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Assessment of Muscular Stress of Rural Women While Performing Different Activities wth Traditional and Improved Tools

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ABSTRACT The present study was undertaken to assess the muscular stress of rural women while performing different household, allied and farm activities with the use of traditional as well as improved tools. Thirty rural women who were in average state of health were involved in the experiment. Muscular stress of selected drudgery prone activities viz. Cleaning of animal shed, Mud plastering of house, milking of animals and weeding was measured in terms of four parameters i.e. frequency of postural change, change in grip strength, angle of deviation of backbone and the incidence of musculo skeletal problems while performing the selected activities. Grip strength was measured by using the Grip Dynamometer, angle of deviation by Flexicurve and Body map was used for measuring musculo skeletal problems. Results of the study showed that all improved tools improved the work posture, therefore reduced muscular stress of women for performing the selected activities and enhanced the work efficiency and health of farm women.

INTRODUCTION

Women form 50% of population and constitute 60 % of work force but earn only 10% of income. They perform multifarious activities in the home, farm and allied activities, which include weeding, harvesting, milking of animal, cleaning animal sheds, mud plastering of house etc. This make their life miserable as the activities are not only fatiguing but also time consuming (Jamal, 1994). The use of traditional tool and equipment for the work add further to their drudgeries. The women adopt long static postures for some of the activities, which increase the static muscular effort resulting in high physiological cost and low productivity. They perform these activities in their own convenient posture like sitting, standing, squatting or bending without realizing the harmful affect on the body. The fact that by keeping the body of the worker in natural alignment, the stress and strain of the women can be minimized without any excessive human input is often ignored. Due to this ignorance women suffer from various musculo skeletal disorders and unnatural posture when adopted for any work induces hazards on the spine (Elisjstom and Nachemson,1970).

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Researches have proved that any work design or work environment that helps to perform the work with minimum energy and put minimum stress on cardio vascular system and muscular system is the best design of work. (Varghese et al., 1995). So working posture becomes an important factor while designing ergonomically sound tools and equipment .The need for assessing reduction of muscular stress on the women worker with the use of improved tools and implements was felt so that the women can be persuaded to use the effective improved equipment to ensure right workposture for the selected activities and can have least fatigue and discomfort to the body. The study was undertaken with the following objectives:

1. To assess the frequency of postural changes while performing different activities with traditional and improved tools.
2. To compare the angle of deviation while performing different activities with traditional and improved tools.
3. To assess the change in grip strength with a use of improved tool over traditional tool.
4. To compare the musculo skeletal problems with the use of traditional as well as improved tools.

METHODOLOGY

Selection of Experimental sample (Rural Women): For each activity 30 rural women who

were in good state of health were selected. Suitability of the experimental women were ascertained by measuring the following physiological parameters before the start of the activity.

Body temperature recorded for 3 minutes: Not above 99°F

Blood Pressure : 120/80 ± 10

Heart Rate : 70-90 bpm

Assessment of Muscular Stress: Muscular stress of selected drudgery prone activities viz. Cleaning of animal shed, mud plastering of house, milking of animals and weeding was measured in terms of four parameters i.e. frequency of postural change, decrease in grip strength, angle of deviation of backbone and the incidence of musculo skeletal problems of farm women while performing the selected activities.

Grip strength was measured by using the Grip Dynamometer, angle of deviation by Flexicurve and Body map (Corlette and Bishop, 1976) was used for musculo skeletal problems.

Procedure for Performance of the Activity: Each selected women was given rest and her grip strength as well as angle of the standing posture was recorded. She was then told to perform the activity. During the performance of the activity, postural changes as well as the angle of different postures were recorded. After the completion of the activity, grip strength and musculo skeletal problems were recorded.

Recording of Muscular Stress

Grip Strength: Grip strength was measured before and after the completion of activities. It was measured separately both for the right and left hand and the Grip strength was determined with the use of following formula :

$$\text{Grip strength in \%} = \frac{Sr - Sw}{Sr} \times 100$$

Decreased grip strength with the performance of the activity was interpreted as grip fatigue of the muscles.

Postural Analysis: Postural analysis of the lumbo-sacral region during the performance of the activity was done with the help of flexicurve. The angle of bend of the back during the performance of the activity was measured and compared with the normal bend of the back and the angle of deviation was determined by subtracting the normal angle of bend from the angle of bend during the bending posture as shown in the figure.

Fig. 1. Body curve

Musculo-Skeletal Problems: Incidence of musculo-skeletal problems were identified using the Body Map (Fig. 2)) indicating pain in different parts of the body after the completion of the activity on five-point scale viz., 5, 4, 3, 2 and 1 as very severe, severe, moderate, mild and very mild respectively.

Statistical Analysis: After collecting data on above parameters, statistical analysis was done suitable to each parameter and the inferences were drawn. Averages, percentages and paired t-test were applied to test the significance of results.

RESULTS AND DISCUSSION

Table 1 shows the data on frequency of postural change while performing the selected activities and it is observed that combination of the different postures like standing, bending, squatting were used during the performance of the selected activities. But with the use of the improved tools, squatting, bending and standing postures were reduced to a significant level that helped the women to perform the work comfortably without any undue fatigue and frustraton (Steidl and Bratton, 1968).

Table 2 shows the data regarding the change in the angle of deviation of the body while performing the selected activities and it is observed that with the use of improved tools for performing the selected activities there was a significant reduction in the angle of deviation for milking of animals (46.15**) as well as for mud plastering of house (28.91**). Angle of deviation was also reduced for cleaning animal shed (86.44) while using selected improved tools as well as weeding with the use of weeder. Thus data given in the table clearly indicate that the

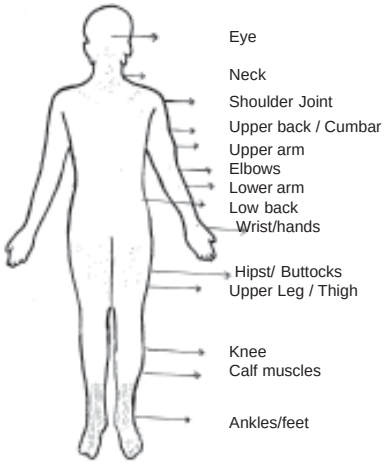

Fig. 2. Body map

use of improved tools for performing the selected activities reduce the angle of deviation of the back and minimize the muscular efforts to perform the task. Lower muscular efforts lead to lower muscular fatigue as shown in many research studies.

Grip fatigue for the selected activities was measured in terms of percentage reduction in grip strength. More the reduction in the grip strength, more was taken as the grip fatigue for the selected activities. The value obtained for the grip fatigue in the selected tasks are given in the table 3.The decrease in grip strength was less with the use of improved tools as compared to traditional tools in all the activities except weeding with the use of weeder The grip fatigue with the use of weeder was found more because of its uncomfortable handles and inappropriate handle dimensions.

Table 1. Frequency of postural change while performing the selected activities with traditional and improved tools.

Activity	*Standing*	*Bending*	*Squatting*	*Significant reduction while using improved tool (%)*		
	1	*2*	*3*	*1*	*2*	*3*
Cleaning of Animal Shed						
Traditional tools Broom, Karahia	7	5	2			
Improved tools Long handle broom, dung collector, garbage trolley	2	2	0	71.43	60	100
Milking of Animals						
Traditional method	7	5	3			
Improved tool using Revolving Pihri	-	-	1	100	100	66.6
Mud Plastering of House						
Traditional	9	6	10			
Improved tool (Wiper)	2	1	-	77.7	83.3	100
Weeding						
Traditional tool Khurpi	9	5	3.5			
Improved tool Weeder	1	0	0	88.89	100	100

Table 2: Change in the angle of deviation of the body while performing the activities with the improved tools.

Activity	*Angle of deviation (degrees)*
Cleaning of Animal Shed	
Traditional tools	10.25
Improved tools	1.39
Significant reduction	*86.44*
Milking of animals	
Traditional tools	13
Improved tools	7
Significant reduction	*46.15**
Mud Plastering of House	
Traditional tools	5.95
Improved tools	7.67
Significant reduction	*28.91***
Weeding	
Traditional tools	10.69
Improved tools	9.99
Significant reduction	*6.55*

It is therefore concluded that use of improved tools for performing the said activities are beneficial because they reduce the grip fatigue of the worker for majority of activities and therefore lead to reduction in drudgery.

Table 4 shows the reduction of pain in different parts of the body at which women experience pain while performing the selected activities with the improved tools. It shows that with the use of improved tools pain was reduced in neck, shoulder, upper back, elbow, upper arm, knees, wrist / hands, calf muscles etc except with the use of weeder and improved tools for cleaning animal sheds which increased the pain in shoulder, upper back, elbow, wrist, hands and lower arms.

Table 3: Percentage change in grip strength while performing the activities with the improved tools

Activity	*Percent change in grip strength*
Cleaning of Animal Shed	
Traditional tools	‘↑ 15.3
Improved tools	‘↑ 12.6
Significant reduction	‘↑ *17.64*
Milking of Animals	
Traditional tools	‘↑ 20.1
Improved tools	‘↑ 18.5
Significant reduction	‘↑ *7.7**
Mud Plastering of House	
Traditional tools	‘↑ 10.65
Improved tools	‘↑ 8.79
Significant reduction	‘↑ *17.46***
Weeding	
Traditional tools	“‡-9.42
Improved tools	“‡-9.58
Significant reduction	“‡-*1.69*

Table 4: Reduction in pain experienced by the women while performing selected activities with improved tools

Parts of the body	*Cleaning shed*	*Milking animals*	*Mud plas-tering*	*Weeding*
Neck	100	-	100	100
Shoulder	66.7	63.7	68.8	100
Upper back	22.2	75	62	-
Upper arm	5.00	-	80	17.8
Elbow	66.7	-	75.5	80
Lower arm	33.4	7.69	64.66	86.6
Low back	20	74.30	95.7	81.69
Wrist/Hand	6.67	-	92.6	40
Upper thigh	-	100	100	78.26
Knees	100	52.04	100	96.55
Calf muscles	33.3	53.18	42.8	38.46
Ankle/feet	-	83.29	94.6	71.15

CONCLUSION

The use of the improved tools reduced the muscular stress for majority of the activities by making the women to adopt correct postures during work. The angle of deviation of the body was reduced with the use of improved tools for all the selected activities giving significant relief from the muscular pain to the women. The grip fatigue was also reduced by the use of improved tools and the incidences of pain in different parts of the body were decreased. Thus we can conclude that use of the improved tools is beneficial and we should motivate more and more women to use these improved tools for reducing their drudgeries in work.

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