

**POSTURAL ANALYSIS OF DIFFERENT FARMING
POSITIONS IN DUBRAJPUR, BANKURA, WEST
BENGAL**

By

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THESIS

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I HEREBY RECOMMEND THAT THE THESIS ENTITLED "**POSTURAL ANALYSIS OF DIFFERENT FARMING POSITIONS IN DUBRAJPUR, BANKURA, WEST BENGAL**" CARRIED OUT UNDER MY/OUR GUIDANCE BY **MR. SUBHADEEP BANERJEE** MAY BE ACCEPTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF "MASTER OF PRODUCTION ENGINEERING".

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COMMITTEE ON
FINAL EXAMINATION
FOR EVALUATION OF
THE THESIS

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Table of Content

| | |
|---|--------------|
| TITLE SHEET | i |
| CERTIFICATE OF RECOMMENDATION | ii |
| CERTIFICATE OF APPROVAL | iii |
| ACKNOWLEDGEMENT | 1 |
| TABLE OF CONTENT | 2 |
| LIST OF FIGURES | 3 |
| LIST OF TABLES | 3-4 |
| 1. INTRODUCTION | 5-9 |
| 1.1. Ergonomic role in society | 5 |
| 1.2. How to Perform an Ergonomic Assessments in a Workplace | 6 |
| 1.3. Why Assess Working Postures | 6 |
| 1.4. What is Ergonomic Assessment? | 7 |
| 1.5.Steps For Conducting Ergonomic Assessment in a Workplace | 7 |
| 2. REVIEW OF PAST LITERATURE | 9-13 |
| 3. RESEARCH GAP | 14 |
| 4. OBJECT AND SCOPE OF PRESENT STUDY | 15 |
| 5. METHOD ADOPTED | 16-33 |
| 5.1. Subjects | 16 |
| 5.2. RULA | 19 |
| 5.2.1. Procedure for Conducting the Posture Assessment using RULA | 16 |
| 5.2.2. Calculating scores | 17 |
| 5.3. REBA | 28 |
| 5.3.1. Application of REBA | 28 |
| 5.3.2. Selection of posture of assessment | 29 |
| 5.3.3. Scoring of postures | 29 |
| 5.3.4. Flow Details of scoring in REBA | 29 |
| 5.3.5. Calculating Scores | 29 |
| 5.4. OWAS | 33 |
| 5.4.1. OWAS General Description | 33 |
| 6. EQUIPMENT USED | 36 |
| 7. RESULTS OBTAINED | 37 |
| 8. CONCLUSIONS | 38-39 |
| 9. SCOPE OF FUTURE RESEARCH | 40 |
| 10. ANNEXURES | 41-72 |
| 10.1. Annexure I: RULA analysis | 41 |
| 10.2. Annexure II: REBA analysis | 59 |
| 10.3. Annexure III: OWAS analysis | 63 |
| 11. REFERENCES | 73-75 |

| List of Figures | | |
|------------------------|------------------------------|----------------|
| Figure no. | Particulars | Page no |
| Figure 1.1 | Weeding 1 | 16 |
| Figure 1.2 | Weeding 2 | 17 |
| Figure 1.3 | Weeding 3 | 17 |
| Figure 2.1 | Rice farming 1 | 18 |
| Figure 2.2 | Rice farming 2 | 18 |
| Figure 3.1 | RULA Upper arm postures | 20 |
| Figure 3.2 | RULA Lower arm Postures | 21 |
| Figure 3.3 | RULA Wrist postures | 22 |
| Figure 3.4 | RULA Neck postures | 24 |
| Figure 3.5 | RULA Trunk postures | 25 |
| Figure 3.6 | RULA Leg postures | 26 |
| Figure 3.7 | Manual Transplanting Machine | 38 |

| List of Tables | | |
|-----------------------|--|----------------|
| Table No | Particulars | Page no |
| Table 1 | Table A (upper arm, lower arm, wrist scores) | 23 |
| Table 2 | Table B (Neck trunk and leg score) | 27 |
| Table 3 | Table C (RULA final Score) | 28 |
| Table 4 | Table A: Scoring of Body parts (Trunk, Neck and Leg) | 30 |
| Table 5 | Table B: Scoring of body parts B (upper arms, lower arms, wrist) | 31 |
| Table 6 | Table C: REBA grand score | 32 |
| Table 7 | OWAS Action Table showing grand score | 35 |

| | | |
|----------|---|----|
| Table 8 | RULA, REBA & OWAS Score for different postures | 37 |
| Table 9 | Comparison of RULA, REBA & OWAS Score of 'Weeding 1' and 'Weeding 3' | 38 |
| Table 10 | Comparison of RULA, REBA & OWAS Score of 'rice farming 1' & 'Manual Transplanting Machine' | 39 |

1. Introduction

Ergonomics deals with the exploration of human physical and mental capabilities during working and adjusting the working load. By using the ergonomics arrangements of the workplace, it is possible to adapt work to a human's physical and mental characteristics and to reduce or prevent adverse effects on health. Correct designing of the workplace also includes human habits to ensure humans' work as productively effectively and safely as possible.

The two most important factors that influence stress at work can be divided into:

1. Working environments with working conditions such as noise, heat, humidity, illumination and air velocity and
2. Body postures; numerous studies confirm the relationship between the risks for developing musculoskeletal disorders and awkward postures.

The number of existing ergonomics methods for assessing body postures is many and they vary in the area of the body they assess. Some methods assess the load of the selected body part independently of each other and other methods provide a total assessment. Some methods are focused on different work tasks such as repetitive and non-repetitive tasks and there are methods that evaluate static load e.g. load sustaining the same posture for a long time. Manual handling is another type of task that should be especially consider.

Posture is one of the most important factors that need to be consider in any postural analysis. Awkward, extreme, repetitive postures can increase the risk of musculoskeletal disorders (MSD). Many researchers have studied ergonomics exposures measurement techniques can be divided into two types: indirect and direct techniques the indirect techniques consist of a self-reported questionnaire or a subjective evaluation, whereas the direct techniques involved trained observers or video recording. The direct technique can be used to measures ergonomics risk factors directly on a person who is at risk by using instrument such as electromyography, goniometry and an inclinometer.

In spite of the popularity and the applicability of indirect measurement techniques as a method for conducting ergonomics assessment in the workplace, there have been very few studies that revealed the association between the developed postural assessment and its associated health effects.

1.1. Ergonomics Role in Society:

Its role in society is to achieve safe, secure and comfortable society and to maintain and promotes people's health along with the productivity rise. Beginning of ergonomics actually started due to need of scientific way to achieve best work with least tiring way of muscle use when working. There are several tasks in an industry sector that need workers to walk a long way, carry heavy loads and while doing these most of the time they have to keep the same posture without any changes for some time which can turn out to be a factor that causes people to feel fatigued. Use of tools that are design keeping ergonomics in mind helps to reduce work related fatigue and strain which ultimately contribute safety assurance as well as prevention of MSD such as back pain, joint pains while increasing productivity at the same time.

On the other aspects, the number of workers involved in the third industry has abruptly increased since the 1950s, which accounts for more than 60% of all workers now. As the

industrial structure changes dramatically, the expectation for ergonomics has also changed with time. But in this 21st century where most of the analytical operations are done in computer so workers are spending their big chunk of working times in front of computer screen on a daily basis, which ultimately results to eye strain and mental stress which are very often found in their complaints. Similarly, it happens while driving or flying cars and airplanes respectively. When display equipment's installed in cars and airplanes for controlling output are designed inappropriately, resulting in severe accidents and disasters.

Working forms have been certainly shifting from simple tasks that are high in physical stress to static muscular work with low workload and high constrained such as monitoring or VDT work using computers. Ergonomics not only plays an important role in establishing smooth interaction in using these appliances (comfortable and effective operation), but also contributes to the harmony and correlation of humans, machines and environments.

Ergonomics is aiming to realize to safe, secure and comfortable society and maintain and promote your health while working in a workplace for efficient productivity.

1.2. How to Perform an Ergonomic Assessments in a Workplace:

In recent times, even the work environment where workers are exposed to low-risk for injuries has started conducting ergonomics assessment, since work environment in industries are now very careful about physical impact injuries and accidents, other serious injuries involving musculoskeletal disorders (MSDs) caused due to repetitive stress are on the rise.

In fact, adults in workplaces according to various researches conducted reported nearly 364 million absences on work days due to musculoskeletal condition more than any other chronic health condition, including chronic high blood pressure and heart condition. These are the results of continuous repetitive motions, such as twisting, pushing, lifting and pulling, prolonged sitting in the same place and bad posture can all results to musculoskeletal issues.

So, we are going to perform comprehensive ergonomics assessment in first step for employees who want to reduce absenteeism due to back pain and other MSDs.

1.3. Why Assess Working Postures:

- Forceful working methods & wrong body posture can lead to permanent damage of body tissues and organs.
- It is important to be able to classify body postures and force and draw conclusions that can be used to improve the design of jobs and workplaces.
- People do not deliberately assume poor work postures, they are forced to do so because of the requirements and characteristics of the task and wrong or poor ergonomics design of work stations. So, its redesigning is highly recommended.

1.4. What is Ergonomic Assessment?

Ergonomics risk assessment is an objective measure of the risk factors in work environment that may lead ultimately to a musculoskeletal disorders or injuries among workforce. The goal of an ergonomic assessment is to identify these risk factors and quantify their weightage so that we can make measurable or quantifiable improvement in the workplace. A thorough ergonomic assessment is the ultimate foundation for creating a safer, healthier, less injury prone workplace and improving the workers wellness.

1.5. Steps For Conducting Ergonomic Assessment in a Workplace:

Conducting a successful ergonomic assessment is a simple process. We have to evaluate the workplace environment and evaluate how the workforce interacts with the environment. Obviously, there is more to it than that but we should keep these broad goals in mind as we begin our ergonomic assessment so that we can analyse the specific without getting bogged down in irrelevant details. Here are five steps for performing a successful ergonomic assessment.

1. Reviewing of existing data: The first step to any ergonomic risk assessment is to take a workplace history and ensure that we understand our baseline. We can consider past workplace injury reports, first aid logs and any other data available to become familiar with any work-related injuries or other incidents that have occurred at the workplace. After reviewing these data's, we can identify higher risk activities or higher risk postures as well as common injuries and complaints.
2. Selecting our tools: During the final three steps of our ergonomic assessment, we are going to gather and analyse current data about our workplace and workforce. Before doing this, it's important to take a step back and determine how we will measure data. Fortunately, we don't have to invent these ergonomics measurement tools on our own. There are many well-respected ergonomics assessment tools available in the public domain that has been developed by different organisations. Here are some of the best available ergonomics assessment tools.
 - WISHA caution zone checklist
 - WISHA hazard zone checklist.
 - Rapid entire body assessment (REBA)
 - Rapid upper limb assessment (RULA)
 - OWAS method.
 - NIOSH lifting equation
3. Gathering Personalised Data: Instead of jumping right into our preferred tools and analysing ergonomic risk factors, we can start in the first hand with personalized evaluations of our picked workplace which in our study are the farmers working in field. We begin with the taking a round and observing to get a real life understanding of the environment the workers are exposed with and making notes about any problem we see. During our walk-by we talked with few of them pulling them aside. We made sure to explain our objectives thoroughly and ask them to open up and answer in the fearless way possible. We asked questions such as:

- Does your task involve any kind of repetitive motions of any of your mobile organs?
 - Do you get exhausted or worn-out while doing your job?
 - Have you ever felt unsafe while doing the job?
 - Can you suggest any changes in the job that would increase the safety while doing the job as well as increase the comfort level?
 - What steps would you suggest for the betterment of the working environment?
4. Gathering Impartial Data: After we have reviewed all the data about work injury and other hazards, we use all the data to prioritise the task and the departments we need to evaluate first objectively using our chosen tools.
 5. Analysing all the data and Risk prioritising: Finally, all the data is collected to create a list of key risk factors and explore the risk-reducing options. To analyse the data, and for the development of the subjective and objective data collected during the comprehensive assessment, along with the existing data we followed the above-mentioned steps. The identification of the main ideas and potential, in order to reduce the risks, and prioritise each of them separately, due to the potential risk of harm and its severity is very necessary. It is also strongly recommended, to recognise short-term and long-term effect. With the help of these five steps, you will have to create a detailed and informative report on all of the ergonomic risk factors.

2. Review of Past Literatures:

Heidari, Soltanzadeh, Asemabadi, Rahimifard, Mohammadbeigi et al. [1] have discussed about the postural analysis of students who were in front of laptops for several hours and its effect on MSDs. Their study was a cross sectional study and they have chosen near about 150 university students who have continuously used laptops for nearly 5 years their Data were gathered by questionnaire (demographic data, laptop use-related questions and visual posture questions) and posture analysis using Rapid Upper Limb Assessment method. T-test, Chi-square and Spearman correlation coefficient tests were used in data analysis. By analysing their data, they have come to a conclusion that Laptop is using frequently as a popular device at home, dormitory or other non-official places. Due to nature of these places and inherent characteristics of laptops, it is not possible to make it adjust for the body based on ergonomic principals. Neck, upper and lower back, shoulder and wrist are organs that influence more by laptop based on body configuration. Sarbswa et. al. [2] This analysis has done on behalf of Maruti Suzuki in this he had been trying to find out why long shifts can cause the muscle problems in workers. He has found that some of the workstations are ergonomically not correct for the workers to work in long shifts they can create some serious troubles like he found the window glass attaching platform was not correct before it was found that the operator had to cover a larger distance to pick up door Glass, they have arranged a platform between them and so the workload has been reduced for the workers like 6 steps per cycle. Similarly, he had found that during steering column fitment the worker have to bend, twist, and stretch for near about 400 cycles/shift now he had arranged a synchro platform with body lift so that the body advanced from hanger for unobstructed access. Herzog N & Buchmeister B et. al. [3] The number of work-related musculoskeletal disorders were still increasing and since these injuries cause high costs for companies and whole society it is important to prevent them through ergonomic analysis and workplace design. Methods for assessing external load were numerous and they differ in the stages of assessment. They also differ in the body area they assess (the load of the back, the upper and lower limbs independently or provide a total assessment) and the types of work tasks they focus on. In the paper the review of the most common methods for assessing body postures has been presented. Beside generally known methods such as OWAS, RULA, REBA, NIOSH and others also newly methods usually developed in companies for specific purposes were discussed such as PEIL, ERIN and Ergo check. Since methods were usually dedicated to a restricted type of work task and restricted body area the review of different ergonomics analysis could be of benefit. Sukhdarin, Ghani, Mohd Rwani and Rasdan Ismail et. al. [4] This review described standardized ergonomics assessment based on pen-and-paper observational methods for assessing ergonomics risk factors. The three main objectives were to analyse published pen-and-paper observational methods, to extract and understand the risk levels of each method and to identify their associated health effects. The authors searched scientific databases and the Internet for materials from 1970 to 2013 using the following keywords: ergo, posture, method, observational, postural angle, health effects, pain and diseases. Postural assessments of upper arms, lower arms, wrists, neck, back and legs in six pen-and-paper-based observational methods were highlighted, extracted in groups and linked with associated adverse health effects. The literature reviewed showed strengths and limitations of published pen-and-paper-based observational methods in determining the work activities, risk levels and related postural angles to adverse health

effects. This provided a better understanding of unsafe work postures and how to improve these postures. Many pen-and-paper-based observational methods have been developed. However, there were still many limitations of these methods. There is, therefore, a need to develop a new pen-and-paper-based observational method for assessing postural problems. Das & Mullick et.al.[5] They have conducted a survey of musculoskeletal problems on truck, taxi and bus drivers they have also tried to find out the degree of musculoskeletal problems for them in their study and suggest ergonomic facilitations to address frequency of musculoskeletal problems among the drivers they have used RULA and CMDQ they have found that their neck, inferior back, subordinate legs upper limb and wrists were the main five greatest usual body parts associate with musculoskeletal issues. As such the study proposed ergonomics interference required for these body proportions. Badhe & Kulkarni et. al. [6] In this they have discussed the importance of posture in different cases it may be sportsperson a school teacher or may be industrial application. They have also discussed the different approaches for postural evaluation like sensor-based approach, manual goniometric approach, digital photography and photogrammetric approaches. They have explained different posture assessment and compared in this paper they have discussed the effect of posture on various health parameters. They have also discussed the different posture parameters to assess. They have analysed the joints for their neutral, resting position, alignment, swelling, angles and range of motion. They have checked if their have equal bulk on left and right side of the body and if their have any noticeable hypertrophy or atrophy anywhere muscle tone and skin are also examined for any inflammation, discolouration or dryness. Jagadish, Ansari, Quraishi, Sultana, Qutubuddin et. al [7] In this paper they have discussed about work related musculoskeletal disorders (WMSD) in small scale industry. They have conducted a survey on different small scale industry workers about their postures on different activities. They have selected near about 140 workers from different industry like stone cutting and polishing, aw mills, brick making and Dal mill were selected on a random basis. This study includes administering musculoskeletal questionnaire to determine the level of MSDs among the workers. The workers were subjected to awkward postures like bending, twisting, and heavy load carrying etc. They have chosen some ergonomics assessment tools like Rapid Upper limb Assessment (RULA) and Rapid Entire Body Assessment (REBA). They have concluded from their study that 32% postures adopted by the workers were in high risk according to RULA and 36% are in high risk according to REBA assessment tools and needed to be changed urgently. Motamedzade, Baroonyzade Kasraei, Faradmali et.al [8] They have conducted this study on 30 postgraduate dental students of Hamadan university of medical sciences of west of Iran. LUBA technique was used to evaluate the postural load index and Nordic questionnaire was used to assess the prevalence of musculoskeletal disorders. The prevalence of musculoskeletal pain in neck, elbow, shoulder, wrist, hand, back, waist, leg and knee has decreased after intervention. They have observed that after intervention the frequency of third and fourth group of corrective actions declined from 50 to 10% and 33.33% to 16.7% respectively. Regarding discomfort score in pre and post intervention, there were no significant differences in wrist, shoulder, neck and waist pain and also postural load index. They have concluded that implementation of educational and engineering interventions showed improvement in musculoskeletal pain, postural load index and discomfort score. Chatterjee, Mahata, Sau, Dhara et.al [9] In their study they have taken the MSD analysis on Carpentry workers by dividing them in their experience groups. They have taken nearly 150 carpenters and they

divide them in three groups according to their work experience like work experience 1: 1-5 years, experience 2: 6-10 years, experience 3: >10 years. They have measured their Body Mass Index (BMI), relative cardiac cost (RCC), net cardiac cost (NCC). The musculoskeletal disorders (MSDs) and perceived rating of discomfort was evaluated by modified Nordic Questionnaire method and 10-point subjective scale respectively. The postural stress was assessed by OWAS, RULA and REBA method. As a result, they have found that the extent of physical work load of the carpenters gradually decreased with the increase in experience. The prevalence of MSD in different body segments was the highest in high experience group (Ex III, > 10 years) followed by low experience group (Ex I, 1-5 years) and it was the lowest in moderate experience group (Ex. II, 6 -10 years). The same trends of results were found in case of body part discomfort rating. Results of postural stress indicated that the action and risk level was comparatively lower in the carpenters of middle experience groups than that of other two groups. Mallick, Rathore, Chandra et.al [10] They have analysed the MSDs in agricultural workers. They took the workers of age 24 to 50 years who were using traditional tools for weeding operation. Rapid upper limb assessment (RULA) was used for the analysis of working postures of the agricultural workers in a virtual environment with one of widely used hand tool. The assessment results obtained from RULA suggests that the postures of the agricultural workers while using existing hoe was extremely harmful and there was an urgent need to be addressed in detail about these postures and tool. Further the existing hoe was redesigned taking into consideration of anthropometric dimensions and analysed through RULA results of which indicates a reduction in MSDs. Suman et al.[11] Performed an investigation to assess the posture of rickshaw pullers at work with the objective of analysing the present working conditions and identifying the hazards of the work and optimizing the design for better ergonomics. The investigation used REBA analysing method to carry out detailed load study and find out stress on shoulders and back. The results depicted a very high REBA score ranges between 8-10 which implies high body suffering. The study suggests improving the design and ergonomics of the rickshaw to reduce the high REBA score and its side effects on the rickshaw puller in the long run. Das et al.[12] Adopted RULA, OWAS and discomfort questionnaire method to collect the data for the analysis of work posture related MSD symptoms and postural stress of skilled welders in manufacturing sectors of west Bengal. FEA method is used for the analysis part. The research work shows that poor working posture increased postural stresses that enhance MSDs of the welders. It also proved that workstation design of the welding unit was extremely poor & prototype of CAD model of new design will improve the working conditions and may reduce the chances of MSDs significantly. Kashif et al.[13] Paper deals with the REBA analysis of the design of adjustable desks and chairs in classroom for the students of Jadavpur University. The detailed evaluation using REBA method gives us the final scores in the range of 8-10 which shows the high-risk level leading to back pain and neck pain of the students sitting in classrooms which implies the demand for investigation for changes. Moreover, further studies suggest for the suitable ergonomic design for chairs and desks which might aid in reducing the chances for WMSDs among students in India. Sahu et al.[14] Adopted modified Nordic questionnaire method to examine the MSDs discomfort prevalent among potters and sculptors in unorganised sectors in west Bengal, India. And for the evaluation part Rapid Entire Body Assessment (REBA) method and Rapid Upper Limb Assessment (RULA) method has been adopted. The analysis readily provided us with the evidence that

the postures they have been adopting are significantly deviated from the natural body curvature of various body parts and most of their postures were really harmful. Amrita et al.[15] In this journal have assessed the postures of undergraduate students and lab assistants of Jadavpur University while working on milling machines in workshop. And as expected the paper concludes that the posture was not ergonomic. Therefore, some remedies have been suggested to make the working on milling machines and workshop in general as well more comfortable and may reduce the pain and discomfort to a certain extent. Singh et al.[16] Studied and evaluated the musculoskeletal disorders (MSDs) of small scale forging industries workers. The number of subjects considered for his study was around 102. The tool or method he opted was RULA. For the analysis purpose he shot videos of different activities of the workers and several images were cropped from it. Results of RULA showed that around 20.33% of the workers were under high risk level and required immediate changes. Yusof et al.[17] Conducted a detailed study MSDs in “canting” batik industry workers Kuala Terengganu. The symptoms were identified through questionnaires method from standard Nordic Questionnaires (SNQ) and RULA and REBA for the analysis purpose. The results revealed that MSDs were prevalent in shoulders (64.5%). Massaccesi et al.[18] Studies on a sample of 77 drivers of rubbish collection vehicles that sit in a standard posture and of road washing vehicles using a postural assessment tool RULA for work related upper limb disorders. And this study showed that all the self- reported pains, aches or discomfort in neck and trunk were interrelated in almost all the subjects. R Anagha and A.S.Xavier [19] Study in this paper focuses on finding the level of MSDs in various task in construction industry and recommend various corrective actions for reducing the risk factors. For the analysis purpose the tools used was REBA and Ergofellow software. Gandavadi et al.[20] In this study assessed two sitting postures of dental students at the University of Birmingham School of dentistry. For the study 60 2nd year dental students were considered who were attending their classes. The postures were assessed using RULA method and A Mann Whitney test was used for statistical analysis. The results showed that students using conventional seat were more prone to risk then compared to students using Bambach Saddle seat. Khayr, Patel, Ningthoujam et al [21] have done a postural and biomechanical analysis of manual weeding operation. They have designed the human model for their analysis by using CATIA and DELMIA software on which they have done postural analysis by RULA method and concluded the best position of weeding operation. Groborz, Tokarski, Roman-Liu et al [22] have analysed the postural load on 2 farmers on two different farms. The participants were full time farmers and they both have experienced in their works. They have used the Ovako Working Posture Analysing System (OWAS) method to evaluate postural load and postural risk. They have divided the tasks according to the score of OWAS in different categories and provide the change of postures for respective tasks. Borah, Kalita et al [23] have discussed the postural load on woman during the harvesting of paddy grains. They have divided the tasks according to the sex and the physical attributes of paddy labours they have categorised the tasks in three main categories of load namely high, medium and low. They have suggested the preventive measures to overcome the MSDs for the workers. Wang, Kong, Jung et al [24] The goal of this study was to evaluate working postures in 9 operations of poultry farming for broiler chickens for 14 body segments with 4 categories, and for fingers with 14 categories. They have used REBA and RULA method to find out the best ergonomically correct postures for the operations. Vijaya Lakshmi, Deepika et al [25] have discussed the postural analysis on the viticulture workers. Data was collected from

fifteen female workers whose BMI is in the range of 25-40 by using an observation schedule and questionnaire. They have analysed different body parts and categorised their discomfort during viticulture operations and categorised them in 5 categories according to their discomfort levels.

3. Research Gap:

From the previous studies I have found that, RULA method is used for the assessment for the high-risk level postures for the workers and suggested immediate change [16], in weeding operation RULA method was used for postural load analysis on human models [21]. OWAS method was used for the study of the farmers on two different types of farms [22], different MSDs were also discussed for the farmers of the paddy grains [23]. The RULA and REBA method were used in case of poultry farmers [24]. By questionnaire method the level of discomforts were discussed and analysed their effects on different parts of the body [25].

In my observation I have not found from these studies that the 'rice farming' operation is taken into consideration for RULA, REBA and OWAS analysis and also not found the proper solutions regarding those ergonomically incorrect postures.

4. Object and scope of present study:

The main objectives of this study are: -

- a) To analyse different postural loads and their effects on different farming operation using Rapid upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA), Ovako Working Posture Assessment System (OWAS).
- b) To find out the ergonomic postures of the assessed postures so that the scores of the RULA, REBA and OWAS got reduced and the chances of the MSDs are got reduced.

5. Method adopted:

5.1. Subjects:

This study has been conducted in the villages of Dubrajpur, Bankura, West Bengal where manual farm working was done mostly. Among different farmers including male and female 10-15 male and 5-10 female workers are selected for the study who have no previous diseases and almost fit persons.

After analysing different postures of the 'weeding' and 'farming' operation of the rice farming 3 postures of 'weeding' (Figure 1.1, 1.2, 1.3) and 2 postures of 'rice farming' are been selected for the stud. (Figure 2.1, 2.2).



Figure 1.1: Weeding 1



Figure 1.2: Weeding 2



Figure 1.3: Weeding 3



Figure 2.1: Rice farming 1



Figure 2.2: Rice farming 2

5.2. RULA:

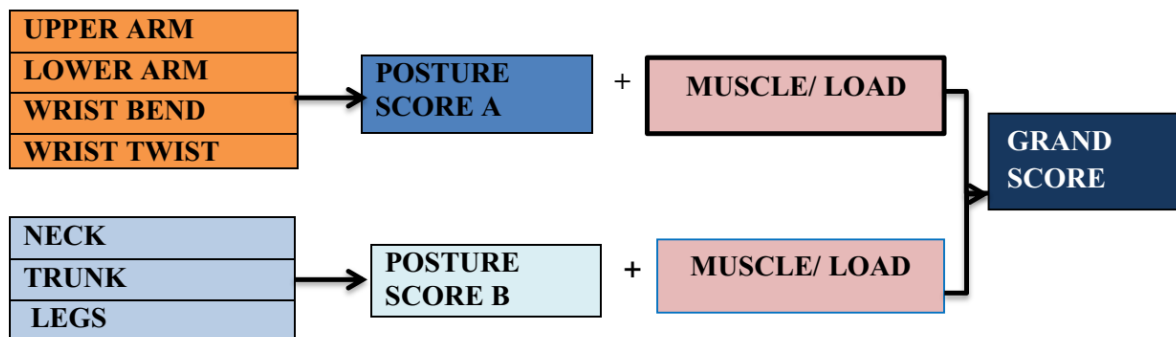
Rapid Upper Limb Assessment focuses on:

- Neck
- Trunk
- legs
- Forearm
- Wrists
- Upper Arms

5.2.1. Procedure for Conducting the Posture Assessment using RULA:

- The Postures to be considered for Assessment are to be selected among different postures with the help of certain criterions.
- The Postures selected are scored using the scoring sheet, body-part diagrams and tables.
- The scores are finally converted and interpreted as one of the four action levels.

Now the RULA score are calculated using RULA assessment form with the help of all the data points captured visually (e.g. filmed, photographed or observed). Now these data points are actually the deviation of the body part from the natural or neutral position, the weight of any load carrying by the worker and the nature of the movements i.e. static or dynamic. Now if there are conditions that are likely to worsen the postural stress, an additional penalty points are added to give the final or grand score. This final score can be used as an indication to tell us the urgency for posture correction of the current posture.



5.2.2. Calculating scores:

Score A :(Upper Arm, Lower Arm, Wrist Analysis)

Upper Arm Score

| | Positions | Score | Additional Score |
|------------------------|------------------------------------|-------|--|
| Upper Arm score | 1) 20° extension, 20° flexion | 1 | ➤ +1 if arm is: <ul style="list-style-type: none"> ● Abducted ● rotated |
| | 2) >20° extension, 20°-45° flexion | 2 | ➤ +1 if shoulder is raised ➤ -1 if leaning, supporting weight of arm or if posture is gravity assisted. |
| | 3) 45°-90° flexion | 3 | |
| | 4) >90° flexion | 4 | |

So we can say that the maximum score can be assigned for the upper arm is 6

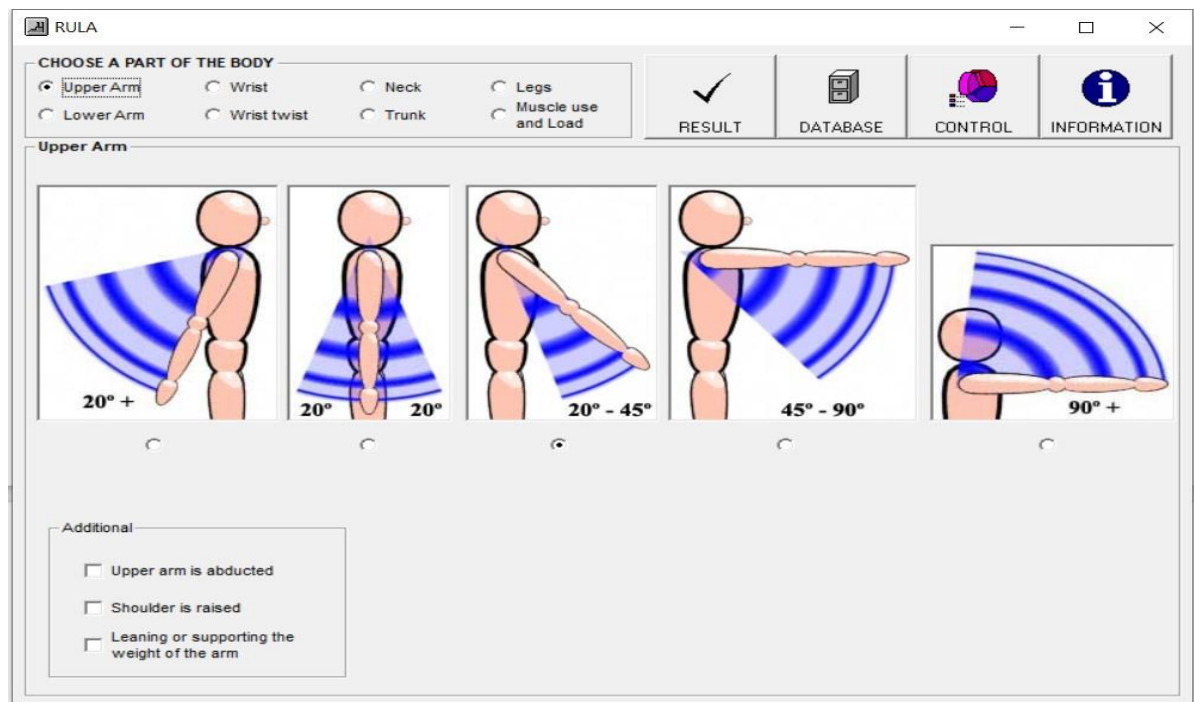


Figure 3.1: RULA upper arm postures

Lower arm Score

| | Movement | Score |
|------------------------|----------------------------------|-------|
| Lower Arm Score | 1) 60°-100° flexion | 1 |
| | 2) <60° Flexion >100° Flexion | 2 |

- Apart from above two possibilities, additional 1 point can be added when the lower arm is working across the midline of the body or out to the sides.
- So the maximum Score that lower Arm can be assigned is 3.

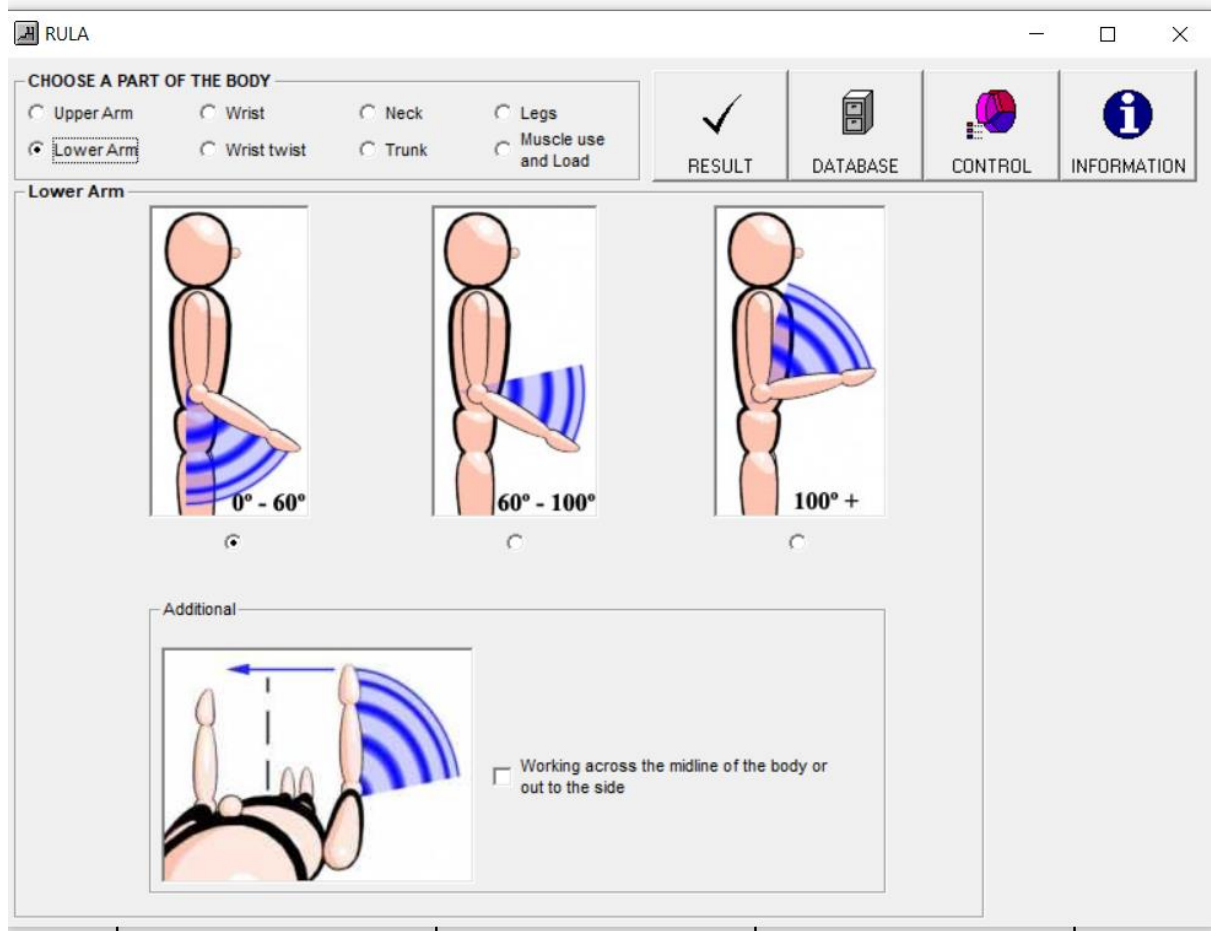


Figure 3.2: RULA Lower arm postures

Wrist Scoring:

| | Movement | Score | Additional Score |
|--------------------|------------------------------------|-------|---|
| Wrist Score | 1) 0° straight in the medial plane | 1 | ➤ +1 if the wrist is twisted or deviated away from the midline. |
| | 2) 0°-15° flexion/extension | 2 | |
| | 3) >15° flexion/extension | 3 | |

➤ So, the maximum Score that we can assign to wrist bent is 4.

- for the wrist twist, +1 for the handshake position and +2 for the twisting away from the handshake position.

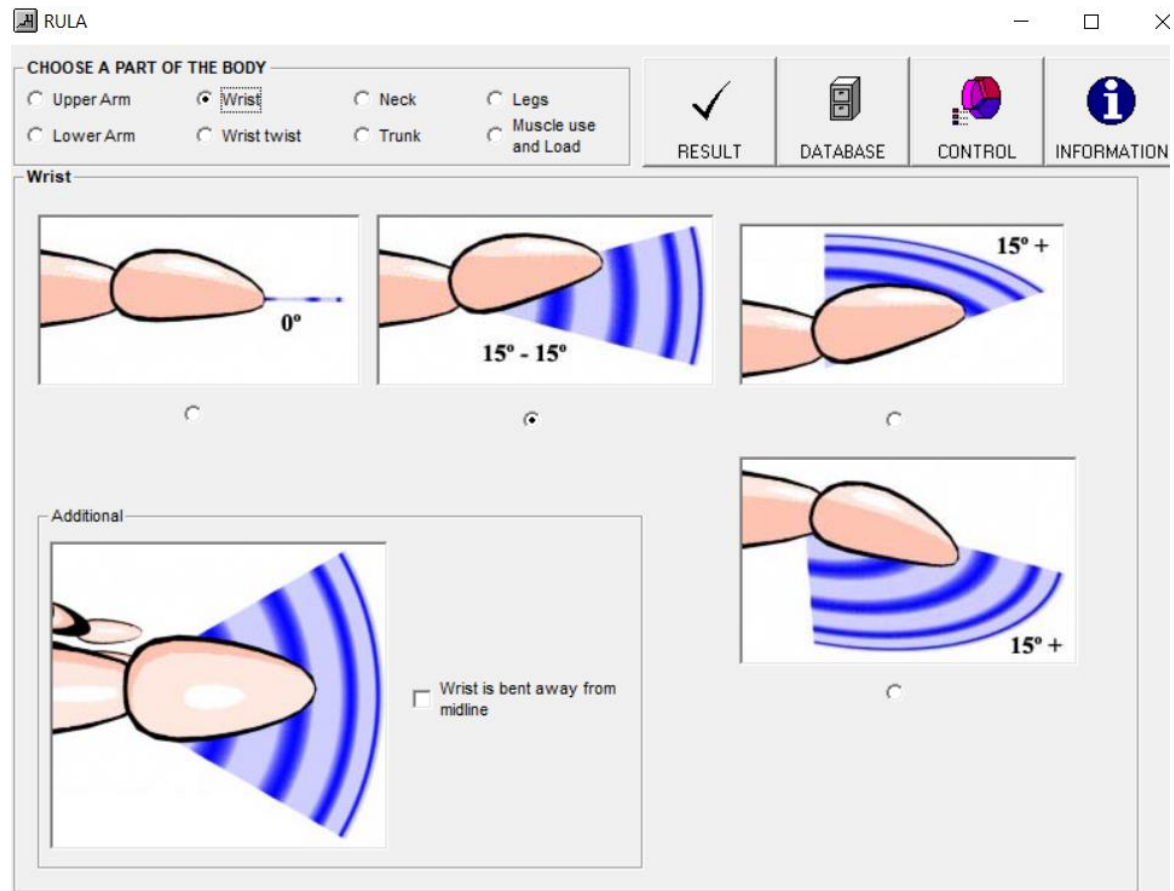


Figure 3.3: RULA wrist postures

| Table A | | Wrist Score | | | | | | | |
|-----------|-----------|-------------|---|-------------|---|-------------|---|-------------|---|
| | | 1 | | 2 | | 3 | | 4 | |
| Upper Arm | Lower Arm | Wrist Twist | | Wrist Twist | | Wrist Twist | | Wrist Twist | |
| | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| 3 | 1 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 |
| | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| 4 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 |
| 5 | 1 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 7 |
| | 2 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 |
| | 3 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 |
| 6 | 1 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 9 |
| | 2 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 |
| | 3 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

Table 1. Table A (upper arm, lower arm, wrist scores)

Forces and Load Score for the Arm

- No resistance, less than 2 kg intermittent load or force “0”
- 2-10 kg intermittent load or force “1”.
- 2-10 kg static load; 2-10kg repeated load or forces; 10kg or more intermittent load or force “2”
- 10 kg static load; 10kg repeated loads or forces; shock or forces with rapid build-up “3”

Muscle Use

- Raise the score by “1”; if the posture is:
 - Mainly static, e.g. held for longer than 10 minutes.
 - Repeated more than 4 times per minutes.

So in this way we get the Posture Score A considering all the possible forces and Muscle score. Similarly now we will calculate the Posture Score B from Neck, Trunk and Legs analysis considering the forces and muscles uses as before.

Score B:(Neck, Trunk and leg Analysis)

Neck Score

| | Movement | Score | Additional Score |
|------------|---|-------|---|
| Neck Score | 1) 0°-10° Flexion in the medial plane. | 1 | ➤ +1 scores if the Neck is twisted in the transverse Plain. |
| | 2) 10°-20° Flexion in the medial Plane. | 2 | |
| | 3) >20° Flexion in the medial Plane. | 3 | ➤ +1 scores for the side bend. |
| | 4) In extension in the medial Plane. | 4 | |

➤ Therefore we can say that the maximum Scores that Neck can be assigned is 6, 4 for the neck bend in the Medial Plane and 1 each for the transverse twist and side bend.

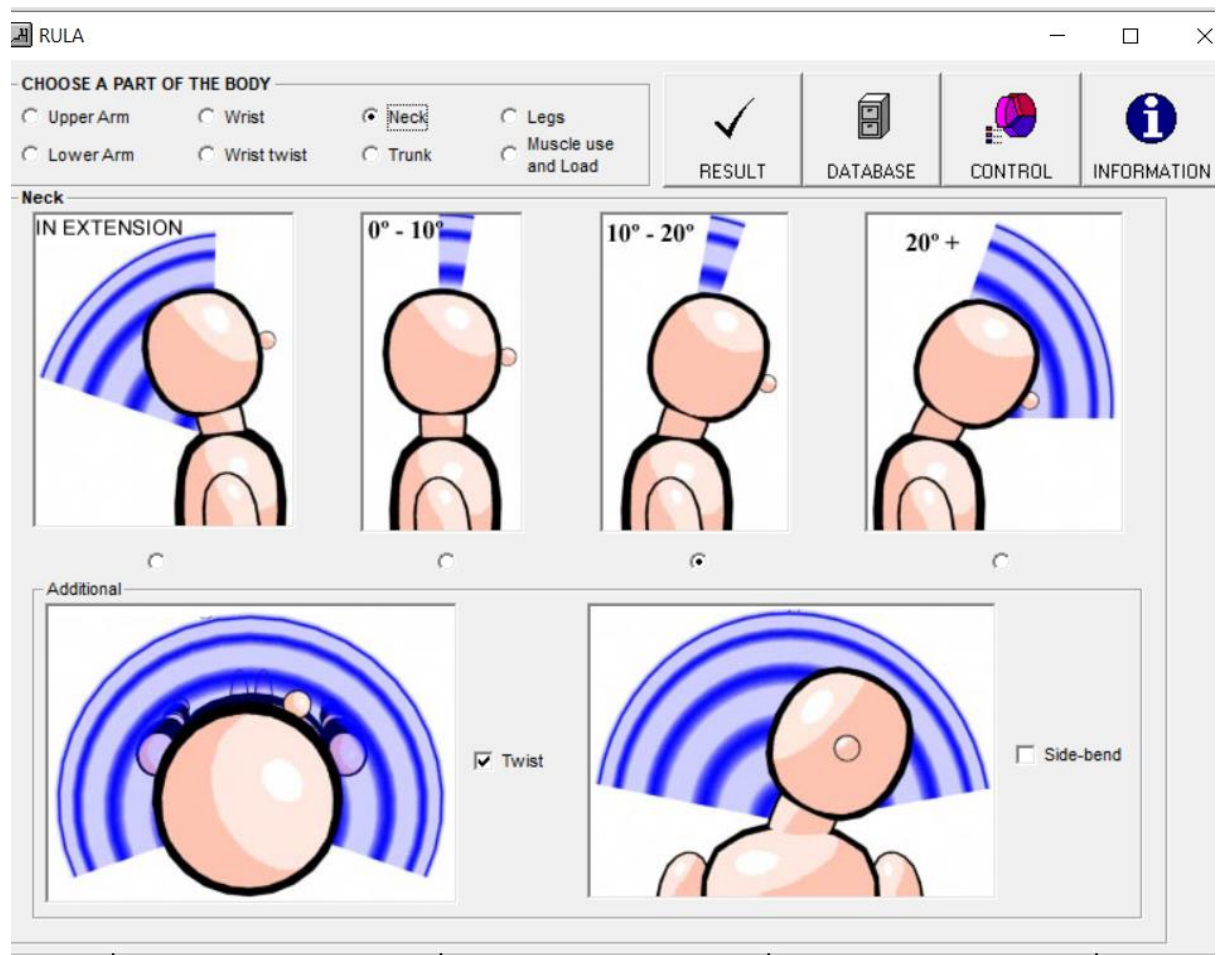


Figure 3.4: RULA neck postures

Trunk

| | Movement | Score | Additional Score |
|-------------|---|-------|------------------------------------|
| Trunk Score | 1) Upright in 0° Angle. | 1 | ➤ Add 1 if the Trunk is Twisted. |
| | 2) 0°-20° Flexion in the Medial Plane. | 2 | ➤ Add 1 if the Trunk is side bend. |
| | 3) 20°-60° Flexion in the Medial Plane. | 3 | |
| | 4) >60° Flexion in the Medial Plane. | 4 | |

- So, the Trunk can have a Maximum Score of 6, 4 for the trunk bend in the medial plane and 1 each for the trunk twist and side bend.



Figure 3.5: RULA trunk postures

Legs

| | Movement | Score |
|------------|--|-------|
| Legs Score | 1) If legs are well supported in an evenly balanced Posture. | 1 |
| | 2) If Legs and feet are not evenly balanced and supported. | 2 |

➤ So the maximum Score that can be assigned to leg is 2.

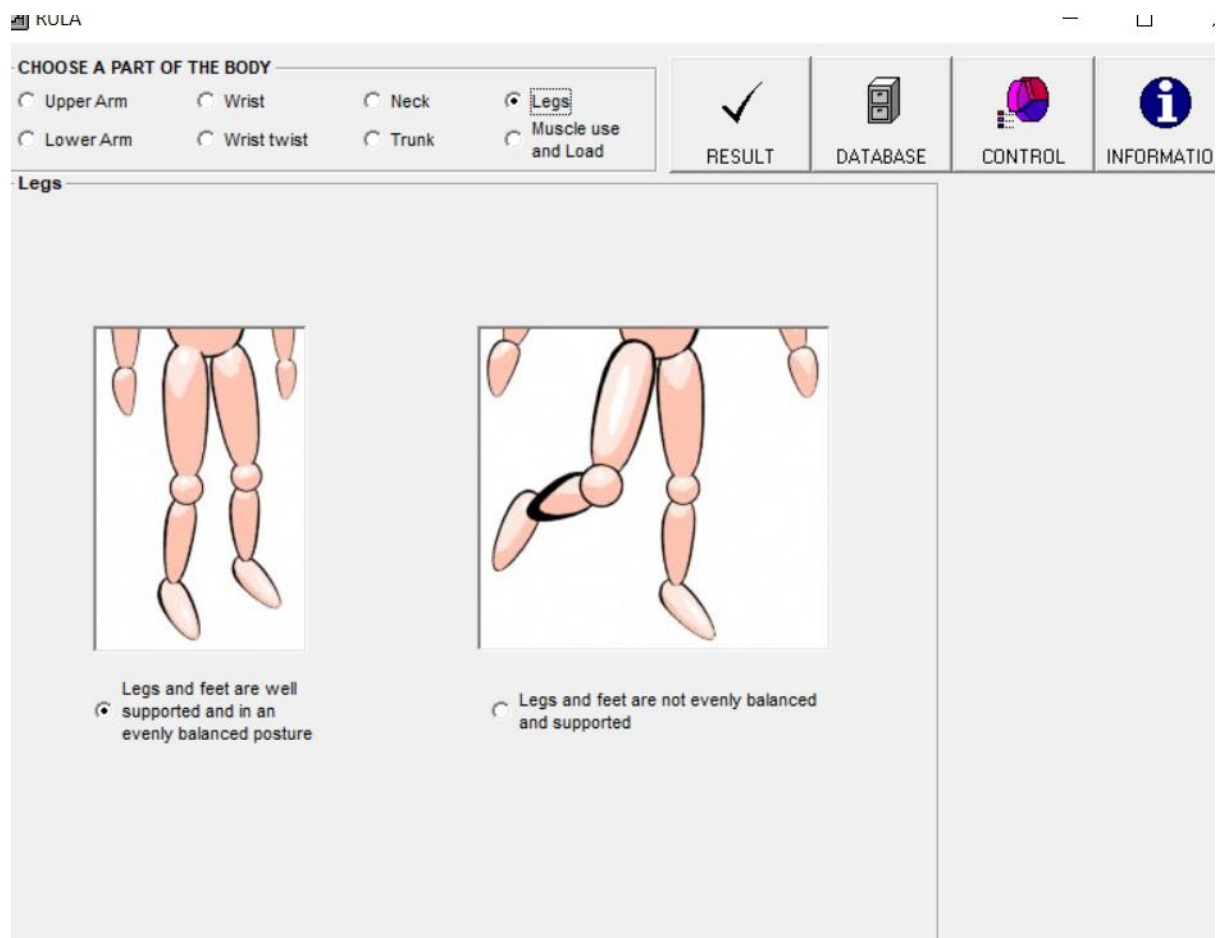


Figure 3.6: RULA leg postures

Table B

| Neck Posture Score | Trunk Posture Score | | | | | | | | | | | |
|--------------------|---------------------|---|------|---|------|---|------|---|------|---|------|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
| | Legs | | Legs | | Legs | | Legs | | Legs | | Legs | |
| | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1 | 1 | 3 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 |
| 2 | 2 | 3 | 2 | 3 | 4 | 5 | 5 | 5 | 6 | 7 | 7 | 7 |
| 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 7 |
| 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 |
| 5 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 6 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 |

Table 2. Table B (Neck trunk and leg score)

Forces and Load score for Neck, Trunk and Legs

- No Resistance; less than 2 kg intermittent Load or force, Add **“0”**
- 2-10 kg intermittent Load or force, Add **“1”**
- 2-10 kg static load; 2-10 kg repeated loads or forces; 10kg or more intermittent load or force **“2”**
- 10 kg static load; 10kg repeated loads or forces ; shock or forces with rapid build-up, Add **“3”**

Muscle Use score for the Neck, Trunk and Legs

- Raise the score by 1, if the posture is
 - Mainly static, e.g. held for longer than 10 minutes.
 - Repeated more than 4 times per minutes.

So in this way we get the Posture Score B considering all the possible forces and Muscle score.

Now as we have got the Wrist/Arm Score or Score A from the Table A and similarly Neck, Trunk, Leg Score or Score B from the Table B, therefore for the Final or Grand Score we look into the Table C.

According to this Final Score or the Grand Score which ranges from 1-7 in RULA method we divide the postures into four Action Levels.

Final Score

| Table C | | Neck,Trunk,Leg Score | | | | | | |
|------------------------|-----------|-----------------------------|----------|----------|----------|----------|----------|-----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| Wrist/Arm Score | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 |
| | 2 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 6 |
| | 4 | 3 | 3 | 3 | 4 | 5 | 6 | 6 |
| | 5 | 4 | 4 | 4 | 5 | 6 | 7 | 7 |
| | 6 | 4 | 4 | 5 | 6 | 6 | 7 | 7 |
| | 7 | 5 | 5 | 6 | 6 | 7 | 7 | 7 |
| | 8+ | 5 | 5 | 6 | 7 | 7 | 7 | 7 |

Table 3. Table C (RULA final Score)

RULA Action levels

| ACTION LEVELS | RECOMMENDATIONS |
|-----------------------|---|
| ACTION LEVEL 1 | Score of 1 or 2 indicates that the posture is acceptable if it is not maintained or repeated for long period of time. |
| ACTION LEVEL 2 | Score of 3 or 4 indicates that further investigation is needed and corrective actions may be required. |
| ACTION LEVEL 3 | Score of 5 or 6 indicates that investigation and corrective actions are required soon. |
| ACTION LEVEL 4 | Score of 7 indicates that investigation and corrective actions are required immediately. |

5.3. REBA:

5.3.1. Application of REBA:

REBA can be used when an ergonomic workplace assessment identifies that further postural analysis is required and:

- The whole body is being used.
- Posture is static, dynamic, rapidly changing or unstable.
- Animate or inanimate loads are being handled either frequently or infrequently.

5.3.2. Selection of posture of assessment:

The criteria for Posture selection are as follows:

- Longest maintained postures.
- Most frequently repeated posture.
- Posture requiring the most muscular activity or the greatest force.
- Posture known to cause discomfort.
- Extreme, unstable or awkward posture, especially where a force is exerted.
- Posture most likely to be improved by interventions, control measures or other changes.

5.3.3. Scoring of postures:

- Use the scoring sheet and body part scores to score the posture.
- The initial scoring is by group:
Group A: trunk, neck and leg.
Group B: Upper Arms, Lower Arms, Wrists.

5.3.4. Flow Details of scoring in REBA:

- For the Trunk, Neck and Leg we have Table A. and adding load/force score to that finally leading us to score B.
- Similarly, for the Upper Arm, Lower Arm and Wrists we have Table B and adding the score for coupling we get the score B.
- Now, using score A and score B we get score C.
- Finally adding the Activity score to score C we get the REBA score.

These REBA scores are eventually converted into any of the five Action Levels

5.3.5. Calculating Scores:

Score A (Trunk, Neck, Leg)

| | Movement | Score | Additional score |
|--------------------|--|-------|--------------------------------|
| Trunk Score | 1) Upright or Neutral | 1 | +1 if twisting or side flexed. |
| | 2) 0°-20° flexion. 0°-20° extension | 2 | |
| | 3) 20°-60° flexion >20° extension | 3 | |
| | 4) >60° flexion | 4 | |
| | Movement | Score | Additional Score |
| Neck Score | 1. 0°-20° flexion | 1 | +1 if twisting or side flexed. |
| | 2. >20° flexion or extension. | 2 | |

| | Movement | Score | Additional Score |
|------|--|-------|---|
| Legs | 1) Bilateral weight bearing, walking or sitting. | 1 | +1 if knee(s) is between 30° and 60° flexion |
| | 2) Unilateral weight bearing, feather weight bearing an unstable posture | 2 | +2 if knee(s) >60° flexion (N.B. not for sitting) |

Based on the above scoring conditions we score the posture to of our consideration in the Table A.

Table A: Scoring of Body Parts A (Trunk, Neck, Legs)

| | | Neck | | | | | | | | | | | |
|-------|---|------|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | 2 | | | | 3 | | | |
| Legs | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Trunk | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 3 | 3 | 5 | 6 |
| | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 |

Table 4. Table A: Scoring of Body parts (Trunk, Neck and Leg)

- Using Table, A, we have generated a single score from the trunk, neck and legs scores.
- This is recorded in the box on the scoring sheet and added to the load/force score to provide score A.

Load/Force Score:

| 0 | 1 | 2 | +1 |
|-------|---------|--------|-----------------------------------|
| <5 kg | 5-10 kg | >10 kg | Shock or rapid build-up of force. |

- So we have reached the Score A.

➤ **Group B scoring (upper arms, lower arms and wrist)**

| | Positions | Score | Additional Score |
|-----------------|------------------------------------|-------|--|
| Upper Arm score | 1) 20° extension to 20° flexion | 1 | ➤ +1 if arm is: <ul style="list-style-type: none"> ● Abducted ● rotated ➤ +1 if shoulder is raised ➤ -1 if leaning, supporting weight of arm or if posture is gravity assisted. |
| | 2) >20° extension, 20°-45° flexion | 2 | |
| | 3) 45°-90° flexion | 3 | |
| | 4) >90° flexion | 4 | |

| Lower Arm Score | Movement | Score |
|----------------------------------|---------------------|-------|
| | 1) 60°-100° flexion | 1 |
| 2) <60° Flexion >100° Flexion | 2 | |

| Wrist Score | Movement | Score | Additional Score |
|---------------------------|-----------------------------|-------|---|
| | 1) 0°-15° flexion/extension | 1 | ➤ +1 if the wrist is twisted or deviated away from the midline. |
| 2) >15° flexion/extension | 2 | | |

Scoring for Body Parts B (Upper Arms, Lower Arms, Wrist Score)

| | | Lower Arm | | | | | |
|------------|---|-----------|---|---|---|---|---|
| | | 1 | | | 2 | | |
| Wrists | | 1 | 2 | 3 | 1 | 2 | 3 |
| Upper Arm1 | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| | 3 | 3 | 4 | 5 | 4 | 5 | 6 |
| | 4 | 4 | 5 | 5 | 5 | 6 | 7 |
| | 5 | 6 | 7 | 8 | 7 | 8 | 8 |
| | 6 | 7 | 8 | 8 | 8 | 9 | 9 |

Table 5. Table B: Scoring of body parts B (upper arms, lower arms, wrist)

➤ Using Table B we have generated a single score from the Upper Arms, Lower Arms and Wrists scores.

- This is recorded in the box on the scoring sheet and added to the load coupling score to provide Score B.

Load Coupling Score

| 0 (Good) | 1 (Fair) | 2 (Poor) | 3 (Unacceptable) |
|--|---|---|---|
| Well-fitting handle and a midrange power Grip. | Handhold Acceptable but not ideal Or Coupling is acceptable via another part of the body. | Handhold not acceptable, although possible. | Awkward, unsafe grip, no handles Or Coupling is unacceptable using other parts of the body. |

- So now we have reached at Score B.
- Now we will look into table C to find Grand score C.

Grand Score

| | | Group B Score | | | | | | | | | | | |
|---------------|----|---------------|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Group A Score | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| | 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 |
| | 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | 5 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | 9 |
| | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Table 6. Table C: REBA grand score

Activity Score:

| Score | Description |
|-------|---|
| +1 | If one or more body parts are static, e.g., held for longer than 1 min. |
| +1 | If repeated small-range actions occur, e.g., repeated more than 4 times per minute (not including walking). |
| +1 | If the action causes rapid large-range changes in postures or an unstable base. |

- Finally, we will convert this REBA Score into one of the five Action Levels.
- These Action Levels corresponding to the bands of final REBA Scores indicates to increasing urgency for the need to make changes.

REBA Action Levels:

| REBA Scores | Risk Level | Action Level | Corrective Actions |
|--------------------|-------------------|---------------------|---------------------------|
| 1 | Negligible | 0 | Not necessary |
| 2-3 | Low | 1 | May be necessary |
| 4-7 | Medium | 2 | Necessary |
| 8-10 | High | 3 | Necessary soon |
| 11-15 | Very High | 4 | Necessary now |

5.4. OWAS (Ovako Working Posture Assessment System):

OWAS is time driven postural assessment tool for gross analysis for the series of postures unlike RULA and REBA which are event driven focusing at one specific posture at one time and we analyse them.

5.4.1. OWAS General Description:

- Postural Analysis using OWAS method consider the following:
 - Back Posture
 - Arms Posture
 - Legs Posture
 - Load Categories
- OWAS identifies the most common work postures for:
 - Back (4 postures)
 - Arms (3 postures)
 - Legs (7 postures)
 - Weight (3 categories)
- Evaluation of posture at regular intervals.
- Whole body posture is described by a four-digit code to describe various postures of the Back, Arms, Legs and the force needed.
- Finally, the observed posture combination is classified into four action categories, which are based on expert's estimates of the health hazards of each work posture combination.

Trunk/Back

Four Categories

- 1) Straight/upright (Neutral)
- 2) Bent Forward
- 3) Straight but Twisted
- 4) Both Bending and Twisted

N.B. And we can see that here specific angles are not mentioned, so whether the bending angle is 30° or 60° or any other angles the score remains 2 for bending. Same for twisting, have no specific twisting angles so score remains 3 for any angle of twist.

Arm Posture : 3 categories are there

- 1) Both Arms below shoulder height (“Neutral”).
- 2) One Arm above shoulder height.
- 3) Both Arms above shoulder height.

Lower Body postures/ Legs : 7 Categories

- 1) Sitting
- 2) Standing-weight on 2 legs, knees straight.
- 3) Standing- weight on 1 leg, knees straight.
- 4) Standing-weight on 2 legs, knees bent.
- 5) Standing-weight on 1 leg, knees bent.
- 6) Neeling-1or 2 knees touching the ground.
- 7) Walking or moving.

Load/Use of Force

- 1) 1= Weight or Force is 10 or < 10 kg.
 - 2) 2= Weight or Force is 10-20 kg.
 - 3) 3= Weight or Force is >20 kg.
- So Final score is a four-digit score e.g., 4261
- 4= Back bent and twisted.
 - 2= One Arm above shoulder height.
 - 6= legs kneeling on the ground.
 - 2= load 10-20 kg.
- This Four-digit score is plotted in the OWAS Action Table.

OWAS Table

| Legs | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | |
|--------------|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Load Handled | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Back | Arms | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

Table 7: OWAS Action Table showing grand score

- From the OWAS Action Table we get the Grand Score corresponding to which we can identify the Action Category Level from among the Four Action Levels listed below:

| <u>Action Categories</u> | <u>Explanation</u> |
|--------------------------|---|
| 1 | Normal and Natural Postures with no harmful effect on musculoskeletal system so- <u>No Actions Required.</u> |
| 2 | Posture with some harmful effects on the musculoskeletal system- <u>Corrective Actions required in near future.</u> |
| 3 | Posture has harmful effect on the musculoskeletal system- <u>Corrective Actions should be taken as soon as possible.</u> |
| 4 | The load caused by these postures has a very harmful effect on the musculoskeletal system- <u>Corrective Actions for improvement required immediately.</u> |

6. Equipment Used:

In this study there have total 5 postures of different farmers performing ‘weeding’ and ‘rice farming’ operations this 5 postures have been selected because they are engaged in these postures for most of the time of the day. For this study the equipment used are listed below:

- I. SONY Cyber-Shot DSC-W800/BC IN5 camera
- II. HSE Ergo RULA software.
- III. HSE Ergo REBA software.
- IV. HSE Ergo OWAS software.

7. Results Obtained:

In this study we have used the three methods mentioned above for analysis of the 5 postures of ‘weeding’ and ‘rice farming’ operations as mentioned earlier. The result i.e., the score obtained from different methods on those postures is shown in the following table.

| Sl. No | Postures | RULA Score | | REBA Score | OWAS Score |
|--------|----------------------------|------------|---|------------|------------|
| 1. | <u>Weeding</u> | | | | |
| 1.1 | Weeding 1 (Fig 1.1) | 7 | | 10 | 3 |
| 1.2 | Weeding 2 (Fig 1.2) | Right Side | 4 | 6 | 2 |
| | | Left Side | 5 | | |
| 1.3 | Weeding 3 (Fig 1.3) | Right Side | 4 | 2 | 1 |
| | | Left Side | 4 | | |
| 2. | <u>Rice Farming</u> | | | | |
| 2.1 | Rice farming 1 (Fig 2.1) | Right Side | 7 | 12 | 4 |
| | | Left Side | 6 | | |
| 2.2 | Rice farming 2 (Fig 2.2) | Right Side | 5 | 6 | 1 |
| | | Left Side | 4 | | |

Table 8: RULA, REBA & OWAS Score for different postures

8. Conclusions:

It is observed in the study that two of the postures of the ‘weeding’ and ‘rice farming’ operation are ergonomically dangerous postures (‘weeding 1’ and ‘rice farming 1’) as they consist very high RULA, REBA and OWAS score. So, they both need ‘immediate change’. As many of the old farmers has developed different kind of musculoskeletal disorders and such postures are found to be accountable for that. Some of the remedial measures are discussed below:

- i. For ‘weeding 1’ operation the neck position is beyond the 20° value and the trunk position is beyond 60° value also, the trunk is twisting. So, the farmers can use any manual weeding machine as shown in ‘weeding 3’ (Fig. 1.3). as the RULA, REBA, OWAS Score is low for that because in this case the neck position is under 0° to 10° and the trunk position is almost 0°.

| Assessment Scores | Weeding 1 | Weeding 3 | |
|-------------------|-----------|------------|-----------|
| | | Right Side | Left Side |
| RULA | 7 | 4 | 4 |
| REBA | 10 | 2 | |
| OWAS | 3 | 1 | |

Table 9: Comparison of RULA, REBA & OWAS Score of ‘Weeding 1’ and ‘Weeding 3’

From the above comparison we can say that the ‘weeding 3’ operation is more ergonomically correct than the ‘weeding 1’ operation.

- ii. For ‘rice farming 1’ operation the neck position is 10°-20° position and the trunk is beyond 60° position also, neck and both are twisting during performing the operation so in different parts of South East Asia the farmers use ‘manual transplanting machine’ for performing the task effectively and also to avoid the MSDs for the farmers.



Fig 3.7: Manual Transplanting Machine

The RULA, REBA and OWAS Score is low for the ‘manual transplanting machine’ with respect to the ‘rice farming 1’ posture.

| Assessment Scores | Rice Farming 1 | | Manual Transplanting Machine | |
|-------------------|----------------|-----------|------------------------------|-----------|
| | Right side | Left Side | Right Side | Left Side |
| RULA | 7 | 6 | 5 | 4 |
| REBA | 12 | | 4 | |
| OWAS | 4 | | 1 | |

Table 10: Comparison of RULA, REBA & OWAS Score of ‘rice farming 1’ & ‘Manual Transplanting Machine’

From the above comparison we can conclude that the ‘manual transplanting machine’ is more ergonomically correct posture for the rice farming operation.

9. Scope of Future Research:

- In this study two postures namely 'weeding 1' and 'rice farming 1' are tried to correct ergonomically, for this 'manual transplanting machine' has been suggested. But, the scores of RULA and REBA for that machine is also not in the acceptable range (refer table 10) which suggest the 'Action level 3 & 2: Further investigation is required and changes are required soon' Similarly for REBA it indicates 'medium risk, further investigation, change soon'. So, if possible, the manual transplanting machine may be replaced with any mechanization process in future.
- There are two other postures namely 'weeding 2' and 'rice farming 2' whose scores are also not in acceptable range (refer table 8) which suggest Action level 3 & 2: Further investigation is required and changes are required soon' Similarly for REBA it indicates 'medium risk, further investigation, change soon' and for OWAS it indicates 'corrective action required in the near future'. The results are same for 'rice farming 2' operation (refer table 8). So, in near future these positions may need to correct ergonomically to avoid the MSDs of the farmers.

10. Annexures:

10.1. Annexure I: RULA Analysis:

Weeding 1



Rapid Upper Limb Assessment (Right Side)

🌀 Final RULA score:

RULA Score: 7

Action level 4: Further investigation and changes are required immediately

👤 Personal details:

Assessee: Subhadeep Banerjee

Assessor:

Email: Subhadeep Banerjee

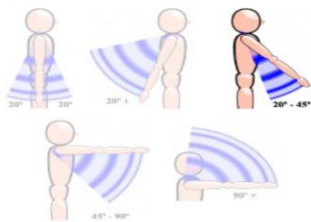
Department/Location: Production Technology

Company/Organisation: Jadavpur University

Date: 2022-06-03

☑️ Answers selected:

Step 1: Locate Upper Arm Position



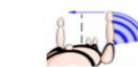
Step 1a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 2: Locate Lower Arm Position

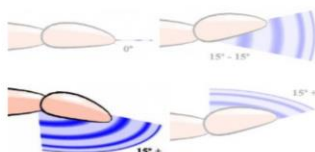


Step 2a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 3: Locate Wrist Position



Step 3a: Also tick the following box if appropriate



- Is wrist bent away from midline?

Step 4: Wrist Twist



Step 5: Arm & wrist - select the force and load that most reflects the working situation

Score 0

- No resistance
- Less than 2 kg intermittent load or force

Score 1

- 2 - 10 kg intermittent load or force

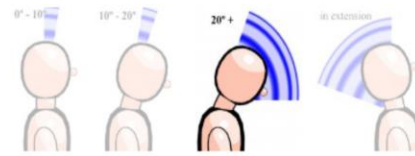
Score 2

- 2 - 10 kg static load
- 2 - 10 kg repeated loads or forces
- 10 kg or more, intermittent load or force

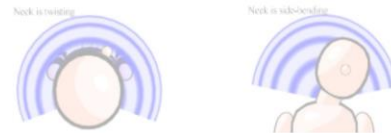
Score 3

- More than 10 kg static load
- 10+ kg repeated loads or forces
- Shock or forces with rapid buildup

Step 6: Locate Neck Position



Step 6a: Also tick the following box if appropriate

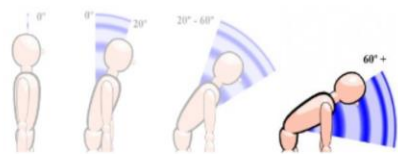


Step 5a: Select this box if it reflects your muscle use

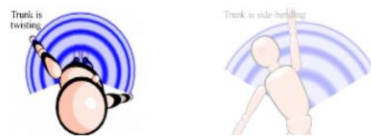
• **Score 1**

Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Step 7: Locate Trunk Position



Step 7a: Also tick the following box if appropriate



Step 8: Legs

Legs and feet are well supported and in an evenly balanced posture.



Step 9: Neck, trunk & leg - select the force and load that most reflects the working situation

Score 0

- No resistance
- Less than 2 kg intermittent load or force

Score 1

- 2 - 10 kg intermittent load or force

Score 2

- 2 - 10 kg static load
- 2 - 10 kg repeated loads or forces
- 10 kg or more, intermittent load or force

Score 3

- More than 10 kg static load
- 10+ kg repeated loads or forces
- Shock or forces with rapid buildup

Step 9a: Select this box if it reflects your muscle use

• **Score 1**

Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Table scores:

If you are familiar with the manual version of RULA, Table A and Table B values are indicated below.

Part A:

| | |
|-----------------------------|---|
| 1. Upper Arm: | 3 |
| 2. Lower Arm: | 2 |
| 3. Wrist: | 3 |
| 4. Wrist Twist: | 1 |
| 5. Muscle Use + Force/Load: | 1 |
| Posture Score (Table A): | 4 |
| Final Arm & Wrist Score: | 5 |

Part B:

| | |
|--------------------------------|---|
| 6. Neck: | 3 |
| 7. Trunk: | 5 |
| 8. Leg: | 1 |
| 9. Muscle Use + Force/Load: | 0 |
| Posture Score (Table B): | 6 |
| Final Neck, Trunk & Leg Score: | 6 |

Weeding 2:



Rapid Upper Limb Assessment (Right & Left Sides)

🔄 Right side:

RULA Score (Right): 4

Action level 2: Further investigation is needed and changes may be required

Left side:

RULA Score (Left): 5

Action level 3: Further investigation and changes are required soon

👤 Personal details:

Assessee:

Assessor: Subhadeep Banerjee

Email: subhadeepbanerjee08@gmail.com

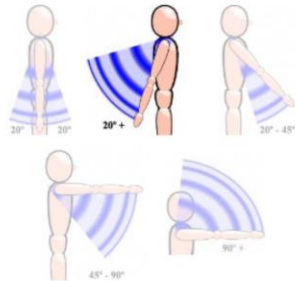
Department/Location: Production Technology

Company/Organisation: Jadavpur University

Date: 2022-06-03

✅ Answers selected:

Step 1: Locate Upper Arm Position (Right)



Step 1a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 2: Locate Lower Arm Position (Right)

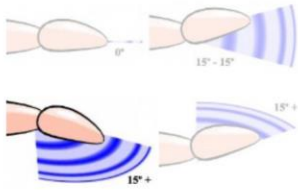


Step 2a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 3: Locate Wrist Position (Right)



Step 4: Wrist Twist (Right)



Step 3a: Also tick the following box if appropriate

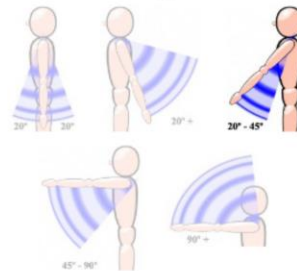


◦ Is wrist bent away from midline?

Step 5: Arm & wrist - select the force and load that most reflects the working situation (Right)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 6: Locate Upper Arm Position (Left)



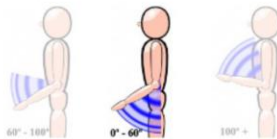
Step 6a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 5a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Step 7: Locate Lower Arm Position (Left)

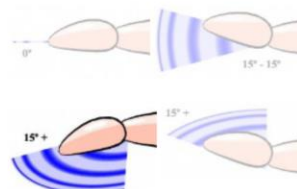


Step 7a: Also tick the following box if appropriate



◦ Is either arm working across midline or out to side of body?

Step 8: Locate Wrist Position (Left)



Step 8a: Also tick the following box if appropriate



◦ Is wrist bent away from midline?

Step 9: Wrist Twist (Left)



Step 10: Arm & wrist - select the force and load that most reflects the working situation (Left)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 10a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

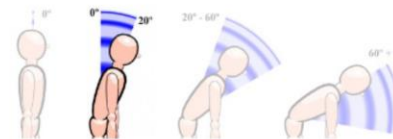
Step 11: Locate Neck Position



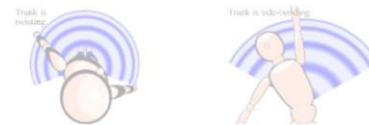
Step 10a: Also tick the following box if appropriate



Step 12: Locate Trunk Position

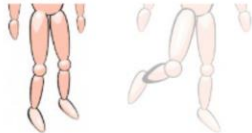


Step 12a: Also tick the following box if appropriate



Step 13: Legs

Legs and feet are well supported and in an evenly balanced posture.



Step 14: Neck, trunk & leg - select the force and load that most reflects the working situation

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 14a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Table scores:

If you are familiar with the manual version of RULA, Table A and Table B values are indicated below.

Part A:

| | |
|---|----------|
| 1. Upper Arm (Right): | 2 |
| 2. Lower Arm (Right): | 2 |
| 3. Wrist (Right): | 3 |
| 4. Wrist Twist (Right): | 1 |
| 5. Muscle Use + Force/Load (Right): | 1 |
| 6. Upper Arm (Left): | 3 |
| 7. Lower Arm (Left): | 2 |
| 8. Wrist (Left): | 3 |
| 9. Wrist Twist (Left): | 1 |
| 10. Muscle Use + Force/Load (Left): | 1 |
| Posture Score - Right (Table A): | 3 |
| Posture Score - Left (Table A): | 4 |
| Final Arm & Wrist Score - Right: | 4 |
| Final Arm & Wrist Score - Left: | 5 |

Part B:

| | |
|---|----------|
| 11. Neck: | 2 |
| 12. Trunk: | 2 |
| 13. Leg: | 1 |
| 14. Muscle Use + Force/Load: | 2 |
| Posture Score (Table B): | 2 |
| Final Neck, Trunk & Leg Score: | 4 |

Weeding 3:



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0345 345 0898

Rapid Upper Limb Assessment (Right & Left Sides)

Right side:

RULA Score (Right): 4

Action level 2: Further investigation is needed and changes may be required

Left side:

RULA Score (Left): 4

Action level 2: Further investigation is needed and changes may be required

Personal details:

Assessee:

Assessor: Subhadeep Banerjee

Email: subhadeepbanerjee08@gmail.com

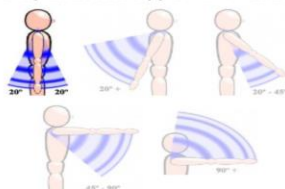
Department/Location: Production Technology

Company/Organisation: Jadavpur University

Date: 2022-06-05

Answers selected:

Step 1: Locate Upper Arm Position (Right)



Step 1a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 2: Locate Lower Arm Position (Right)

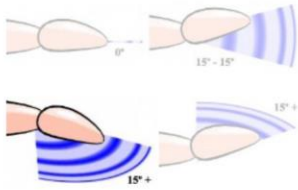


Step 2a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 3: Locate Wrist Position (Right)



Step 4: Wrist Twist (Right)



Step 3a: Also tick the following box if appropriate

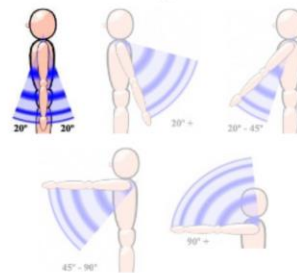


Is wrist bent away from midline?

Step 5: Arm & wrist - select the force and load that most reflects the working situation (Right)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> No resistance Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> 2 - 10 kg static load 2 - 10 kg repeated loads or forces 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> More than 10 kg static load 10+ kg repeated loads or forces Shock or forces with rapid buildup |

Step 6: Locate Upper Arm Position (Left)



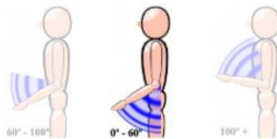
Step 6a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 5a: Select this box if it reflects your muscle use

- Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Step 7: Locate Lower Arm Position (Left)

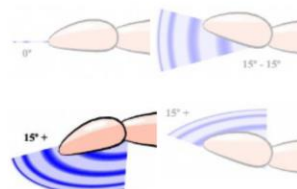


Step 7a: Also tick the following box if appropriate



Is either arm working across midline or out to side of body?

Step 8: Locate Wrist Position (Left)



Step 8a: Also tick the following box if appropriate



Is wrist bent away from midline?

Step 9: Wrist Twist (Left)



Step 10: Arm & wrist - select the force and load that most reflects the working situation (Left)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg Intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg Intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, Intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 10a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

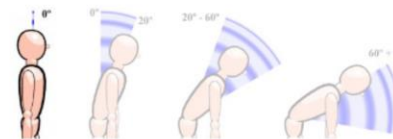
Step 11: Locate Neck Position



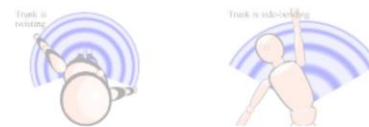
Step 10a: Also tick the following box if appropriate



Step 12: Locate Trunk Position

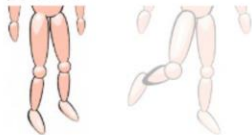


Step 12a: Also tick the following box if appropriate



Step 13: Legs

Legs and feet are well supported and in an evenly balanced posture.



Step 14: Neck, trunk & leg - select the force and load that most reflects the working situation

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 14a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Table scores:

If you are familiar with the manual version of RULA, Table A and Table B values are indicated below.

Part A:

| | |
|---|----------|
| 1. Upper Arm (Right): | 1 |
| 2. Lower Arm (Right): | 2 |
| 3. Wrist (Right): | 3 |
| 4. Wrist Twist (Right): | 1 |
| 5. Muscle Use + Force/Load (Right): | 3 |
| 6. Upper Arm (Left): | 1 |
| 7. Lower Arm (Left): | 2 |
| 8. Wrist (Left): | 3 |
| 9. Wrist Twist (Left): | 1 |
| 10. Muscle Use + Force/Load (Left): | 3 |
| Posture Score - Right (Table A): | 3 |
| Posture Score - Left (Table A): | 3 |
| Final Arm & Wrist Score - Right: | 6 |
| Final Arm & Wrist Score - Left: | 6 |

Part B:

| | |
|---|----------|
| 11. Neck: | 1 |
| 12. Trunk: | 1 |
| 13. Leg: | 1 |
| 14. Muscle Use + Force/Load: | 1 |
| Posture Score (Table B): | 1 |
| Final Neck, Trunk & Leg Score: | 2 |

Rice farming 1:



Rapid Upper Limb Assessment (Right & Left Sides)

🌀 Right side:

RULA Score (Right): 7

Action level 4: Further investigation and changes are required immediately

Left side:

RULA Score (Left): 6

Action level 3: Further investigation and changes are required soon

👤 Personal details:

Assessee:

Assessor:

Email: subhadeepbanerjee08@gmail.com

Department/Location:

Company/Organisation:

Date: 2022-07-01

☑️ Answers seleted:

Step 1: Locate Upper Arm Position (Right)



Step 1a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 2: Locate Lower Arm Position (Right)

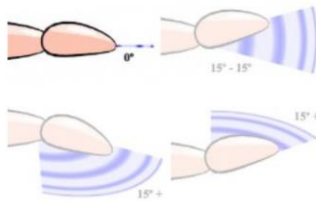


Step 2a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 3: Locate Wrist Position (Right)



Step 4: Wrist Twist (Right)



Step 3a: Also tick the following box if appropriate

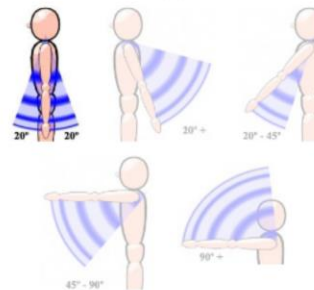


- Is wrist bent away from midline?

Step 5: Arm & wrist - select the force and load that most reflects the working situation (Right)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 6: Locate Upper Arm Position (Left)



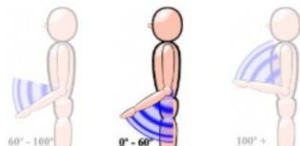
Step 6a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 5a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Step 7: Locate Lower Arm Position (Left)

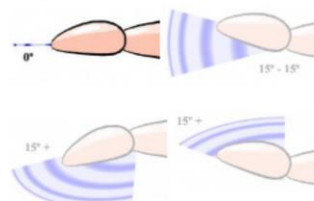


Step 7a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 8: Locate Wrist Position (Left)



Step 8a: Also tick the following box if appropriate



- Is wrist bent away from midline?

Step 9: Wrist Twist (Left)



Step 10: Arm & wrist - select the force and load that most reflects the working situation (Left)

Score 0

- No resistance
- Less than 2 kg intermittent load or force

Score 1

- 2 - 10 kg intermittent load or force

Score 2

- 2 - 10 kg static load
- 2 - 10 kg repeated loads or forces
- 10 kg or more, intermittent load or force

Score 3

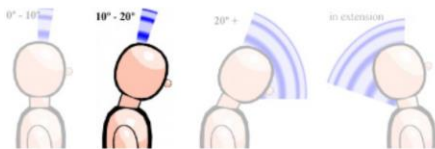
- More than 10 kg static load
- 10+ kg repeated loads or forces
- Shock or forces with rapid buildup

Step 10a: Select this box if it reflects your muscle use

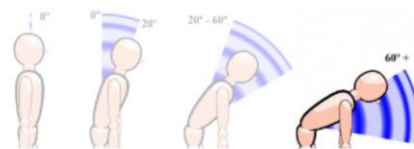
• **Score 1**

Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

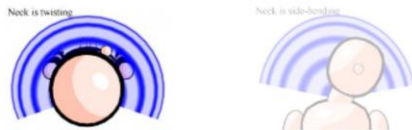
Step 11: Locate Neck Position



Step 12: Locate Trunk Position



Step 10a: Also tick the following box if appropriate



Step 12a: Also tick the following box if appropriate



Step 13: Legs

Legs and feet are well supported and in an evenly balanced posture.



Step 14: Neck, trunk & leg - select the force and load that most reflects the working situation

Score 0

- No resistance
- Less than 2 kg intermittent load or force

Score 1

- 2 - 10 kg intermittent load or force

Score 2

- 2 - 10 kg static load
- 2 - 10 kg repeated loads or forces
- 10 kg or more, intermittent load or force

Score 3

- More than 10 kg static load
- 10+ kg repeated loads or forces
- Shock or forces with rapid buildup

Step 14a: Select this box if it reflects your muscle use

• **Score 1**

Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Table scores:

If you are familiar with the manual version of RULA, Table A and Table B values are indicated below.

Part A:

| | |
|-------------------------------------|---|
| 1. Upper Arm (Right): | 4 |
| 2. Lower Arm (Right): | 3 |
| 3. Wrist (Right): | 2 |
| 4. Wrist Twist (Right): | 1 |
| 5. Muscle Use + Force/Load (Right): | 1 |
| 6. Upper Arm (Left): | 1 |
| 7. Lower Arm (Left): | 2 |
| 8. Wrist (Left): | 1 |
| 9. Wrist Twist (Left): | 1 |
| 10. Muscle Use + Force/Load (Left): | 1 |
| Posture Score - Right (Table A): | 4 |
| Posture Score - Left (Table A): | 2 |
| Final Arm & Wrist Score - Right: | 5 |
| Final Arm & Wrist Score - Left: | 3 |

Part B:

| | |
|--------------------------------|---|
| 11. Neck: | 3 |
| 12. Trunk: | 5 |
| 13. Leg: | 1 |
| 14. Muscle Use + Force/Load: | 1 |
| Posture Score (Table B): | 6 |
| Final Neck, Trunk & Leg Score: | 7 |

Rice farming 2:



Rapid Upper Limb Assessment (Right & Left Sides)

🔄 Right side:

RULA Score (Right): 5

Action level 3: Further investigation and changes are required soon

Left side:

RULA Score (Left): 4

Action level 2: Further investigation is needed and changes may be required

👤 Personal details:

Assessee:

Assessor: Subhadeep Banerjee

Email: subhadeepbanerjee08@gmail.com

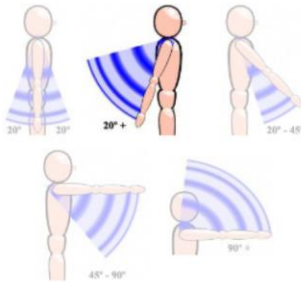
Department/Location:

Company/Organisation:

Date: 2022-06-05

☑️ Answers selected:

Step 1: Locate Upper Arm Position (Right)



Step 1a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 2: Locate Lower Arm Position (Right)

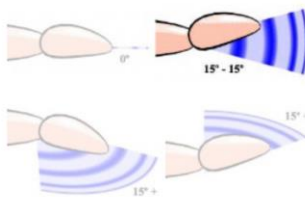


Step 2a: Also tick the following box if appropriate



- Is either arm working across midline or out to side of body?

Step 3: Locate Wrist Position (Right)



Step 3a: Also tick the following box if appropriate



- Is wrist bent away from midline?

Step 4: Wrist Twist (Right)



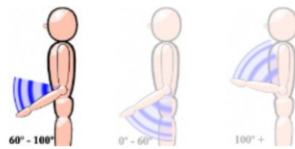
Step 5: Arm & wrist - select the force and load that most reflects the working situation (Right)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 5a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Step 7: Locate Lower Arm Position (Left)



Step 7a: Also tick the following box if appropriate

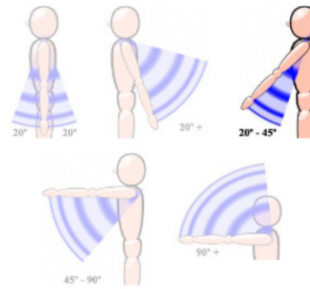


- Is either arm working across midline or out to side of body?

Step 9: Wrist Twist (Left)



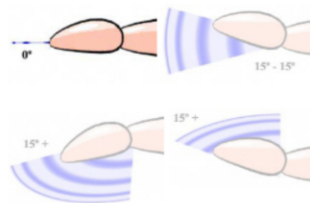
Step 6: Locate Upper Arm Position (Left)



Step 6a: Also tick the following boxes if appropriate

- Shoulder is raised
- Upper arm is abducted (away from the side of the body)
- Leaning or supporting the weight of the arm

Step 8: Locate Wrist Position (Left)



Step 8a: Also tick the following box if appropriate



- Is wrist bent away from midline?

Step 10: Arm & wrist - select the force and load that most reflects the working situation (Left)

- | | |
|--|--|
| <p>Score 0</p> <ul style="list-style-type: none"> • No resistance • Less than 2 kg intermittent load or force | <p>Score 1</p> <ul style="list-style-type: none"> • 2 - 10 kg intermittent load or force |
| <p>Score 2</p> <ul style="list-style-type: none"> • 2 - 10 kg static load • 2 - 10 kg repeated loads or forces • 10 kg or more, intermittent load or force | <p>Score 3</p> <ul style="list-style-type: none"> • More than 10 kg static load • 10+ kg repeated loads or forces • Shock or forces with rapid buildup |

Step 10a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

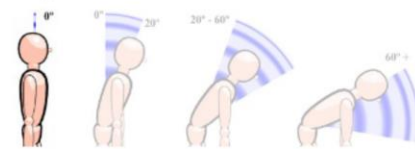
Step 11: Locate Neck Position



Step 10a: Also tick the following box if appropriate



Step 12: Locate Trunk Position

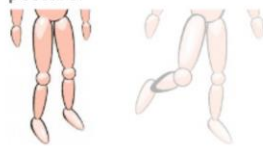


Step 12a: Also tick the following box if appropriate



Step 13: Legs

Legs and feet are well supported and in an evenly balanced posture.



Step 14: Neck, trunk & leg - select the force and load that most reflects the working situation

- Score 0**
 - No resistance
 - Less than 2 kg intermittent load or force
- Score 1**
 - 2 - 10 kg intermittent load or force
- Score 2**
 - 2 - 10 kg static load
 - 2 - 10 kg repeated loads or forces
 - 10 kg or more, intermittent load or force
- Score 3**
 - More than 10 kg static load
 - 10+ kg repeated loads or forces
 - Shock or forces with rapid buildup

Step 14a: Select this box if it reflects your muscle use

- **Score 1**
Posture is mainly static, e.g. held for longer than 1 minute or repeated more than 4 times per minute.

Table scores:

If you are familiar with the manual version of RULA, Table A and Table B values are indicated below.

Part A:

| | |
|---|----------|
| 1. Upper Arm (Right): | 4 |
| 2. Lower Arm (Right): | 1 |
| 3. Wrist (Right): | 2 |
| 4. Wrist Twist (Right): | 1 |
| 5. Muscle Use + Force/Load (Right): | 1 |
| 6. Upper Arm (Left): | 2 |
| 7. Lower Arm (Left): | 2 |
| 8. Wrist (Left): | 1 |
| 9. Wrist Twist (Left): | 1 |
| 10. Muscle Use + Force/Load (Left): | 1 |
| Posture Score - Right (Table A): | 4 |
| Posture Score - Left (Table A): | 3 |
| Final Arm & Wrist Score - Right: | 5 |
| Final Arm & Wrist Score - Left: | 4 |

Part B:

| | |
|---|----------|
| 11. Neck: | 1 |
| 12. Trunk: | 1 |
| 13. Leg: | 1 |
| 14. Muscle Use + Force/Load: | 3 |
| Posture Score (Table B): | 1 |
| Final Neck, Trunk & Leg Score: | 4 |

10.2. Annexure II: REBA analysis: Weeding 1



REBA Employee Assessment Worksheet

Permission granted by Dr Lynn McAnatomy to convert the paper based format to an Excel spreadsheet version.

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position

Step 2a Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs

Step 4: Look-up Posture Score in Table A
Using values from steps 1-3 above, locate score in Table A

Step 5: Add Force/Load Score
If Load < 5kgs: +0
If Load is 5 to 10kgs: +1
If load > 22lbs: +2
Adjust: If shock or rapid build up of force: add +1

Step 6: Score A, Find Row in Table C
Add values from steps 4 & 5 to obtain Score A.
Find row in Table C.

Scoring:

- 1 = Negligible risk
- 2 or 3 = low risk, change may be needed
- 4 to 7 = medium risk, further investigation, change soon
- 8 to 10 = high risk, investigate & implement change
- 11+ = very high risk, implement change

SCORES

Table A: Neck

| | | 1 | | | 2 | | | 3 | | | | | | |
|------------|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| Neck Score | Legs | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 5 | 3 | 3 | 5 | 6 |
| | Trunk Posture Score | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | |
| | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 | |

Table B: Arms and Wrist Analysis

| | | 1 | | | 2 | | | |
|-----------------|-------|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | |
| Upper Arm Score | Wrist | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| | 2 | 1 | 2 | 3 | 2 | 3 | 4 | |
| | 3 | 3 | 4 | 5 | 4 | 5 | 5 | |
| | 4 | 4 | 5 | 5 | 5 | 6 | 7 | |
| | 5 | 6 | 7 | 8 | 7 | 8 | 8 | |
| 6 | 7 | 8 | 8 | 8 | 9 | 9 | | |

Table C

| | | Score B, (table B value + coupling score) | | | | | | | | | | | |
|---|-----------|---|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Score A (score from table A + load/force score) | Leg Score | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 |
| | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| | 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 |
| | 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | 5 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | 9 |
| | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 |
| | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Score A: 7 + Table C Score: 8 = Activity Score: 2

Final REBA Score: 10

B: Arms and Wrist Analysis

Step 7: Locate Upper Arm Position:

Step 7a: Adjust...
If shoulder is raised: +1
If Upper Arm is abducted: +1
If arm is supported or leaning: -1

Step 8: Locate Lower Arm Position:

Step 9: Locate Wrist Position:

Step 9a: Adjust.....
If wrist is bent from midline or twisted: Add +1

Step 10: Look-up Posture Score in Table B:
Using values from steps 7-9 above, locate score in Table B

Step 11: Add Coupling Score

| | |
|---|--|
| Well fitted handles and mid range power grip, good: +0 | |
| Acceptable but not ideal hold or coupling acceptable with another body part, fair: +1 | |
| Hand hold not acceptable but possible, poor: +2 | |
| No handles, awkward, unsafe with any body part, Unacceptable: +3 | |

Step 12: Score B, Find column in Table C
Add values from steps 10 & 11 to obtain Score B

Step 13: Activity Score

- +1 1 or more body parts are held longer than a minute (static)
- +1 Repeated small range actions (more than 4x per minute)
- +1 Action causes rapid large range change in postures or unstable base

Task Name Weeding 1

Reviewer Subhadeep Banerjee

Date: 26-06-2022

Weeding 2:



REBA Employee Assessment Worksheet

Permission granted by Dr Lynn McAnatomary to convert the paper based format to an Excel spreadsheet version.

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position

Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs

Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, locate score in Table A

Step 5: Add Force/Load Score

If Load < 5kgs: +0
If Load is 5 to 10kgs +1
If load >22lbs +2
Adjust: If shock or rapid build up of force add +1

Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A.
Find row in Table C.

Scoring:
1 = Negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 10 = high risk, investigate & implement change
11+ = very high risk, implement change

SCORES

| Table A | | Neck | | | | | | | | | | | |
|---------|---------------------|------|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | 2 | | | | 3 | | | |
| 1 | Legs | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | Trunk Posture Score | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |

| Table B | | Lower Arm | | |
|---------|-----------------|-----------|---|---|
| | | 1 | 2 | |
| 2 | Wrist | 1 | 2 | 3 |
| | Upper Arm Score | 1 | 2 | 3 |
| | | 2 | 3 | 4 |
| | | 3 | 4 | 5 |
| | | 4 | 5 | 6 |
| | | 5 | 6 | 7 |

| Table C | | Score B, (table B value + coupling score) | | | | | | | | | | | |
|---|----|---|----|----|----|----|----|----|----|----|----|----|----|
| Score A (score from table A + load/force score) | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | |
| 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 | |
| 4 | 3 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | |
| 5 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | |
| 6 | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | |
| 7 | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | |
| 8 | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | |
| 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | |
| 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | |
| 11 | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | |

| Table C Score | | Activity Score | |
|---------------|---|----------------|---|
| 4 | + | 2 | = |
| | | 6 | |

Final REBA Score

B: Arms and Wrist Analysis

Step 7: Locate Uoer Arm Position:

Step 7a: Adjust...
If shoulder is raised: +1
If Upper Arm is abducted: +1
If arm is supported or leaning: -1

Step 8: Locate Lower Arm Position:

Step 9: Locate Wrist Position:

Step 9a: Adjust.....
If wrist is bent from midline or twisted: Add +1

Step 10: Look-up Posture Score in Table B:

Using values from steps 7-9 above, locate score in Table B

Step 11: Add Coupling Score

Well fitted handles and mid range power grip, good: +0
Acceptable but not ideal hold or coupling: fair: +1
acceptable with another body part, Hand hold not acceptable but possible: poor: +2
No handles, awkward, unsafe with any body part, Unacceptable: +3

Step 12: Score B, Find column in Table C

Add values from steps 10 & 11 to obtain Score B- Find Column in Table C and match with Score A in row from step 6 to obtain Table C score.

Step 13: Activity Score

+1.1 or more body parts are held longer than a minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range change in postures or unstable base

Task Name Weeding 2 Reviewer Subhadeep Banerjee Date: 26-06-2022

Weeding 3



REBA Employee Assessment Worksheet

Permission granted by Dr Lynn McAnatomary to convert the paper based format to an Excel spreadsheet version.

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position

Step 2a Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs

Step 4: Look-up Posture Score in Table A

Step 5: Add Force/Load Score

Step 6: Score A, Find Row in Table C

Scoring:
1 = Negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 10 = high risk, investigate & implement change
11+ = very high risk, implement change

SCORES

Table A: Neck

| | | 1 | | | 2 | | | 3 | | | | | | |
|------------|---------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| Neck Score | Legs | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| | Trunk Posture | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | Score | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 | |

Table B: Lower Arm

| | | 1 | | | 2 | | | |
|-----------------|-------|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | |
| Upper Arm Score | Wrist | 1 | 2 | 3 | 1 | 2 | 3 | |
| | Score | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| | | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| | | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | | 4 | 4 | 5 | 5 | 5 | 6 | 7 |
| | 5 | 6 | 7 | 8 | 7 | 8 | 8 | |
| | 6 | 7 | 8 | 8 | 8 | 9 | 9 | |

Table C: Score B, (table B value + coupling score)

| | | Score B, (table B value + coupling score) | | | | | | | | | | | | |
|---|-----------|---|----|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Score A (score from table A + load/force score) | Leg Score | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 7 |
| | | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| | | 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 9 |
| | | 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | | 5 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| | | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| | | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 11 | 11 |
| | | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 |
| | | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| | | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Table D: Activity Score

| | | Activity Score | | | | | | | | | | | | |
|---------|-----------------|----------------|----|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Score A | Posture Score A | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 7 |
| | | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| | | 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 9 |
| | | 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | | 5 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| | | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| | | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| | | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 11 | 11 |
| | | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 |
| | | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| | | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Final REBA Score: 2

B: Arms and Wrist Analysis

Step 7: Locate Upper Arm Position

Step 8: Locate Lower Arm Position

Step 9: Locate Wrist Position

Step 10: Look-up Posture Score in Table B

Step 11: Add Coupling Score

Step 12: Score B, Find column in Table C

Step 13: Activity Score

Task Name Weeding 3 Reviewer Subhadeep Banerjee Date: 26-06-2022

Rice farming 1:



REBA Employee Assessment Worksheet

Permission granted by Dr Lynn McAnatomary to convert the paper based format to an Excel spreadsheet version.

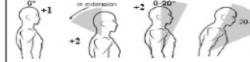
A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position



Step 1a Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position



Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs



Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, locate score in Table A

Step 5: Add Force/Load Score

If Load < 5kgs: +0
If Load is 5 to 10kgs +1
If load >22lbs +2
Adjust: If shock or rapid build up of force: add +1

Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A. Find row in Table C.

Scoring:

| |
|--|
| 1 = Negligible risk |
| 2 or 3 = low risk, change may be needed |
| 4 to 7 = medium risk, further investigation, change soon |
| 8 to 10 = high risk, investigate & implement change |
| 11+ = very high risk. Implement change |

| Table A | | Neck | | | | | | | | | | | | |
|-----------------|---------------------|------|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | 2 | | | | 3 | | | | |
| 3 Neck Score | Legs | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| | Trunk Posture Score | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 5 | 3 | 3 | 5 | 6 |
| | | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 | |

| Table B | | Lower Arm | | | | | | |
|------------------|-------|-----------|---|---|---|---|---|---|
| | | 1 | | | 2 | | | |
| 5 Trunk Score | Wrist | 1 | 2 | 1 | 2 | 3 | | |
| | | 1 | 1 | 2 | 1 | 2 | 3 | |
| | | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| | | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | | 4 | 4 | 5 | 5 | 6 | 7 | |
| | | 5 | 6 | 7 | 8 | 7 | 8 | 8 |
| | 6 | 7 | 8 | 8 | 8 | 9 | 9 | |

| Score A (score from table A + load/force score) | | Table C | | | | | | | | | | | |
|---|-----------|---|----|----|----|----|----|----|----|----|----|----|----|
| | | Score B, (table B value + coupling score) | | | | | | | | | | | |
| 9 Posture Score A | Leg Score | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| | | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 |
| | | 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 |
| | | 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 |
| | | 5 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 |
| | | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 |
| | | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| | | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| | | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| | | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 |
| | | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 |
| | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

| | | | |
|---------------|----|---|----------------|
| Score A | 10 | + | 2 |
| Table C Score | | | Activity Score |

12
Final REBA Score

B: Arms and Wrist Analysis

Step 7: Locate Uper Arm Position:

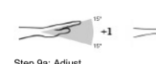


Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or leaning: -1

Step 8: Locate Lower Arm Position:



Step 9: Locate Wrist Position:



Step 9a: Adjust.....
If wrist is bent from midline or twisted: Add +1

Step 10: Look-up Posture Score in Table B:

Using values from steps 7-9 above, locate score in Table B

Step 11: Add Coupling Score

Well fitted handles and mid range power grip, good: +0
Acceptable but not ideal hold or coupling acceptable with another body part, fair: +1
Hand hold not acceptable but possible, poor: +2
No handles, awkward, unsafe with any body part, Unacceptable: +3

Step 12: Score B, Find column in Table C

Add values from steps 10 & 11 to obtain Score B. Find Column in Table C and match with Score A in row from step 6 to obtain Table C score.

Step 13: Activity Score

+1 1 or more body parts are held longer than a minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range change in postures or unstable base

Task Name Rice farming 1

Reviewer Subhadeep Banerjee

Date: 26-06-2022

Rice farming 2:



REBA Employee Assessment Worksheet

Permission granted by Dr Lynn McAnatomany to convert the paper based format to an Excel spreadsheet version.

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a Adjust...
If neck is twisted: +1
If neck is side bending: +1

NECK SCORE: 2

Table A

| | | Neck | | | | | | | | | | | | |
|---------------------|--|------|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | 2 | | | | 3 | | | | |
| Legs | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| Trunk Posture Score | | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 5 | 3 | 3 | 5 | 6 |
| | | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 |

Step 2: Locate Trunk Position

Step 2a Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

TRUNK SCORE: 1

Table B

| | | Lower Arm | | | | | | |
|-----------------|--|-----------|---|---|---|---|---|---|
| | | 1 | | | 2 | | | |
| Wrist | | 1 | 2 | 3 | 1 | 2 | 3 | |
| Upper Arm Score | | 2 | 1 | 2 | 2 | 1 | 2 | 3 |
| | | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | | 4 | 4 | 5 | 5 | 6 | 7 | 8 |
| | | 5 | 6 | 7 | 8 | 7 | 8 | 8 |
| | | 6 | 7 | 8 | 8 | 9 | 9 | 9 |

Step 3: Legs

Adjust: 30-60°: +1, 60-90°: +2

Leg Score: 2

Table C

| Score A (score from table A + load/force score) | Score B (table B value + coupling score) | | | | | | | | | | | |
|---|--|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| 3 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 7 | 8 | 8 |
| 4 | 3 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 |
| 5 | 4 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 |
| 6 | 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 |
| 7 | 7 | 7 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| 8 | 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 |
| 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 |
| 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, locate score in Table A

Posture Score A: 2

Step 5: Add Force/Load Score

If Load < 5kgs: +0
If Load is 5 to 10kgs: +1
If load > 22lbs: +2

Adjust: If shock or rapid build up of force: add +1

Force/Load Score: 0

Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A. Find row in Table C.

Score A: 2

Table C Score: 4

Activity Score: 2

Final REBA Score: 6

Scoring:

- 1 = Negligible risk
- 2 or 3 = low risk, change may be needed
- 4 to 7 = medium risk, further investigation, change soon
- 8 to 10 = high risk, investigate & implement change
- 11+ = very high risk, implement change

B: Arms and Wrist Analysis

Step 7: Locate Upper Arm Position:

Step 7a Adjust...
If shoulder is raised: +1
If Upper Arm is abducted: +1
If arm is supported or leaning: -1

UPPER ARM SCORE: 4

Step 8: Locate Lower Arm Position:

LOWER ARM SCORE: 1

Step 9: Locate Wrist Position:

Step 9a Adjust...
If wrist is bent from midline or twisted: Add +1

WRIST SCORE: 1

Step 10: Look-up Posture Score in Table B

Using values from steps 7-9 above, locate score in Table B

Posture Score B: 4

Step 11: Add Coupling Score

Well fitted handles and mid range power grip: good: +0
Acceptable but not ideal hold or coupling: fair: +1
Hand not acceptable but possible: poor: +2
No handles, awkward, unsafe with any body part: Unacceptable: +3

Coupling Score: 0

Step 12: Score B, Find column in Table C

Add values from steps 10 & 11 to obtain Score B. Find Column in Table C and match with Score A in row from step 6 to obtain Table C score.

Score B: 5

Step 13: Activity Score

+1 1 or more body parts are held longer than a minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range change in postures or unstable base

Task Name: Rice farming 2 Reviewer: Subhadeep Banerjee Date: 26-06-2022

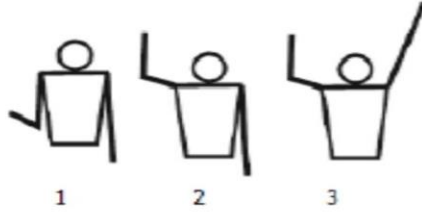
10.3. Annexure III: OWAS analysis:

Weeding 1

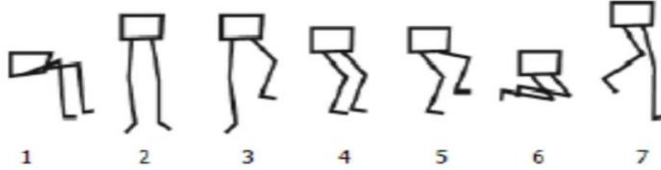




back posture
 1 – upright
 2 – leaning forward
 3 – flexuous
 4 – leaning forward and flexuous



forearms posture
 1 – both below elbow joint
 2 – one above elbow joint
 3 – both above elbow joint



legs work
 1 – sitting position
 2 – standing with legs upright
 3 – standing with one leg upright
 4 – standing with legs bent
 5 – standing with one leg bent
 6 – kneeling on one or both knees
 7 – walking



external load volume for men [kg]
 1 – below 10
 2 – within the range 10-20
 3 – above 20

| | | | |
|-------------------|------------------------|----------------|---------------------------|
| back posture code | forearms position code | legs work code | external load volume code |
|-------------------|------------------------|----------------|---------------------------|

| | |
|---------------------------|---|
| Back Posture Code | 2 |
| Forearms posture code | 1 |
| Legs work code | 4 |
| External load volume code | 1 |

| Back | Arms | Legs | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|---|---|
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | |
| | | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

INTERPRETATION OF THE RESULT

1 - No actions required

2 - Corrective actions required in the near future

3 - Corrective actions should be done as soon as possible

4 - Corrective actions for improvement required immediately

Final OWAS Score: 3

Weeding 2



back posture

1 – upright

2 – leaning forward

3 – flexuous

4 – leaning forward and flexuous

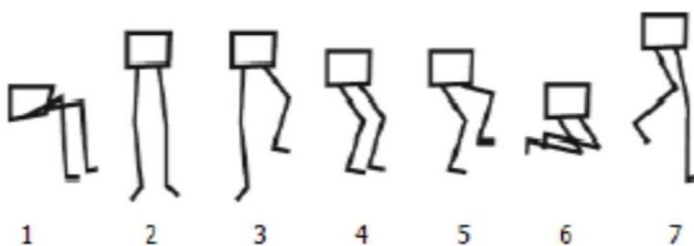


forearms posture

1 – both below elbow joint

2 – one above elbow joint

3 – both above elbow joint



legs work

1 – sitting position

2 – standing with legs upright

3 – standing with one leg upright

4 – standing with legs bent

5 – standing with one leg bent

6 – kneeling on one or both knees

7 – walking



external load volume for men [kg]

1 – below 10

2 – within the range 10-20

3 – above 20

| | | | |
|-------------------|------------------------|----------------|---------------------------|
| back posture code | forearms position code | legs work code | external load volume code |
|-------------------|------------------------|----------------|---------------------------|

| | |
|---------------------------|---|
| Back Posture Code | 2 |
| Forearms posture code | 1 |
| Legs work code | 7 |
| External load volume code | 1 |

| Back | Arms | Legs | | | | | | | | | | | | | | | | | | | | |
|------|------|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | |
| | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

INTERPRETATION OF THE RESULT

1 - No actions required

2 - Corrective actions required in the near future

3 - Corrective actions should be done as soon as possible

4 - Corrective actions for improvement required immediately

Final OWAS Score: 2

Weeding 3



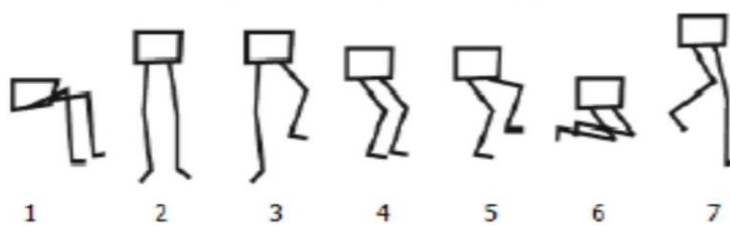
back posture

- 1 – upright
- 2 – leaning forward
- 3 – flexuous
- 4 – leaning forward and flexuous



forearms posture

- 1 – both below elbow joint
- 2 – one above elbow joint
- 3 – both above elbow joint



legs work

- 1 – sitting position
- 2 – standing with legs upright
- 3 – standing with one leg upright
- 4 – standing with legs bent
- 5 – standing with one leg bent
- 6 – kneeling on one or both knees
- 7 – walking



external load volume for men [kg]

- 1 – below 10
- 2 – within the range 10-20
- 3 – above 20

| | | | |
|-------------------|------------------------|----------------|---------------------------|
| back posture code | forearms position code | legs work code | external load volume code |
|-------------------|------------------------|----------------|---------------------------|

| | |
|---------------------------|---|
| Back Posture Code | 1 |
| Forearms posture code | 1 |
| Legs work code | 2 |
| External load volume code | 1 |

| Back | Arms | Legs | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | |
| | | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load | Load |
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

INTERPRETATION OF THE RESULT

1 - No actions required

2 - Corrective actions required in the near future

3 - Corrective actions should be done as soon as possible

4 - Corrective actions for improvement required immediately

Final OWAS Score: 1

Rice farming 1



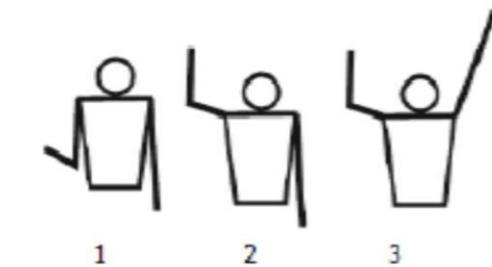
back posture

1 – upright

2 – leaning forward

3 – flexuous

4 – leaning forward and flexuous

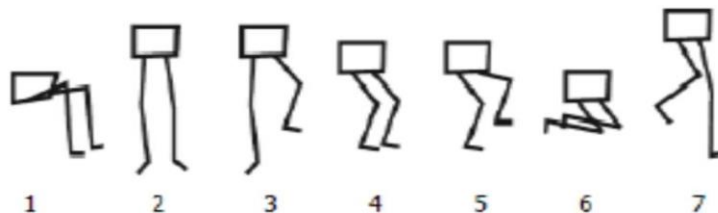


forearms posture

1 – both below elbow joint

2 – one above elbow joint

3 – both above elbow joint



legs work

1 – sitting position

2 – standing with legs upright

3 – standing with one leg upright

4 – standing with legs bent

5 – standing with one leg bent

6 – kneeling on one or both knees

7 – walking



external load volume for men [kg]

1 – below 10

2 – within the range 10-20

3 – above 20

| back posture code | forearms position code | legs work code | external load volume code |
|----------------------|---------------------------|-------------------|---------------------------------|
|----------------------|---------------------------|-------------------|---------------------------------|

| | |
|---------------------------|---|
| Back Posture Code | 4 |
| Forearms posture code | 2 |
| Legs work code | 4 |
| External load volume code | 1 |

| Back | Arms | Legs | | | | | | | | | | | | | | | | | | | | |
|------|------|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | |
| | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | |
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

INTERPRETATION OF THE RESULT

1 - No actions required

2 - Corrective actions required in the near future

3 - Corrective actions should be done as soon as possible

4 - Corrective actions for improvement required immediately

Final OWAS Score: 4

Rice farming 2



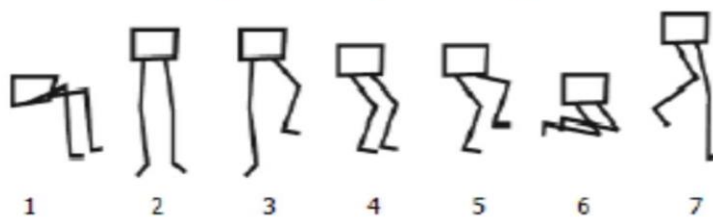
back posture

- 1 – upright
- 2 – leaning forward
- 3 – flexuous
- 4 – leaning forward and flexuous



forearms posture

- 1 – both below elbow joint
- 2 – one above elbow joint
- 3 – both above elbow joint



legs work

- 1 – sitting position
- 2 – standing with legs upright
- 3 – standing with one leg upright
- 4 – standing with legs bent
- 5 – standing with one leg bent
- 6 – kneeling on one or both knees
- 7 – walking



external load volume for men [kg]

- 1 – below 10
- 2 – within the range 10-20
- 3 – above 20

| back posture code | forearms position code | legs work code | external load volume code |
|----------------------|---------------------------|-------------------|---------------------------------|
|----------------------|---------------------------|-------------------|---------------------------------|

| | |
|---------------------------|---|
| Back Posture Code | 1 |
| Forearms posture code | 1 |
| Legs work code | 7 |
| External load volume code | 1 |

| Back | Arms | Legs | | | | | | | | | | | | | | | | | | | | |
|------|------|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | |
| | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | | Load | | |
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
| | 3 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| 4 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 2 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |
| | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |

INTERPRETATION OF THE RESULT

1 - No actions required

2 - Corrective actions required in the near future

3 - Corrective actions should be done as soon as possible

4 - Corrective actions for improvement required immediately

Final OWAS Score: 1

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