

Ergonomic Interventions in Fodder Collection- Impact on Rural Farm Women

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ABSTRACT Rural women are food providers not only to family members but also to animal stock. The present endeavour aims to design a women friendly fodder collector to alleviate her from back breaking drudgery of continuous bending during collection and bundling of fodder for animal feed. The research was carried out in three phases viz. survey, experimental analysis and field technology-testing trials. The cardiovascular, muscular, physiological and environmental stresses on women (N=30) while fodder collection were studied by employing various parameters viz. anthropometric data of women workers, physical fitness test, total cardiac cost of work, energy expenditure, rated perceived exertion and impact of environmental parameters on work output and health status both in existing practices and while using fodder collector for collection of fodder. The analysis of existing fodder collection practices by rural women showed stress on back and calf muscles, improper posture, lack of any tool/ technology to lessen the workload and drudgery involved. Hence, long handled standing fodder collector was designed to eliminate the repeated bending for collection and bundling of fodder. The results indicated a significant reduction in average and peak heart rate, circulatory and physiological stress of women while using fodder collector. Production per unit and coverage of land under operation was significantly increased. Usage of fodder collector significantly reduced the angle of bend, thereby, improving the posture and reducing the body pains. Therefore, training is suggested in use of both appropriate posture and technology to reduce drudgery, workload and stress on women.

INTRODUCTION

Since last many decades the picture of women in the farm front remained very submissive, illiterate, ignorant and asset less. Inaccessibility, small and scattered landholding and poor facilities are the main characteristics of mountain agriculture due to which males migrate to plains to seek employment leaving all management responsibilities including agriculture to the women of the family. The multifarious tasks performed by these women have a strong bearing not only on their own health but also on their children at large. Studies carried out by different study groups reveal that women are exploited without any consideration of workload demands due to their performing the dual role, physical fitness and nutritional status and their biological functions (Shrama, 1988). The root cause of these sufferings is ignorance, age old methods of doing the work, inappropriateness of the technology and attitudinal constraints such as innate conservatism and resistance to change. Moreover, gender bias approach of technology transfer system is blocking the road to progress and prosperity of women in our country.

There is a need to identify the drudgery prone tasks and available technologies, which can be

transferred to reduce the drudgery and increasing efficiency, thereby, improving health and well being of women. More attention is needed in simple low cost drudgery relieving technologies, which are easily adaptable. Moreover, it is incorrect to report that available technologies are gender neutral because women have different technological needs than men due to difference in stamina and anthropometric measurements in sloppy terrain of mountains. Suitability of tools and implements as per physical capacities of rural mountain women is lacking. Hence, present endeavour aims to design a women friendly fodder collector to alleviate them from back breaking drudgery of continuous bending during collection and bundling of fodder for animal feed. Keeping in view the above factors the present study was planned to achieve the following specific objectives.

1. To measure the ergonomic cost of fodder collection activities in terms of physiological, cardio-vascular, musculo-skeletal, postural and environmental stresses on women workers.
2. To devise and test a fodder collector in terms of reductions of drudgery of women in terms of physiological, cardio-vascular, musculo-skeletal, postural and environmental stresses.

METHODOLOGY

The study was conducted in lower Dhauladhar range (900-1400m) of Himachal Pradesh after survey of 500 representative sample to identify fodder collection as a drudgery prone activity. Thirty volunteer subjects involved in fodder collection activity were selected to test ergonomic cost of work with existing method viz.-a -viz. newly developed fodder collector.

All the above selected parameters were tested with three replications for thirty minutes each and averages were calculated. Paired t- test was employed to determine the significant differences between existing methods of work viz.-a.-viz. use of newly developed fodder collector for easy collection and bundling of fodder.

RESULTS AND DISCUSSION

The respondents under the study had an average age of 36.13 years, body height 151.53 cm, gross body weight 45.45 kg, lean body mass 23.38 kg and body mass index 19.87. The VO₂ max of the sample size was found to be 30.64 ml/kg (Fig. 1).

Majority (66.66 %) falling in the high average physical fitness category having ectomorph body type (Fig. 2).

Activity details in Existing Conditions and Using Improved Technology

Existing Method of Work: Fodder was cut by traditional sickle, tied in small bundles with

Parameters	Tools/ Techniques	Formula
i) Physical fitness index	Step stool ergometer/ treadmill min recovery heart rate * 100	Duration of stepping (sec)/ sum of 1+2+3
ii) Physiological parameters		
Heart rate	Polar Heart rate monitor (NV vantage mode)	-
Energy expenditure	-	0.159* Average heart rate- 8.72
Total cardiac cost of work	-	Cardiac cost of work + Cardiac cost of recovery
Physiological cost of work		Total cardiac cost of work / Total time of work
Musculo skeletal problems	Human body map	-
Postural analysis	Flexi curve	-
Muscular strength	Grip dynamometer	Strength of muscles at rest- Strength of muscles at work / Strength of muscles at rest * 100

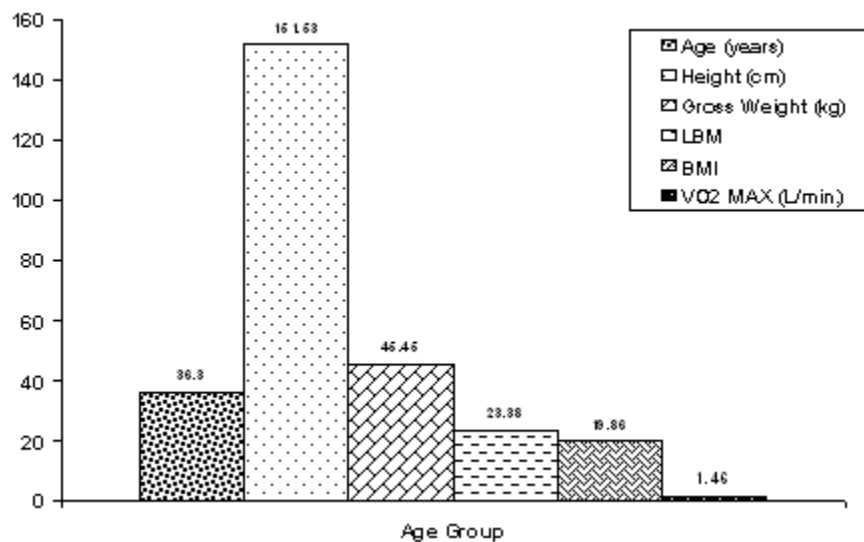


Fig. 1. Physical Characteristics of Subjects

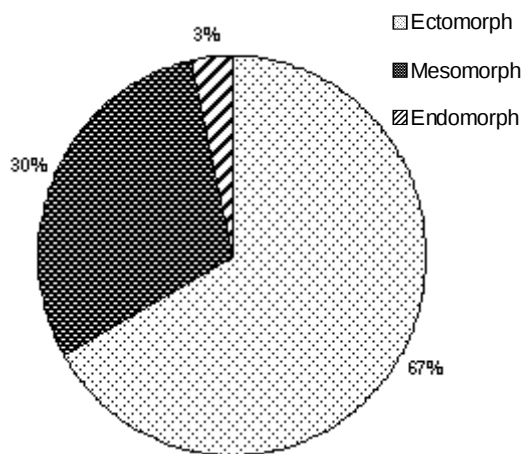


Fig. 2. Distribution Respondents according to Body Type

bare hands, pooled in a large bundles tied with grass rope, and carried back home on head.

Improved Technology: Fodder collector was introduced instead of collecting with bare hands and frequent bending by the users through demonstration, motivational pursuance, practice and follow up in the field.

Specifications of Fodder Collector

Material Used: Iron pipes

Source: Local blacksmith

Cost: 250/-

Handle length: 60cm

Grip handle length: 20cm and slightly bent

Ergonomic Cost of Activity

Ergonomic evaluation of the activity showed significant reduction in the average heart rate (-3.29**), and the peak heart rate (-2.42**), total cardiac cost of work (5.30**), and physiological stress of women while using new technology for collecting and bundling fodder as compared to existing methods (Table 1). Significant decrease in time spent was found while collecting fodder by collector (-5.11**). Production per unit and coverage of land under operation due to fodder collector was significantly increased (7.169**) (Table 1).

Frequency in postural change while collection and bundling of fodder was significantly reduced particularly in squatting posture due to usage of fodder collector (Table 2). *Frequent bending posture* was used in collection and bundling of fodder during existing practices.

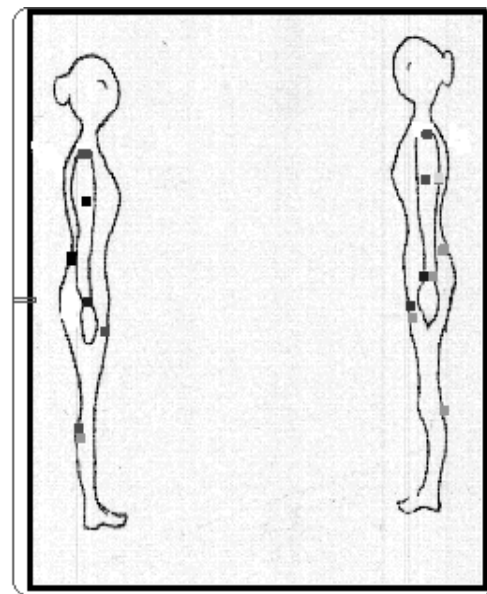
Use of *fodder collector* significantly reduced the angle of bend, thus, relieving the backache of women workers. The most common factor, which forces the user to acquire an awkward posture, is the incorrect reach ability (Ray, 1999), which affects the energy expenditure (Gross and Knoll, 1973) of users adversely.

Existing- Vary severe pain in upper arm and lower back; severe pain in thighs and calf muscles was reported while fodder collection by existing practices of almost using primitive or no technology at all.

Improved- Mild to very mild pain in low back thighs and calf muscles was reported by using improved and new technologies while collecting fodder (Fig.3).

CONCLUSION

Results of all selected parameters showed that stress during traditional methods of fodder collection was found to be much higher than acceptable limits. Significant decrease in the total cardiac cost of work, physiological cost of work, heart rate, average energy expenditure, time spent, distance traveled, angle of bend and muscular



■ Very severe ■ Mild
■ Severe ■ Very mild

Fig. 3. Musculo-skeletal problems during existing and while using improved fodder collector

Table 1: Ergonomic cost of work while performing the activity in existing conditions and by use of newly developed fodder collector

<i>Physiological parameters</i>	<i>Existing (Average of 3 replications) Collection & Bundling</i>	<i>Improved Treatment (average of 3 replications) Collection & Bundling</i>	<i>Significant reduction in improved over existing Collection & Bundling</i>
Average working heart rate (Beats/min.)	110	101	-3.29**
Average peak heart rate (Beats/min.)	114	107	-2.42**
Average energy expenditure (Kj. /min.)	8.77	7.39	-3.29**
Average Peak energy expenditure (Kj. /min.)	9.41	8.19	-2.42**
Average TCCW (Beats/min.)	188	64.9	5.30**
Average PCW (Beats/min.)	32	18.6	5.30**
Average RPE	3.0	2.98	-
Output Parameters			
Total time taken for the activity (min.)	6.4	3.9	-5.11**
Coverage of land under operation (sq.mt.)	24.80	36.83	7.169**
Production per unit	12.8	16.8	4.08**
Environmental Parameters			
Mean temp. (°C)	34.48	30.56	
Mean Relative Humidity (%)	35.95	82.33	
Test applied	Paired t-test	*- Significant at one tail **- Significant at two tail	

Table 2: Postural stresses (average) while performing the activity in existing conditions and by use of fodder collector

<i>Parameters Frequency of postural change</i>	<i>Existing condition Collection and bundling</i>	<i>Improved treatment Collection and bundling</i>	<i>Significant reduction in improved over existing Collection and bundling</i>
Standing	15	37	-2.29*
Sitting	2	-	-
Bending	15	42 (stoop)	2.72*
Squatting	30	14	1.91*
Postural Analysis (Angle of Bend)			
Angle of normal curve	196.3	198.2	-0.29
Angle of bending	200.12	194.4	5.85*
Angle of deviation	3.82	2.71	0.21

pain was noted after the adoption of newly developed fodder collector. Significant increase in per capita output and production area under operation was observed with the use of improved technologies. Hence, it may be concluded that developed fodder collector used in fodder collection have significant contribution in reducing drudgery and improving the output and satisfaction of mountain women.

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