

## An Ergonomic Study On Occupational Drudgery And Musculoskeletal Disorders By Vegetable Transplantation Of Uttarakhand, India

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### Abstract

MSDs have been a widespread problem in agriculture sector. The proper matching of machine requirements with the human capabilities is basically necessary for optimum performance of any man-machine system and to guarantee safety of workers. Work Related Musculoskeletal Disorders (WRMSDs) are one of the greatest occupational health hazards. Amongst many types of Musculoskeletal Disorders (MSDs), Low Back Discomforts (LBDs) are the most prevalent and constitute a major health and socio-economic problem. The symptoms may vary from discomfort and pain to decreased body function. Although it is not clear to what extent MSDs can interfere with activities at work and can cause a reduction in productivity. High incidents rate for Work Related Musculoskeletal Disorders (WRMSDs) of the upper extremities have been reported by the agriculture workers which includes numerous agricultural operations. . The present study was carried out in two places i.e. Vegetable Research Center (VRC) of U.S. Nagar District and Doguda villege of Nainital district of Uttarakhand to assess their postural discomfort. A total sample size of 70 farm workers was taken for data using Purposive and Random sampling without replacement. Due to long working hours, awkward body postures, repetitive work and physical load there exist a high prevalence of physiological discomforts among farm workers. Highest Postural load factor was reported during manual transplanting and land preparation activities for which workers have adopted Bending and Semi Bending postures respectively.

**Key Words:** WRMSDs, Musculoskeletal disorders, posture, discomfort, awkward.

### Introduction:

Agriculture ranks among the most hazardous industries. Farmers are at very high risk for fatal and non-fatal injuries; and farming is one of the few industries in which family members (who often share the work and live on the premises) are also at risk for fatal and non-fatal injuries (NIOSH 2013). 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. Thus the health of agricultural worker is always at risk.

Most of the vegetable production activities describe a wide range of inflammatory and



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degenerative diseases and disorders that result in pain and functional impairment and may affect the body's soft tissues, including damage to tendons, tendon sheaths, muscles and nerves of the hands, arms, wrists, elbows, shoulders, neck, back, knee and legs which are produced due to awkward posture of farm workers. When there is excessive muscular and work stress on body of farm workers, fitness tends to decline and this results in less productivity and working efficiency. By managing the stress and strain, physical performance and productivity can be enhanced and the risk of musculoskeletal disorders is controlled within acceptable limits. Wheat production activities being a physically laborious work, inevitably places farm workers at potential risk of musculoskeletal disorders such as osteoarthritis (OA) of the hip and knee, low back pain (LBP), neck and upper limb complaints. There are various risk factors related to these activities which may contribute to the development of musculoskeletal disorders among farmers. Some of these occupational risk factors include static positioning, forward bending and squatting. So, the WMSDs are defined as impairments of bodily structure such as muscles, joints, tendons, ligaments, nerves or the localized blood circulation system that are caused or aggravated primarily by the performance of work and by the effects of the immediate environment in which work is being carried out (**National Institute for Occupational Safety and Health 1999**). The majority of the farm workers reported musculoskeletal problems is non-specific and lacks a well-defined clinical diagnosis (**National Research Council and Institute of Medicine 2001**).

**OSHA (Occupational Safety and Health Administration)** define ergonomics as “the science of fitting the task to the worker. When there is a mismatch between the physical requirements of the job and physical capacity of the worker, work related Musculoskeletal Disorders (MSDs) result. Workers who repeat the same motion throughout their workday, who do their work in an awkward position, who use a great deal of force to perform their jobs, who repeatedly lift heavy objects or who feel a combination of these risk factors are most likely to develop work related musculoskeletal Disorders (WMSDs).”

MSDs have been a widespread problem in agriculture sector. The proper matching of machine requirements with the human capabilities is basically necessary for optimum performance of any man-machine system and to guarantee safety of workers. Work-related musculoskeletal disorders develop slowly over months and years of repeated stresses. The risk factors themselves are ubiquitous, found during almost farm activities. Left unaddressed, musculoskeletal disorders can result in lifelong pain and permanent damage to body tissues and cells. Most work-related MSDs are cumulative disorders, resulting from repeated exposure to high-or low-intensity loads over a long period of time. However, MSDs can also be acute traumas, such as fractures, that occur during an accident. The symptoms may vary from discomfort and pain to decreased body function and invalidity. Although it is not clear to what extent MSDs are caused by work, their impact on working life is huge. MSDs can interfere with activities at work. The consequences may include decreased productivity, a financial burden for the

worker and vice versa. Thus the study was planned with the following objectives;

#### Objectives:

1. To assess the prevalence of occupational drudgery and MSD among farm workers.

#### Material and Method:

The present study was carried out in three villages of Nainital district of Uttarakhand to assess work postures. A total sample size of 60 farm workers (30 males and 30 females) was taken for experimental data using Purposive and Random sampling without replacement. Postural discomfort analysis questionnaire was used to assess musculoskeletal disorders among farm workers.

#### Postural Discomfort Analysis Questionnaire

The postural discomfort analysis questionnaire was used to find out the discomforts of different body parts. The questionnaire was given to each subject and was asked to put the mark on the line, ranging from 0-10 (known as VAS scale), with 0 meaning 'no discomfort' and 10 meaning 'severe discomfort'. This data was then being analyzed. Mean and SD values were determined, validated by **Corlett and Bishop (1976) and Huskisson (1983)**.

#### Results and Discussion:

Work related musculoskeletal discomforts of the workers were assessed using Postural

discomfort analysis questionnaire. Responses of 70 workers were analysed.

#### Physical characteristics of the respondents

The physical characteristics of the respondents selected for ergonomic experiments to carryout the identified drudgery prone activities of vegetable transplanting with mean has been presented in the Table 1. The mean age of the male respondents of manual transplanting activity was 39.65 years, height was 154.95 cms. and experience was 21.65 years. The mean body weight was 56.95 kgs. The computation of Body Mass Index (BMI) revealed that the average BMI was 23 per cent and almost all the respondents fell in the normal range. Similarly the female workers who engaged in manual transplanting of vegetables, and there mean age of females was 39 years, height of 148 cms., weight was 55.4 kgs. and experience was 12.9 years respectively. The mean Body mass index of female respondents was 25 percent.

In transplanter method, the mean age of the male respondents was 32.25 years, body weight was 51.8 kgs., height was 158.8 cms. and experience was 10.8 years. The Body Mass Index (BMI) of male respondents was 23.3 percent. In female category the mean age was 36.8 years, body weight 53.33 kgs., average height was 152 cms. and experience was 17.6 years. Average BMI of female respondents of sapling transplanting was 24.17 percent.

Physical	Traditional method	Transplanter method	t value	Traditional method	Transplanter method	t value
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characteristics	(n=40)	(n=30)		(n=40)	(n=30)	
	Male	Male		Female	Female	
	Mean± SD	Mean ± SD		Mean ± SD	Mean ± SD	
<b>AGE (year)</b>	39.65±8.1	39.05±7.5	2.64*	32.25±7.4	36.8±7.0	NS
<b>HEIGHT (cm)</b>	154.95±4.7	148.05±4.6	2.10*	158.8±6.04	152±9.8	NS
<b>WEIGHT (Kg)</b>	56.95±6.7	55.4±10.3	NS	51.8±7.7	53.3±8.5	NS
<b>EXPERIENCE (year)</b>	21.65±8.8	10.8±3.2	5.06*	12.9±5.4	17.6±5.5	NS
<b>BMI</b>	23±3	25±4	2.14*	23.3±3.07	24.17±4.06	NS

**Table 1: Physical characteristics of the respondents**

\*significant, NS- Non-significant

#### **Postural Discomfort Analysis (VAS scale)**

The postural discomfort analysis questionnaire was used to find out the discomforts of different body parts during the vegetable pre-harvesting activities. The questionnaire was given to each subject and was asked to put the mark on the line, which was then being analyzed. The descriptive (mean and SD values) were determined for VAS (Visual Analogue Scale) validated by **Corlett and Bishop (1976) and Huskisson (1983)**. Similar work was reported by **Newel (2003)**. She conducted studies to find out the comparison

of instantaneous and cumulative loads of the low, back and neck in orthodontists. She applied the VAS scale ranging from 0-10, with 0 meaning 'no discomfort' and 10 meaning 'severe discomfort'. Her individual values ranged between 0.6-9. The neck had the highest mean value 2.6, with shoulder and lower back closest behind at the 2.3 and 1.6 respectively. The mean and SD results of the postural discomfort questionnaire were analyzed and found among respondents.

**Table 2: Mean and SD of postural discomfort during vegetable production activities (VAS Scale)**

Body parts	Traditional method (n=40)		Transplanter method (n=30)	
	Male	Female	Male	Female
Neck	5.35±0.67	5.55±0.82	-	-
Shoulder	5.95±0.68	6±0.91	-	3±2.32
Upper back	6.35±0.98	6.6±0.82	-	-
Upper arm	-	-	3.8± 1.15	3.4± 0.63
Mid back	6.1±1.02	6.5±0.82	-	-
Lower arms	-	-	-	-
Low back	7.1±0.64	7.45±0.88	-	-
Buttocks	-	-	-	-
Thighs	6.2±1.05	5.4±0.68	-	-
Legs	6.2±0.69	6.95±0.82	-	-

Percentage is given in parentheses

The results depict (Table 2) that the mean value was highest during manual transplanting in the lower back i.e. 7.1 for male followed by upper back (6.3), mid back (6.1), thighs, legs (6.2), shoulder (5.95), and neck (5.35) for male, whereas in females, the mean value was highest in lower back (7.45) followed by upper back (6.6), legs (6.9), mid back (6.5), shoulder (6), thighs (5.4) and neck (5.5) respectively.

Similarly the mean value was highest during sapling transplanting in upper arm 3.8 in male respondents and 3.4 in female respondents respectively whereas in shoulders (3) only female respondents reported discomfort.

The pain and discomfort in lower back was highest due to bending posture in manual

transplanting, whereas discomfort in neck, shoulder and thigh were comparatively low. In sapling transplanting the low pain and discomfort in upper arm was recorded. This revealed that the workers suffered from pain and discomforts more in lower back due to manual transplanting in bending posture for a long duration, which also cause musculoskeletal disorders. The pain in legs and thighs was also noticed due to transplanting in squatting posture motion. The discomfort in lower and upper back were due to blending postures adopted by them at work place. .

Hence the above investigation revealed that the workers suffered from pain and

discomforts more in low back, mid back, upper back, r etc. arm due leg and thigh in manual transplanting rather than mechanical transplanting for a long duration, which also cause musculoskeletal disorders. These discomforts were due to bending, squatting and standing postures adopted by them at work place. Finally it can be concluded that the continuous maintaining of static posture and repetitive movements were the main reason for discomfort in these parts. Whereas, the respondents who involved in mechanical way of transplanting by transplanter was having low risk of MSD due to neutral posture i.e. standing posture. **Toomingas et al. (2002)** conducted a study which revealed that eighty six per cent female and sixty eight per cent male reported for musculoskeletal problems, especially pain in neck and shoulder regions.

#### **Conclusion:**

Farm workers suffer from multiple musculoskeletal problems that are caused by over use or misuse of muscles, bones and nerves and significantly impair their activities

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of daily living. High incidence of pain as reported by farm workers in various body parts viz. neck, shoulder, elbow, wrist, mid back and low back, knee and calf muscles in over burdened rural workers indicates that farm workers are at continuous health risk. The erroneous habit of not mentioning about musculoskeletal problems at the right time, or "having learned to live with pain" makes them susceptible to high health risks, as left unaddressed, musculoskeletal disorders that comprise of over many diseases and syndromes and are usually progressive and associated with pain, result in lifelong pain and permanent disability giving rise to enormous health care expenditure and loss of work. The fact that is required to be ascertained before the farm workers is that when they suffer from musculoskeletal problems although their physical health is principally impinged on, but their mental, economic and social functions are also impaired, thus affecting the quality of life of not only the farm workers themselves, but their families as well.

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