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Study and Justification of Body Postures of Workers Working In SSI by Using Reba

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Abstract*— An efficient and effective system, which is the base of a productive system, depends on the manner of service delivery by human operators. Important aspect is an ergonomics in order to improve performance of workers at work, develop an independent measure at work which will coordinate psychological, physical, and physiological aspects that is dependable for person behavior and effectiveness at work and stand as a key factor deciding workers efficiency. This paper center of attention on the ergonomics thought required to be governed in the small scale industries (SSIs), a precise case of Cultivators and Harvestor manufacturing unit is considered, which is different from all these aspects. mainly, an important & large component 'turn table' is consider for analyzing the ergonomic manufacturing methods. The crack between ergonomic considerations and actual practices at the place of work gives the standpoint to design the workstation. The data of musculoskeletal disorder of employee working at workplace of Cultivators and Harvestor manufacturing unit is collected, analyzed and justified by using REBA.

Index Terms*—— Ergonomic, Small Scale industries (SSIs), Cultivators and Harvestor, musculoskeletal disorders, REBA etc.

I. INTRODUCTION

Ergonomics enhances human performance including the health, safety and productivity of workers. The International Ergonomics Association (IEA) defines ergonomics as; the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. In the current market scenario, cost fall technique is on stage significant role to meet the competition in the market. Drop weight, ease in design and appliance of industrial engineering etc. are the basis of the techniques which are used. Different sizes components or products used in rural areas are regularly manufactured in small scale industries such as farming machinery, thrashers, Cultivators and Harvestor etc. It has been practical that these rural products are not correctly designed. These products are by and big manufactured as per need, by trial and error methods of manufacturing. These products are receiving improved by means of opinion of failure as and when it occurs. Large industrial sectors have not up till now entered in manufacturing of these products; hence no major development in design of rural product has been completed so far. Thus most of rural products are manufactured without ease of use of design. Cultivators and Harvestor are manufactured in small to moderate scale industries. Though Cultivators and Harvestor are manufactured of various capacities by various industries, still there is a huge deviation in manufacturing methods, part designs etc.

The ergonomics is the key importance in design of work place, series of production, well working environment, working method, security at work, personal security etc. which will as a result helps in falling fatigue, stress and human strain, strength (internal capacity), humanizing efficiency, overview of work, progress in the quality of services and product, integration of safety, establishing a healthy culture work, etc. It has been observed that while manufacturing the goods rural industries do not take into account the ergonomic method of manufacturing it.

Padma Agro Industries. MIDC Wardha is one of the leading manufacturers of Cultivators and Harvestor driven agricultural implements in the central India. The manufacturing operation consists of turning, cutting and drilling various steel sections by machining process at different workstations. The existing plant layout is the combination of various process, product and fixed layout governed for different phases of manufacturing of Cultivators. Machining is the main process which contributes a major part of total manufacturing of the product. Machining workstation at fixed layout are observed and noted and found that there is scope of improvement as regard the ergonomics and industrial engineering aspects are concerned for Machining.

Machining in the industry is done on standing posture as the fixture used for Machining is placed on the ground. Continuously worker has to stand on that posture and has to perform Machining of turn table. It is observed and found that due to continuous standing posture worker get fatigued frequently and musculoskeletal problems are identified in them which is then justified by using REBA.

The workers are doing work mainly in standing and forward bending postures they are found out with the more problems of MSDs as compared to those who are doing the same work in kneeling posture. The data is analyzed as per the occupational experience of the workers. The number of sites of musculoskeletal pain has increased with the increase in length of experience.

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It is found that with the increase in length of experience of work that is with the increase in years of working the site of pain is increasing and it can be reduced by evaluation of existing posture and with the change of suitable posture. The problems in the standing postures are less as compared to the existing postures which they are following currently in the industry. Due to large size of machining table and continuous rotating of machining table severe problem of shoulder may occur and because of it worker might not work properly for long years and will might not lift weight in future.

II. LITERATURE SURVEY

Performing jobs in prolonged standing has contributed numerous health effects such as work-related musculoskeletal disorders, chronic venous insufficiency, preterm birth and spontaneous abortion, and carotid atherosclerosis. However, those injuries can be minimized through application of engineering and administrative controls [1]. Unawareness about ergonomics is observed in industry in which work is undertaken. Musculoskeletal disorders are there in the welding process where workers are working in kneeling posture and it shows that there is need to change the body postures [2]. The application of ergonomic principles would help to increase machine performance and productivity, but mostly help human operator to be comfortable and secure [3]. Musculoskeletal disorders (MSDs) are common health problem throughout the world. Work related musculoskeletal disorders are group of painful disorders of muscles, tendons and nerves, recommended the awareness and proper ergonomics training to the workers [4]. Discomfort increased with the progress of the day and was highest at the end of a shift; subject age had no effect on patient tendency to experience discomfort levels [5]. That an ergonomic workstation design can contribute significantly to improve physiological performance of the operators [6]. Workers work under tough conditions to perform the desired task. These tough conditions normally give rise to various musculoskeletal disorders within the workers. These disorders emerge within the workers body due to repetitive lifting, differential lifting height, ambient conditions etc [7]. Ergonomics related to the design of methods and processes can help eliminate or decrease work related risks as well as improve the company's quality and productivity [8]. The importance of ergonomics in product design, working environment, and its influence in industrial workstation design, the interdisciplinary nature of ergonomics and the implications of ergonomics in industrial engineering function [9]. A significant proportion of the workers are working in very bad postures. The study recommended proposed that there is dire need of implementation of ergonomics intervention with proper awareness among worker [10]. The study revealed that there had been several gaps in work environment, tools and equipment that affect the health and safety of workers at the work site [11].

III. REBA

REBA (Rapid Entire Body Assessment) was developed by Hignett S. and McAtamney, REBA is a quick and easy to use observational postural analysis tool for whole body activities and giving a musculoskeletal risk action level. The method is similar to RULA tool where the assessor assigns scores to postures and body alignment based on body part diagram. Load, Force and coupling scores are added to calculation for the body and then final score for both groups are summated to form the final action score.

Tables 1 Analysis of REBA

REBA Score	Risk Level	Action
1	Negligible	Corrective action including further assessment is **not necessary**
2 – 3	Low	Corrective action including further assessment **may be necessary**
4 - 7	Medium	Corrective action including further assessment is **necessary**
8 - 10	High	Corrective action including further assessment is **necessary soon**
11 - 15	Very High	Corrective action including further assessment is **necessary now**

A. Data Collection Procedures

1. Observe the entire task to become familiar with the postures and work practices.
2. A part of the task is identified that includes postures to assess.
3. Score the postures and forces on the diagrams of the REBA worksheet for each body part in chosen postures.
4. Scores can be put into a table by following the instruction on the score sheet.
5. Intervention, action levels, or the types of investigation needed will be determined by the final score.

B. Procedure

REBA was proposed by Hignett and McAtamney as a means to assess posture for risk of work related musculoskeletal disorders (WRMSDs).

Select the observed posture range number for the Trunk, Neck and Legs and record them in the boxes labeled A in the score sheet. Using scores of trunk, leg and neck, locate score from Table A and add load/force score.

Similarly, score the Upper Arms, Lower Arms, and Wrists. Table B score and the Coupling score for each hand and involved and enter the scores in the B boxes.

C. Reba Score For The Justification Of Work

After investigating the MSD's through the questionnaire in the industry, it has been observed that there is need of investigation. So with the help of REBA the postures are evaluated for finding the severity of the problem. Below figure shows the pictures of workers use angles are evaluated by graphical method and which are evaluated through REBA, The goals of the method are to be sensitive to musculoskeletal disorders for different body regions. Similar to RULA, the REBA method divides the body into two segments. Group A includes the trunk, neck and legs. Group B consists of the upper arms, lower arms and wrists. Each part is given a score based on pre-determined flexion and extension degrees. The working postures of the workers and the angle at which they are working are recorded by taking photographs. Graphs are made on the photograph to find the angle of posture so that it can be evaluated through REBA.

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Fig. 1.Trunk, Neck and Legs Angle

Movement	Score	Change Score	Posture	Score
Trunk				Trunk Score
Upright	1	If back is twisted or tilted to side: +1		
Flexion 0-20° Extension 0-20°	2			
Flexion 20°-60° Extension >20°	3			
Flexion >60°	4			
Neck		If neck is twisted or tilted to side: +1		Neck Score
Flexion 0-20°	1			
Flexion > 20° Extension				
Legs				Leg Score
Bilateral weight bearing, walking, sitting	1	Knees flexion 30°-60° +1		
Unilateral weight bearing, unstable	2	Knees flexion > 60°		

Fig. 2.Upper Arms, Lower Arms and Wrists Angle

Movement	Score	Change Score		Total Score
Upper Arms				L R
20° flexion to 20° extension	1	Arm abducted/rotated + 1		
Flexion 20° – 45° Extension >20°	2	Shoulder raised +1 Arm supported -1		
Flexion 45° - 90°	3			
Flexion >90°	4			
Lower Arms		No Adjustments		L R
Flexion 60°-100°	1			
Flexion< 60° Flexion > 100°				
Wrists				L R
Flexion 0-15° Extension 0-15°	1	Wrists deviated/twisted +1		
Flexion >15° Extension >15°	2			

From fig. 1 & 2, it can be observed the Upper arm, Lower arm and wrist of the workers posture and by selecting the related position of the model in the worksheet of the database of REBA the score of '5' has obtained. While working the shoulder get raised and arm get abducted so the final score of upper arm is '3'. In the same way for lower arm, by selecting the model score of '2' has been obtained and as the arm is working across midline of the body and while working worker has to move the arm out to the side of the body, it will get grand score of the lower arm is '2'. While working the wrist bent from the midline machining can be any type, here it is of continuous type so for this type of machining some of the time wrist has to be bend so the wrist twist position score is '2'. After getting these three scores, to find score of posture B, table B has to be used in that the upper arm score '3' and in that lower arm score '2' wrist position score '2' has to be observed this will give the score '5' for posture B which will be further get added to coupling score for final score of Posture B. Coupling score of '1' has been found as the posture there is mainly static and the Machining action is repetitive. And the load of Machining wheel is of around 4 kg and is again static and repetitive so it gives the score of '1'.After this score of posture B '1' is added to Upper arm, Lower arm and wrist and coupling the grand score of Posture B is '6'

Fig. 3 Trunk Angle and Neck Angle

Fig. 4 Trunk Bending Angle

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From above figure 3 & 4, we can observe the neck angle of the posture of the worker and related to that the model from worksheet is selected and it gives the score '2'. Now the neck twist that is any movement of neck on either side of the body, in continuous machining operation neck has to twist till the end of the machining length. Figure 4 shows that the worker is bending on his side while working.

From figure 4, it can be observed the trunk and neck angel of the workers posture and by selecting the related position of the model in the worksheet of the database of REBA the score of '2' has obtained. The worker works on both of their legs so it gives score for limb as '2' the final score for trunk as '5'. The worker works on both of their legs so it gives score for limb as '1'. So by using table B for neck, trunk and leg as for Posture A we find the score of Posture A and it is '5'. This score is than will be added to the Load/Force to get grand score for Posture A. The Load/Force score is '2' as work is mainly static and it is repetitive and So the grand score for the Posture A by adding '5' to '2' is '7'. Figure 5 shows the worksheet of employee assessment with REBA which can be used to assess directly the REBA score and seriousness of the problem.

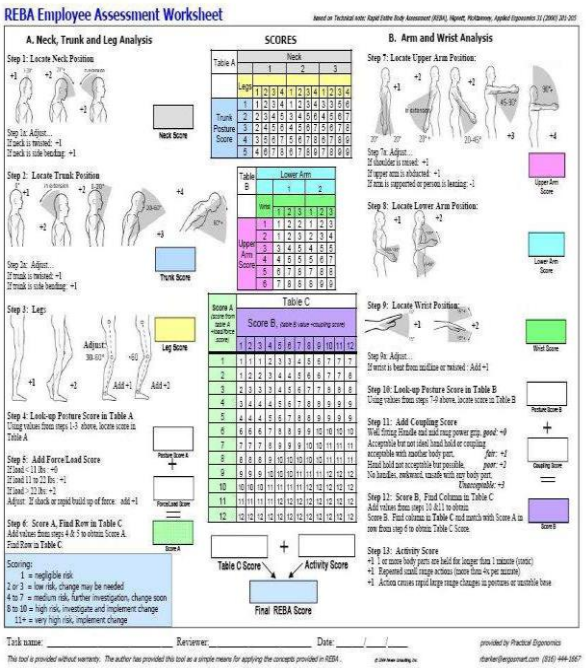
IV. RESULTS

At present the grand score of Posture A and Posture B is used to find the Final result of investigation that is Score C after looking in table C for final result the score of posture A '7' in row and of posture B '6' in column is observed and it gives the result final score C as '9'. This score is than will be added to the Activity to get grand score (REBA Score) is '11'. This score lies in Very High risk level which means the workstation has to be Corrective action including further assessment is NECESSARY NOW.

V. CONCLUSION

In the manufacturing process where workers are working in standing posture lack of knowledge regarding ergonomics is studied and analyzed in industry in which work is carried out. Musculoskeletal disorders are found and it shows that there is need to modify the existing body postures. Mostly in some of the site of the upper body section the extremity of pain is more and cause of rigorous trouble to worker in the outlook which they do not understand and sense now. It is justified through REBA which gives score of '11' which lies in Very High Risk Level. Evaluation of postures. REBA analysis showed that there is a corrective action including further assessment is necessary now.

VI. APPENDIX



SOURCE [12]: HIGNETT S AND MCATAMNEY L (2000). RAPID ENTIRE BODY ASSESSMENT (REBA). APPLIED ERGONOMICS.

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