ERGONOMIC RISK ASSESSMENT OF WORKING POSTURES USING RULA, REBA & NIOSH

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ABSTRACT:

In Industries the most common occupational problem among the workers are musculoskeletal disorders. Musculoskeletal disorders are injuries and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage and spinal disks. Many occupational tasks in industrial area till associated with strenuous working postures and movement. Assessment of exposure levels to MSD risk factors can be an appropriate base for planning and implementing interventional ergonomics program in the workplace. The present project was aimed to evaluate the MSD of workers engaged in an engineering industry. The Study was conducted on workers of production area using posture analysis tool REBA, RULA & NIOSH Lifting equations. The awareness and proper ergonomics training to the workers and essential workplace changes are recommended in this study. Necessary control measures are given to reduce the ergonomic risk inside the industry to make the work easier and reliable to the workers.

Keywords: REBA, RULA, Musculoskeletal disorder, NIOSH, Ergonomic Risk

1.INTRODUCTION:

Ergonomics is the study of the relationship between the workers and the working environment. It is vital for the workers to concern and realizes the potential ergonomics risk factors around their workplace as the consequences are fatal like death and disability. The examples of the potential ergonomics risk factors include repetitive motion, static posture, heavy lifting, forceful exertion, expose to excessive vibration etc. The Common ergonomic problems at workplace are High Task Repetition, Forceful Exertions and Repetitive/Sustained Awkward Postures.

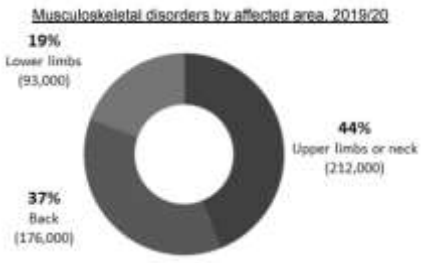
There are many ways to identify ergonomic problems, ranging from general observations and checklists to quantitative assessment.

- Talking to employees and seeking their views.
- Assessing the work system by addressing questions
- Examining the circumstances surrounding frequent errors and incidents for clues of ergonomic problems.
- Recording and looking at sickness absence and staff turnover levels.

Musculoskeletal disorders can affect muscles, joints and tendons in all parts of the body. Most WRMSDs develop over time. They can be episodic or chronic in duration and can also result from injury

sustained in a work-related accident. Additionally, they can progress from mild to severe disorders. These disorders are seldom life threatening but they impair the quality of life of a large proportion of the adult population.

The total number of WRMSDs cases (prevalence) in 2019/20 was 480,000, a prevalence rate of 1,420 per 100,000 workers. These comprised 212,000 cases where the upper limbs or neck was affected, 176,000 where the back was affected and 93.000 where the lower limbs were affected.The number of new cases was 152,000, an incidence rate of 450 per 100,000 workers. The total number of working days lost due to this condition in 2019/20 was 8.9 million days. This equated to an average of 18.4 days lost per case. Working days lost per worker due to self-reported workrelated musculoskeletal disorders shows a generally downward trend.In 2019/20 musculoskeletal disorders accounted for 30% of all work-related ill health cases and 27% of all working days lost due to work-related ill health.Most of these WRMSDs affect the Upper limbs or neck, 44% of all WRMSD cases, or the Back, 37% of all WRMSD cases with the remaining 19% of cases affecting the lower limbs. However, conditions affecting the back represent a relatively lower proportion of the working days lost than their relative prevalence would suggest.



Labour force survey

2. LITERATURE SURVEY

Er. Surinder Singh., (2013) published a paper on the title, "A Proposed REBA on Small Scale Forging Industry". This paper briefs to evaluate the MSD of workers engaged in Small scale forging industries. Study was conducted on 102 workers of a forging industry using the posture analysis tool REBA Method. The results of REBA showed that about 7.63% of the workers were under very high-risk levels and required immediate change. About 44.6% of the workers were at high risk levels which required changes soon and 45.03% of the workers were at medium risk levels. The Study recommended the awareness and proper ergonomics training to the workers. Chowdury., (2014), published a paper on the title, "Study And Analysis Of Work Postures Of Workers Working In A Ceramic Industry Through Rula". In this paper they used REBA and RULA techniques to quantize the fatigue experienced by the worker while manually lifting loads. The fatigue involved in a particular operation was quantified and accordingly changes in work method for system improvement were suggested. Qutubuddin S.M and S.S. Hebbal., (2013), published a paper on the title, "Ergonomic Evaluation of Tasks Performed by Workers in Manual Brick Kilns in Karnataka, India". The present study focuses on the brick industries located in North Karnataka, India, where about 1500 brick kilns are operating employing thousands of workers. The main aim of this study is to investigate the self-reported WRMSD experienced by the

workers during the raw brick making activities and to analyze the causes of discomfort related to various postures adopted by the worker and provide counter measure and alternate postures. M.Manzoor Hussain and Qutubuddin S.M. (2019), published a paper on the title "Digital Human Modeling in Ergonomic Risk Assessment of Working Postures using RULA". In this paper they analyze the working postures of manual workers in small scale industries by using Rapid Upper Limb Assessment (RULA) assessment in CATIA V5R20 software. The results indicate that awkward working posture risks can be minimized by effectively using ergonomic interventions. N.A. Ansari and Dr. M.J. Sheikh., (2014), published a paper on the title, "Evaluation of work Posture by RULA and REBA: A Case Study". This study presents assessment of work posture of workers engaged in different activities of small scale industry. Evaluation of posture was carried out using RULA and REBA. Assessment is carried out using worksheet. The RULA method determined that the majority of the workers were under high risk levels and required immediate change.

3.OBJECTIVES:

The aim of this study is to

1. Reduce the potential for accidents.
2. Reduce the potential for injury and ill health.
3. Improve performance and productivity.

4.METHODOLOGY:

In the manufacturing industry, the production process is manual process with high interactions of human and process.Ergonomic risk is very high in the production area due to the continuous nature of manual work. The production area has the following manual operations are

1. Burring job
2. Checking work pieces for grit blasting
3. Setting for heating process,
4. Chipping on material for cleaning process
5. Unloading the stacked work pieces
6. Dragging the stacked work pieces.

4.1 Hazards Identified in The Production Task:

OBSERVATION	HAZARDS	TOOL
The Worker doing Burring Job at the Time His Back Bone Was Bent for a Long Time, Sit in Improper Posture and Neck Position Was Improper.	Back Pain, Wrist Pain, Neck Pain	RULA
Checking Work Pieces for Grit Blasting, Workers Have to Bend His Back Bone for a Long Time and Standing in Improper Posture.	Back Pain, Shoulder Pain, Knee pain, Neck Pain	REBA
White setting for heating process, the worker has to bend his back bone for a long time and standing in improper posture.	Back pain, shoulder pain, knee pain, neck pain	REBA

Chipping on material for cleaning process, the worker has to bend his back bone for a long time and standing in improper posture.	Back pain, shoulder pain, knee pain, neck pain	RULA
Worker was unloading the stacked work pieces in hand from one place to another for loading in workpieces, his back bone was bent for a long time and he was working in improper posture.	Shoulder pain, back pain	REBA
Worker was dragging the stacked work pieces in hand from one place to another for loading in grit blasting, his back bone was bent for a long time and he was working in improper posture.	Shoulder pain, back pain	REBA

4.2 ERGONOMIC RISK ASSESSMENT TOOL

The Ergonomic Platform empowers you to conduct faster, more accurate ergonomic assessments, keep all your data in one place, get your team up to speed with built-in ergonomics training, and easily generate reports on risk reduction and program results. Ergonomic risk Assessment have to be done using NIOSH, REBA & RULA assessment tool in ergo plus platform. The Procedures for ergonomic risk assessment

1. Observe the task/job
2. Select the task/job for assessment
3. Score the task/job
4. Calculation of exposure scores
5. Consideration of actions level

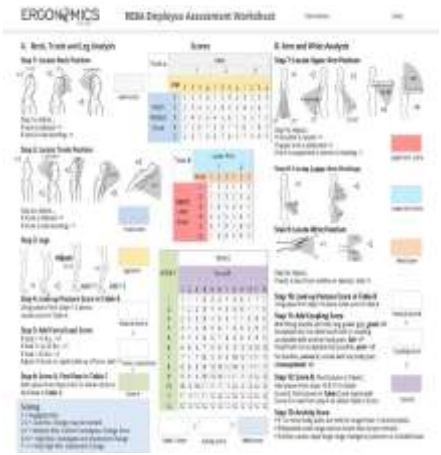
Risk assessment tool

Types of task	Risk assessment tool
Lifting/lowering	NIOSH lifting equation
Upper body posture	RULA
Entire body posture	REBA

4.3 Rapid Entire Body Assessment (REBA)

This tool uses a systematic process to evaluate whole body postural MSD and ergonomic design risks associated with job tasks. A single page form is used to evaluate required body posture, forceful exertions, type of movement or action, repetition, and coupling.

A score is assigned for each of the following body regions: wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees. After the data for each region is collected and scored, tables on the form are then used to compile the risk factor variables, generating a single score that represents the level of MSD risk.

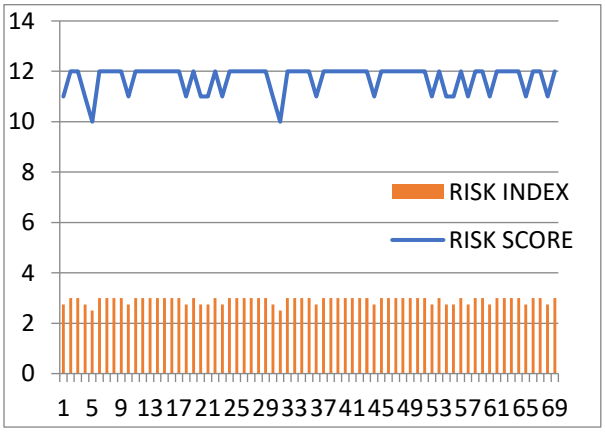


Risk score table

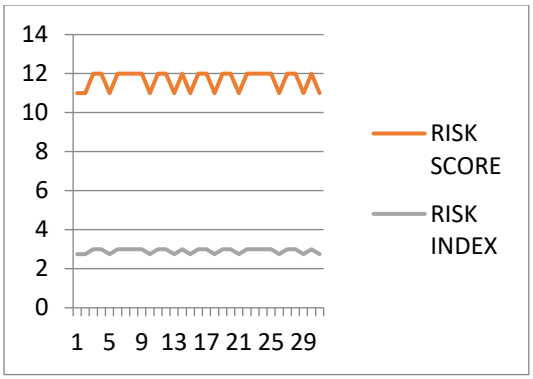
Reba Score	Risk Level	Action
1	Negligible	No action required
2-3	Low	Change may be needed
4-7	Medium	Further investigation, change soon
8-10	High	Investigate and implement change
11-15	Very high	Implement change

4.3.1 REBA Score Unloading Work Pieces

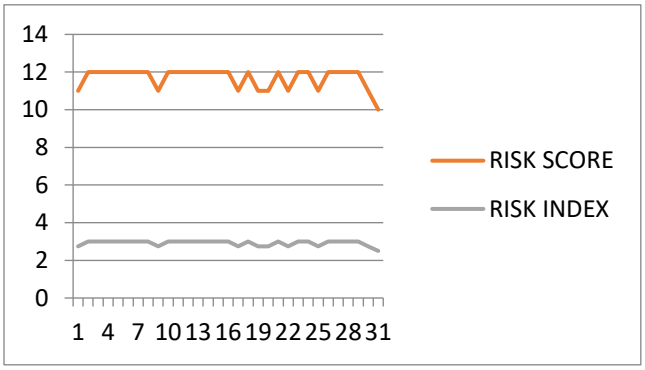
- Risk Index Value Less Than 1 Low Risk
- Risk Score 11+ Means Very High Risk, Immediate Action



4.3.2 REBA Score-Setting Work Pieces

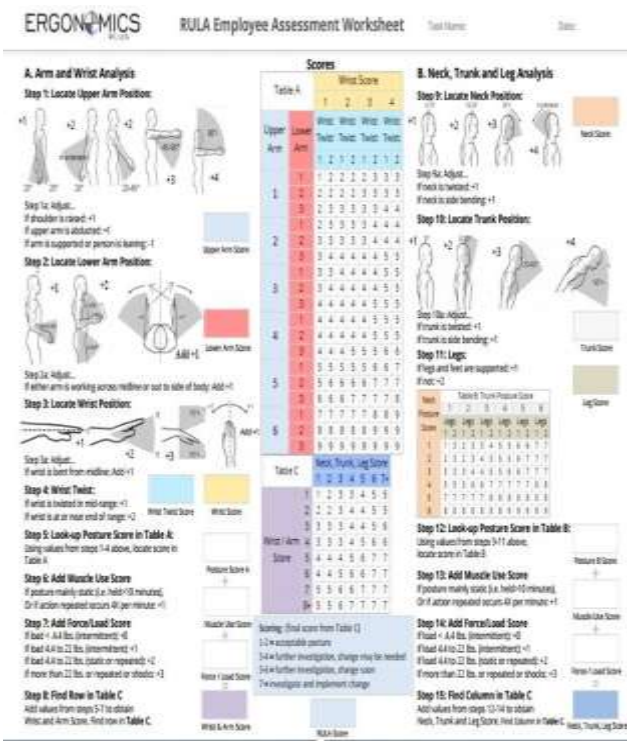


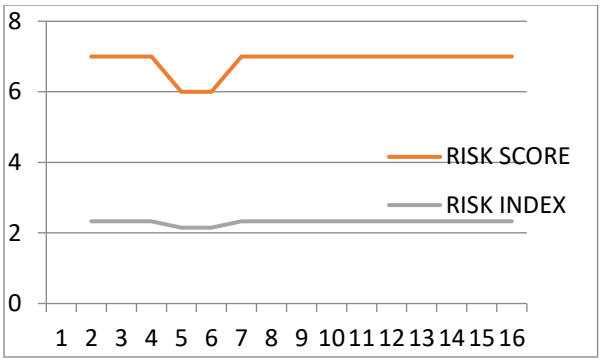
4.3.3 REBA Score- Checking Work Pieces



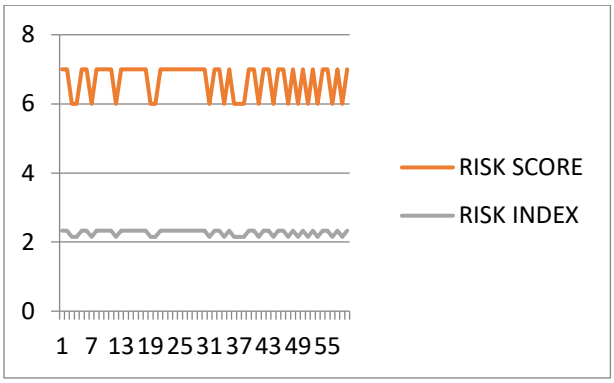
4.4 RAPID UPPER LIMB ASSESSMENT (RULA)

This diagnostic tool assesses biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities. A single page form is used to evaluate required body posture, force, and repetition. Based on the evaluations, scores are entered for each body region in section A for the arm and wrist, and section B for the neck and trunk





4.4.2 RULA- Chipping on material



RULA SCORE	RISK LEVEL	ACTION
1-2	Negligible	No action required
3-4	Low	Change may be needed
5-6	Medium	Further investigation, change soon
7+	High	Implement change

4.4.1 RULA - inspection on rings

- Risk Index Value Less Than 1 Low Risk
- Risk Score 6+ Means Very High Risk, Immediate Action

4.5 NIOSH LIFTING EQUATION

The NIOSH Lifting Equation is a tool used by occupational health and safety professionals to assess the manual material handling risks associated with lifting and lowering tasks in the workplace. The primary product of the NIOSH lifting equation is the Recommended Weight Limit (RWL), which defines the maximum acceptable weight (load) that nearly all healthy employees could lift over the course of an 8-hour shift without increasing the risk of musculoskeletal disorders (MSD) to the lower back.

The NIOSH equation uses a load constant (LC) with a value of 23 kgs. i.e., the maximum weight to be lifted or lowered under perfect conditions.

The equation then uses several variables for each task expressed as multipliers or coefficients. (In the given equation, 'M' is a multiplier) that tends to reduce the load

constant to get a value of RWL for a specific lifting task.

RWL= LC (23) x HM x VM x DM x AM x FM x CM

The task variables necessary to calculate RWL are;

H = Horizontal location of the object in relation to the body

V = Vertical location of the object in relation to the floor

D = Vertical distance of the object moved

A = Asymmetry angle or Twist of body

F = Frequency and duration of lifting activity

C = Coupling or quality of the workers grip on the object being lifted

4.5.1 LIFTING INDEX (LI):

Lifting Index provides an estimate of the MSD risk and physical stress related with the manual lifting tasks evaluated. The lifting index gives the significant level of risk.

Lifting Index LI = Actual Load Weight/RWL

LI < 1= Low Risk

LI > 1< 3 = Mild /Moderate Risk

LI > 3 = High Risk

As the Lifting Index increases, the risk of lower back disorder increases correspondingly. The purpose is to design the lifting tasks to achieve a LI of less than 1.0.

NIOSH Lifting Equation-Machine Process

Risk	Origin	End Point
Risk Index	1.43	1.01
RWL	13.98	19.89
Independent	21.0	30.59
RWL		
Lifting Index	1.43	1.01
Action	Medium Risk	Medium Risk

FINAL SCORE TABLE

Task	Score	No. of Operators
Inspection on Rings	RULA-6.866	16
Unloading Work Pieces	REBA-11.69	70
Dragging the Stacked Work Pieces	REBA-12.48	26
Setting Work Pieces	REBA-11.64	32
Checking Work Pieces	REBA-11.67	32
Chipping on Material	RULA-6.733	60
Machine Process Loading Weight	NISOH-1.43to1.01 (Risk Index)	12

5.CONTOL MEASURES:

Chipping Work Has High Ergonomic Risk as Per the RULA Study.

To Eliminate Poor Ergonomic Postures, Ergonomic design saw is Implemented for Ergonomic Benefits.

Ergonomic Design saw

After this implementation change, RULA risk level score is reduced to 4, it indicates low risk in this job.

Checking Work Pieces for Grit Blasting has High Ergonomic Risk as Per the REBA Study.
To Eliminate Poor Ergonomic Postures, Ergonomic design of hydraulic drum is Implemented for Ergonomic Benefits.

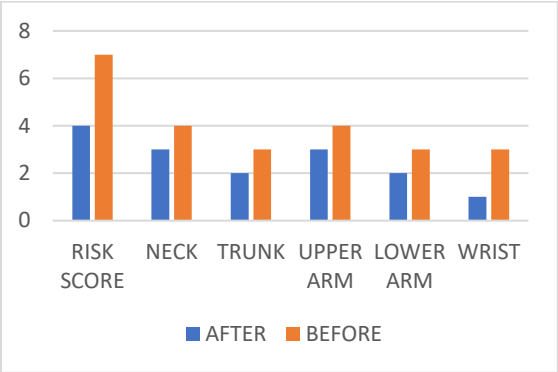
Ergonomic design of hydraulic drum

After this implementation, REBA risk level score is reduced to 6, this indicates low risk only occurred this job.

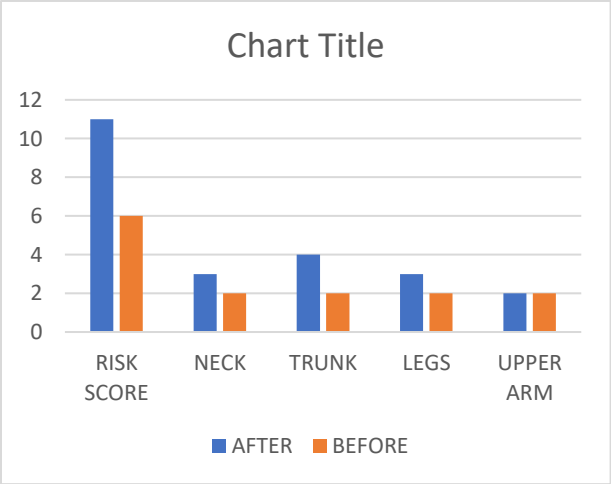
6.RESULT AND DISCUSSION:

Before Observation And Hazard	After Observation Minimize Hazard
Chipping on material for cleaning process, the worker has to bend his back bone for a long time and standing in improper posture.	Easy Handling on Operation 

RULA Score 6.73(Mean Value)	RULA Score 4 (Mean Value)



Before Observation And Hazard	After Observation Minimize Hazard
Worker was unloading the stacked work pieces in hand from one place to another for loading in workpieces, his back bone was bent for a long time and he was working in improper posture	Too design on hydraulic drum to using weight carrying on up and down
REBA Score 11.69 (Mean Value)	**REBA Score 6 (Mean Value)**



7.CONCLUSION

The evaluation of body posture has been carried out for this particular manufacturing unit by Ergonomic risk assessment tools, it can be concluded that; significant proportion of the workers are working in uncomfortable and painful postures as found by analysis. This is due to lack of ergonomics knowledge and awareness in small scale industry. Thus, the workers are under moderate to high risk of musculoskeletal disorders as determined from REBA, RULA & NIOSH risk level. This study recommends the immediate implementation of ergonomics interventions with proper knowledge among workers and health education on common postural change, implementation and monitoring of laws among industries are recommended to take down morbidity due to musculoskeletal disorder.

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