



REST Journal on Emerging trends in Modelling and Manufacturing

Vol:1(1),2015

REST Publisher

ISSN No: 2455-4537

Website: www.restpublisher.com/journals/jemm

Evaluation of Ergonomic Issues in Manufacturing Industry and Improvement of Workplace

Chaudhary Saurabh Sanjay, Dhote Ashish Madhukar

^{[1][2]} RC Patel Institute of Pharmaceutical Education & Research, Dhule, India.

ari423@gmail.com, ashishdhote747@gmail.com

Abstract

Ergonomics is one of the major problems in manufacturing industries. An ergonomic hazard is a physical factor within the environment that harms the musculoskeletal system. This paper works on the assessment of workbench in Backhoe Assembly line for reduction of Ergonomic issues and improvement of workplace. It is observed that ergonomic hazards are reduced by selection of appropriate employee to the workbench. Workbench was measured and validates the work area measurement with reference standards such as Indian anthropometry data. Based on the requirements of work area, anthropometry values are consolidated and suitable recommendations were given to the workstation.

Keywords: Ergonomics, Musculoskeletal disorders, Anthropometry, Workplace design.

I. Introduction

Ergonomics was derived from two words “ergo” and “nomos”. Ergo means work and nomos means laws. Ergonomics is defined as the study of the interface between employee and workstation [12]. The primary focus of ergonomics is to see whether the workstation design matches the human body dimensions. Mismatches in workplace design lead to ergonomic hazards. In order to reduce ergonomic hazards, we should fix the suitable employee to the workplace. Anthropometry has long been used for a range of ergonomic applications & product design.[4]. The term Anthropometry refers to human body dimensions. In general body dimensions are categorized into two types; there are Static measurements and Dynamic measurements. Static measurements are the Measurements taken when the body is in a fixed position. E.g., height, breadth. And Dynamic measurements are the Measurements taken when the body is engaged in some physical activity.

II. Literature Survey

Anthropometry of Industrial populations by **W.S marrasand J.Y. Kim**, said that anthropometry data was collected in several manufacturing industries across the United States. These data were measured by anthropometer. In order to identify the unique anthropometric data of the people, data was compared with civilian and military anthropometry data. This comparison was used for to design the workplace. How does the size and shape of local populations in China compare to general anthropometric surveys currently used for product design by Nathan Daniella, François Frayssea,* and Gunther Paulasaid that data was obtained from the Chinese people and this data was compared with the Chinese database and Western database. This paper tells that how that anthropometry data differs from the Western country database. In order to improve the operator efficiency and to designing the good workplace, accurate anthropometry data is needed. Workplace Design for Manual Assembly Tasks: Effect of Spatial Arrangement on Work-Cycle Time by Kamal P. Kothiyal Berman Kayis, says that experimental study was carried out to investigate design of the assembly boards in assembly workstation. Work cycle time was observed during the normal operation. Results show that size of the parts and distance factors are the impact on the cycle time. So workplace should be designed ergonomically for assembly tasks, which would help to reduce the musculoskeletal disorder and to improve the employee efficiency. Swedish anthropometrics for product and workplace design by .Lars Hanson a,* , Lena Sperling, Gunvor Gard ,Staffan Ipsen , Cindy Olivares Vergara says that anthropometric data were measured for 367 subjects. These subjects were measured in different positions. Several studies were conducted

and this data was recorded separately. These data was merged and compared with another database. Compared values are validated and show that existing employee anthropometric data was perfectly matched with database. Existing workstation is the major concern, so adjust the workstation and equipment tools to the database values. An Ergonomics Study on Assembly Line Workstation Design by Baba MdDeros, Nor Kamaliana Khamis, Ahmad Rasdan Ismail, Haris Jamaluddin, Azmi Mat Adam and Sarudin Rosli says that study was conducted in sub assembly line motor cycle manufacturing company. Oral interview was conducted to employees who are working the sub assembly station 3. This interview results that problem faced by the employee while working in a sub assembly station. Employee movement was recorded by video recorder. Employee stature and elbow height was determined and compared with the database. Employee anthropometric data was compared with workstation measurement. Workbench height was not suitable for the current employee to work for prolonged period. To increase the productivity, workstation should be designed according to the employee anthropometric data.

III. Methodology

It is a problem solving technique used to improve the workplace. It is also known as the Deming Cycle. Corrective action of pdca cycle was classified into two types temporary and permanent. The temporary action was correcting the present problem. And permanent action was analyzing the root cause of the particular problem[2]. Anthropometry surveys detailing various measurements have been conducted in various populations. (Pheasant,1986). In India, the most referenced anthropometry data are an Indian anthropometric dimension to ergonomic design practice by Debkumar Chakrabarti . It provides the standard data for designers to redesign the workplace based on the anthropometry survey. In some situations redesign is not possible, so we have to select the appropriate human to the suitable workplace. This study aims that recommending the suitable anthropometry of human to the workplace. Based on the workplace measurement values, suitable anthropometry data are observed from the Indian anthropometry data.

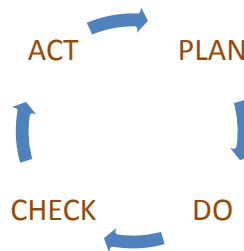


Figure 1: PDCA cycle

Plan is to analyze the workplace and identify the problem identification. Do is to Measure the workplace. Check is to validate the wok area with Indian anthropometry data and other standards and consolidate the requirements. Act is to recommend the compared findings to the workplace.

IV. Results and Discussion

A. Direct measurement:

Workbench was used in this workstation for assembling the stabilizer cylinder. The workbench used in this assembly line is shown in figure 3.

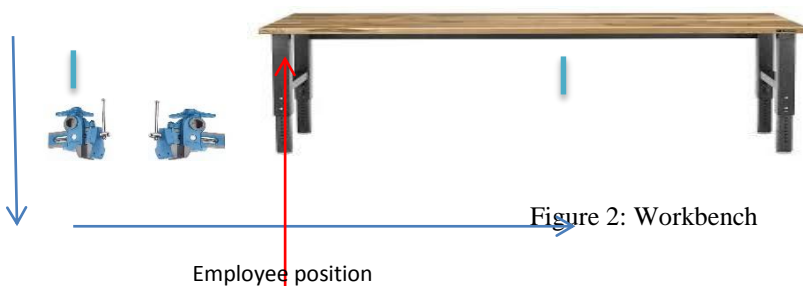


Figure 2: Workbench

Workbench was measured by using the tape. The measured values are tabulated below.

Height	910 mm
Width	1300 mm

Table 1: Existing Workbench Measurement Values

In Existing workbench three problems are observed during the work activity. They are

1. Neck pain.
2. Shoulder pain
3. Leg pain.

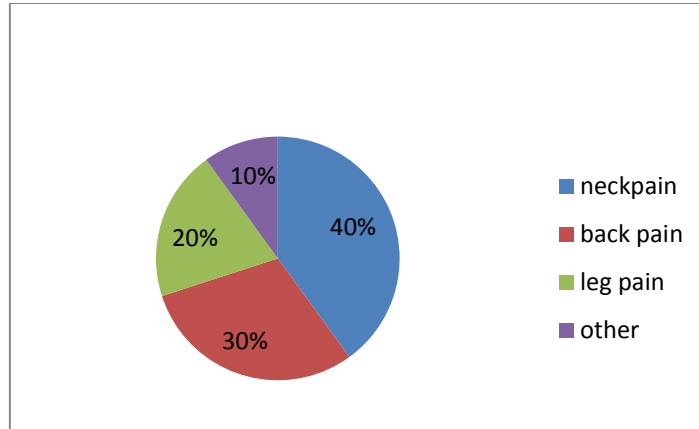


Chart 1: Problems in the Existing workbench

These problems will create pain on muscles. The pain may be widespread. These damaged muscles will stop the blood stream and harm to kidneys and leads to kidney failure. For this, workstation should be ergonomically designed or suitable employee (anthropometry data) should be selected in the workstation.

i. For neck pain:

Recommendation 1 → Workbench should be redesigned.

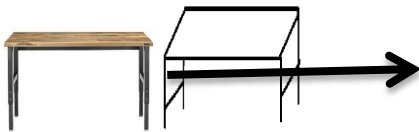


Figure 3: Recommending workbench design

Recommendation 2 → clamp height should be self-adjustable



Figure 4: Existing workbench

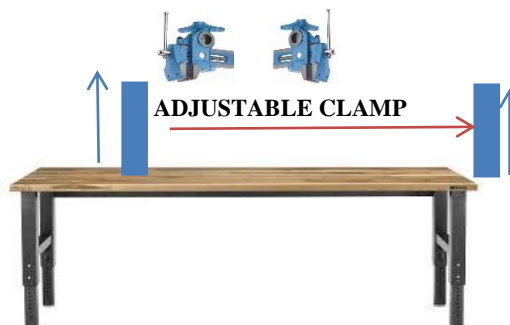


Figure 5: Recommending Clamp height

ii. For Shoulder pain:

Recommending that Selection of appropriate employee for existing workbench. The values from the table 1 are compared with the Indian anthropometry database. Approximate Anthropometry data:

Employee height:

Male : ranges from (1200* to 1396* mm)

Female : ranges from (800 to 1276* mm)

*Values are taken from Indian anthropometry table

iii. For Leg pain:

The Employee was standing long period of time for assembling the stabilizer cylinder. Recommending that, providing built in foot rails allows the employee to transfer body weight from one leg to another.



Figure 6: Recommending Foot Rest

V. Conclusion

After implementing all those recommendations, it has been identified that, ergonomic problems are reduced. Ergonomic problems are long term problems so we should identify this problem in the initial stage and appropriate control measures should be taken. Now day's ergonomic problems are the major factor in industries. Many industry workplaces were not ergonomically designed. So management should take the necessary steps to build the workplace ergonomically.

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