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Ergonomic Assessment of Prevalence of Musculoskeletal Disorders among Indian Agricultural Workers

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Abstract

Musculoskeletal problems have become endemic in agricultural work. The workers often complain about pain in various parts of the body while performing agricultural activities. The results revealed that during land preparation, sowing, irrigation most of the males and female agricultural workers reported very severe to severe pain in lower back and moderate pain in other body parts viz. neck, shoulder, upper arm, palm/fingers, upper back and thighs. In the activity of sowing, due to frequent changes in posture and continuous movement, 75 per cent of females and half of the male respondents reported pain. percentage of women reporting musculoskeletal problems in plant protection activity were less but 70 per cent of males reported very severe to moderate pain in neck, shoulders and upper arms as the act of spraying required considerable strength. While weeding activity all females experienced severe pain in lower back. In harvesting activity male and female agricultural workers experienced severe to very severe pain in upper arms, shoulders, neck, thighs and lower back because of the repetitive motion of the body part and the heavy loads, which they carried. The data of musculoskeletal problems during the activity of threshing indicated that the respondents perceived very severe to moderate pain in upper back, shoulders, upper arms and lower back although the intensity varied. Body Part Discomfort Score (BPDS) of the male and female respondents engaged in the agricultural activities reveal that it was highest in the activity of weeding followed by the activity of land preparation and the next in order were threshing, harvesting, irrigation and use of chemicals. The Overall Discomfort Rating scores shows 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 in the range of 'moderate discomfort' and the ODR of females in case of plant protection activity was in the range of 'light discomfort'.

Keywords: Musculoskeletal problems; Body discomfort; Agricultural workers

Introduction

Musculoskeletal disorders are frequent during agriculture work due to exposure to heavy, repetitive and forceful work, adoption of awkward and uncomfortable postures and carrying of excessive loads which has been observed to impose a great impact on health of agricultural workers. These factors place stress on muscles and joints, affect the soft tissues of the neck, shoulder, elbow, hand, wrist, fingers and back. Also the traditional tools and methods used for work require high human energy and can increase the risk of musculoskeletal injury. Furthermore, changes in production processes and the increase in the pace of work have brought to the fore new occupational pathologies. Chronic musculoskeletal disorders are very likely to develop cumulatively in time and most of them can lead to permanent disability.

Walker-Bone et al. [1] 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. Carrying of heavy loads can cause serious musculoskeletal disorders, such as chronic back pain, chest pain and miscarriages [2]. Bartels et al. [3] analyzed job hazards for musculoskeletal disorders for youth working on farms and 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.

Objectives of the Study

The objectives of the study are as follows:

1. To analyze the musculoskeletal problems of the agricultural workers.
2. To assess the overall discomfort and body part discomfort perceived by the agricultural workers while performing farm activities.

Methods and Materials

The present study was conducted in two villages of Badgoan Panchayat Samiti of Udaipur district of Rajasthan where most of the farmers had small land holdings. The geographical diversity of the state causes varied climatic conditions. The weather of Rajasthan state is mostly hot and arid. The temperature ranges from 32°C to 45°C in summers and 10°C to 27°C in winters.

A sample of 120 agricultural workers comprising of 60 men and 60 women engaged in agricultural activities since last 8-10 years were selected. Simple random sampling without replacement (SRSWOR)

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was followed for selection of the sample. The samples were chosen using Fisher and Yates tables. For the purpose a list of all the farmers possessing irrigated land was procured from the Patwari of the village. The age of the sample was between 25-50 years.

The prevalence of musculoskeletal problems among agricultural workers were found using Psychophysical techniques developed by Corlett et al. [4]. 'Body Map' technique was used to determine musculoskeletal problems and Body Part Discomfort Score (BPDS) and Visual Analogue Discomfort (VAD) scale was used to assess Overall Discomfort Score (ODR) of the respondents while performing different agricultural activities.

Body Part Discomfort Score (BPDS) was obtained using "Human Graphic" or a "Body Map" (Figure 1). In this technique the body is divided into 13 regions. The intensity of pain perceived in each reported body part was determined on a 5-point continuum. The total BPDS of the subject was the rating multiplied by the number of body parts corresponding to each category. It was the sum of all the scores of the body parts assigned by the subject.

Overall discomfort scores in each of the selected agricultural activities were also found through Visual Analogue Discomfort (VAD) Scale. It is an 11-point scale, 0 being the lowest point showing no discomfort and 10 being the uppermost point showing extreme discomfort. Conceptually, the focus of this tool is on discomfort and not pain. The present scale is appropriate for Indian workers as they are familiar with the decimal system and it is easier for them to assign a value of discomfort between 0-10.

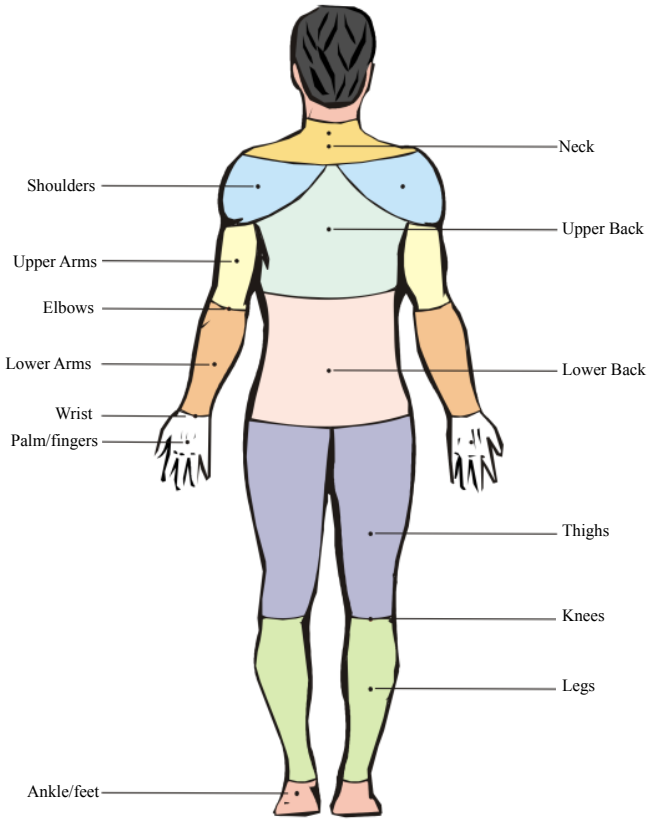

Figure 1: Body Map Technique for determining musculoskeletal problems and Body Part Discomfort.

Results

Musculoskeletal problems of the agricultural workers in selected activities

Land Preparation: During land preparation 67 per cent of males and 70 per cent of female respondents reported very severe to severe pain in lower back and rest of them reported moderate pain because the activity required continuous long hours of back bending. Very severe to moderate pain in other body parts viz. neck, shoulder, upper arm, palm/fingers and upper back, was reported by 70-80 per cent of males and females. More than 65 per cent of males and 70 per cent of females reported pain in thighs also.

Sowing: In the activity of sowing, due to frequent changes in posture and continuous movement, 75 per cent of females expressed severe and very severe pain in lower back whereas approximately 55 per cent of male respondents reported this problem. Approximately 70 per cent of men and 80 per cent of women reported very severe to severe pain in upper arm and about 65 per cent of males and 75 per cent of females experienced very severe to moderate pain in shoulder and neck as the loads were being carried from one place to another. Males and females reporting very severe to moderate pain in palm/fingers were 60-65 per cent whereas 50-60 per cent of the respondents reported pain in upper back and thighs.

Irrigation: During irrigation back bending caused low back pain and was reported by cent percent of the respondents although the intensity of pain reported varied from very severe to very mild. More than 90 per cent of males and females reported pain in lower legs whereas females also reported pain in knees and neck.

Plant protection: While plant protection activity percentage of women reporting musculoskeletal problems were less. Approximately 70 per cent of males reported very severe to moderate pain in neck as the sprayers were hung whereas nearly 60 per cent of males reported very severe to moderate pain in shoulder and upper arm as the act of spraying required considerable strength. About 40-50 per cent of male respondents also reported very severe to moderate pain in lower arms and palm/ fingers while spraying or dusting chemicals.

Weeding: Weeding was the most arduous task and was done in a bending posture with movement. All females experienced pain in lower back and approximately 80 per cent reported very severe and severe pain and 20 per cent of them reported moderate pain. The males reporting very severe and severe pain in lower back were 50 per cent whereas 37 per cent indicated moderate pain. Very severe to moderate pain in neck, shoulder, upper arm, palm/fingers and upper back was reported by 80-85 per cent of females and approximately 55-60 per cent of males. Nearly 70 per cent of female respondents also reported very severe to moderate pain in lower arm.

Harvesting: In harvesting activity 25 per cent of male and female respondents experienced very severe and severe pain in upper arm and lower back because of the repetitive motion of the body part and the heavy loads, which they carried. Approximately 33 per cent of females reported severe pain in shoulder and 40 per cent in lower back and nearly one- third of the respondents reported moderate pain in neck and thighs.

Threshing: Threshing was the activity performed by wheat growers and the data of musculoskeletal problems reported by respondents

Activities	Mean BPDS of total respondents	
	Male	Female
Land Preparation	36.4	38.7
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
Threshing	31.50	33.43

Table 1: Body Part Discomfort Scores of the respondents in the selected agricultural activities.

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 Scale
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

Table 2: Overall Discomfort Rating of the respondents.

during threshing indicated that very severe and severe pain in upper back was experienced by approximately 50 per cent of the respondents whereas 40 per cent reported moderate pain. The other parts in which most of the respondents reported pain were shoulder, upper arm and lower back although the intensity varied from very severe to moderate.

Body Part Discomfort Scores of the respondents

Table 1 reveals the Total Body Part Discomfort Score (BPDS) of the male and female respondents engaged in the agricultural activities. The data reveals that for female respondents the highest total BPDS was for weeding i.e. 42.17 followed by the activity of land preparation for which the BPDS was 38.7 whereas for male respondents highest total BPDS was for land preparation i.e.36.4 followed by sowing and harvesting for which the BPDS 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 use of chemicals. There may be two reasons for higher body part discomfort score of women. One, that they may have 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.

Overall discomfort rating of the respondents

Subjective, self-reported estimate of discomfort was assessed to know overall discomfort rating using Visual Analogue Discomfort 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. Table 2 depicts the Overall Discomfort Rating (ODR) of the respondents performing the selected agricultural activities.

The table presents the mean scores of the male and female agricultural workers irrespective of the crops grown by them. The Overall Discomfort Rating score shows 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 in the range of more than 'moderate discomfort' and the ODR of females in case of plant protection activity, which was in the range of '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.

Discussion

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 health of agricultural workers. Each activity in agriculture brings about certain stress and strain on bones and muscles leading to work-related musculoskeletal disorders (WMSD). Disorders of the musculoskeletal system represent a main cause for absence from occupational work and may lead to considerable costs for the agricultural workers.

Specific disorders of the musculoskeletal system may relate to different body regions and occupational work. Disorders in the lower back are often correlated to lifting and carrying of loads. Upper-limb disorders (at fingers, hands, wrists, arms, elbows, shoulders, neck) may result from repetitive or long-lasting static force exertion or may be intensified by such activities. The severity of these disorders may vary between occasional aches or pain to permanently diagnosed specific diseases [5]. Occurrence of pain may be interpreted as the result of a reversible acute overloading or may be a pre-symptom for the beginning of a serious disease.

The musculoskeletal system of a person may be overloaded by a succession of small traumas which, when taken one by one, do not injure but, their cumulative effects can lead to pains and aches not only of muscles but also the joints, tendons and other tissues. Studies have shown that maintained and repetitive loads are associated with a higher risk of arthritis of joints due to mechanical stress, inflammation of tendons, degeneration of joints, painful muscle spasms and intervertebral disc troubles leading to back pain [6,7]. Gomez et al. [8] also studied the prevalence and predictors of joint pain in farmers and farm residents. The 12-month prevalence of joint trouble was: lower back 41 per cent, neck/shoulders 35 per cent, knees 29 per cent, hands/wrists 28 per cent, and hips 15 per cent. Older age and being female increased the risk of aches, pain, or discomfort in most joints. Doing tractor work was associated with trouble in all five joint areas, and milking was associated with knee trouble. The findings indicate that personal risk factors and the intensity and nature of the farm work contribute to joint trouble.

In a study done by Holmberg et al. [9] the main objective was to find the prevalence of musculoskeletal symptoms among farmers as compared to rural referents. Data revealed that the farmers reported higher lifetime prevalence of pain in hands and forearms, low back and hips as compared to the referents [10]. The farmers did not seek medical advice more often than the referents, and they reported significantly fewer sick leaves. Low back pain was associated with musculoskeletal

symptoms and with chest discomfort, dyspepsia, symptoms from mucous membranes, skin problems, work-related fever attacks, and primary care for digestive disorders. Presence of both respiratory and digestive disorders doubled the low back pain prevalence.

In the present study it was found that pain in body during work was due to stress and strain on muscles and joints because of awkward posture, repetitive motions, excessive force applied, etc. The purpose of analyzing musculoskeletal problems in agricultural work was to know about the risk factors dangerous to health so that these can be avoided or diminished. The data of research can also be used while designing work and work environment or for preparing information materials and training programs which would be helpful in reducing musculoskeletal disorders, increase the efficiency of work and reduce costs on treatment of ailments occurring due to WMSD's.

The farmworkers are untrained, uneducated, unaware and careless during work or are ignorant about effect the musculoskeletal problems can place on their health. They usually do not use any safety measures while work. The use of improper and unergonomic tools and equipment for work and improper and awkward posture usually bring about body discomfort and musculoskeletal problems that are harmful for their health.

Training and education of agricultural workers for prevention of MSDs has become vital today. Training should also be given to community leaders who can act as health educators or promoters. This can prove to be one of the effective ways of educating and empowering the community. Knowledge regarding safe work methods, work practices, improved tools and equipment etc. can help decrease musculoskeletal disordes. Promotion strategies might also be used to increase the adoption of safe practices among farmers. The working and living conditions also require improvement to decrease occupational risks for farmworkers.

Although basic and applied research is needed to identify, evaluate and develop control strategies for specific agriculture work related musculoskeletal disorders and to assure their practicality and usability in work places. Management of MSDs in agriculture can be done by application of engineering controls, administrative controls and use of properly designed ergonomic equipments equipment. Further, area specific research is needed to identify material handling jobs in agriculture work with high risk of back injury and pathophysiologic mechanisms of chronic musculoskeletal injury for developing safe work strategies.

Conclusion

Musculoskeletal problems have become endemic in agricultural work. The workers often complain about pain in various parts of the body and the maximum report very severe to severe pain in low back while performing agricultural activities. Lifting heavy loads, overexertion, long hours of work, continuous and forceful motions, bending and awkward postures are some of the main causes which attribute to many occupational musculoskeletal disorders in agriculture. The agricultural workers are usually careless towards prevention of these and only indigenous and homemade remedies form a part of their treatment. Thus, it can be concluded that almost all the agricultural activities brought musculoskeletal hazards to the workers and if timely precautions are not taken the health of the largest workforce of the country will be affected.

Training and education for bringing about awareness of MSD's and safety has become imperative so as to improve the quality of life of the largest workforce of the country. Knowledge regarding use of improved agriculture equipment, safe work methods and proper postures can help reduce risk of many musculoskeletal aches and pains. It can be a very effective way of empowering the farming community and to mitigate musculoskeletal hazards in agriculture. Future research can be done to address specific musculoskeletal problems while work in agriculture and thereby giving suggestions for improvement in work strategies and leesen such problems.

References

1. Walker-Bone K, Palmer KT (2002) Musculoskeletal disorders in farmers and farm workers. Occup Med (Lond) 52: 441-450.
2. Forastieri V (2000) The ILO programme on occupational safety and health in agriculture. International Labour Office, Geneva.
3. Bartels S, Niederman B, Waters TR (2000) Job hazards for musculoskeletal disorders for youth working on farms. J Agric Saf Health 6: 191-201.
4. Corlett EN, Bishop RP (1976) A technique for assessing postural discomfort. Ergonomics 19: 175-182.
5. Kirkhorn SR, Schenker MB (2002) Current health effects of agricultural work: respiratory disease, cancer, reproductive effects, musculoskeletal injuries, and pesticide-related illnesses. Journal of Agricultural Safety and Health 8: 199-214.
6. Meyers J, Bloomberg L, Faucett J, Janowitz I, Miles JA (1995) Using ergonomics in the prevention of musculoskeletal cumulative trauma injuries in agriculture: learning from the mistakes of others. Journal of Agromedicine, 2: 11-24.
7. Ray GG (1998) Musculoskeletal Disorders in Indian Context: In Asian - Pacific Newsletter on Occupational Health and Safety 5: 3.
8. Gomez MI, Hwang S, Stark AD, May JJ, Hallman EM, et al. (2003) An analysis of self-reported joint pain among New York farmers. J Agric Saf Health 9: 143-157.
9. Holmberg S, Thelin A, Thelin N (2004) Is there an increased risk of knee osteoarthritis among farmers? A population-based case-control study. Int Arch Occup Environ Health 77: 345-350.
10. Stål M, Englund JE (2005) Gender difference in prevalence of upper extremity musculoskeletal symptoms among Swedish pig farmers. J Agric Saf Health 11: 7-17.

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