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Prevalence of Musculo - Skeletal Disorders among Hill Farm Women involved in Transplanting of Vegetable Saplings

Neena Vyas, Aruna Rana
Prof. and Head, Department of Family Resource Management, College of Home Science, CSKHPKV Palampur

Madhu Dadwal
Department of Family Resource Management, College of Home Science, CSKHPKV Palampur

Abstract: *The impact of Musculoskeletal Disorders (MSDs) is pervasive and prevalent across a wide spectrum of occupations, as is evident across the globe through the numerous studies conducted. However, there are few studies that document the prevalence of MSDs of women in India as the country's farming community constitutes more than 58 percent of the Indian work force. Thus in the present study an attempt has been made to analyze the prevalence of MSDs in women farmers involved in Transplanting of Vegetable Saplings. The study was carried out on thirty women of Simbalkhola village where women were mainly involved in vegetable growing. Green chilies, brinjal were transplanted by both traditional and improved sapling transplanter. The results revealed that the working heart rate of the woman was 122 bpm^{-1} while working with the traditional method as compared to 116 bpm^{-1} while working with new sapling transplanter. The postural analysis showed much of bent in the trunk and neck area while working in the traditional method as compared to the slight bent while working with the sapling transplanter. Further, the technology usage satisfaction was seen among the women users with slight some alterations and additional feature like handles on both the sides along with a sapling carrier bag.*

Keywords: - *Ergonomic, Technology, Sapling transplanter, Hill farmer.*

Introduction

Agriculture ranks among the most hazardous industries. Farming is one of the few industries in which farmers are at risk for fatal and non-fatal injuries India is the largest producer of Ginger and Okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, Cabbages, etc. India is an agricultural country. Most of the population is engaged in farming activities which is unique but not an organized sector. As a result, the farmers have to adapt to the various uncertainties like environmental changes like extreme temperatures, dust, psychosocial problems, type of work with respect to the crop, viruses associated with the changing weather and new forms of chemical fertilizers and insecticides, etc. These farmers are exposed to a variety of physical stress in terms of physical movements: lifting and carrying heavy loads, kneeling, repetitive movements of the hand, twisting the trunk in prolonged flexion during picking, risk of trips and falls on slippery and uneven farm ground, unexpected actions of livestock, and exposure to vibration from farm vehicles, which makes them prone towards musculoskeletal disorders. Musculoskeletal disorders (MSDs) are defined as a group of injuries that affect

the musculoskeletal system including the nerves, tendons, muscles, and supporting structures such as intervertebral discs (NIOSH, 1997). The physical demand of the farm work which range from moderate to heavy, often include standing, squatting, bending and reaching, carrying heavy loads and working for long hours, may cause certain hazards to the person. (NIOSH 2013) The women who are the major work force in agricultural and allied sectors work in awkward and uncomfortable posture that leads to many health hazards mainly musculoskeletal disorders like strain/sprain, neck pain, shoulder pain, back pain, accidents like cut/wounds, lacerations/scratches, injury leading to surgical treatment, fatal injuries, knee injuries and tendon disorders. In addition to causing pain, suffering, illness and injury, they can also result in reduced work ability and, consequently, reduced farm income (Whelan et al., 2009). Tripathy and Kwatra (2016) stated that vegetable production places farm workers at a risk of postural discomfort and musculoskeletal disorders. Keeping the working pattern of the hill farm women in mind the study was based on the objective of identifying the musculo skeletal disorders that developed during the transplanting of the vegetable saplings.

Review of Literature

Singh Surabhi et.al. in her research on MSDs and discomforts found that none of the farm women were working in an acceptable posture and it required changes and their discomfort level was found around the lumber and lower limbs which were found to be the most affected body parts due to poor posture and poor job design.

According to the observations of Shruti R Murthy and Dr. Nitin Nikhade. (2017) the persistence of pain developed in a particular part of body is bound to remain over a long time and become chronic. This basically might happen due to negligence and unavailability of proper health care facilities and lack of proper ergonomics. In our study, we found that males had a higher risk of developing musculoskeletal disorders than females. Although females reported to have a higher incidence of wrist pain than males. This can be due high repetitive motion, abnormal postures and technique, use of heavy tools, etc as quoted by Banibrata Das, Somnath Gangopadhyay (2015). There is a high risk of developing musculoskeletal disorders in farmers especially in the knees and low back region.

Methodology

Locale – The data were collected from five villages of Kangra district of Himachal Pradesh.

Tool used: A pre-structured interview schedule was used to collect the data personally by interview method. The ergonomic assessment was done on a total sample of 30 farm women performing the activity of vegetable sapling transplanting.

Assessment of ergonomic cost of work - An experimental analysis of clod breaking was done in terms of assessment of physiological and cardio-vascular (*heart rate, energy expenditure)* parameters while using the traditional and improved tool.

Parameters	Formula/ Equipment
Physical parameters	
Body Weight	Weighing scale
Body Height	Anthropometer
Variables of ergonomic cost	
Heart Rate	Polar heart rate monitor (beats per minute)
Energy Expenditure	0.159* heat rate (bpm)-8.72
Total cardiac cost of work (TCCW)	CCW + CCR (Cardiac cost of work + Cardiac cost of recovery) **Cardiac cost of work (CCW)** = (Average working heart rate-Average resting heart rate)* Duration of activity **Cardiac cost of recovery (CCR)** = (Average recovery heart rate-Average resting heart rate)* Duration of activity
Physiological cost of cost	• TCCW / Total time of work

Results and Discussion

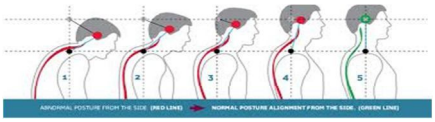
Table 1: Physical characteristics of selected farm workers

Physical characteristics	Mean ± SD
Age (yrs)	39.83 ± 9.75
Height (cm)	155 ± 7071
Weight (kg)	45 ± 1.92

The average height of the women respondents involved in the sapling transplanting activity was 39.83 years followed by 155 cm height and 45kg of body weight.

Table 2: Other factors related to the activity

Other Factors	Conventional method	Transplanter
Location of the study	Simbalkhola	Simbalkhola
Production system	Vegetable Production system	Vegetable Production system
Name of the crop	Green Chilly	Green Chilly
Time and Work *(Productivity output factors)*		
No. of Saplings transplanted/ h/worker (pace of work)	166.5	119.88
Time for transplanting /worker/h	1506	1513

Man days needed for transplanting/h	5	8
Perceived rating on time load by worker	2 (fast)	4 (slow)
Physiological load		
Working heart rate (bm^{-1})	122	116
Peak heart rate (bm^{-1})	140	132
Energy expenditure (kjm^{-1})	10.73	9.714
Peak Energy expenditure(kjm^{-1})	13.53	12.25
CCW (Beats)	576	430
CCR (Beats)	18.06	12.31
TCCW (Beats)	594.06	442.31
PCW (bm^{-1})	19.80	14.33
Average RPE	4	4
Postural analysis of trunk and neck		
Degree of Trunk deviation 	1	4
Degree of neck deviation 	D	B
Postural load rating (5-Very comfortable, 4-comfortable, 3-moderate, 2-discomfort, 1-very uncomfortable)	3	2
Physical load while carrying the trans-planter while working		
Weight of trans- planter	-	30

The research was carried out at Simbalkhola village of Panchrukhi block. Green chilli plants were transplanted. It was tested on green chilli. The working heart rate of the women was 122 bpm while working with the traditional method as compared to the 116 bpm while working with the sapling transplanter.

The postural analysis of trunk and neck showed that the much of bent while working in the traditional method (pic 1) and a slight bent while working with the sapling transplanter (pic 4). There was slight discomfort while working with the sapling

transplanter because it was a new tool and the women were seeing and handling it for the first time.

Table 3: Musculoskeletal Disorders of selected farm workers

Body parts	Presence specific Pain symptom (Frequency & percentage)		Tolerance to the symptom/s		level of pain	
	Conventional	Transplanter	Conventional	Transplanter	Conventional	Transplanter
Neck						
Shoulder						
Wrist						
Palm		Itching (15)		Bearable (15)		Low (15)
Fingers	Pain (30)		Bearable (10) Ignorable (20)		Low (30)	
Upper back						
Lower back	Pain (12)	Pain (8)	Bearable (12)	Bearable (8)	Low (12)	Low (8)
Upper legs						

Tolerance to the symptom/s: Ignorable-1; Bearable-2, Unbearable-3 Level of pain: Very low-5, Low-4, Moderate-3, severe -2 and very severe-1 Figures in parenthesis indicates number

While working with the new sapling transplanter bearable to ignorable pain was ignited in the fingers and bearable itching in the palm because in some cases the hands were sweating and the handle was to be pressed again and again causing itching in the palm. Bearable pain in the lower back was expressed by very few respondents while working with the new sapling transplanter as compared to the bearable pain in suffered while working in the traditional method with no tool.

Table 4: Opinion of the users on sapling trans-planter

STATEMENTS	OPINIONS		
Height of the trans-planter should be	Increased	**Sufficient**	Decreased
Lever operator of the trans-planter should be	**Loose**	Sufficient	Tight
Separate handle on the trans-planter to lift is	**Needed on both sides**	Sufficient as it is	Needed one side
The lower edge of the trans-planter should be	**More slant and sharp**	Sufficient	Any other to be specified
Weight of trans-planter should be	Less weight	**Sufficient**	More weight
Bottom opening of the tool	Should fit the sapling accurately in the soil.		

This table depicts the opinions of the users. The height of the transplanter is sufficient where as the level operator of the transplanter should be loose. Separate handle on the trans-planter to lift is needed on both sides. The lower edge of the trans-planter should be more slant and sharp. Weight of trans-planter is sufficient. Bottom opening of the tool should fit the sapling accurately in the soil.

Conclusion

- Bearable pain in the lower back was expressed by very few respondents while working with the new sapling transplanter. Slight discomfort while working with the sapling transplanter was faced because it was a new tool and the women were seeing and handling it for the first time.
- Inspite of the discomfort, women were willing to adopt and use the new sapling transplanter.

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