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# POSTURAL ASSESSMENT OF VEGETABLE PRODUCTION FARM WORKERS: AN ERGONOMIC STUDY

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**ABSTRACT**

Work related musculoskeletal disorders have become a major risk in agriculture industry due to lack of ergonomically designed instruments and the wrong work postures occupied by the workers. This paper presents a study on various working postures occupied in manual transplantation activity of vegetables. The agriculture sector have major role in Indian economy and it is the place where work posture analysis is mostly neglected. The study was conducted on 70 workers engaged in various activities of vegetable production. Posture analysis tool Rapid Upper Limb Assessment was used. The different activities of the workers were recorded by video and still photography, and these images were used for analysis. The final scores of Rapid Upper Limb Assessment during various working activities were found to be high. The findings revealed that there are ergonomic deficiencies in the planning and work methods. A significant proportion of the workers are working in high risk postures. Thus the workers are under moderate to high risk of work-related musculoskeletal disorders. The study recommended a proper implementation of ergonomics interventions program with awareness and training among workers to reduce the risks of WMSD.

**Keywords**- RULA, Occupational, Postural analysis, musculoskeletal disorders, vegetable production

## 1. INTRODUCTION

Musculoskeletal disorders (MSDs) are a common health problem and major cause of disability throughout the world. The economic loss due to such disorders affects not only the individual but also the organization and the society as a whole **(Kemmlert, 1994). Kumar et al., (2012)** reported that musculoskeletal disorder is a worldwide concern and distributed among both industrialized countries (ICs) and Industrially Developing Countries (IDCs). In IDCs, the problems of workplace injuries are extremely serious. Poor working conditions and absence of an effective work injury program in IDCs has resulted in high rate of MSD **(Jafry et al., 2000).** It has been widely accepted that awkward and constrained postures result in musculoskeletal stress on different body regions and the major factor in the development of musculoskeletal disorders **(Li et al., 1995).** Poor postures have also been found to be associated with decreased efficiency of performance, an important cause of which are recognized to be the body discomfort resulting from the restricted postures **(Haslegrave, 1994).** The objective of this investigation is to provide a systematic ergonomic approach to the assessment of the transplantation activity to reduce the postural discomfort of transplantation activity.

## 2.MATERIALS AND METHODS

### 2.1 Selection of sample

For the study, 70 agricultural workers (40 traditional method and 40 transplanter method) aged 25-45 years, were selected by simple random sampling method from the Doguda village of Nainital and VRC, Pantnagar in Udham Singh Nagar of Uttarakhand. This cross-sectional study was conducted in order to investigate the ergonomic risks involved in the automobile manufacturing industry. All the vegetable production activities were observed before start of the study and detailed assessment of activity was collected to ensure the completion of ergonomic risk assessment tools. A video recording and photographs were taken in different vegetable production activities.

### 2.2Postural Analysis

For the study used assessment tools namely RULA (Rapid Upper Limb Assessment) to assess the working postures and recommend the changes to be made. The Rapid Upper Limb Assessment (RULA) was developed earlier by **McAtamney and Corlett (1993),** to provide a rapid objective measure of musculoskeletal risk caused by mainly sedentary tasks where upper body demands were high and where work related upper limb disorders are reported. RULA assesses the posture, force and movement associated with sedentary tasks; such tasks include computer tasks, manufacturing or retail tasks where the worker is seated or standing without moving about. The use of RULA results in a risk score from one to seven, where higher scores signify greater levels of apparent risk **(McAtamney et al., 1993).** This tool requires no special equipment in providing a quick assessment of postures of the neck, trunk and upper limbs along with muscle function and the external loads experienced by the body. A coding system is used to generate an action list which indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator. Briefly, the upper arm, lower arm, and wrists postures are evaluated and scores are given for each body part posture. Then, the scores are combined (using a specially developed scoring table 1) to generate the upper limb posture score. Similarly, the neck, trunk, and legs postures are evaluated and scores are also given. They are combined to generate the neck-trunk-legs score. For both combined scores, scores for muscle use and force are added. Finally, the grand score is determined and action to be taken is recommended. The RULA score sheet was used to assess the upper limbs mainly arms and wrist of posture; each body part is divided into sections depending on the range of movement and these sections are numbered so that the number 1 is assigned to the range of movement or working posture where minimal risk is involved. Higher numbers are assigned to parts of the movement range with more extreme postures indicating an increasing presence of risk factors causing load on the structures of the body segment. The exposure scores according to RULA were divided into four risk categories negligible, low, medium and high. Medium and high risk actions should be urgently addressed to reduce the level of exposure of risk factors **(Qutubuddin et al., 2013).**

## 3.RESULT AND DISCUSSION

### 3.1 Physical characteristics of the subjects

The mean age of the male and female respondents of manual method was found to be 39.65 years and 39.05 years respectively, and height of the male respondents was 154.95 cm. and female 148.05 cm. The mean body weight of male and female respondents was 56.95 kg. and 55.4 kg. The mean Body Mass Index of male and female was 23 kg/m² and 25 kg/m² respectively.

Similarly, in mechanical method sapling transplanting, the mean age of the male respondents was found to be 32.25 years and for females it was found to be 36.8 years and range of height of the male respondents was found as 158.8 cm. and 152 cm. for female respondents. The mean body weight of male and female respondents was 51.8 kg. and 53.3 kg. respectively. The mean body mass index of male was 23.3 kg/m² and 24.17kg/m² of female respondents.

**Table1. classification of risk according to scores of assessment tools**

| RULA SCORE | ACTION REQUIRED |
|---|---|
| 1-2 | Acceptable |
| 3-4 | Change may be necessary |
| 5-6 | Change necessary soon |
| 7 | Change Immediately |

**Table 2: Physical characteristics of the respondents.**

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

***significant, NS- Non-significant**

### 3.2 Postural Analysis

The video was cropped every 27 seconds to get snapshots of the workers and these snapshots were analyzed to fill the scores in RULA worksheet. Later on stick diagrams were drawn from freezed frame video records and eventually subjected to analysis. The most frequent postures adopted by the workers were taken into consideration. The results of the RULA assessment of the workers are shown in **Table 3**. The posture codes of the RULA indicate that, working postures of workers in different vegetable production activities represents that usually farm workers adopt stressful and awkward postures during maximum activities which demand corrective measures immediately. Thus it is clear that due to adoption of awkward postures at work for a prolonged period of time, the farm workers suffer from high rate of work related musculoskeletal disorders.

**Table 3: Application of REBA for the Postural Analysis of Vegetable Production**.

| Agricultural activities in vegetable production | posture | Posture analysis | | |
|---|---|---|---|---|
| | | REBA | | |
| | | REBA Score | Risk level | Action category |
|  | Back bent forward/backward, both arms below shoulder level, walking or moving, weight needed over 10 kg but less than 20 kg. | **10** | High | Action needs to be taken very soon. |
|  | Squatting posture, knees bent walking or moving, weight needed over 10 kg or less. | **6** | Medium | Further consideration should be given as to how risk can be lowered. |
|  | Back bent and twisted or back bent forward and sideways, both arms below shoulder level, both knees bent, weight / force needed 10 kg or less. | **11** | Very high | Work must stop until a safer solution can be found |
|  | Standing upright, neck deviations forward, weight/force needed 10 kg or less. | **3** | Low | Change may be needed. |

## 4.DISCUSSION

From the analysis of results and scores obtained by RULA postural assessment techniques it can be concluded that there is a lack of awareness and knowledge about ergonomics practices and principles in the working methods in vegetable production. The workers adopt awkward postures involving frequent squatting, twisting, bending, and over-reaching, which are a result of poorly designed traditional tools and working methods. These actions force them into a non-neutral position that increases the overall discomfort and pain at the lower back, legs, thighs, neck, and shoulders **(Qutubuddin et al., 2013).** Almost one third of the study populations claimed to feel uncomfortable to their upper and lower extremities. Thus the workers are under moderate to high risk and in some postures at a very high risk of Work related Musculoskeletal disorders (WMSDs). Application of ergonomic principles, biomechanical and engineering principles can be effective in reducing the risks and occurrence of WMSD. The present study recommended that there is dire need of implementation of ergonomics interventions with proper awareness and training among the transplanting workers to improve the work postures and minimize safety hazards. This study also proposed that various ergonomically designed tools could be used to human strength capabilities and limitations and to reduce the level of fatigue and discomfort of male and female vegetable production workers.

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