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Research Article

ERGONOMIC ASSESSMENT OF FARM WOMEN USING APRON AND PICK BAG FOR COTTON PICKING

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ABSTRACT

Ergonomics is the scientific study of the relationship between man and his working environment. The ergonomically designed things make the life style better. Women's contribution to agriculture is seldom recognized in spite of their active role in the agriculture as well as household activities in developed as well as developing world. The selected 30 farm women who were engaged in cotton picking since 5 yrs belonging to age groups of 20 – 50 yrs were selected for the experiment. The present study was conducted in four villages of Parbhani and Beed districts of Marathwada region of Maharashtra State. Comparative evaluation was worked out between cotton picking apron developed by AICRP Family Resource Management, College of Home Science M.K.V. Parbhani and pick bag developed by Family Resource Management, College of Home Science, CCS, H.A.U. Hisar. The heart rate of female workers was more while performing cotton picking activity in pick bag method. The rated perceived exertion was highest in case of pick bag method. Ergonomically physiological workload of cotton picking was at par in case of traditional, pick bag and apron method. It has been concluded that there was reduction in physiological cost of work when cotton picking activity was performed with cotton picking apron. From this study it was concluded that cotton picking is recommended for reduction of drudgery with certain improvements.

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INTRODUCTION

Inventory of women work carried out in three agro climatic zones of Maharashtra viz, Marathwada, Vidarbha, and Konkan region revealed that cotton picking and dibbling is sole responsibility of women (AICRP report, 1998). There are no effective technologies available for immediate use of farm women to perform these activities. Cotton crop is a valuable source of income for farmers. Cotton picking is a major activity performed by farm women all over the Maharashtra. About 1565 man h/ha are required in cotton picking using conventional practice of hand picking in India (Goyal, 1979). There are three manual picking in a season at an interval of 15 days. Cotton picking is exclusively a farm women's responsibility in most part of India especially in Marathwada. On an average she spends 6 hours daily in collecting 20-24 kg of cotton during 4-5 cycles of cotton picking in cotton harvesting season (AICRP, 1999). As the entire cotton crop in India is hand-picked by women *(Anon 2011)* labour shortages have bean experienced in intensively cultivated Andhra Pradesh and Tamil Nadu states. Hand picking operation requires 450-500 women-h/ha which costs $.113 tonn-1 and $ 79-248 ha-1 (*Chaudhary, 2011*)

MATERIALS AND METHODS

The present study was conducted in four villages of Parbhani and Beed districts of Marathwada region of Maharashtra State. The selected 30 cotton picking women who were engaged in cotton picking since 5 yrs belonging to age groups of 20 – 50 yrs were selected for the experiment. Comparative evaluation was worked out between cotton picking apron developed by AICRP Family Resource Management, College of Home Science M.K.V. Parbhani and pick bag developed by Family Resource Management, College of Home Science, CCS, H.A.U. Hisar. The data regarding heart rate (resting, working and recovery), perceived exertion, energy expenditure and musculoskeletal problems were assessed by using questionnaire and with the help of scientific equipment such as heart rate monitor. Average working heart rate (AWHR): Working heart rate was recorded with the help of heart rate monitor. It was taken till the completion of work both in traditional and improved method.

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Average peak heart rate (APHR): Peak heart rate was noted down while performing the activity.

Average and peak energy expenditure ($Kj.m^{-1}$) (AEE and APEE): It was calculated by using the formula:

EE ($Kj.m^{-1}$) =0.159Xheart rate (bm^{-1}) -8.72
Total cardiac cost of work (TCCW) (b.m-1): Total cardiac cost of work was calculated by using the following formula:

TCCW= cardiac cost of work + cardiac cost of recovery.
Cardiac cost of work= (Average working heart rate - Average resting heart rate X duration)

Cardiac cost of recovery= (Average recovery heart rate - Average resting heart rate X duration)

Physiological cost of work (PCW) (beats): It was calculated by using the following formula:

$$\text{Physiological cost of work (PCW)} = \frac{\text{Total cardiac cost of work}}{\text{Total time of work}}$$

RESULTS AND DISCUSSION

Assessment of physiological workload while performing the cotton picking activity

Ergonomic evaluation of cotton picking activity was carried out to know the physiological workload of the female workers in conventional, apron and pick bag method.

Physiological workload while performing cotton picking activity in conventional, apron and pick bag method is shown in table 1and 2. It is clear from table that average working heart rate (105 $b.m^{-1}$) and peak heart rate (116 $b.m^{-1}$) were noted highest in pick bag method of cotton picking activity than the apron and traditional method (104 & 113 $b.m^{-1}$ respectively). On an average there was no reduction in working heart rate and peak heart rate while working with apron method over traditional method. Non significant statistical results were obtained when't' test was applied (Table 2). Similar results were obtained regarding energy expenditure, total cardiac cost of work (TCCW) and physiological cost of work (PCW).

Table 1 Physiological Workload While Performing the Cotton Picking Activity

Physiological Parameters	Traditional method (Mean ± SD)	Apron (Mean ± SD)	Pick Bag (Mean ± SD)	Reduction / Increase (Traditional Vs Apron)	Reduction / Increase (Pick bag Vs Apron)	Reduction / Increase (Pick bag Vs Traditional)
Average working heart rate ($b.m^{-1}$)	104 ± 6.57	104 ± 6.92	105 ± 6.49	0(0)	+1(0.96)	+1(0.96)
Average peak heart rate ($b.m^{-1}$)	113 ± 6.8	113 ± 6.24	116 ± 16	0(0)	+3(2.65)	+3(2.65)
Average energy expenditure ($kj.m^{-1}$)	9.33 ±1.09	9.28 ±1.00	9.73 ± 0.98	+ 0.05(0.53)	+ 0.45(4.84)	+ 0.4(4.28)
Average peak energy expenditure ($kj.m^{-1}$)	7.84 ±1.04	7.82 ± 1.10	8.01 ± 1.02	0.02(0.25)	+0.19(2.42)	+0.17(2.16)
Average TCCW (beats)	817 ± 233	817± 236	880 ± 232	0(0)	+63(7.71)	+ 63(7.71)
Average PCW (beats)	27 ± 8	27 ± 8	29 ± 8	0(0)	+ 2(7.40)	+2(7.40)
Average RPE	1. 5± 0.50	1.53 ± 0.57	2.06 ± 0.73	+ 0.03(2)	+ 0.53(34.64)	+0.56(37.33)
Work out put	3.54± 0.86	3.73 ± 0.91	3.58 ± 0.58	+ 0.19(5.36)	+ 0.15(4.02)	-0.04(1.12)

Note- Figure in parenthesis indicate percentage
TCCW = Total cardiac cost of work PCW = Physiological cost of work RPE =Rated perceived exertion
- Indicates Reduction + Indicates Increase

Table 2 Comparison of Physiological Workload While Performing the Cotton Picking Activity by Different Methods

Physiological Parameters	"t" values		
	Traditional Vs Apron	Traditional Vs Pick bag	Apron Vs Pick bag
Average working heart rate ($b.m^{-1}$)	NS	NS	NS
Average peak heart rate ($b.m^{-1}$)	NS	NS	NS
Average energy expenditure ($kj.m^{-1}$)	NS	NS	NS
Average peak energy expenditure ($kj.m^{-1}$)	NS	NS	NS
Average TCCW (beats)	NS	NS	NS
Average PCW (beats)	NS	NS	NS
Average RPE	NS	3.95**	3.74**
Work out put	NS	NS	NS

NS – Non Significant * Significant at 5% level * * Significant at 1% level
TCCW = Total cardiac cost of work PCW = Physiological cost of work
RPE =Rated perceived exertion

It indicated that physiological workload of cotton picking in traditional and apron method was at par. Physiological workload of cotton picking activity with pick bag was higher than traditional and apron method.

There was 2.42 and 7.71 per centincrease in average energy expenditure and, average total cardiac cost of work over apron and traditional method. But statistically results were, non significant. It indicated that Physiological workload of cotton picking in traditional, apron and pick bag method was similar.

Regarding rated perceived exertion, it was found that rated perceived exertion was increased by 2 per centin case of apron over traditional and it was increased by 37.33 percent in case of pick bag over traditional method. When apron and pick bag method was compared the rated perceived exertion score was increased (34.64%) in case of pick bag method. Statistically results were highly significant. It indicated that rated perceived exertion was significantly higher in pick bag method than apron and traditional method. Work output was considered in terms of weight of cotton bolls collected during 30 min period of experiment. Work output was increased (5.36%) and (1.12%) in case of apron and pick bag respectively over

traditional method. But statistically results were non-significant as work output higher with apron. It indicates that apron was convenient and comfortable technology for farm women while performing cotton picking activity.

Hence, it can be concluded from the data that though rated perceived exertion was highest in case of pick bag method, ergonomically physiological workload of cotton picking was at par in case of traditional, pick bag and apron method. However work output was little higher in case of apron method. Hence, it can be concluded that there was no reduction in physiological stress by using apron and pick bag but cotton picking apron was found more comfortable for farm women.

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