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Musculo-Skeletal Disorders of the Farm Women While Performing the Top Dressing of Fertilizer Activity*

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ABSTRACT Musculo-skeletal disorder is the leading cause of the occupational ill health. This risk of musculo-skeletal disorders may be higher in agricultural workers because of the longer working hours (O'Neill, 2004). Hence the research is aimed to study the postural stress and musculo-skeletal problems of the farm women while performing top dressing of fertilizer activity and to reduce their musculo-skeletal disorders by introducing an improved technology and ergonomically evaluate both the methods. Thirty subjects with normal health, without any major illness or cardio-vascular problems were selected for the study. The age range of the subjects was between the active working period i.e. 20-45 years. Care was taken to select the farm women who are non pregnant and perform the agricultural activities regularly. While performing the top dressing of fertilizer activity in traditional method majority of the women complained 'Very Severe' and 'Severe' pain in shoulder joint, upper arm, low back, wrist/hands and knees as they had to carry the basket filled with 4-5 kg of fertilizer either in hands or tie the fertilizer cloth bag around their waist. But reduction in the percentage of women complaining about the musculo-skeletal problems was observed with the use of improved fertilizer trolley. The percentage reduction in grip strength was also observed to be lower in improved method compared to traditional method. Development of such small improved agricultural tools can reduce the physiological workload and drudgery of farm women and increase the efficiency.

INTRODUCTION

The occupational health problems may be due to mainly two reasons, i.e., the use of harmful chemicals in the occupation and the biomechanical and postural demand of the workplace leading to musculo-skeletal disorders. The musculo-skeletal disorder is of very high concern of the Ergonomists. The risk of developing musculo-skeletal problems is mainly due to the inconvenient work postures. This risk of musculo-skeletal disorders may be higher in agricultural workers than in most other industries because of the longer working hours. Uncertainities of agricultural production make farming a relatively stressful job anyway, then people employed in agriculture may be even more vulnerable to musculo-skeletal disorders (O'Neill, 2004).

Musculo-skeletal disorder is the leading cause of the occupational ill health. An awkward and static posture has been recognized as a risk factor for work related muskulo-skeletal problems. From an occupational point of view, the cervical spine, head and shoulders, elbow and wrist joint can be considered to be interrelated as far as the problems of efficiency, design and comfort are considered. It is well known that certain jobs causes pain at the work to the people with disorder and the symptoms are amplified or exposed by the demands of the job. Musculo-skeletal pains of these types are said to be work related because it is partially caused by the work conditions. It is clear that poor work place and tool design can increase the discomfort of both the healthy and less fit individuals. The design of tools and workspaces can have a profound effect on the posture of the body and long term exposure to hazardous working conditions which alters the physiological and psychological functions of an individual and produces many types of musculo-skeletal problems.

In developing countries agricultural activities are expected to cause musculo-skeletal disorders (Nwuba and Kaul, 1986; Nag et al., 1988).But an extensive survey is required to confirm that this is the case and to identify the specific problems and the tasks that are associated with it. The application of ergonomics and improved tools or task design based on the both researchers and subject's perception of a need to improvement has the potential to reduce bio-mechanical

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disorders associated with agricultural tasks or tools.

Women in India are the major work force in agriculture and perform almost all the agricultural activities. Research conducted on the identification of drudgery prone activities performed by rural women has shown that top dressing of fertilizer is one of the maximum drudgery involved agricultural activity with a Drudgery Index of 45.57 per cent (Annual Report, 1997-1998). This activity is performed in standing posture for the field crops like wheat, paddy etc. where the fertilizer is broadcasting by hand. Women carry the fertilizer either in iron/plastic baskets or tie the fertilizer filled cloth bag to waist and apply the fertilizer near the root of the each plant in bending posture in commercial crops like chilli, tomato, cotton etc. (Annual Report, 2001-2003). The bending posture with a load of fertilizer increases the fatigue and drudgery of farm women while top dressing of fertilizer which leads to aches and pains in the lower back and cervical region.

This research is aimed to know the postural stress and musculo-skeletal problems of the farm women while performing top dressing of fertilizer activity and reduce their musculo-skeletal disorders by introducing an improved technology and ergonomically evaluate both the methods.

METHODOLOGY

Thirty subjects with normal health, without any major illness or cardio-vascular problems were selected for the study. The age range of the subjects was between the active working period i.e. 20-45 years. Care was taken to select the farm women who are non pregnant and perform the agricultural activities regularly. Top dressing of fertilizer to individual plant i.e. to crops like tomato, chilli, and cotton is selected to analyse the musculo-skeletal problems of women while performing top dressing of fertilizer activity with traditional method and use of the improved tool-fertilizer trolley.

To reduce the drudgery of farm women carrying the fertilizer load, musculo-skeletal problems and to increase the work efficiency of the farm women the scientists of AICRP-FRM of UAS, Dharwad have developed a handy trolley to carry the fertilizer for top dressing of fertilizer to the root of the crop in the field. The trolley has three wheels and weighs 5.00 kg. It has a circular stand at the top to hold the fertilizer basket. It can be easily pulled with the chain in the field while performing the activity. The trolley can carry about 10kgs of fertilizer at a time.

Pain in musculo-skeletal system is recorded by showing the Corlett and Bishop (1976) body map to the subjects and asking them to identify the region of any pains/aches in the body parts after the performance of the activity by traditional and improved methods. Five point scale ranging from very mild pain (1) and very severe pain (5) is to used to quantify the stress on muscles used in work.

Grip dynamometer was used to measure the strength of grip muscles before and after performance of the activity. It was measured separately both for the right and left hand and the percentage change in grip strength was calculated using the following formula,

Change in grip strength

$$(\%) = \frac{Sr - Sw \times 100}{Sr}$$

Where, Sr= Strength of muscles at rest

Sw= Strength of muscles after work

Decreased grip strength was interpreted as grip fatigue of the muscles.

RESULTS

Physical characteristics of the subjects selected for the study are depicted in table 1. The mean age of the women was 33.60 years with the height of 149.77cms and weight of 42.10kgs. The mean blood pressure was observed to be 110.27/66.53. Based on height and weight of the sample the mean Body Mass Index was calculated and found to be 18.80 percent, which means that the sample belonged to the Low Weight Normal range as per Garrow (1987) classification table. Majority of the of the sample

Table 1: Physical characteristics of the subjects selected for top dressing of fertilizer activity.

Physical characteristics	*Mean*	*Standard Deviation*
Age (years)	33.60	7.52
Height (cms)	149.77	5.14
Weight (kgs)	42.10	7.27
Body Mass Index (%)	18.80	3.27
VO_2 Max. (ml/kg x min.)	35.22	6.40
Blood Pressure	110.27/66.53	13.58/10.48

belonged to the good category of physical fitness with 35.22 ml/kg. min. VO_2 Max.

Table 2 presents the percentage of women experiencing musculo-skeletal problems after performing the top dressing of fertilizer activity with existing and improved methods. While performing the top dressing of fertilizer activity in traditional method majority of the women complained 'Very Severe' and 'Severe' pain in shoulder joint, upper arm, low back, wrist/hands and knees as they had to carry the basket filled with 4-5 kg of fertilizer either in hands or tie the fertilizer cloth bag around their waist. The fertilizer load in this method of application was directly transferred to the backbone. Reduction in the percentage of women complaining about the musculo-skeletal problems was observed with the use of improved fertilizer trolley. Negligible percentage of women experienced moderate pain in shoulder joint, upper arm and low back. The percentage of women experiencing pain in knees also has reduced considerably with the use of fertilizer trolley.

Percentage reduction in incidence of musculo-skeletal problems by improved technique over the traditional method is depicted in table 3. The decrease in percentage of women (91.42 %) complaining the shoulder joint was observed when top dressing of fertilizer activity was performed with the improved technique as the fertilizer load was shifted from shoulders to the trolley. Similarly 75 per cent, 47.83 per cent, 72.72 per cent and 68.85 per cent decrease in percentage of farm women experiencing pain in upper arm, low back, wrist/hands and knees respectively was found when they performed the top dressing of fertilizer activity in improved method compared to traditional method.

Change in grip strength while performing the top dressing of fertilizer activity both with traditional and improved method is shown in table 4. The grip strength of both hands has reduced after performing the top dressing of fertilizer activity with both traditional and improved methods. But the percentage reduction in grip strength was observed to be lower in improved method compared to traditional method.

Table 3: Reduction in incidence of musculo-skeletal by improved technique over the traditional method

Body parts	*Percentage reduction in improved over traditional method*
Shoulder joint	91.42
Upper arm	75.00
Low back	47.83
Wrist/ hands	72.72
Knees	68.85

Table 2: Average incidence of musculo-skeletal problems after performing top dressing of fertilizer activity in existing and improved conditions (N=30)

Body parts	*Incidence of pain*									
	Traditional method					*Improved method*				
	5	*4*	*3*	*2*	*1*	*5*	*4*	*3*	*2*	*1*
Shoulder joint	-	2 (6.67)	9 (30.00)	-	-	-	-	1 (3.34)	-	-
Upper ram	-	2 (6.67)	4 (13.34)	2 (6.67)	-	-	-	2 (6.67)	-	-
Low back	1 (3.34)	3 (10.00)	2 (6.67)	-	-	-	1 (3.34)	1 (3.34)	-	-
Wrist/ hands	-	4 (13.34)	2 (6.67)	-	-	-		2 (6.67)	-	-
Knees	-	4 (13.34)	13 (43.33)	3 (10.00)	-	-	2 (6.67)	3 (10.00)	1 (3.34)	-

(Figures in parenthesis indicate percentages)

Table 4: Change in grip strength while performing top dressing of fertilizer activity with both traditional and improved methods.

Parameters	*Traditional method*		*Improved method*		*Percentage change in improved over existing*	
	Right	*Left*	*Right*	*Left*	*Right*	*Left*
After work	17.38	16.25	17.54	16.73		
Before work	18.33	16.33	18.17	16.76	1.72	0.31
Percentage change in grip strength	5.18	0.48	3.46	0.17		

(-) denotes increase in grip strength (+) denotes decrease in grip strength

CONCLUSION

In order to ensure health, safety and well being and there by improving the quality of work life and achieving higher productivity, it is essential that workstation must be designed ergonomically and should be user friendly. Agriculture is one of the important labour intensive activity, where maximum percentage of women work force in rural areas is dependent for their livelihood. Very few studies are done in India to improve the work situation of women in agriculture. By developing such small tools, the work and work environment can be improved, physiological workload can be reduced in the agriculture and the efficiency and work out put can be improved significantly.

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