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A Literature Review On MSDs Using Ergonomic Body Assessment Tools: RULA And REBA

Engineering

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ABSTRACT

Work related Musculoskeletal disorders (MSDs) is the most common problem occurring in the Manual Material Handling (MMH) industries and effected the body muscles of the workers. Activities having risk of musculoskeletal disorders are linked to the on-site worker productivity. Work MSDs is one of the most typical problems occurring in the industries and has significantly affected the body parts. This is caused by the unawareness about proper working methods by the worker. In order to assessing these MSDs, RULA and REBA tools are used to calculate the risk associated with the activities. This assessment is helpful in improving worker knowledge in ergonomic applications and their safety measures. In this paper, the past studies done on the assessment of musculoskeletal disorders using these tools, procedure involved in scoring risk factors and evolved with conclusion that MSDs is a area of concern in industries has been discussed.

1. Introduction And Background:

1.1 RULA (Rapid Upper Limb Assessment)

Rapid Upper Limb Assessment (RULA) is a survey method developed for use in ergonomic investigations of workplaces where work related upper limb disorders are reported. RULA is a screening tool that assesses biomechanical and postural loading on the whole body with particular attention to the neck, trunk and upper limbs. McAtamney and Corlett (1993) introduce RULA, or Rapid Upper Limb Assessment. It is designed to assess operators who may be exposed to musculoskeletal loading which is known to contribute to upper limb disorders. RULA fulfils the role of providing 'a method for screening a large number of operators quickly, but the scoring system developed also provides an indication of the level of loading experienced by the individual body parts. RULA is used without the need for any equipment and, after training in its use, has proved a reliable tool for use by those whose job it is to undertake workplace assessments. It can be used as a screening tool or incorporated into a wider & ergonomics assessment of epidemiological, physical, mental, environmental and organizational factors.

1.2 REBA (Rapid Entire Body Assessment)

The basic idea of REBA is similar to that of RULA: positions of individual body segments will be observed and the more there is deviation from the neutral posture the higher will the score of each body part be. REBA has been developed to fill a perceived need for a practitioner's field tool, specifically designed to be sensitive to the type of unpredictable working postures found in health care and other service industries. Hignett and McAtamney (2000) introduce REBA and stated that it is used to assess posture for risk of work- related musculoskeletal disorders (WRMSDs). REBA is a sensitive tool for musculoskeletal risks by classifying the bodies to the parts (wrist, upper arm, lower arm, neck, trunk, and legs). REBA is useful for manual tasks risk assessment. REBA proposes the prioritization for corrective measures according to risk assessment and risk level. But some limitations, shortages and disadvantages of REBA are: REBA does not provide an integrated assessment of biomechanical risk factors; REBA cannot steer to the effective controls as the function of severity of various risk factors present in different tasks or jobs.

2. Need And Use Of RULA And REBA Tools:

These working posture risk assessment tools are used to determine the risk of musculoskeletal disorders like pain in joints, ligaments or muscles. This pain is due to unfavorable working posture.

The uses of these methods lead to:

- Know which posture has high risk.
- Increase efficiency and productivity.
- Less painful work and less injuries and ultimately to safe and healthy workers.

These working posture risk assessment tools are the first step towards risk reduction and preventions. After this step necessary action should take place to change the posture. RULA (Rapid Upper Limb Assessment) provide a quick assessment on the musculoskeletal system i.e. on neck, trunk and upper limb. REBA (Rapid Entire Body Assessment) is sensitive to musculoskeletal risk in variety of task i.e. assessment of working postures in health care and service industries. It concentrates on upper arm, lower arms, wrists, trunk, neck and legs.

3. Working Procedure Of RULA And REBA:

3.1. RULA: RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks/on the neck, trunk and upper eternities. In this tool a single page worksheet is used to evaluate required body posture, force and repetition.

The evaluated scores are entered for each body segment in section A for arm and wrist and section B for neck and trunk. When the data for each region is collected and scored, then tables are used to compile the risk factor variables.

Score that represents the level of MSD risk is listed below:

SCORE	LEVEL OF MSD RISK
1-2	Negligible risk, no action required
3-4	Low risk, change may be needed
5-6	Medium risk, further investigation change soon
6+	Very high risk, implement change now.
Source: www.ergo-plus.com	

In RULA ergonomic assessment the workers interview should be taken for understanding of job tasks and demands and also workers movements and postures should be observe during work. Selection of the posture should be based on:

- Most difficult postures and work tasks.
- The posture which sustained for longest time.
- Posture which has highest force load.

RULA is quick method, so multiple positions & tasks within the work cycle can usually be evaluated without much time & effort. But only the right or left side is assessed at a time.

3.2 REBA: REBA ergonomics assessment tools uses a systematic process to evaluate whole body postural MSD. Here also a single page worksheet is used to evaluate selected body posture, force-

ful excretion, type of movement or action, repetition and coupling. For this assessment you need only worksheet and a pen. Using this worksheet the evaluator will assign a score for different body region: Wrist, Forearms, Elbows, Shoulders, Neck, Trunk, Back, Legs and Knees. After data collected and scored. Then tables are used to compile risk factor variables.

Score that represent the level of MSD risk:

SCORE	LEVEL OF MSD RISK
1	Negligible risk, no action required
2-3	Low risk, change may be needed
4-7	Medium risk, further investigation change soon
8-10	High risk, investigate and implement change
11+ Very high risk, implement change now.	
Source: www.ergo-plus.com	

For REBA ergonomic assessment the evaluator should prepare for the assessment by interviewing the work. To gain information of the job tasks and demands and also observing the workers movements and postures during work cycle. Selection of the posture should be based on:

- Most difficult postures and work tasks.
- The posture which sustained for longest time.
- Posture which has highest force load.

Here also multiple positions and tasks can usual be evaluated without significant time. Here also only right and left side is assessed at a time.

4. Literature Survey:

Lynn McAanncy and E. Nigel Corlett (1993) [1] proposed a method called RULA which is designed to assess operators who may be exposed to musculoskeletal loading. This method is used to screening a large number of operators quickly. It is used without the need of any equipment and it is a reliable tool. Sue Hignett and Lynn McAtanncy (2000) [2] proposed a method REBA which is another postural analysis tool. This tool is found to be sensitive to the type of unpredictable working posture in health care and other service industries. This is a time consuming method. The user has to observe the worst posture and time aspect not consider. Ira L. Janowitz et al. (2006) [3] measure the physical demands of work in hospital setting. For this they use Rapid Entire Body Assessment (REBA). As a result the inter-rater reliability Kappa was 0.54 for upper body and 0.66 for lower body. Kee D. and Karwowski W. (2007) [4] made a comparison of three observational techniques for assessing postural loads in industry. For this study OWAS, RULA and REBA are taken as observational techniques. In this 301 working postures are observed. And they found that the inter-method reliability for postural load between OWAS and RULA was 29.2% and between RULA and REBA was 48.2%. These result showed that compared to RULA, OWAS and REBA generally underestimated postural loads for the analyzed postures, irrespective of industry, work type and whether or not the body is balanced. Pascual SA and Naqvi S. (2008) [5] did an investigation of ergonomics analysis tool used in industry in the identification of work related musculoskeletal disorders for this web-based survey absent to Canadian certified ergonomists, Joint Health and Safety Committee (JHSCs) and health and safety certification trainees to understand better which ergonomic analysis tool were used in the industry. The result showed that most of the certified ergonomists used the snook/Mital tables, the National Institute of occupational Safety and Health (NIOSH) equation and RULA/REBA. The survey for the health and safety certification trainers receivable that most curricula did not include ergonomics analysis tools. T. Jones & S. Kumar (2008) [6] made a comparison of ergonomic risk assessment output in a repetitive saw-mill occupation: trim-saw operator. Here 29 subjects are examined from saw-mill occupation to see at what physical risk they were. The aim of this study is to compare the output of RULA, REBA. ACGIH LTV, strain index and OCRA ergonomics risk assessment method; examine the assessment ability to difference between facilities reporting meaningful difference incidence rates, examine the effect of varying the definition of the end range posture and excretion required on risk assessment scores. This result's that the risk evaluate output assigned by all methods were not sensation suggesting interpretation of risk index and components of all methodology were sensitive to worker technique and facility assessed. The significant effect of posture and excretion variable definition suggests definitions taken to be interchangeable by work site evaluators are not equivalent. Mukhopadhyay P. and Srivastava S. (2010) [7] evaluating ergonomic risk factors in non-regulated stone carving units of Jaipur. For this 25 male workers were selected in each of three sections of a stone carving unit. Still photography and video photography was used to record different activities. Here RULA, REBA, Occupational Repetitive Action Index (OCRA) were used. Psychophysical measures were investigated by body part discomfort map, rated perceived exertion scale and visual analogue scale. Objective measurements (heart rate and skin temperature) were recorded with stop watch and digital thermometer. It is found that the working heart rate after 30 minutes of work was 112.4 beats/min and categorizing the work as moderately heavy. The REBA indicated high score (13/13) and analysis by RULA showed high score (7/7). These indicate vulnerability of many of the postures to musculoskeletal disorder and injury. Gentzler M. and Stader S. (2010) [8] studied the posture stress on firefighters and emergency medical technicians (EMTs) associated with repetitive reaching, bending, lifting and pulling task. These ergonomic evaluations analyze threat of musculoskeletal injuries primarily due to awkward and extreme postures across two-post fire tasks and a patient care task. The ergonomic tools used for evaluations are National Institute of occupational Safety Health (NIOSH) Lifting Equation, RULA, REBA and Anthropometric measurements of equipment and persons. Very high risks were found for lifting the hose above the shoulder to drain it of excess water and of rolling the hose on the ground. Extreme risks were found for lifting the hose from chest height to above the shoulders during hose drainage. High risk was found for EMT patient care tasks that require reaching for overhead equipment or sorted tasks that require horizontal bending and twisting. R. Bhattacharya and G. Biswas (2011) [9] studied the assessment of working postures and associated health status of construction workers. This is a survey on working postures and occupational health hazards of masonry workers is conducted to highlight the risk factors related to construction activities. 84% of the workers have experienced musculoskeletal related problems after daylong hard work. Out of six frequent observed postures, five are found harmful and fall in action category. (AC)>2. It is noted that the workers belong to the age group (25-33) years with working experience less than 5 years have no complain regarding their job related health problems. Intensity of pain in different parts of body of 47.62% workers fall in the range moderate to high in Body Part Discomfort (BPD Scale). The estimate risk using OQAS differ from the REBA in all activities except one posture (P2). The most harmful postures found for jobs are bending of back, kneeling of legs, raising of shoulders and twisting of wrist involved. Marie-Eve Chiasson et al. (2012) [10] compare the results of eight methods used to evaluate risk factors associated with musculoskeletal disorders. In this study, Quick Exposure Check (QEC), the Ergonomic Workplace Analysis developed by Finnish Institute of Occupational Health (FIOH), ACGIH's Hand Activity level threshold limit values method (HAL), the Job Strain Index (JSI), the OCRA Index, the EN 1005-3 standard, RULA, REBA method were used to assess 224 workstation involving 567 tasks in various industries. The results are compared in 3 risk categories (low, moderate, high). The EN 1005-3 standard assessing risk to shoulder was the most conservative and over 86% of work stations are at high risk. The HAL classified 37% of the workstation as low risk to hand and wrist compared to JSI with 9%. Correlation was highest between RULA and REBA and between JSI and HAL. QEC indentifying 35% of workstations as high risk, compares to RULA with 76%. The QEC hand/wrist and OCRA hand/wrist/elbow showed similar results for the number of workstations with high risk. This information is useful when choosing a method prior to an ergonomic intervention in industry. F. Abouelkhair and S. Deprey

(2012) [11] studied the assessing shoulder posture ergonomic thanks to a finite element analysis. This study RULA assessment is used. According to which, the first posture (45° abduction) is less painful than the second and third postures (90° loaded abduction and hand breaking). The maximum stresses on the glenoid surface obtained in this study are in accordance with literature data found values for 48 to 58 MPa for a prosthetic shoulder during a 90° abduction. This study is a preliminary step towards determination of biomechanical parameters associate with shoulder posture hardness and discomfort. The novelty of this study is the use of FE method which has rarely been applied in discomfort investigation. Adila Md Hashim et al. (2012) [12] studied the ergonomic evaluation of postural stress in school workshop. The objective of this study is to compare the evaluating of postural analysis between a self report questionnaire and physical assessment method for students 13 to 15 years old in school workshop. For this study 336 students were examined to fill in the questionnaire and being observed in the workshop. 104 positions were selected and analyzed while students performing their tasks. The questionnaire date was examined to specify the prevalence of postural stress symptoms. The relationship of postural stress b physical assessment methods (RULA and REBA methods) was defined to identify the risk level of students working positive result, it shows that the 13 year old student were faced higher posture problems while using the workstation. The obtained results from physical assessment method and questionnaire analysis have identified 13 year old student aced higher risk exposure. The results also shows that an intervention is needed to overcome the posture problems. Shanahan CJ et al. (2013) [13] made a comparison of RULA, REBA and Strain Index to four psychological scale in the assessment of non fixed work. For this comparison to four occupationally relevant Borg to psychological scales: Lifting Effort, Grasping effort, wrist discomfort and low back discomfort are done. From this study, it was found that perceived Grasping Effort and Wrist Discomfort Scales differentiated between the WMSD risks associated with rod working tasks and SI was found to be more effective than RULA and REBA in assessment of non fixed work WMSD risks. Nicolas Viganis et al. (2013) [14] studied that the innovative system for real time ergonomic feedback in industrial manufacturing. This study presents a system that permits real time ergonomics assessment of manual tasks in an industrial environment. First of all the biomechanical model of the upper body has been developed by using inertial sensor placed at different parts of upper body. Based on this model a computerized RULA ergonomics assessment was implemented to permit a glob risk assessment of musculoskeletal disorders in real time. Then local score were calculated per segment, and gave information on the local risks for musculoskeletal disorders, visual information was feedback to the user by using a seethrough head mounted display. In a user study (N=12 participants) a group with the RULA feedback was compared to a control group. Results demonstrate that the real time ergonomics feedback significantly decreased risk of MSDs at global and segmental levels. The real time ergonomics tool presented in this study could be used to directly reduce the risk of MSDs in industry and to optimize the long term performance of workers.

5. Conclusion:

From the past study we found that there is lack of knowledge among workers regarding ergonomic awareness in industries. Due to this problem musculoskeletal disorders are observed in various activities. It is concluded that RULA and REBA tools are applied to assess body postures in activities having high score. Thus the workers who are working under such conditions have suffered from musculoskeletal disorders. So, finally it has been observed that most of the industries do not have any safety equipments and policies. So in order to avoid musculoskeletal disorders, industries should focus on area generating work related problems.

REFERENCE

[1] Lynn McAtamney and E Nigel Corlett, 1993. RULA: a survey method for the investigation of world-related upper limb disorders. Applied Ergonomics, 24(2):91-99. | [2] Sue Hignett and Lynn McAtamney, 2000. Rapid Entire Body Assessment (REBA). Applied Ergonomics, 31(2):201-205. | [3] Ira L. Janowitz, Marion Gillen, Greg Ryan, David Rempel, Laura Trupin, Louise Swig, Kathleen Mullen, Reiner Rugulies, Paul D. Blanc, 2006. Measuring the physical demands of work in hospital settings: Design and implementation of an ergonomics assessment. Applied Ergonomics, 37(5):641-658. | [4] Kee D and Karwowski W, 2007. A comparison of three observational techniques for assessing postural loads in industry. Int J Occup Saf Ergon, 13(1):3-14. | [5] Pascual SA and Naqvi S, 2008. An investigation of ergonomics analysis tools used in industry in the identification of work-related musculoskeletal disorders. Int J Occup Saf Ergon, 14(2):237-45. | [6] T. Jones and S. Kumar, 2008. Comparisons of ergonomic risk assessment output in a repetitive sawmill occupation: trim-saw operator. Work, 31(4):367-76. | [7] Mukhopadhyay P and Srivastava S, 2010. Evaluating ergonomic risk factors in non-regulated stone carving units of Jaipur. Work,35(1):87-99. | [8] Gentzler M and Stader S, 2010. Posture stress on firefighters and emergency medical technicians (EMTs) associated with repetitive reaching, bending, lifting, and pulling tasks. Work, 37(3):227-39. | [9] R. Bhattacharya and G. Biswas, 2011. Assessment of Working Postures and Associated Health Status of Construction Workers. Sci. & Cult. 77 (1–2):52–57. | [10] Marie-Ève Chiasson, Daniel Imbeau, Karine Aubry, Alain Delisle, 2012. Comparing the results of eight methods used to evaluate risk factors associated with musculoskeletal disorders. International Journal of Industrial Ergonomics, 42(5):478-488. | [11] F. Abouelkhair and S. Duprey, 2012. Assessing shoulder posture ergonomy thanks to a finite element analysis. Computer Methods in Biomechanics and Biomedical Engineering, 15(S1):348–349. | [12] Adila Md Hashim, Siti Zawiah Md Dawal , Nukman Yusoff, 2012. Ergonomic evaluation of postural stress in school workshop. Work, 41:827-831. | [13] Shanahan CJ, Vi P, Salas EA, Reider VL, Hochman LM, Moore AE, 2013. A comparison of RULA, REBA and Strain Index to four psychophysical scales in the assessment of non-fixed work. Work, 2013 Jan 2. | [14] Nicolas Vignais, Markus Miezal, Gabriele Bleser, Katharina Mura, Dominic Gorecky, Frédéric Marin, 2013. Innovative system for real-time ergonomic feedback in industrial manufacturing. Applied Ergonomics 44: 566-574. | [15] www.ergo-plus.com