of crop, Hand operated linseed thresher were fitted with two nylon roller (dimension 300×125 mm), Blower diameter (280mm), Gear (dia.130 mm) etc.

### **Working Procedure of Workers on Threshing**

For working on linseed thresher workers of different age group (20-24, 25-29, 30-34, 35-39, 40-44 yrs) were selected. First of all stable heart rate measured using heart rate monitor in resting condition of different age groups for 10-15 min before operating linseed thresher. After that started linseed thresher for threshing sample at 15% MC for approximate 10min for measuring the working heart rate of different age group for at least three replications. Same procedure was adopted for measuring the working heart rate of workers at 20% and 25% moisture levels of crop.

### **Determination of variables**

#### **Independent Variable**

- a. Different age groups = 20-24, 25-29, 30-34, 35-39 and 40-44 yrs
- b. Three levels of moisture contents = 15, 20 and 25% MC

#### **Dependent variable**

1. Heart rate (b/min)
2. Oxygen consumption rate (l/min)
3. Energy expenditure rate (kJ/min)

### **Oxygen consumption rate (OCR)**

The OCR of workers on their measured heart rate was determined based on general equation as given by Singh *et al.*, (2008).

$$OCR = 0.0114 \times HR - 0.68 \dots\dots\dots 3.1$$

Where,

Oxygen consumption rate (OCR) in lit/min  
 Heart rate (HR) in beats/min  
 The oxygen consumption rate (lit/min) was converted in kJ (1 lit. O<sub>2</sub> = 20.93 kJ)

**Energy expenditure rate (EER)**

The EER was computed by using the following equation given by Nag *et al.*,

(1979) and Philip (2002).  
 $EER = 20.86 \times OCR \text{ (kJ/min) ...eqn3.2}$

**Results and Discussion**

**Physical properties of linseed crop**

Physical property of linseed crop sample at different moisture levels was determined with the help of suitable measuring instruments.

S. No.	Particulars	Specification
1.	Name of crop	Linseed
2.	Spacing, mm	230
3.	Avg. plant height, mm	300
4.	Avg. length of linseed grain, mm	4.54
5.	Avg. width of linseed grain, mm	2.27
6.	Avg. thickness of linseed grain, mm	1.1
7.	Avg. mass of 1000 seed, gm	5.5
8.	No. of pods in each plant	22 pods
9.	No. of seeds in each pod	6-8 Seeds

**Physiological effect of workers on linseed thresher**

**Effect of heart rate of workers during working on linseed thresher at different moistures**

The results of heart rate of different age groups are presented in Fig. 1 and Table 1. When age of subjects was increased, there was an increase in heart rate during working on linseed thresher at different moisture levels. Maximum heart rate of age group workers of 40-44 yrs varied from 103 to 126 beats per min during working at different moisture levels of linseed crop. Minimum heart rate of workers of 20-24 yrs observed from 82 to 100 beats per min at same conditions. Similar result investigated by Patel and Ram (2020).

**Effect of oxygen consumption rate of workers during working on linseed thresher at different moistures**

The results of OCR of different age groups are presented in Fig. 2 and Table 2, during working on linseed thresher. When age of subjects was increased, there was an increase in OCR during working on linseed thresher at different moisture level of linseed crop.

Maximum OCR of age group workers of 40-44 yrs varied from 0.50 to 0.76 lit/min during working at different moisture levels of linseed crop. Minimum OCR of workers of 20-24 yrs observed from 0.25 to 0.46 lit/min at same conditions. Similar result investigated by Patel and Ram (2020).

**Table.1** Measured heart rate of workers at different moisture levels of linseed

Age groups (in years)	Stable heart rate (beats/min)	Working heart rate at diff. moisture of sample (beats/min)		
		15% MC	20% MC	25% MC
20-24	75	82	91	100
25-29	71	86	98	106
30-34	73	92	105	113
35-39	74	98	107	118
40-44	76	103	113	126

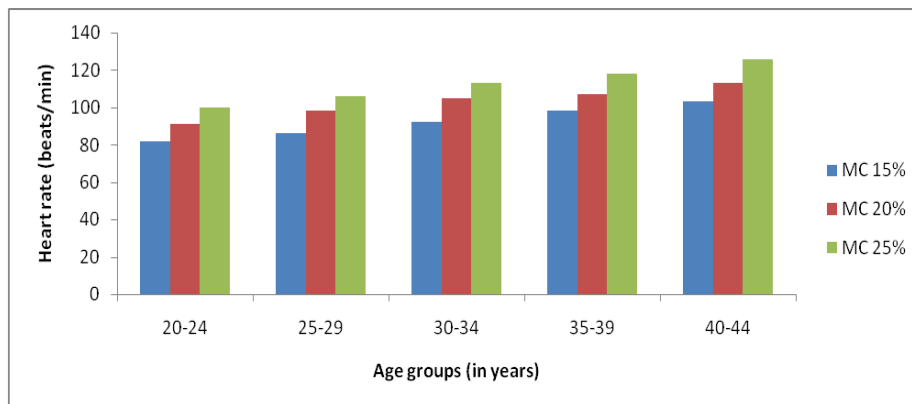
**Table.2** Measured OCR of workers at different moisture levels of linseed

Age groups (in years)	OCR at different moisture of sample (lit/min)		
	15% MC	20% MC	25% MC
20-24	0.25	0.36	0.46
25-29	0.30	0.44	0.53
30-34	0.37	0.52	0.61
35-39	0.44	0.54	0.67
40-44	0.50	0.61	0.76

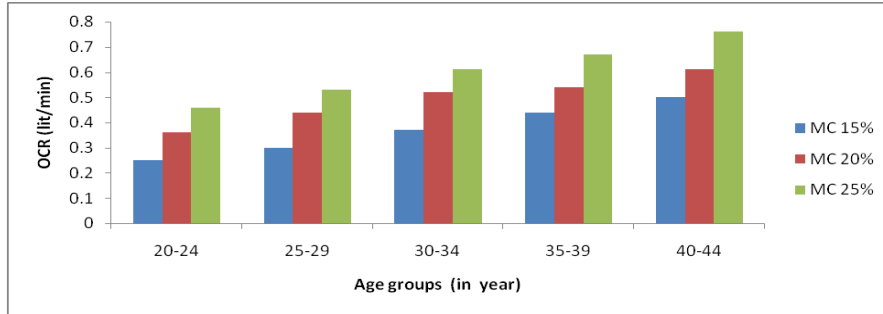
**Table.3** Measured EER of workers at different moisture levels of linseed crop

Age groups (in years)	EER at different moisture of sample (kJ/min)		
	15% MC	20% MC	25% MC
20-24	5.23	7.51	9.60
25-29	6.26	9.18	11.06
30-34	7.72	10.85	12.72
35-39	9.18	11.26	13.98
40-44	10.43	12.72	15.85

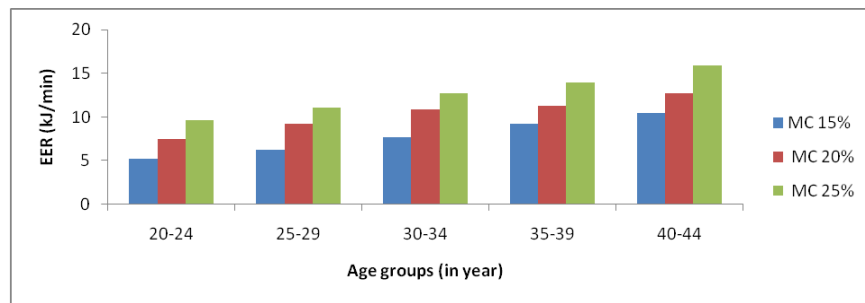
**Fig.1** Relationship between age groups and heart rate of workers



**Fig.2** Relationship between age groups and OCR of workers



**Fig.3** Relationship between age groups and EER of workers



**Fig.4** View of Oven Dryer



**Fig.5** View of Heart Rate Monitor



**Fig.6** View of linseed thresher





### **Effect of energy expenditure rate of workers during working on linseed thresher at different moisture levels of linseed crop**

The results of EER of different age groups are presented in Fig. 3 and Table 3 during working on linseed thresher. When age of subjects was increased, there was an increase in EER during working on linseed thresher at different moisture levels of linseed sample crop. Maximum EER of age group workers of 40-44 yrs varied from 10.43 to 15.85kJ/min during working at different moisture levels of linseed crop. Minimum EER of workers of 20-24 yrs observed from 5.23 to 9.6 kJ/min at same conditions. Similar result investigated by Patel and Ram (2020).

In conclusions the following conclusions were drawn from the study:

Linseed thresher was fabricated as parts namely gear, chain & sprocket, blower, threshing cylinder (Nylon roller) etc with suitable specifications.

Physical property of linseed seed as length, width and thickness of grain, plant height, no. of pods in each plant and no. of seeds in each pod were also determined.

With increasing age groups of subjects, heart rate also increased during working on linseed thresher at different moisture levels of plant sample.

With increasing age groups of subjects, oxygen consumption and energy experiment rate also increased as same parameters.

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**How to cite this article:**

Ramchandra Ram and Meera Kumari. 2020. Effect of the Physiological Parameters of Different Age Group Operators on the Linseed Thresher at Different Moisture Levels of Crop. *Int.J.Curr.Microbiol.App.Sci*. 9(10): 3461-3468. doi: <https://doi.org/10.20546/ijcmas.2020.910.399>