Technology to reduce farmwomen's drudgery while milking: a revolving stool

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ABSTRACT: In Uttaranchal, majority of the rural women are involved in dairy activities. Out of all dairy activities, milking of animal is the most commonly performed activity. Milking of animals is found much drudgery prone activity for the rural women. To reduce the drudgery of the squatting posture, which is adopted by women while milking, a stress reducing devise i.e. revolving stool was developed and tested to reduce physiological stress and strain. The result indicated that physiological strain was significantly reduced and revolving stool was readily accepted by all farmwomen engaged in milking activity as it reduced intensity of body pain.

Key words: Drudgery prone activity, revolving stool, milking activity

Management of livestock is one of the important allied agricultural activity in which rural women contribute a lot. In animal husbandry, there is an estimated 20 million women involved as compared to 1.5 million men folk and in the dairy sector there is an estimated 75 million women indulged as compared to 1.5 million men. Per cent involvement of women in dairy activities ranged from 70-75 in different states of India (Sharma, 2002).

Though modernization of agriculture is taking place at a rapid pace, the jobs attended by women remain more or less the same. They perform all the activities selected to dairy in unnatural postures like stooping and squatting due to the faulty designs of the tools they are using. Frequent stooping and lifting heavy load in bending postures wear out the spinal column and induce hazards from the supporting system of the spine (Bridger, 1995; Grandjean, 1983). The women also have to adopt long static postures for some of the dairy activities like milking animal, collecting dung, and cleaning animal shed. This increases the static muscular efforts resulting in high physiological cost and low productivity. While performing milking activity, women adopt squatting posture and experience severe pain in lower back, legs, knees, and feet. Lower legs become heavy and stiff due to the pooling of blood in the lower extremities. In order to reduce the drudgery of farmwomen while performing the milking activity, it is desirable that some appliances/ equipment or tool should be developed which can ease the activity. Keeping the requirement of the farmwomen in mind a revolving stool was designed. The length and width of revolving stool is designed as per the dimensions of rural women for giving maximum comfort. The stool height was 12 – 13 cm. whereas the diameter of the stool was 34 cm. Ball bearing is provided to make it possible to move. Steel plate is used in the revolving stool as a seat. Therefore, the present study was designed to test the acceptability of the revolving stool to farmwomen while performing milking activity with the following objectives :

1. To measure the physical fitness of women involved in selected activity.
2. To measure the circulatory stress, total cardiac cost of work, physiological cost of work and rate of perceived exertion while performing the activity
3. To analyze the muscular stress on women while performing the activity.
4. To introduce measures/suitable technologies to minimize the drudgery of the women while performing the activity.
5. To study the acceptability of the revolving stool.

MATERIALS AND METHODS

The study was conducted in Tarai region of Uttaranchal. Thirty respondents belonging to 20-45 years of age were selected to study the physical fitness.

body composition, postural analysis and determination of perceived exertion. Ergonomic cost of selected parameters was recorded with the help of instruments indicated in Table 1.

by good PFI. On the whole health status of farmwomen were found to be good.

The milking activity was performed in squatting posture, which was most strenuous because back muscles have to support a comparatively heavy weight.

Table 1: Variables and their measurements

Parameters		Name of the instruments
Physical parameters	Body weight	Bathroom weighing scale
	Anthropometric measurements	Anthropometer
	Blood pressure	Sphygnomanometer, stethoscope
	Physical Fitness Index	Step-test Ergo meter, Metronome
	Body composition	Skin fold calipers
Environmental parameters	Temperature	Multi-stem thermometer
	Humidity	Hygrometer
Activity parameters	Distance traveled	Pedometer
	Time	Stop watch
Physiological parameters	Heart rate	Polar vantage Nv-Heart Rate monitor
	Grip strength	Grip dynamometer
	Posture	Flexi curve
	Musculo skeletal problems	Body map (Corlette & Bishop, 1978)
	Perceived exertion	RPE- scale (Varghese *et al.*, 1994)

RESULTS AND DISCUSSION

Health status of selected women was assessed and it was found that mean gross weight was 54.0 and mean LBM was found to be 46.21 ± 4.25. Fig. 1 shows that 40.0 per cent respondent fell in ectomorph and mesomorph body type indicating that they have good body built. On the basis of PFI scores maximum number of respondents (30.0%) scored high average followed

Ergonomic cost of milking activity was assessed in terms of heart rate, energy expenditure and total cardiac cost of work. Since while using revolving stool the posture stress reduces therefore there was reduction in total physiological cost of work. It was also found that there was a reduction in heart rate (2.39%), energy expenditure (6.19 %), total cardiac cost of work (13.59%) along with physiological cost of work (8.79%) when the activity was performed while using improved revolving stool.

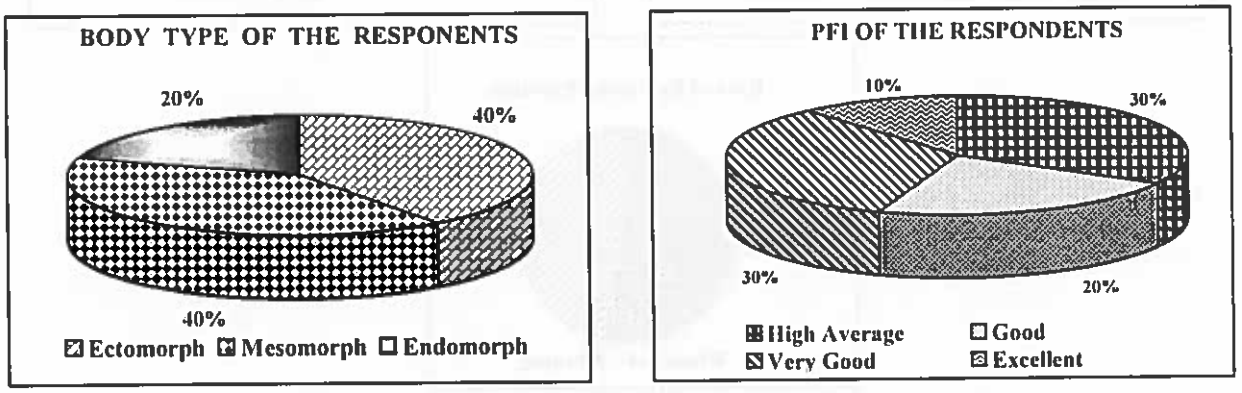

Fig. 1. Distribution of the respondents according to Body type & PFI

Table 2: Reduction in Ergonomic Cost

Ergonomic Parameters	% Reduction while using revolving stool
Heart Rate	2.39
Energy Expenditure	6.19
TCCW	13.59
PCW	8.79

Muscular stress of the women while milking

Muscular stress for the selected activity was measured in terms of four parameters, viz frequency of postural change, decrease in grip strength, angle of deviation of backbone from normal and the incidences of musculoskeletal problems.

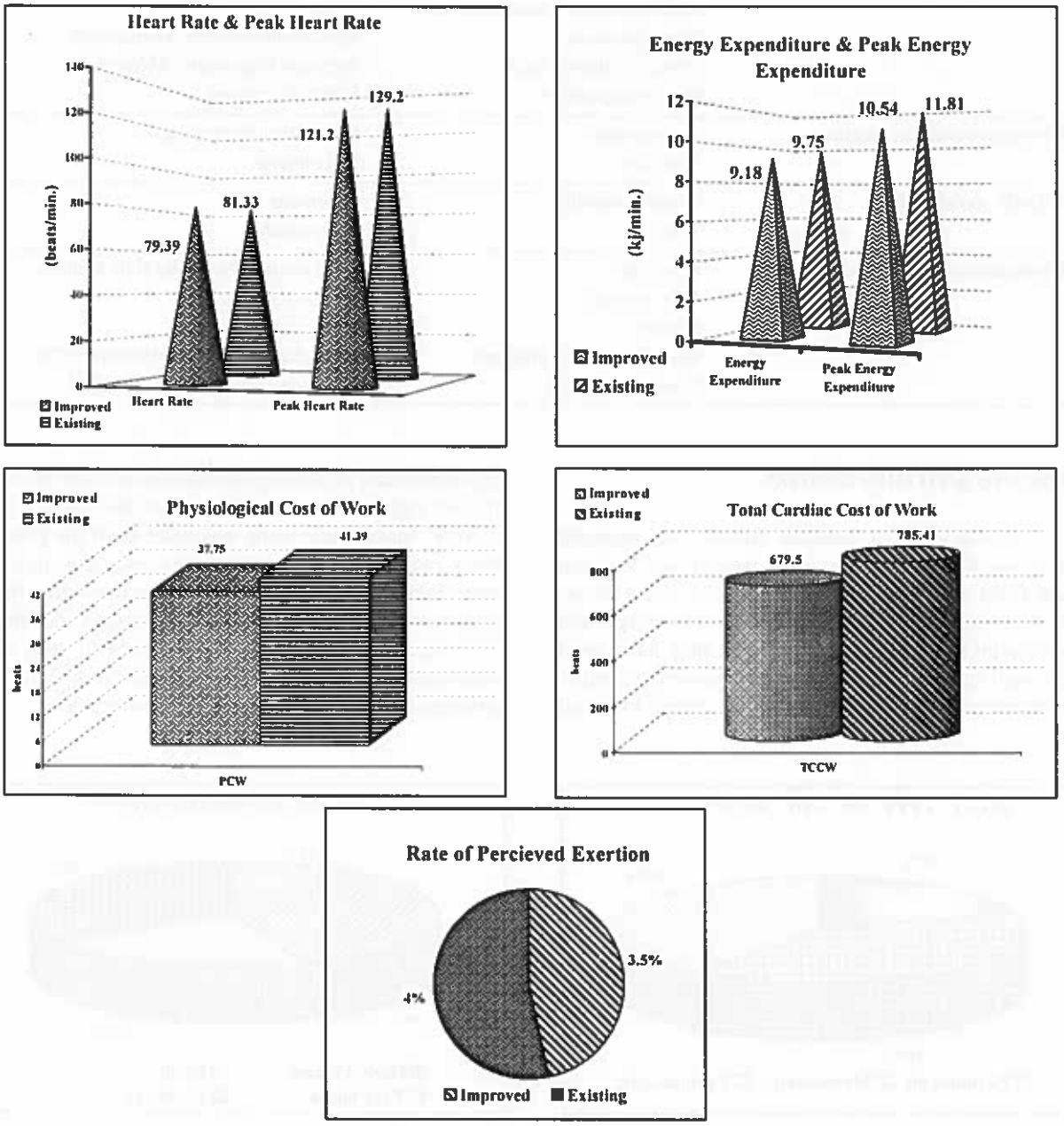

Fig. 2. Physiological workload while performing the activity using existing and improved tool

Frequency of postural change

Data in Table 3 envisage that while using improved stool there was not much change in frequency of change in posture. The activity was performed in sitting posture without making any adjustment. The revolving stool, as per the need, made most of the adjustments. With the use of improved stool respondents felt comfortable while performing the milking activity.

Angle of deviation

Higher the bend from the normal, higher will be the incidences of pain, which could be reduced by introducing improved tool. Thus making the task more comfortable and increases the efficiency of the work. The reduction in angle of deviation was 7° (degree). On the whole reduction in angle of backbone from the normal was 4.14 per cent by using revolving stool in improved condition as compared to existing conditions.

Incidence of Musculoskeletal problems while performing milking

Incidence of Musculoskeletal problems while performing milking was calculated on 5-point scale as very severe, severe, moderate, mild and very mild through body map suggested by Corlette and Bishop, 1978. All the respondents reported hundred per cent reduction of pain in low back and ankle/feet in improved condition. All the respondents felt comfortable while working with improved stool, as there was reduction in severity/ intensity of pain, which made the working comfortable (Table 4).

Table 3: Muscular stresses (average) when milking in existing and improved conditions

Parameters	Existing Condition		Improved (Treatment)		Significant reduction in improved over existing	
Frequency of postural change						
Standing	4		4			
Sitting	0		1			
Bending	4		4			
Squatting	1		0			
Postural analysis (Angle of Bend)						
Angle of normal curve	156°		156°			
Angle of bending	179°		162°		4.14	
Angle of deviation	13°		6°			
Per cent change in Grip strength						
	Right	Left	Right	Left	Right	Left
After work	17.0	22.7	16.5	20.5	5.71	9.69

Table 4: Average incidence of musculoskeletal problems during existing and improved conditions

Body parts	Incidence of pain %										
	Existing					Improved					Per cent Reduction in pain
	5	4	3	2	1	5	4	3	2	1	
Neck		9							9		
Shoulder joint		9						9			
Low back	3	8	6						17		100
Upper leg / thigh		10	5					5	10		50
Ankles/feet		15	10							25	100

5= very severe; 4= severe; 3= moderate; 2= mild; 1= very mild.

Characteristics of revolving stool

- The length and width of the stool is designed as per the squatting anthropometric measurements of rural women therefore, gives maximum comfort to the respondents.
- The seat of stool is made by steel plate to make it comfortable.
- Ball bearing is provided with the stool to make it possible to move with the animal's movement while milking.

CONCLUSION

- The use of revolving stool reduces the heart rate and energy expenditure to 3-6 per cent.
- It also reduces the angle of deviation of backbone therefore, reduces the back pain significantly.
- Reduces the pain in legs, knee and feet significantly due to the comfortable posture, therefore, efficiency of work also enhanced.
- Due to the reduced physiological and muscular stress, the drudgery of women was reduced to a great extent.

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