

# Mitigation of musculoskeletal problems and body discomfort of agricultural workers through educational intervention<sup>1</sup>

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**Abstract.** Farming is a physically arduous occupation that places farm workers' at potential risk of musculoskeletal disorders, which has been observed to impose a greater impact on their health. Each activity in agriculture brings about certain stress and strain on bones and muscles leading to work-related musculoskeletal disorders which can lead to several permanent diseases and disabilities. The purpose of analyzing musculoskeletal problems among male and female workers engaged in agriculture was to know about the risk factors dangerous to health so that interventions can be planned for mitigating them thereby increasing the efficiency of work. Educational intervention included audio-visual aids as well as printed literature. It was hoped that awareness of these factors through dissemination of information would contribute at preventing hazards amongst farmers and their families. The results revealed that the workers reported very severe to severe pain in low back while performing agricultural activities. Weeding was the most strenuous activity for females and threshing crop for males. Training and education on MSDs through educational intervention proved that the knowledge of the farm workers could be enhanced and can help reduce risk of many musculoskeletal problems. It can be help in empowering the community and mitigate MSDs in agriculture.

Keywords: musculoskeletal problems, body discomfort, educational intervention.

## 1. Introduction

Musculoskeletal problems and discomfort are among the major occupational hazards perceived by the farm workers as farming is a physically demanding occupation. These have been observed to impose a great impact on health of millions of Indian workers engaged in agriculture. Each and every activity in agriculture brings about certain stress and strain on bones and muscles causing discomfort and leading to work-related musculoskeletal disorders (WMSD) which individually may not harm but their cumulative effects can lead to several permanent diseases and disabilities. Walker-Bone and Palmer (2002) in their research concludes that farming is a physically arduous occupation and this places farm workers at

potential risk of musculoskeletal disorders such as osteoarthritis of the hip and knee, low back pain, neck and upper limb complaints, and hand-arm vibration syndrome.

Musculoskeletal problems and body pain during agriculture work are a result of heavy, repetitive and forceful work, working in painful or awkward postures and positions; handling heavy loads, repetition of body motions and unergonomic work methods and traditional tools. Agricultural workers often view pain as a normal part of work and seek care when the condition becomes severe or disabling. But such problems may represent a main cause for absence from work and may lead to considerable costs for the agricultural workers.

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Work-related musculoskeletal disorders and body discomfort can be prevented. Rural communities often lack education and information on the subject. Farm workers do not understand the association of a problem with its source. They are unaware and not able to understand the preventive measures designed to reduce the incidence of musculoskeletal injuries or other hazardous work exposures. In most cases, three basic factors viz. inadequate education and training, poverty and lack of awareness hinder attempts to deal with the occupational related health problems. Effective prevention of musculoskeletal disorders and body discomfort may require rethinking of the risk factors in the workplace and then practical measures should be taken to prevent or reduce these risks with relatively simple and inexpensive modifications to work methods, tools or tasks. Thus the purpose of analyzing musculoskeletal problems and body discomfort among male and female workers engaged in agriculture was to know about the risk factors dangerous to health so that interventions can be planned for mitigating them thereby increasing the efficiency of work. It was hoped that a greater awareness of these factors through dissemination of such information would contribute at preventing hazards and injury amongst farmers and their families.

## 2. Objectives

- To study the musculoskeletal problems and body discomfort confronted by the male and female workers in the selected agricultural operations.
- To develop an educational intervention for imparting knowledge to the agricultural workers regarding '**Safety and Hazards in Agriculture Work**'.
- To test the effectiveness of the educational intervention in terms of gain in knowledge by the respondents regarding ways of preventing and reducing musculoskeletal problems and body discomfort during work.

## 3. Methodology

### 3.1 Sample selection

A sample of 120 agricultural workers, 60 male and 60 female were selected. Simple random sampling without replacement (SRSWOR) was followed for selection of the sample. The samples were chosen using Fisher and Yates tables.

### 3.2 Survey of musculoskeletal problems and body discomfort

The prevalence of musculoskeletal problems and body discomfort among agricultural workers was found using Psychophysical techniques developed by Corlett and Bishop (1976). Body Part Discomfort Score (BPDS) was obtained using "Human Graphic" or a "Body Map". The intensity of pain perceived in each reported body part was determined on a 5-point continuum. The total body discomfort score of the subject was the sum of all the scores of the body parts assigned by the subject. Overall Discomfort Rating in each of the selected agricultural activities were also found using Visual Analogue Discomfort (VAD) Scale which is an 11-point scale. At the end of each agricultural activity the respondents were asked to indicate their overall discomfort rating (0-no discomfort to 10-extreme discomfort) on the VAD scale. The ratings given by the subjects were added and averaged to get the mean rating.

### 3.3 Developing an educational intervention on 'safety and hazards in agriculture work'

For creating awareness among respondents on various causes of MSDs, hazards and safety during agriculture work and possible means of preventions an educational package was developed in simple local language i.e. Hindi. The package included audio-visual aids viz. a documentary film and a VCD regarding information on 'Improved Agricultural Improvements' along with printed literature viz. a booklet and four folders covering various topics to make the respondents conscious of the improved technologies that could be used to minimize musculoskeletal problems and body discomfort during farm work.

### 3.4 Evaluation of the educational intervention

A Panel of judges comprising of subject matter specialist, expert from extension education, communication and media production were selected for evaluating the developed educational intervention. The aids were evaluated for various criteria on a 5-point continuum (5- Excellent, 4- Very Good, 3- Good, 2- Average and 1-Poor).

### 3.5 Testing the effectiveness of the educational package

For judging the effectiveness of the educational intervention pretest-posttest design was used. A questionnaire was prepared for testing the knowledge of the respondents. Each section consisted of two parts i.e. knowledge regarding MSD hazards and knowledge regarding prevention and safety. Prior to exposure to the educational intervention knowledge of the respondents was obtained through pretest. The group was then introduced to the educational intervention. Using the same questionnaire, a posttest was then administered to the group to find their gain in knowledge. Scoring of the pre-test and post-test questionnaires was done. The significance of difference in gain in knowledge was determined.

#### 4. Results and discussion

##### 4.1 Background information of the respondents

The background information of the respondents showed that most of the respondents were in the age group of 35-40 years. The percentages of respondents residing in joint families were marginally more and were having large size families. Most of the respondents belonged to upper caste i.e. they were from the Brahmin community. Approximately half of the respondents received formal education whereas others were able to read and write or were illiterate.

##### 4.2 Musculoskeletal problems of the agricultural workers

Meyers, et al. (1998) study on agricultural workers proves that rates of musculoskeletal disorder (MSD) incidence ranks among the highest risk industries Table 1 indicates the musculoskeletal problems reported by the respondents during the selected agricultural activities.

Table 1

Percentage of Male and Female Respondents reporting Musculoskeletal Problems in selected Agricultural Activities

Body Parts	Percentage of Male and Female Respondents											
	Land Preparation		Sowing		Irrigation		Plant Protection		Weeding		Harvesting	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Neck	100.0	100.0	100.0	100.0	88.3	91.7	100.0	30.0	96.7	100.0	100.0	100.0
Shoulder	100.0	100.0	100.0	100.0	73.3	85.0	100.0	35.0	98.3	100.0	100.0	100.0
Upper arm	100.0	100.0	100.0	100.0	83.3	71.7	100.0	30.0	88.3	100.0	100.0	100.0
Elbow	80.0	80.0	86.7	91.7	45.0	48.3	75.0	31.7	76.7	85.0	65.0	78.3
Lower arm	80.0	96.7	100.0	100.0	81.7	85.0	80.0	40.0	86.7	100.0	96.7	96.7
Wrist	83.3	96.7	80.0	85.0	50.0	71.7	73.3	26.7	71.7	91.7	63.3	40.0
Palm/fingers	100.0	100.0	100.0	100.0	63.3	75.0	81.7	28.3	98.3	100.0	100.0	100.0
Upper back	98.3	100.0	85.0	88.3	81.7	86.7	70.0	26.7	90.0	100.0	100.0	100.0
Lower back	100.0	100.0	100.0	100.0	100.0	100.0	78.3	30.0	100.0	100.0	100.0	100.0
Thighs	100.0	96.7	88.3	95.0	83.3	86.7	51.7	28.3	93.3	100.0	100.0	100.0
Knees	75.0	90.0	78.3	83.3	88.3	93.3	41.7	31.7	86.7	90.0	85.0	85.0
Lower leg	70.0	80.0	86.7	91.7	91.7	96.7	41.7	28.3	73.3	93.3	100.0	93.3
Ankle/feet	78.3	78.3	86.7	93.3	85.0	88.3	45.0	23.3	85.0	95.0	93.3	86.7

The data clearly indicates that 100 per cent of male and female respondents had musculoskeletal problems of neck, shoulder, upper arm and palm/fingers while performing the activities of land preparation, sowing and harvesting whereas during plant protection 100 per cent of males and during weeding 100 per cent of females reported pain in these body parts. In all the activities except plant protection 100 per cent of the male and female respondents reported pain in lower back. The severity of pain in different body parts was measured on a 5- point continuum (very severe to very mild) and the data revealed that it varied from very severe to moderate which was reported by approximately 70 per cent of the respondents. Carrying of heavy loads can cause serious musculoskeletal disorders, such as chronic back pain, chest pain, etc (Forastieri, 1997).

#### 4.3 Body part discomfort score of the agricultural workers

Table 2 represent the data of the discomfort perceived by the male and female respondents during the performance of the selected agricultural activities. The mean Body Part Discomfort Score for land preparation activity reveal that for lower back it was approximately 4.00 for both males and females indicating severe to very severe pain in this part. The score of about 3.5 was observed for upper back, upper arm, neck and shoulder indicating that pain was severe to moderate whereas scores of mild pain were observed in other body parts. The overall discomfort rating score for land preparation was 7.20 for males and 8.17 for females.

Table 2

Mean Body Part Discomfort Scores of Male and Female Respondents in selected Agricultural Activities

Body Parts	Mean Body Part Discomfort Scores of Male and Female Respondents											
	Land Preparation		Sowing		Irrigation		Plant Protection		Weeding		Harvesting	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Neck	3.45	3.43	3.03	3.78	2.25	2.35	3.13	0.85	2.78	3.62	2.90	2.93
Shoulder	3.52	3.50	3.10	3.38	1.78	2.22	3.03	1.03	2.90	3.52	3.09	3.10
Upper arm	3.40	3.50	3.05	3.45	2.18	1.95	3.02	1.00	2.55	3.70	3.68	3.72
Elbow	1.75	2.05	2.13	2.32	0.95	1.07	1.93	0.75	2.03	2.25	1.67	1.98
Lower arm	2.37	2.63	2.82	3.00	2.02	2.17	2.38	1.13	2.48	2.27	2.50	2.35
Wrist	2.33	2.50	2.17	2.35	1.22	1.75	1.78	0.75	1.93	2.67	1.30	1.07
Palm/fingers	3.17	3.25	2.87	3.02	1.50	1.93	2.05	0.88	2.85	3.63	2.68	2.83
Upper back	3.23	3.40	2.65	2.75	2.10	2.33	1.72	0.85	2.90	3.65	3.08	3.15
Lower back	3.83	4.00	3.61	3.93	2.67	2.93	2.25	0.85	3.48	4.18	3.67	3.80
Thighs	2.92	3.12	2.60	2.90	2.17	2.30	1.35	0.80	2.45	3.53	3.05	3.07
Knees	2.18	2.60	2.12	2.23	2.15	2.42	1.18	0.87	2.07	2.62	2.15	2.25
Lower leg	1.92	2.37	2.28	2.47	2.30	2.55	1.10	0.77	2.17	2.80	2.63	2.72
Ankle/feet	1.92	2.22	2.38	2.58	2.13	2.38	1.05	0.65	2.20	2.73	2.45	2.60

Scores: 1- Very Mild, 2- Mild, 3- Moderate, 4- Severe, 5- Very Severe

For sowing activity the Mean Body Part Discomfort Scores revealed that all the subjects experienced severe pain in lower back, the scores being approximately 4.00. For males the scores for shoulder, neck, palm/ fingers, upper arm, lower arm, upper back and thighs were between 3.00 - 4.00 indicating severe to moderate while pain in rest of the body parts it was mild. After irrigation the Mean Body Part Discomfort Score for lower back was approximately

3.00 for both male and female respondents which correspond to moderate pain. The work of irrigation was done in a bending posture and thus the score for neck, shoulder, lower arm, upper back, thighs, knees, lower leg and ankle/feet was between 2.00 - 2.5 indicating moderate to mild pain. The Mean Body Part Discomfort Score for plant protection activity reveals that the scores for neck, shoulder and upper arm was 3.00 indicating moderate pain whereas scores for

other body parts indicated that the pain was mild. No females reported discomfort in plant protection activities as they did not participated much in activities related to plant protection.

Weeding was the most arduous task and was done in a bending posture with movement. It can be inferred from the data in Table 2 that Mean Body Part Discomfort Score in weeding activity was highest for lower back. For females it was 4.18, which proves that they experienced very severe pain and for males it was 3.48 indicating that they experienced severe to very severe pain in lower back. Besides this, all the male respondents reported moderate pain in neck, shoulder, upper arm, palm/fingers and upper back with the score between 2.5 – 3.0 whereas females reported higher intensity of pain in these body parts with scores ranging from 3.0 – 4.0. Women also experienced moderate pain in elbows, knees, lower leg and ankle / feet with a score of nearly 3.00. The Mean Body Part Discomfort Score of the respondents for harvesting activity portrays that male and female respondents had moderate pain in neck, shoulder, palm/fingers, upper back, thighs and lower leg. The discomfort score for these body parts ranged between 2.5 – 3.00. The respondents reported severe pain in upper arm, lower arm and lower back with the discomfort score ranging between 3.5 – 4.00.

Total Body Discomfort scores were also calculated based on the data of body part discomfort scores by summing them up. Table 3 illustrates the data of Total Body Discomfort of the male and female respondents in various agricultural activities.

Table 3  
Total Body Discomfort Scores of the respondents in various agricultural activities

Activities	Mean BPDS of total respondents	
	Male	Female
	Land Preparation	36.4
Sowing	34.75	37.67
Weeding	32.8	42.17
Irrigation	25.37	28.35
Plant protection	25.8	11.19
Harvesting	34.73	35.57

The data reveal that for female respondents the highest total body discomfort was for weeding i.e. 42.17 followed by the activity of land preparation for

which the total summated score was 38.7 whereas for male respondents it was highest for land preparation i.e. 36.4 followed by sowing and harvesting for which the total body discomfort score was 35.7. The next in order were threshing, harvesting, irrigation and use of chemicals. It can be interpreted from the data that women experienced more body pain than men in all the activities expect in the activity of plant protection. There may be two reasons for higher body part discomfort score of women. One that they worked for longer hours than men i.e. they not only performed farm work but also performed household and animal husbandry jobs. Secondly, the women are usually physically weaker than men. Bartels, et al (2000) analyzed job hazards for musculoskeletal disorders for youth working on farms. He found that most adults indicated that lifting object, forking, or shoveling was responsible for most of the serious non-traumatic injuries. Bending over while working, sitting in an awkward position looking back at equipment from a tractor, sitting in a cramped position, looking down at a combine header, and long hours of work were also identified as potential problems. They described muscle aches and strains of the legs, arms, shoulder, back or neck as everyday occurrences.

#### 4.4 Overall discomfort rating of the respondents

Subjective, self-reported estimate of discomfort perceived by the respondents was assessed to know overall discomfort using Visual Analogue Discomfort scale. Table 4 depicts the Overall Discomfort Rating (ODR) of the respondents performing the selected agricultural activities.

Table 4  
Overall Discomfort Rating of the respondents

Activity	Mean scores		Discomfort rating
	Male	Female	
Land Preparation	7.20	8.17	High discomfort
Sowing	7.44	8.27	High discomfort
Irrigation	5.84	6.70	More than moderate discomfort
Plant protection	7.18	2.33	High discomfort for males & Light discomfort for females
Weeding	7.34	8.38	High discomfort
Harvesting	7.72	7.97	High discomfort
Threshing	8.12	8.55	High discomfort

**Discomfort Rating :** 0 - No discomfort, 1-3 : Light discomfort, <3-5: Moderate discomfort, <5-7 :More than moderate discomfort, <7-9 : High discomfort, <9-10 : Extreme discomfort

The Overall Discomfort Rating scores show that all the activities were in the range of ‘high discomfort’ both for males and females except irrigation in which the Overall Discomfort Rating scores were for ‘moderate discomfort’ and the ODR of females in case of plant protection activity, which indicated ‘light discomfort’. Although in all the activities the discomfort scores for females were higher. In a study conducted by Stal and Englund (2005) it was found that the women had significantly more problems than the men with respect to the upper extremities. Symptoms in the wrists and hands such as numbness, reduced muscle strength, aching fingers and wrists, and tendency to drop things were significantly more common among the women than the men. The gender difference in prevalence of upper extremity musculoskeletal symptoms among farmers was obvious.

4.5 Evaluation of the educational aids

The developed educational intervention was evaluated by a panel of judges. The overall scores given by the experts confirmed that the educational aids prepared were of very good quality. The scores so gained are given in Table 5.

Table 5  
Evaluation of the educational aids

Evaluation criteria	Mean scores	
	Video Compact Discs	Printed material
Language	4.0	4.5
Content	4.5	4.5
Visual quality	3.5	4.0
Continuity	4.0	4.0
Sound in case of VCD's	4.5	N.A.
Over all presentation	4.0	4.5

5- Excellent, 4- Very Good, 3- Good, 2-Average and 1-Poor

4.6 Effectiveness of the developed educational intervention

For determining the effectiveness of the developed educational package in creating awareness among agricultural workers regarding musculoskeletal hazards and safety, the pre-test and post-test scores of the respondents were used. It was assumed that only an effective aid can enhance the knowledge and make agricultural workers aware of safety and

hazards during farm work. The mean pre-test and post-test scores obtained by the respondents regarding hazards and safety in the four categories of hazards are given in Figure 1.

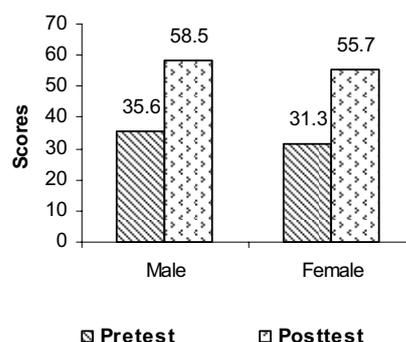


Figure 1 - Average Pre-test and Post-test knowledge scores of male and female respondents

Knowledge of male and female respondents regarding safety for prevention of musculoskeletal hazards was low prior to exposure of the educational intervention. The total average pre-test knowledge score for males was 35.6 and for females was 31.3 as can be seen in Fig. 1. After exposure to the educational intervention, the score of both male and female respondents increased. The post-test knowledge score was 58.5 for males, with a percentage increase of 64 and for females it was 55, with 78 percent increase in knowledge. The drastic gain in knowledge of the respondents confirms that the educational intervention was effective in creating awareness.

5. Conclusion

Musculoskeletal problems and discomfort are among the major occupational hazards perceived by the farm workers as farming is a physically demanding occupation. These have been observed to impose a great impact on health of millions of Indian workers engaged in agriculture. Thus the main aim of the present research was to analyze musculoskeletal problems and body discomfort among male and female workers engaged in agriculture so that educational interventions can be planned for mitigating them through a better understanding of musculoskeletal disorders and strategies for reducing them.

The results of the study revealed that the workers reported about pain in various parts of the body and the maximum of the respondents reported very severe

to severe pain in low back while performing agricultural activities. The overall discomfort scores revealed that weeding was the most strenuous activity for females. Lifting heavy loads, overexertion, long hours of work, continuous and forceful motions, bending and awkward postures, unsafe use of chemicals and environment were some of the main causes identified, which attribute to MSD's in agriculture. The agricultural workers were usually careless towards prevention of musculoskeletal problems confronted by them and they viewed pain as normal part of their life. Training and education for bringing about awareness on MSDs through educational intervention proved that the knowledge of the farm workers could be enhanced through exposure to such information. Knowledge regarding use of improved agriculture equipment, safe work methods and proper postures can help reduce risk of many musculoskeletal problems. It can be a very effective way of empowering the community and to mitigate MSDs in agriculture. Occupational health and safety has become imperative to improve the quality of life of the largest workforce of the country.

## References

- [1] Bartels S., Niederman B., Waters T. R. (2000). Job hazards for musculoskeletal disorders for youth working on farms. *Journal of Agricultural Safety and Health*, 6(3): 191-201.
- [2] Chaudhuri R.N. (2000) Occupational health problems among agricultural and plantation workers. *Journal of Indian Medical Association*, 98(8): 439-41, 445.
- [3] Corlett E. N., Bishop R. P. (1976) A technique for assessing postural discomfort. *Ergonomics*. 19: 175-182.
- [4] Fraser et al (2005) Farming and mental health problems and mental illness. *International Journal of Social Psychiatry*, 51(4): 340-9.
- [5] Linaker C, Smedley J (2002) Respiratory illness in agricultural workers. *Occupational Medicine*, 52:451-459.
- [6] Meeker B J, Carruth A, Holland C B (2002) Health hazards and preventive measures of farm women. *Emerging issues. AAOHN J*. 50 (7): 307-14.
- [7] Nag P K, Nag A (2004) Drudgery, accidents and injuries in Indian agriculture. *Industrial Health*, 42(2): 149-62.
- [8] Ngowi AV, Maeda DN, Partanen T J (2001) Assessment of the ability of health care providers to treat and prevent adverse health effects of pesticides in agricultural areas of Tanzania. *International Journal of Occup Med Environ Health*.;14(4): 349-56.
- [9] Meyers J , Miles., J, Faucett, J, Janowitz, I, Tejada, D, Weber, E, Smith, R, Garcia, L. (1998a). Ergonomics risk factors for musculoskeletal disorder in wine grape vineyard work. Paper presented at the National Institute for Farm Safety, Winnepeg, Canada.
- [10] Simpson K, Sebastian R, Arbuckle T E, et al (2004) Stress on the farm and its association with injury. *Journal of Agricultural Safety and Health*. 10(3): 141-53.
- [12] Walker-Bone K, Palmer KT (2002) Musculoskeletal disorders in farmers and farm workers. *Occupational Medicine (London)*, 52 (8) : 441-50.