Effect of ergonomics on workers' performance in Indian small-scale industry

Rohit Sharma, Parveen Sharma* and Soyal Mohammed

School of Mechanical Engineering,
Lovely Professional University,
Phagwara – 144411, Punjab, India
Email: rohitvasudev@gmail.com
Email: parveen.21569@lpu.co.in
Email: i.parveensharma@gmail.com
Email: soyalmohammed2@gmail.com
*Corresponding author

Abstract: The worker's daily work-related musculoskeletal condition is becoming a problem in India. As of now, the research is being carried out physically in the majority of small and medium enterprises along these lines, the problems of business-related musculoskeletal clutters and injury in different body locations are of major concern. Postural examination tool utilising REBA is connected for evaluation, which demonstrates that the workers are working to a great extent. The investigation was conducted on 30 employees working in the small-scale industry. Subsequently it was inferred that; there is an absence of ergonomics mindfulness and comprehension in the small-scale enterprises. Assessment utilising postural examination REBA demonstrates that the specialists are working to a great extent. The working levels of the workers are having very clumsy stances. Therefore, the workers were told not to be in a bad posture and to change their postures in order to get rid of musculoskeletal problems.

Keywords: ergonomics; small scale industry; posture analysis; rapid entire body assessment; REBA.

Reference to this paper should be made as follows: Sharma, R., Sharma, P. and Mohammed, S. (2021) 'Effect of ergonomics on workers' performance in Indian small-scale industry', *Int. J. Six Sigma and Competitive Advantage*, Vol. 13, No. 4, pp.393–411.

Biographical notes: Rohit Sharma is working as an Associate Professor in the School of Mechanical Engineering at Lovely Professional University, Phagwara, Punjab. He obtained his PhD from Department of Industrial and Production Engineering at National Institute of Technology (NIT), Jalandhar, Punjab, India and working in the area of Production and Industrial Engineering. He obtained his BTech in Mechanical Engineering in 2001 from PTU and ME in Production and Industrial Engineering in 2011 from PEC, Chandigarh, India. His research interest includes lean manufacturing, Six Sigma, operations management, TQM, data analytics and system dynamics, etc. He has about six years of teaching, five years of research and professional experience. He published near about 20 research papers in various national and international conferences as well as in journals.

Parveen Sharma is working as an Associate Professor in the School of Mechanical Engineering at Lovely Professional University, Phagwara, Punjab. He obtained his PhD from Department of Mechanical Engineering at National Institute of Technology (NIT), Kurukshetra, Haryana, India and working in the area of industrial and production engineering. He obtained his BTech in Mechanical Engineering in 2009 from KUK and ME in Mechanical Engineering in 2011 from NITTTR, Chandigarh, India. His research interest includes facility layout planning and design, material handling, etc. He has about five years of teaching, research and professional experience. He published near about 40 research papers in various national and international conferences as well as in journals.

Soyal Mohammed is a Masters student in the School of Mechanical Engineering at Lovely Professional University, Phagwara, Punjab. He is working in the area of industrial and production engineering.

This paper is a revised and expanded version of a paper entitled 'Evaluation of work posture using ergonomics in Indian small scale industry' presented at International Conference on Functional Materials, Manufacturing, and Performances (ICFMMP), India, 12–13 September 2019.

1 Introduction

Ergonomics got its beginning in the USA amid World War II, when researchers structured progressed new frameworks without completely considering the general population who might utilise them. Amid World War II, the military and aviation programs turned ergonomics and human elements plan the multidisciplinary science that it is today. Amid World War II, the mind-boggling design of military flying machine cockpits, radar and other hardware, prompted administrator execution issues. Groups framed from a few controls, including engineers, analysts, anthropologists and physiologists. These groups were united to tackle the plan and execution issues (Mohammed and Sharma, 2018). This was the first multidisciplinary group way to deal with tackling ergonomics issues in the workplace. It step by step turned out to be certain that frameworks and items would need to be intended to consider numerous human and ecological components in the event that they are to be utilised securely and viably (Sharma and Singhal, 2016). This attention to individuals' physical prerequisites brought about the order of ergonomics. A portion of the science that involves ergonomics incorporating biomechanics, building, anthropometry, physiology, science, brain science and human science in it.

The base of the expression 'ergonomics' comes from the Greek 'nomos' which means rule and 'ergo' which means work. One could suggest that ergonomics ought to create 'rules' for a more forward-looking, imminent concept of design. Relating the corrective ergonomics with the prospective ergonomics the idea is to take consideration of the profitability margins (Asante, 2012). Ergonomic typically handles the physical issue related with work environment by diminishing jumble between customer anthropometric and biomechanical parameters with physical estimation of workplace, equipment's, furniture (Jeong and Park, 1990).

To the extent cash sparing points of interest, the upside of ergonomics changes is that they will make the movement faster, less requesting, more secure and update benefit. It is basic to overview the points of interest in the short, medium and whole deal, as expensive apparatus and process changes may set aside some chance to take effect. The term ergonomics has a few definitions, however, is most normally alluded to as the investigation of work. The ergonomics procedure has advanced in the course of the last couple of hundred years to a multidisciplinary science that envelops ideas from material science, work physiology, anthropometry, biomechanics, human elements designing and work association factors.

It is an ambitious endeavour to build a working atmosphere without harm for workers, but businesses/industries who are actively looking for new methods of improving health and working environments will help to achieve this aim. The removal of workplace hazards is difficult, but regular office ergonomics assessments can increase employee productivity. In the assessment of ergonomics at work, multiple aspects will be investigated. Company managers need to examine the short-term and long-term effects of these choices and potential costs of decision-making in this area.

How does the ergonomics procedure or program, work in the work environment? A fruitful ergonomics program uses the abilities of numerous orders, including designing, brain research, medicinal, security, the board and the workers or partners. The group cooperates to distinguish the issue, organise the issue, assess the reason or purpose behind the issue and choose the best method of move to make to cure the issue. When these inquiries have been distinguished and assessed, ergonomic change strategies can be executed.

At last, there is a chain of importance of favoured methods for change in the workplace. Arranged by preference, the principal methods for change or work adjustment is through designing controls. Building controls include changing or substituting the work procedure or workplace. A case of building controls is change the genuine item or materials, or the size or shape or weight of the gear used to play out the work. The second change strategy is authoritative controls that change the manner in which the work is overseen. This can mean changing the workplace or the administration of the work. Instances of regulatory controls are: including work revolution, changing rest work cycles or changing the request or time of presentation to the work assignments issues (Mohammed and Sharma, 2018). The last strategy for control that ought to be executed is the utilisation of individual defensive gear (PPE). PPE is utilised as a last line of guard and just as a hindrance between the specialist and a specific work danger. Instances of PPEs in ergonomics include: utilisation of gloves or defensive rigging, security goggles, gel embeds for stun absorbance or steel toes boots. Sometimes, more than one of these methods might be utilised to unravel an ergonomic test. Fruitful ergonomic projects are a progressing procedure.

The hazard must be measured or evaluated, high hazard or issue zones must be recognised and changes actualised through a procedure of basic leadership. Development, after the work changes have been executed, is a fundamental segment of a fruitful program to re-measure hazard, guarantee that the alterations are proper and securely clung to and decide whether further intercession is required. In the current research, a small scale industry has been selected and ergonomics tool has been implement, to assess the reasons behind the health related issue occurring frequently on the shop floor of the selected industry.

2 Literature evaluations

The survey of literature was carried out for conducting this study in the industry. Table 1 demonstrates a brief about the implemented techniques of ergonomics. In Jones and Kumar (2010), to separate the perception between five ergonomic hazard evaluation methods discovered reliant on quantitative associate measures and with look at the point of confinement of the frameworks to satisfactorily depict four in risk occupations. In Ansari and Sheik (2014), this examination presents evaluation of work position of professionals required with various exercises of little scale industry. Assessment of position was done utilising RULA and rapid entire body assessment (REBA). Assessment is done utilising worksheet. The process of research paper selection for the current research has been demonstrated in Figure 1. Various research papers have been selected and studied for the present work. The RULA procedure developed that most of the specialists were under high peril levels and required quick change. The REBA framework confirmed that a piece of the specialists were under lower levels and lion's idea at high hazard levels. Thusly it was considered that; there is a non-appearance of ergonomics care and awareness in little scale associations. In Hignett and McAtamney (2000), this note determine about the phases of the REBA judgement and has conveyed to 'each of the an undeniable need for a master's' weld gadget, exceptionally wanted to be delicate to the sort of flighty working positions found in remedial organisations and other association undertakings. Kong et al. (2018) supported common lower appendage assessment ergonomics inspiration, which was made for different agrarian assignments. 196 working positions were perused the ensured agrarian assignments to insist ALLA, a lower part body present assessment instrument and a brief timeframe later reviewed by 16 ergonomic experts.

In Bhandari at el. (2013), the evaluations were done by a procedural examination of body positions included. The exhaustion attracted with a specific errand was assessed and as necessities be changes in work technique for framework change were endorsed. These strategies helped in procedure refinement by perceiving practices causing high weakness. In Kulkarni and Devalkar (2019), this examination is identified with different undertakings on building headway. Most by a long shot of the wounds, stresses and strains happen because of overexertion and dull work works out. The principle point of examination is to value the stature of the ergonomics at different assignments in the headway business. Another motivation behind the examination is to locate the dimension of musculoskeletal issue and propose therapeutic measures for each errand having high hazard factor. In Cimino et al. (2009), the makers propose a methodology for the effective ergonomic blueprint of workstations inside mechanical plants. The strategy in perspective of various layout parameters and different execution estimates reinforces the arrangement and the evaluation of workstations to the extent both ergonomics and work procedures.

In Ojha and Vinay (2018), his examination shows an examination on different working positions connected with bike vehicle industry of SIDCUL, Pantnagar. The vehicle mechanical zones have enormous part in Indian economy and it is the spot work act examination is commonly dismissed. The subjects were offset with the Harvard organise stool test to pick their physical prosperity archive. For posture examination shows 111 bosses had with different arrangement of hiding away of bicycles were picked and surveyed the positions. Rost and Alvero (2020) worked on an ergonomics approaches to workplace safety management. In Cimino et al. (2009), the creators propose a system

for the powerful ergonomic outline of workstations inside mechanical plants. The technique in context of various layout parameters and diverse execution gauges strengthens the course of action and the assessment of workstations to the degree both ergonomics and work systems.

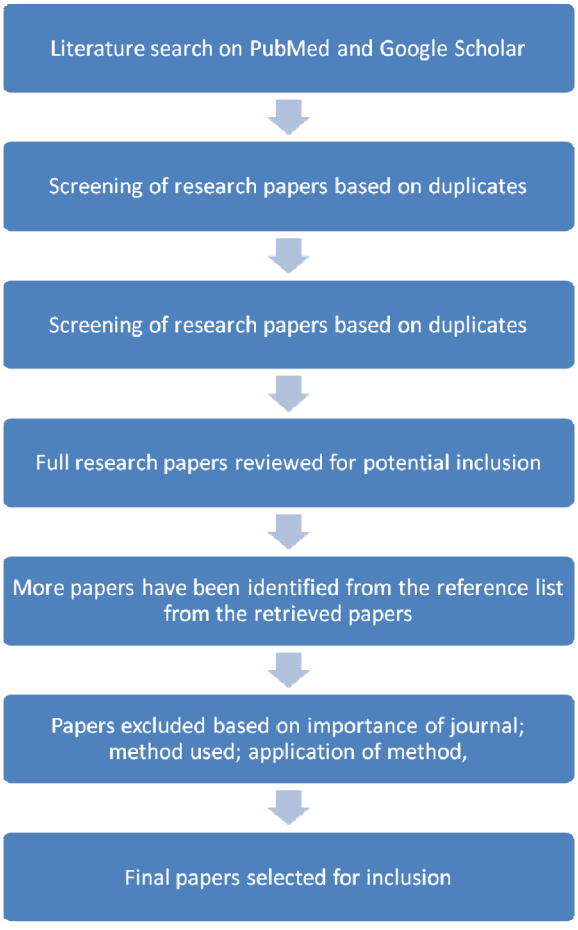
Table 1 REBA technique used by various researchers

Year	*Author details*	*Tool used*
2000	Hignett and McAtamney	REBA
2010	Jones and Kumar	REBA
2012	Singh	REBA
2012	Wintachai and Charoenchai	REBA
2014	Ansari and Sheikh	REBA
2015	Domingo et al.	REBA
2007	Kee and Karwowski	REBA
2015	Mali and Vyavahare	REBA
2015	Rafie et al.	REBA
2017	Goswami et al.	REBA
2016	Norhidayah et al.	REBA
2016	Shah et al.	REBA
2017	Fazi et al.	REBA
2017	Kong et al.	REBA
2017	Nam et al.	REBA
2018	Boulila et al.	REBA
2019	Kulkarni and Devalkar	REBA
2020	Hita-Gutiérrez et al.	REBA
2018	Ojha and Vinay	REBA
2018	Kong et al.	REBA
2019	Schwartz et al.	REBA
2019	Dwyer et al.	REBA
2020	Bortolini et al.	REBA
2020	Hita-Gutiérrez et al.	REBA

In Das and Sengupta (1996), for the course of action of a forefront workstation, ergonomics rules are appeared. The fundamentals give a found out begin to an average workstation plan. In an authentic system circumstance, the execution of the proposals or rules needs the arranging of the majority anthropometry with the diverse parts of the workstation. Satisfactory position, work stature, regular and most critical working territories, level space and visual need are agreed to the organised client masses. The framework for picking the workstation estimations and design has been cleared up. The criticalness of structure an affront up of the masterminded workstation and its evaluation with administrator subjects is engaged. In Kulkarni and Devalkar (2019), this examination is related to various endeavours on building advancement. Most by far of the injuries, stresses and strains occur due to over-exertion and repetitive work exercises. The main aim of examination is to appreciate the height of the ergonomics at various

assignments in the advancement business. Another purpose of the examination is to find the level of musculoskeletal issue and propose medicinal measures for every errand having high peril factor.

Figure 1 Method for research article selection for the current study (see online version for colours)



The literature demonstrates that REBA technique is mostly used tool for handling the health related disorder on the shop floor.

3 Rapid entire body assessment

This ergonomic appraisal instrument utilises an orderly procedure to assess entire body postural MSD and dangers related with employment assignments. Utilising the REBA worksheet, the evaluator will appoint a score for every one of the accompanying body districts: wrists, lower arms, elbows, shoulders, neck, trunk, back, legs and knees. After the information for every locale is gathered and scored, tables on the structure are then

used to order the hazard factor factors, creating a solitary score that speaks to the dimension of MSD chance. Table 2 shows a list of levels.

Table 2 Level of postural hazard

Tally	*Level of the postural hazard*
1	Negligible risk, no activities required
2–3	Little risk, alter may be required
4–7	Medium risk, further analysis required
8–10	Elevated risk, investigate and execute change
11+	Very elevated risk, execute change now

Determination of the stances to be assessed ought to be founded on:

- the most troublesome stances and work undertakings (in view of specialist meeting and starting perception)
- the stance continued for the longest time frame
- the stance where the most elevated power loads happen.

The body is divided into various sections, which are coded freely with reference to the improvement planes. Hignett and McAtamney (2000) state that the headway of REBA expected to: Develop a postural examination structure sensitive to musculoskeletal perils in a variety of endeavours. The body is isolated into fragments and coded dependent on the portion partition. Give a scoring system to muscle development brought about by static, dynamic, speedy changing or shaky positions. Mirror that matching is imperative in the treatment of weights anyway may not by and large be through the hands. Give action level with an indication of criticalness. There is a prerequisite of irrelevant fittings like pen and paper system. Takala et al. (2010) state that REBA was organised as a quick and straightforward observational postural examination gadget for whole body practices in social protection and other organisation undertakings.

4 Implementation

4.1 Case industry

The name of the industry is Chopra Industries Private Limited (CIPL) and situated in Ludhiana, Punjab, India. This industry is mostly centred around the assembling of the different bike car parts. The fundamental mission of the organisation is that their focal objective is to be a model in the business through mastery improvement, thing structure and collecting capability. They are focused on constantly advance and update out development and place assets into HR to get vitality for flawlessness and the organisation vision is to achieve such an unusual condition of significant worth and structure's adequacy that they are a trademark choice of their customers/accomplices for the things that they make.

History of CIPL: CIPL is a fundamental producer of sheet metal, adjusted parts and social affairs for a broad number of clients in the vehicle division. The company is progressed by experienced administrators having over 30 years of contribution in the

structure business. At the present time CIPL has three creator workplaces all arranged at Ludhiana (Punjab) and Haridwar (UK). The parts of the silencer that this industry makes are: silencer bend, STA inlets steel silencer bend pipes, prism or loose golden and red silencer clamp, silencer elbow, silencer stud.

4.1.1 Steps of REBA

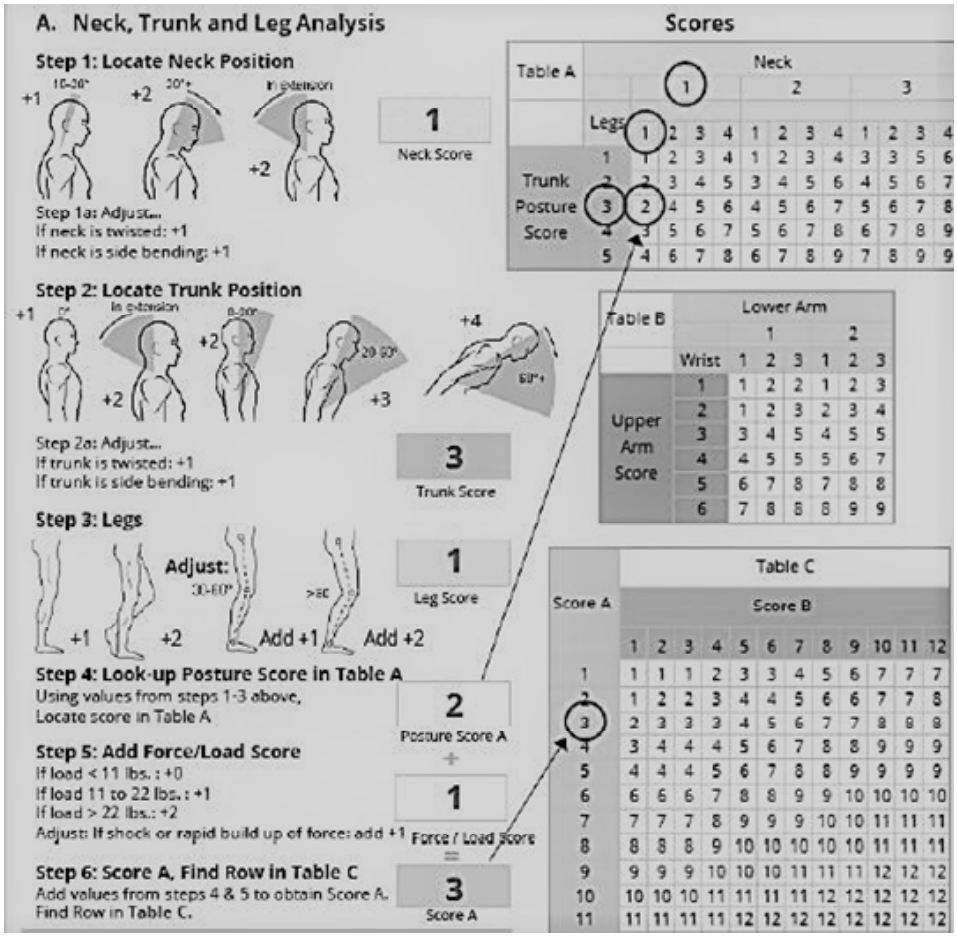
Stage 1 neck posture

Stage 2 trunk posture

Stage 3 legs posture

Stage 4 analyse the posture marks in the table.

Figure 2 Neck, trunk and leg analysis



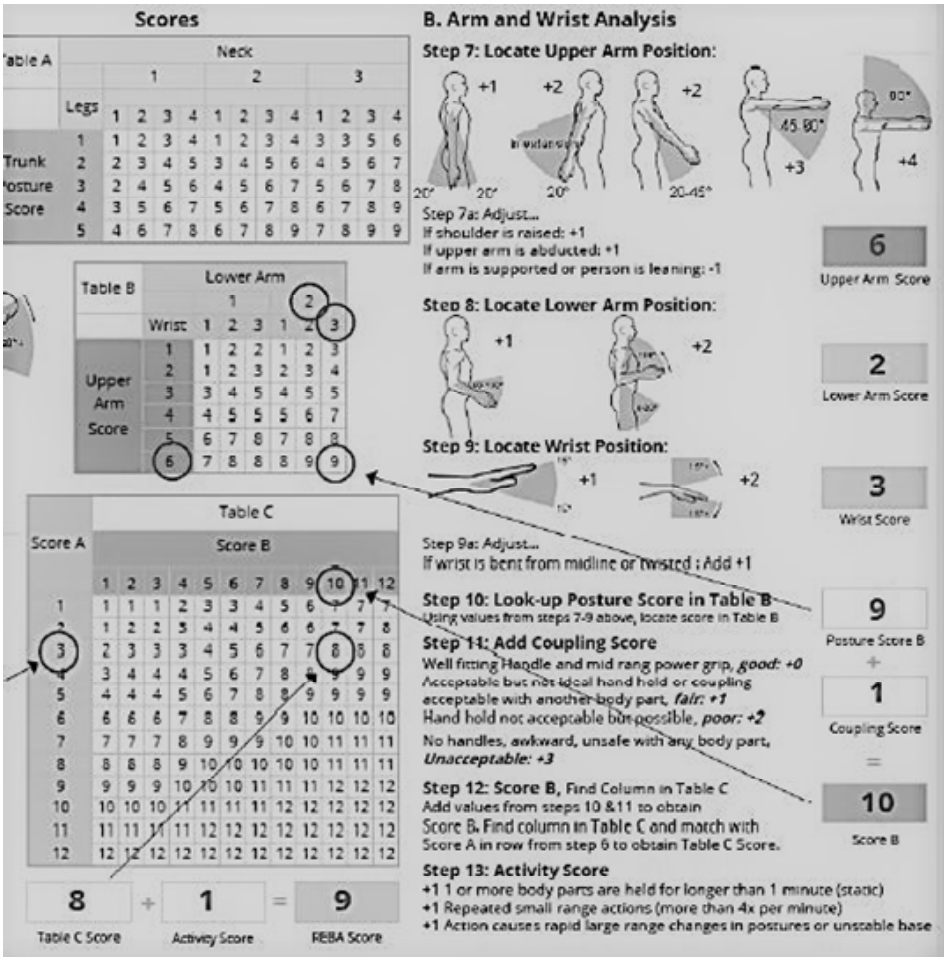
Stage 5 Add load marks

- If the load is less than 11 lbs then + 0 will be awarded.

- If the load is in between 11 and 22 lbs then + 1 marks will be awarded.
- If the load is greater than 22 lbs then + 2 marks will be awarded.

Stage 6 (Adding of values from stage 4 and 5 to obtain score A to find out the row in table).

Figure 3 Arm and wrist analysis



Stage 7 Upper arm posture

Stage 8 Lower arm posture

Stage 9 Wrist posture

Stage 10 See the posture marks in table by using the values from stages 7 to 9

Stage 11 Add grip marks

- good – + 0
- fair – + 1
- poor– + 2
- awkward (unacceptable) – + 3

Stage 12 For getting of score B we have to find column in table (add marks of 10 and 12 stages).

Stage 13 Activity score (range + 1).

Figure 2 and Figure 3 represents the basic stages of the REBA techniques along with various body positions.

4.2 Implementation of REBA technique

Points to be considered while making the study:

a Study structure: It is a descriptive cross sectional examination led in CIPL, Ludhiana, Punjab, India.

b Study zone: The examination region is mechanical region point in focal point 2 in Ludhiana area of Punjab, India.

c Study population: The investigation populace incorporates some mechanical labourers in the examination region.

d Study period: The study was conducted for a period of one month (April 2019-May 2019)

e Incorporation criteria: In this investigation the labourers having a place with the examination region and the individuals who were eager to take part were altogether incorporated into the examination. The specialists performing task for a delayed timeframe for a normal of five days in seven days were just incorporated into the investigation.

f Avoidance criteria: Workers who would not like to take part in the examination were avoided.

g Test measure: According to the investigation objective, all inclusive testing was utilised in the examination. The examination for the most part centres around the shop floor specialists where the absolute populace of labourers is 70. Where 40 individuals were not accessible or not willing to take part, accordingly the last number of individuals partook in this investigation are 30. The members were unmistakably clarified about the reason for the investigation and its advantage.

h Study apparatus and information gathering: A pretested organised poll is planned in connection to the investigation objective. The readied poll is utilised at the season of information accumulation. The respondents were met, by making the inquiries to the labourers in their nearby language.

i Data analysis: The data was collected among the workers from various lines by clicking the still photographs and some videos then the data was entered in Microsoft Word and was analysed.

j Informed consent: The participants were briefed about the purpose of the study and informed consent was obtained prior to the data collection.

In CIPL, we have selected the workers on the basis of their work. We have categorised the workers into three basis like:

a welding workers

b pressing machines workers

c pipe bending workers.

In the above categories, the stress is developing onto the parts of the body like – neck, trunk, legs, upper arm, lower arm, shoulders and wrists. These workers are suffering a lot of stresses on their body parts. This industry basically manufactures the two wheeler automotive parts and supply to the demanding automotive industry. They all work in the standing postures. But continuous standing postures of the workers are making their body in more stress. The working environment of this particular industry is very noisy. All the machines working at the same time and they are creating lot of noise. In the total we have studied the postures of 31 workers in which there are seven welding workers postures, 14 pressing machine workers and ten pipe bending workers. As we can see now we will be implementing the REBA technique to the workers in below section

4.2.1 Welding worker

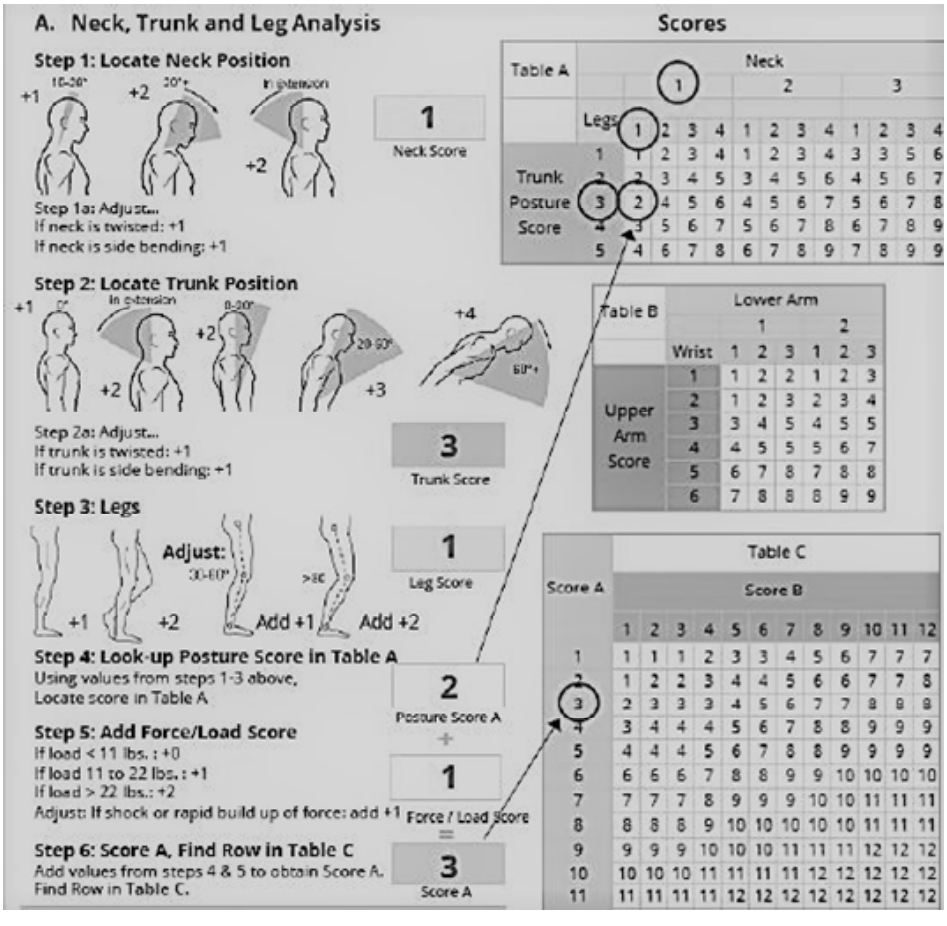
The person on shop floor doing the welding task has been demonstrated here (Figure 3), analysis of his body postures has been done. This analysis has been conducted on near about 30 workers but only one has been shown with explanation.

Figure 4 Welding person

Stages 1–3 Neck, trunk and leg analysis (Figure 5)

Note: In stage 1, a + 2 score was utilised for neck position (> 20 degrees) and + 1 was included for the side twisting change (when seen from behind, specialist was left side bowing) for an all out score of + 3.

Figure 5 Neck, trunk and leg analysis



In stage 2, a + 2 score was utilised for the storage compartment position (in expansion) and + 1 was included for the turned minute, so the all out trunk score is + 3. In stage 3, a + 2 score was utilised for the legs. In stage 4, we need to look into the stance score in table. From the score of neck, trunk and legs, we got an estimation of + 6 in table A. In stage 5, including the heap score we get + 0 score in light of the fact that the heap on the specialists is under 11 lbs. In stage 6, for score A we need to include the score of stage 4 and stage 5, at that point we see the table C. We get 6 + 0 = 6 and we need to see table C and enclose at 6.

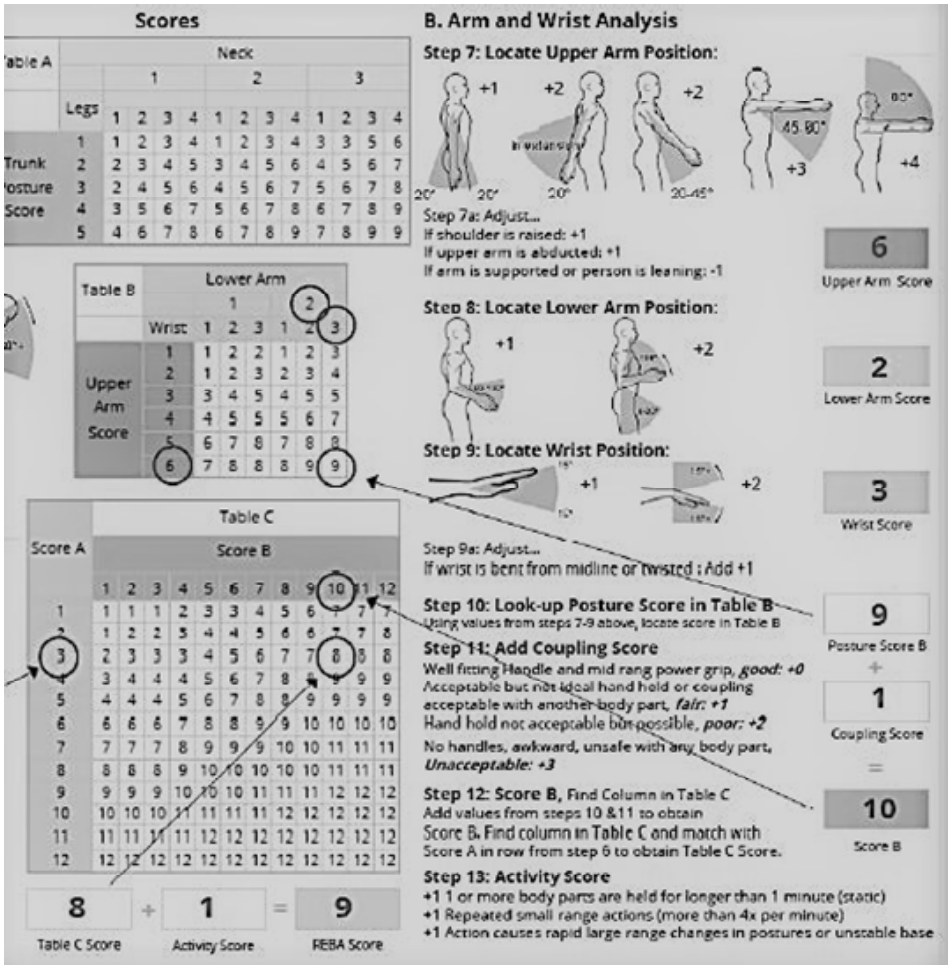
Stages 7–9 Arm and wrist analysis (Figure 6)

Note: In stage 7, the correct upper arm is raised in excess of 90 degrees for a score of + 4, a complete change of + 1 is included in light of the fact that the shoulder is raised (+ 1) for an absolute score of + 5. In stage 8, a + 2 score was utilised because of the arm position outside of the non-partisan range.

In stage 9, the position score of + 2. In Stage 10, Using esteems from stages 7–9, find the stance score for this progression in table B. We get + 7.

In stage 11, add the coupling score. For this situation, the coupling is viewed as good (+ 0). In stage 12, firstly include the qualities in stage 10 and 11 to acquire score B. Next, discover segment in table C, we get 7 + 0 = 7 and coordinate with score. An in line from stage 6 to get table C score, we get 9. In stage 13, the activity score is + 1 because of employment requiring little range activities (more than 4x every moment). The final REBA score = table C score + activity score = 9 + 1 = 10.

Figure 6 Arm and wrist analysis of welder



5 Results and discussion

The analysis predicted final REBA score as 10, for this situation, the last REBA score of 10 demonstrates high hazard and calls for further examination and designing as well as work technique changes to lessen or dispense with MSD chance. The corrected poster for welding person has been demonstrated in Figure 7. Scoring of various workers is shown in Table 3 to Table 6. After further examination, it was controlled by the labourer and the office bunch pioneer that an alternate strategy could be utilised to play out this errand. See after picture and new REBA results:

Figure 7 Corrected posture of welding worker

A subsequent examination utilising the REBA worksheet was performed. Utilising the new work technique, the last REBA score was diminished from 10 to 2.

Table 3 Scoring of welding workers

Workers serial no.	*Neck*	*Trunk*	*Legs*	*Upper arm*	*Lower arm*	*Wrist*	*REBA score*
1	+3	+3	+2	+5	+2	+1	10
2	+3	+3	+1	+5	+2	+1	9
3	+2	+3	+1	+2	+2	+1	5
4	+3	+2	+1	+3	+2	+2	6
5	+3	+4	+2	+3	+2	+1	9
6	+2	+1	+1	+2	+1	+1	2

These are the six welding workers in which only one worker works in the good posture. But then also the danger zone is there. But it's fine for the sixth worker. He will not be having any problem in the body due to his postures.

Table 4 Scoring of pressing machine workers

Workers serial no.	*Neck*	*Trunk*	*Legs*	*Upper arm*	*Lower arm*	*Wrist*	*REBA score*
1	+2	+3	+1	+4	+2	+3	9
2	+1	+1	+1	+4	+2	+2	4
3	+1	+1	+1	+2	+1	+1	2
4	+2	+4	+4	+3	+2	+2	11
5	+2	+1	+1	+2	+2	+1	2
6	+3	+2	+2	+2	+1	+1	5
7	+1	+1	+4	+5	+2	+1	8
8	+2	+1	+1	+1	+1	+1	2
9	+2	+2	+2	+4	+1	+1	5
10	+2	+1	+1	+2	+1	+1	2
11	+2	+1	+1	+2	+2	+1	2
12	+1	+3	+2	+1	+1	+1	2
13	+2	+3	+3	+2	+1	+1	7

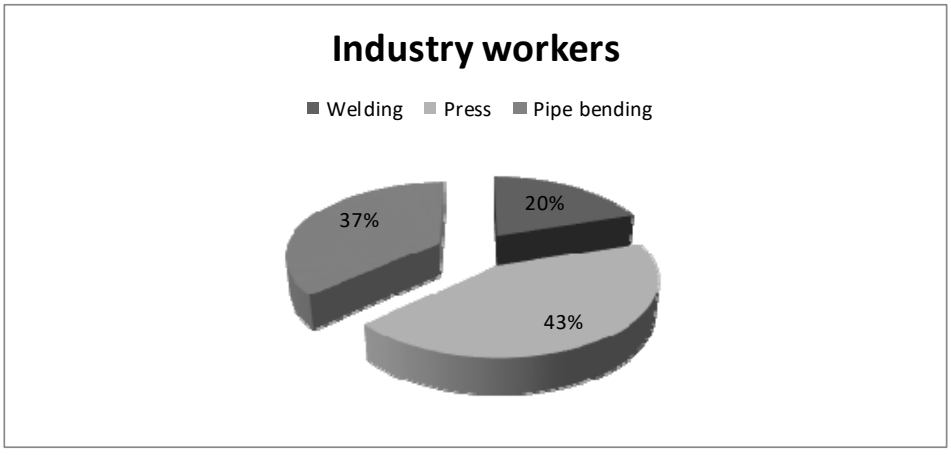
The problem arises here that the other five workers posture is not correct and the changes has to be done in the postures so that they can feel good and the productivity of company gets increases overall. So, there are 13 press machines workers in the Table 4 in which only six workers are out of danger. But the other seven workers are at the danger level. They really need to correct their postures so that they don't get any problem in the body like don't get any stress in their bodies.

Table 5 Scoring of pipe bending workers

Workers serial no.	*Neck*	*Trunk*	*Legs*	*Upper arm*	*Lower arm*	*Wrist*	*REBA score*
1	+3	+2	+1	+2	+1	+1	5
2	+2	+4	+1	+3	+1	+2	6
3	+1	+3	+2	+3	+1	+1	5
4	+2	+2	+3	+2	+1	+1	5
5	+2	+2	+3	+4	+2	+2	7
6	+1	+1	+1	+2	+1	+2	2
7	+1	+1	+2	+1	+1	+1	2
8	+3	+3	+1	+2	+1	+2	5
9	+1	+1	+1	+2	+1	+3	2
10	+3	+2	+1	+1	+1	+2	5
11	+3	+4	+2	+4	+2	+2	10

So, there are 11 pipe bending workers whom the data has been taken. Only three workers are close to the good posture and the other eight workers are at the danger level. Their working posture is not good, so there is a need to change in the posture of the workers.

Figure 8 Categories of case study industrial workers



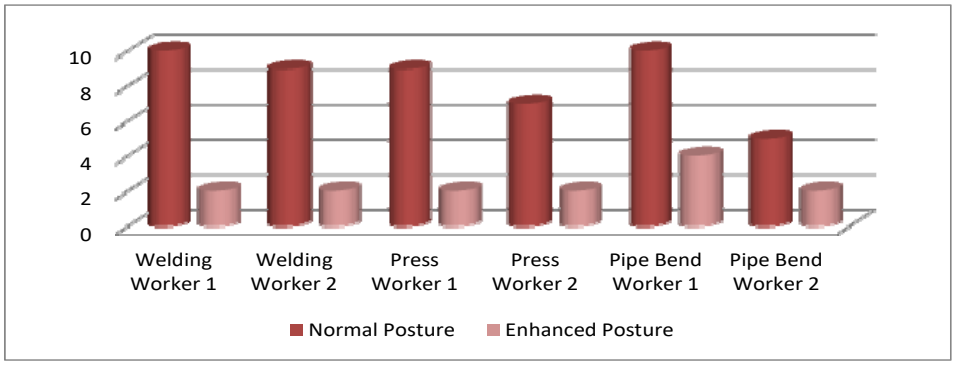
In Figure 8, we have categorised the industrial workers into three groups, we can see that there are total of 30 industrial workers for which the data has taken in which six welding workers, 13 press workers and 11 pipe bending workers are there. The blue colour is indicating the six welding workers. The red colour is for 13 press workers and green colour representing the 11 pipe bending workers.

Table 6 Enhancement of workers REBA score

S no.	*Worker*	*Normal posture*	*Enhanced posture*
1	Welding 1	10	2
2	Welding 2	9	2
3	Press 1	9	2
4	Press 2	7	2
5	Pipe bend 1	10	4
6	Pipe bending 2	5	2

The various workers considered for this study has been shown in Figure 8.

Figure 9 Improved REBA scores (see online version for colours)



This indicates that there is enhancement in the workers posture. If the workers posture is enhanced then their health also affects by becoming better. And if their health is better, then automatically the productivity and the profitability of the industry increases to very much extent. The workers presence is now there in a very happy mood rather than bad mood. The workers also didn't take many holidays now. Otherwise in a single week they used to take three days off and it would have been a major problem. But now they come and work every day without taking any holiday. In Figure 9, when standing in the normal postures, the industrial workers were getting very high REBA scores like ten, nine, nine, seven, ten and five. But after enhancing their postures, they got good REBA scores like two, two, two, two, four and two respectively. And it greatly is improving their performances.

6 Conclusions and future scope

This research predicted that the staff faces health-related problems. They complained day after day about their deteriorating health. In this study, authors introduced an ergonomic technique known as REBA that is very useful to the workers' health. By this, the fatigue level of the workers can be reduced to very much extent. The present examination has attempted to connect the holes as left by earlier studies done by different scientists in the previous couple of decades. Specific articles have been outlined on REBA methodologies or structures or tools, including the methods used and their point of principle. In this paper the current changes and potential scale of the REBA process is considered and mapped. It has been seen that the REBA instrument or method have been intentionally considered for the advancement of the human stances. Using different programming programs makes it all the more possible for scientists to analyse human attitudes. The pen and paper can take some time but we can also use various online apps. Where there is involvement of the workers or persons, we can apply this technique to reduce their stresses on the body parts. Using the computerised program in a very less time can be much more successful. Only we have to put the required data into software and then it will give us the full brief information about the workers. Finally, we can attain the desired industrial workers' status. The present study has been carried out for welding section of the industry, it can be extend for the other departments as well. This analysis was carried out for near about six month data, it can be extent/conduct for more than one year including different weather conditions effects on the worker.

References

Ansari, N.A. and Sheikh, M.J. (2014) 'Evaluation of work posture by RULA and REBA: a case study', *IOSR Journal of Mechanical and Civil Engineering*, Vol. 11, No. 4, pp.18–23.

Asante, K. (2012) *The Impact of Office Ergonomics on Employee Performance; A Case Study of the Ghana National Petroleum Corporation (GNPC)*, Doctoral dissertation.

Bhandari, S.B., Bhandari, R., Uppal, R.S. and Grover, D. (2013) 'Musculoskeletal disorders in clinical dentistry and their prevention', *Journal of Orofacial Research*, Vol. 1, No. 1, pp.106–114.

Cimino, A., Longo, F. and Mirabelli, G. (2009) 'A multimeasure-based methodology for the ergonomic effective design of manufacturing system workstations', *International Journal of Industrial Ergonomics*, Vol. 39, No. 2, pp.447–455.

Das, B. and Sengupta, A.K. (1996) 'Industrial workstation design: a systematic ergonomics approach', *Applied Ergonomics*, Vol. 27, No. 3, pp.157–163.

Domingo, J.R.T., De Pano, M.T.S., Ecat, D.A.G., Sanchez, N.A.D. and Custodio, B.P. (2015) 'Risk assessment on Filipino construction workers', *Procedia Manufacturing*, Vol. 3, No. 1, pp.1854–1860.

Dwyer, A., Huckleby, J., Kabbani, M., Delano, A., De Sutter, M. and Crawford, D. (2019) 'Ergonomic assessment of robotic general surgeons: a pilot study', *Journal of Robotic Surgery*, Vol. 1, No. 1, pp.1–6.

Fazi, H.M., Mohamed, N.M.Z.N., Ab Rashid, M.F.F. and Rose, A.N.M. (2017) 'Ergonomics study for workers at food production industry', in *MATEC Web of Conferences*, EDP Sciences, Vol. 90, p.1003.

Goswami, S., Ghosh, S. and Sahu, S. (2017) 'Evaluation of ergonomic risk factors in manual patient handling tasks of Indian nurses', *Ergonomics SA: Journal of the Ergonomics Society of South Africa*, Vol. 29, No. 1, pp.2–10.

Hignett, S. and McAtamney, L. (2000) 'Rapid entire body assessment (REBA)', *Applied Ergonomics*, Vol. 31, No. 2, pp.201–205.

Hita-Gutiérrez, M., Gómez-Galán, M., Díaz-Pérez, M. and Callejón-Ferre, Á.J. (2020) 'An overview of REBA method applications in the world', *International Journal of Environmental Research and Public Health*, Vol. 17, No. 8, p.2635.

Jeong, B.Y. and Park, K.S. (1990) 'Sex differences in anthropometry for school furniture design', *Ergonomics*, Vol. 33, No. 12, pp.1511–1521.

Jones, T. and Kumar, S. (2010) 'Comparison of ergonomic risk assessment output in four sawmill jobs', *International Journal of Occupational Safety and Ergonomics*, Vol. 16, No. 1, pp.105–111.

Kee, D. and Karwowski, W. (2007) 'A comparison of three observational techniques for assessing postural loads in industry', *International Journal of Occupational Safety and Ergonomics*, Vol. 13, No. 1, pp.3–14.

Kong, Y.K., Lee, S.Y., Lee, K.S. and Kim, D.M. (2018) 'Comparisons of ergonomic evaluation tools (ALLA, RULA, REBA and OWAS) for farm work', *International Journal of Occupational Safety and Ergonomics*, Vol. 24, No. 2, pp.218–223.

Kulkarni, V.S. and Devalkar, R.V. (2019) 'Postural analysis of building construction workers using ergonomics', *International Journal of Construction Management*, Vol. 19, No. 6, pp.464–471.

Mali, S.C. and Vyavahare, R.T. (2015) 'An ergonomic evaluation of an industrial workstation: a review', *International Journal of Current Engineering and Technology*, Vol. 5, No. 3, pp.1820–1826.

Mohammed, S. and Sharma, P. (2018) 'Ergonomics as a tool for improvement in small scale industries', *International Journal of Emerging Trends in Research*, Vol. 3, No. 6, pp.1–6.

Norhidayah, M.S., Mohamed, N.M.Z.N., Mansor, M.A. and Ismail, A.R. (2016) 'A study of postural loading in Malaysian mining industry using rapid entire body assessment', in *MATEC Web of Conferences*, EDP Sciences, Vol. 74, p.00014.

Ojha, P. and Vinay, D. (2018) 'Assessment of physical fitness and postural discomfort among assembly workers', *Journal of Pharmacognosy and Phytochemistry*, Vol. 7, No. 1, pp.1812–1814.

Rafie, F., Zamani Jam, A., Shahravan, A., Raoof, M. and Eskandarizadeh, A. (2015) 'Prevalence of upper extremity musculoskeletal disorders in dentists: symptoms and risk factors', *Journal of Environmental and Public Health*, Vol. 1, No. 1, pp.1–6.

Rost, K.A. and Alvero, A.M. (2020) 'Participatory approaches to workplace safety management: bridging the gap between behavioral safety and participatory ergonomics', *International Journal of Occupational Safety and Ergonomics*, Vol. 26, No. 1, pp.194–203.

Schwartz, A.H., Albin, T.J. and Gerberich, S.G. (2019) 'Intra-rater and inter-rater reliability of the rapid entire body assessment (REBA) tool', *International Journal of Industrial Ergonomics*, Vol. 71, No. 1, pp.111–116.

Sharma, P. and Singhal, S. (2016) 'Design and evaluation of layout alternatives to enhance the performance of industry', *Opsearch*, Vol. 53, No. 4, pp.741–760.

Singh, L.P. (2012) 'An investigation into work postures of workers engaged in casting industry: a study in India', *Asian J. Manag. Sci*., Vol. 1, No. 1, pp.17–22.

Takala, E.P., Pehkonen, I., Forsman, M., Hansson, G.Å., Mathiassen, S.E., Neumann, W.P. and Winkel, J. (2010) 'Systematic evaluation of observational methods assessing biomechanical exposures at work', *Scandinavian Journal of Work, Environment & Health*, pp.3–24.

Wintachai, P. and Charoenchai, N. (2012) 'The comparison of ergonomics postures assessment methods in rubber sheet production', in *2012 IEEE International Conference on Industrial Engineering and Engineering Management*, IEEE, December, pp.1257–1261.