

ERGONOMIC RISK ASSESSMENT IN MANUFACTURING INDUSTRY BY USING RAPID ENTIRE BODY ASSESSMENT (REBA)

S.Mithunraj¹, Dr.K.Visagavel², Dr.PSS.Srinivasan²

¹ PG Scholar, Department of Mechanical Engineering, Knowledge Institute Of Technology, Tamilnadu

² Professors, Department of Mechanical Engineering, Knowledge Institute Of Technology, Tamilnadu

Abstract — The predominant problem in occupation is musculoskeletal disorders among the workers — specifically for the Manual material handling workers. This project involves the “Ergonomic risk assessment in manufacturing industry by using Rapid Entire Body Assessment (REBA)”. Material handling works in the manufacturing industry plays a major role. The Material handling works consists of more than on activity in different awkward postures e.g. High Task, Forceful Exertion, and Repetitive Awkward Postures. These activities when carried out repeatedly for the whole day leads to stress, muscle fatigue and other disorders. This study presents the assessment of the work posture of the Material handling workers engaged with different activities that causes the MSD (Musculoskeletal disorder) risk. An interview was conducted among Material handling workers at the Storage area to know about their work ergonomics, working conditions, occupational diseases etc. The postures were evaluated using Rapid Entire Body Assessment (REBA). After the analysis of data collected, the method indicated that the workers are working above the risk levels. Recommendations are provided in order to minimize the risk limits benefiting the workers.

Keywords: Ergonomics, Risk, Manual Material handling, REBA.

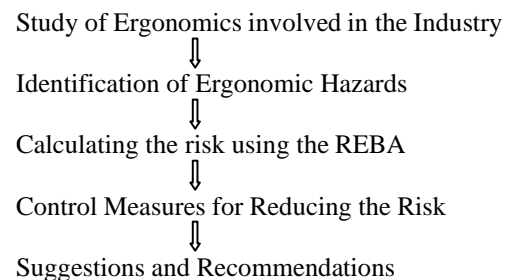
I. INTRODUCTION

In every workplace, there is likelihood for workers to develop occupational-related disorders and injuries. For instance, in the manufacturing industries, the High Task, Forceful Exertion, Repetitive Awkward Posture is the major ergonomic issues especially among the Material handling workers. In order to reduce this possibility to the minimal, the Total Workplace Safety and Health approach can be implemented in companies to manage safety and health in the workplace. After conducting risk assessment to identify health-related risks, appropriate intervention can be implemented, i.e., ergonomics factors could be incorporated in the design of proper work tools and work procedures where flexibility and adjustability should be considered and incorporated in order to fit most workers given that everyone has different anthropometry. Therefore, there must be good fitting and compatibility of the workers with the work activity and equipment used for better working conditions. Not with standing that, high-risk workers

dealing with heavy load and repetitive work should also be trained and aware of the correct posture and handling procedures.

The term ‘ergonomics’ was derived from the Greek words “*ergo*” (work) and “*nomos*” (law) and it is defined as the study of people's efficiency in their working environment. Among those disciplines are psychology, cognitive science, cognitive physiology, biomechanics, applied physical anthropometry and industrial systems engineering. Ergonomics application predominantly is focused on fitting the task to the person to increase productivity while focusing on the person's well-being. Domains of specialization in ergonomics are physical ergonomics, cognitive ergonomics and organizational ergonomics. This study would focus more on the physical ergonomics domain. The assessment is done by REBA (Rapid Entire Body Assessment) sheet.

II. METHODOLOGY



25 journal papers were collected for the study. The literature review was done and finally got the idea for does the Ergonomic risk assessment by using REBA. A patrol was done in the factory to absorb the works where the ergonomic hazards present. The major ergonomic hazards were present in a loading and an unloading area which is (i) a scrap area, (ii) a workplace (iii) a stores. Total 20 employees were selected in the various workplaces for the study of ergonomic hazards. A single page REBA worksheet is used to assess the score for each body portions and finally gives the risk score. The Rapid Entire Body Assessment tool uses a systematic process to evaluate both upper and lower parts of the body associated with the job task are being evaluated. The body is divided into two groups was observed, namely group A and Group B. Group A consists of the neck, trunk and legs while Group B consists of the upper arm, fore arm and wrist.

1. Sec 57 of Tamil Nadu factories rules 1950 (Excessive weights).
2. MHOR (material handling operations regulations) 1992 (UK).

Check the existing HIRA that includes ergonomic hazards. Go through the HIRA and visit the work place for the further improvement. Walk through audit to the storage area to capture the working postures. The video recordings of the working postures of the workers during works were recorded. Capturing of 20 workers performing their work was obtained.

AGE :	NAME :	DEPARTMENT :		
		ACTIVITY :		
S.NO	QUESTIONS	YES	NO	
1	Whether there is the pain in the neck region after the work for a prolonged time.			
2	Whether there is the pain in the trunk area after the work for a prolonged time.			
3	Whether there is the pain in the legs after the work for a prolonged time.			
4	Whether there is a pain in the upper arm after the work for a prolonged time.			
5	Whether there is the pain in the lower arm after the work for a prolonged time.			
6	Whether there is the pain in the wrist portion after the work for a prolonged time.			

Table 2.1 Questionnaire Checklist

S. NO	QUESTIONS	LOADING AND UNLOADING WORKERS
1	Sample Size	20 Participants 20 Males
2	Avg. Age Range	37-42 years
3	Avg. working experience	Min 5 years-Max 10 years
4	Avg. working hours/day No of days/week	5 hrs/day 5 days/week
5	Work activities	High Task, Forceful Exertion and Repetitive awkward posture.
6	Pain experienced in different body parts	Neck, Abdominal Area, Knees, Thighs, Shoulders, Forearms, Wrist.
7	Any other previous injuries/conditions	Nil

Table 2.2 Interview Findings

PAIN REGION	Neck	Trunk	Legs	Upper Arm	Lower arm	Wrist
NUMBER OF WORKERS WITH PAIN	10	13	15	13	13	15

Table 2.3 Pain Values of Workers

The REBA sheet contains the risk score chart which is used to find the level of MSD risk and the sheet has been tabulated in the Table 2.4

Besides, this tool has six important advantages for analyzing working posture risk which are listed as follows:

- i. This tool is sensitive to musculoskeletal risk therefore it could reflect the level of MSD (Musculoskeletal Disorders) risk;
- ii. In this worksheet, it divides the body into segments for analysis;
- iii. It gives a scoring system for analyzing muscle activity caused by static, dynamic and rapid changing or unstable postures;
- iv. It analyzes the handling of loads not only via hands but also coupling;
- v. It gives an indication of the urgency of remedial actions required; and
- vi. There is minimal equipment involved in this tool.
- vii. The REBA worksheet is divided into two body segment sections as A and B. Section A (left side) covers the neck, trunk, and leg positions. Section B (right side) covers the upper arm, lower arm and wrist positions;
- viii. This segmenting of the worksheet ensures that any awkward or constrained postures of the neck, trunk or legs which might influence the postures of the arms and wrist are included in the assessment;
- ix. Compute the Score for Group A (Trunk, Neck and Legs) first, followed by Group B (Upper Arms, Lower Arms, and Wrists). For each region, there is a score and additional adjustment scores are given for the accurate scores;

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

Table 2.4 REBA Risk Score Chart

There are about 13 steps involved in this tool for analysis starting from Neck, Trunk, Leg, Upper and Lower Arm, Wrist etc., Such a single sheet is to evaluate whole body and risk related to job tasks. The various posture involved by the workers are observed and assessed with the help of this sheet. Scores were obtained from Score A and Score B tables and final REBA Score are obtained from Score C table and with the activity Score and REBA sheet is Provided in Figure 2.1



Figure 2.1 REBA Employees Assessment Worksheet

III. RESULTS AND DISCUSSIONS

S.NO	AGE	NAME	TASK	REBA SCORE	LEVEL OF RISK
1	45	Mohan	High Task	6	Medium Risk , Further investigation, Change soon
2	35	Tamilvanan	High Task	8	High Risk , Investigate and implement Change
3	33	Silambarasan	Repetitive Awkward Posture	6	Medium Risk , Further investigation, Change soon
4	47	Bala Krishnan	Repetitive Awkward Posture	6	Medium Risk , Further investigation, Change soon
5	51	Nandhu	High Task	10	High Risk , Investigate and implement Change
6	43	Pandiyan	High Task	7	Medium Risk , Further investigation, Change soon
7	34	Deepak	Repetitive Awkward Posture	5	Medium Risk , Further investigation, Change soon
8	32	Pechimuthu	Repetitive Awkward Posture	7	Medium Risk , Further investigation, Change soon
9	31	Venkatesh	Repetitive Awkward Posture	5	Medium Risk , Further investigation, Change soon
10	24	Ajay Krishna	Forceful Exertion	10	High Risk , Investigate and implement Change
11	28	Ouppu	High Task	7	Medium Risk , Further investigation, Change soon
12	31	Issac	Forceful Exertion	8	High Risk , Investigate and implement Change
13	25	Pintu Raut	High Task	5	Medium Risk , Further investigation, Change soon
14	26	Tikana Bionoi	High Task	6	Medium Risk , Further investigation, Change soon
15	28	Sathish Rao	Forceful Exertion	8	High Risk , Investigate and implement Change
16	44	Velmurugan	Forceful Exertion	9	High Risk , Investigate and implement Change
17	37	Karthick	Repetitive Awkward Posture	5	Medium Risk , Further investigation, Change soon
18	55	Perumal	High Task	8	High Risk , Investigate and implement Change
19	24	Bhoopathi	High Task	7	Medium Risk , Further investigation, Change soon
20	32	Nidhan	High Task	8	High Risk , Investigate and implement Change

Table 3.1 REBA Risk Score Rating

A. CONTROL MEASURES FOR REDUCING THE RISK

1. Eliminating high task, forceful exertion and repetitive awkward posture will reducing worker fatigue.
2. Providing safe & effective procedures for

completing work tasks can reduce MSD risk.

3. Advised to take regular intervals for the stretch to recovery.
4. Change the process to reduce the work exposure.
5. By using of mechanical tools, will reduce work effort and muscle exertions.
6. Carts and dollies are used to reduce lifting and carrying demands.
7. Workers should be trained how to use proper lifting and work techniques to reduce force requirements.
8. Advised not to lift more than approved KGs.
9. SOP should be created and give proper training.
10. Job rotation and regular intervals is a way to reduce fatigue that can lead to MSD.
11. Advised to do team lifting.
12. Periodic evaluation techniques.
13. PPE that can help address ergonomic problems includes:
 - Knee pads.
 - Shoulder pads.
 - Gloves for cold, vibration, or rough surfaces.

B. SUGGESTIONS

1. Use a portable hoist or crane.
2. Use a forklift.
3. Use a hand pallet truck.
4. Use a cart or platform truck.
5. Stack pallets to create a higher work surface
6. Use electric or Pneumatic scissors lift.
7. Use powered stackers.
8. Provide variable-height work surfaces.
9. Use mobile scissors lifts.
10. Use stationary scissors lifts.
11. Use fixed or adjustable tilt stands for smaller containers.
12. Powered tilters provide better access to large containers.
13. Get co-worker assistance when necessary with same height.
14. Use a conveyor, slide, or chute.
15. Use EOT Crane.

C. TRAINING

It's a legal requirement that our employees are trained and competent in everything they do, including manual handling. However, it's equally important that you consider the use of mechanical aids and assess the task, before introducing manual handling training as a control measure. SOP (STANDARD OPERATING PROCEDURE) where given and explained.

1

IV. CONCLUSION

Result obtained from the REBA sheet showed that the workers taking the following works High task, Forceful exertion, Repetitive awkward posture. Mainly concentrated on the workers pain involved during the process in the Loading and Unloading are carried out by using the REBA tool by this tool we can lower the level of MSD risks of workers. For the high risk rating calculated works where

the control measures and suggestions are given for the improvement. The SOP (Standard Operating Procedures) were implemented and given to the workers working in the Loading and Unloading locations. This can help to maximize efficiency of production and to minimize human errors.

REFERENCES

1. Jakfat haekal,(2020), **"Analysis of operator body posture packaging using rapid entire Body assessment (REBA) method"**, International Journal of Engineering Research and Advanced Technology (IJERAT) Volume.6-Issue:7,July.
2. Silvi Ariyanti, (2019), **"Design Work Station Of Pipe Welding With Ergonomic Approach"**, SINERGI Volume.23-No:2, June.
3. Das Suman,(2018), **"A Report Based on Analysis of Posture and Occupational Health of Welders in Different Welding Units"**, Universal Journal of Public Health volume.6-No:3.
4. Ayub Y, Shah ZA (2018),**"Assessment of Work Related Musculoskeletal Disorders in Manufacturing Industry,"**Ergonomics 8: 233. doi: 10.4172/2165-7556.1000233
5. Baba Md Deros, (2017), **"Ergonomic Risk Assessment Of Manual Material Handling At An Automotive Manufacturing Company,"** Press academia procedia volume.5-No: 44, May.
6. Mahindra K.C, (2016), **"Ergonomic Analysis of Welding Operator Postures"**, International Journal of Mechanical and Production Engineering Volume: 4-Issue: 6, June.
7. Srikanth P Chakravarthya Subbaiah.K Shekar.G.L, (2015),**"Ergonomic assessment and Risk Reduction of Automobile assembly tasks using Postural AssessmentTools"**, Volume: 2-Issue: 6, June.
8. N. A. Ansari, Dr. M. J. Sheikh, (2014),**"Evaluation of work Posture by RULA and REBA:A Case Study"**, IOSR Journal of Mechanical and Civil Engineering", Volume:11-Issue:4, July.
9. Andrzej M. Lasota, (2014), **"A Reba-Based Analysis of Packers Workload: A Case study, Scientific Journal of Logistics,"** Volume: 10 (1), 87-95.
10. Surinder Singh, Amanjot Singh,Harvinder Lal, [2013], **"A Proposed REBA on Small Scale Forging Industry,"** International Journal of Modern Engineering Research (IJMER) Vol. 3, Issue. 6, Nov - Dec. 2013 pp-3796-3802.
11. Salami Olasunkanmi ISMAILA,(2011), **"Ergonomic Evaluation of Welding Workplace"**, Human Factors In Organizational Design And Management – X M. Göbel (Editor),April.
12. Silvia A. Pascual, Syed Naqvi , [2008], **"An Investigation of ergonomics analysis tools used in industry in the identification of work-related musculoskeletal disorders,"** International Journal of Occupational Safety and Ergonomics (JOSE) 2008, Vol. 14, No. 2, 237–245.
13. Sue Hignett, (2000),**"Rapid Entire Body Assessment (REBA),"** Elsevier Science Issue:31 ,June
14. Biman Das and Arijit K. Sengupta, (1996),**"Industrial workstation designs: A systematic ergonomics approach"**, Applied Ergonomics Vol. 27, No. 3. 1996, pp.157-163.
15. M. Rabiul Ahasan, Seppo Vayrynen, Heli Kirvesoja, [1996], **"Physical workload analysis among small industry activities using postural data,"** International journal of occupational safety and ergonomics 1996, Vol 2, no. 1, 27-34.