

An Ergonomic Design of Workplace Layout Based on Anthropometric Measurements: A Literature Review

Abdalla Esmael*

Department of Textile Engineering and Technology, University of Gezira, Wad Medani, Sudan

ABSTRACT

The paper proposes a systematic review of the literature on the ergonomic design of workplace layout based on anthropometric measurements. The main objective is to provide the reader with an accurate overview on the main scientific approaches proposed by researchers and scientists working in this specific area. The paper passes through the description of several research works as they run through the literature review. The initial search identifies a huge number of articles which were reduced to about 30 studies based on content and quality. The descriptive analysis of the literature reveals heterogeneity in the content of the scientific approaches due to the different principles, methods and tools applied for improving the interaction between humans and their working environment. Knowledge of human abilities, limitations and physiological conditions should be taken into consideration.

Keywords: Environment; Limitations; Anthropometric; Ergonomics; Musculoskeletal

INTRODUCTION

The high complexity of manufacturing systems in terms of interaction between humans and their working environment continuously provides challenging problems for researchers working in this specific field. An ergonomic approach to the design of an industrial workplace (ergonomic effective design) attempts to achieve an appropriate balance between the worker capabilities and worker requirements, to optimize worker productivity, as well as provide worker physical and mental well-being, job satisfaction and safety. During the last years this research area has become more and more important due to its effects on system efficiency and productivity. In this regard, different research works have been proposed and numerous scientific approaches have been developed trying to achieve the ergonomic effective design of the workplaces layout belonging to the manufacturing system (A literature review of the anthropometric studies of school students for ergonomics purposes: Are accuracy, precision and reliability being considered? It is the intent of the paper to present a literature review on this specific area clustering the high quality research works according to the scientific approach they propose. In this regard, the authors identify three different scientific approaches based on different principles, methods and tools. The description of the research works for each scientific approach represents the core part of this literature review. Based on the

review of the literature, it was possible to conclude that the considered anthropometric studies had not focused their attention to the analysis of precision, reliability and accuracy of the manual measurement methods. The role of anthropometric measurements in nasal surgery and research: A systematic review.

Hence, and with the aim of avoiding measurement errors and misleading data, anthropometric studies should ergonomic evaluation in plant suppression and investigation. Put more efforts and care on testing measurement error and defining the procedures used to collect anthropometric data. The main objective of this paper is to provide the reader with an accurate overview on the main scientific approaches proposed by researchers and scientists working in the ergonomic field [1].

LITERATURE REVIEW

Following are the literature review of some of the papers which gives more information about their share in field of ergonomics and the factors which are to be considered while designing the workplace layout.

History of ergonomics

The term ergonomics originally comes from the Greek words *ergon* means work and *nomos* means natural laws. The fact that

Correspondence to: Abdalla Esmael, Department of Textile Engineering and Technology, University of Gezira, Wad Medani, Sudan, Tel: 249965714490; E-mail: abdalla33065@gmail.com

Received: 30-Jul-2022, Manuscript No. JER-22-18611; **Editor assigned:** 01-Aug-2022, PreQC No. JER-22-18611 (PQ); **Reviewed:** 15-Aug-2022, QC No. JER-22-18611; **Revised:** 01-Nov-2022, Manuscript No. JER-22-18611 (R); **Published:** 08-Nov-2022, DOI: 10.35248/2165-7556.22.12.323

Citation: Esmael A (2022) An Ergonomic Design of Workplace Layout Based on Anthropometric Measurements: A Literature Review. *J Ergonomics*. 12:323.

Copyright: © 2022 Esmael A. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

the word ergonomics was coined by a polish scholar, Wojciech Jastrzebowski, in 1857. Ergonomics draws on a number of scientific disciplines, including physiology, biomechanics, psychology, anthropometry, industrial hygiene, and kinesiology. In addition, it is not a new science; it was firstly used by a polish scholar in 1857. However it is a new for the most underdeveloped countries including Iraq [2].

Ergonomics risk factors

Ergonomic risk factors are the aspects of a job or task that impose a biomechanical stress on the worker. The most important factor that results in the formation of MSD is the balance between local soft tissue fatigue and the individual's ability to recover from this fatigue. Understanding basic ergonomic principles is essential for prevention of these injuries. Each employee needs to understand the ergonomic risk factors related to his or her work tasks and solutions to minimize such risks. The basic elements of ergonomic program in any workplace design [3].

The main aim of safety program is eliminated or decrease incidents, accidents and injuries by reducing of their root causes. Based on much organization with good safety performance, ergonomic program is the best choice to achieve this goal. Having successful ergonomic program depend on several elements. Amongst them, training and education are considered as critical element of a successful ergonomic program, as it can familiarize workers with such principals such as risk identification, risk reduction, injuries management etc., which are essential for ergonomic improvement process. It can increase the worker's potential regarding skills, abilities and knowledge to execute their intended obligations. Besides training and education, management, employees' participation, development of solutions and program evaluation are also essential elements of successful ergonomic program which can be seen in the following Table 1.

Table 1: Key elements in successful ergonomic program.

Key elements	Successful ergonomic program
Management	Focusing the employer's belief on necessity of ergonomics program appointing persons in charge for ergonomic program execution establishing goals.
Training	Increasing knowledge of ergonomic Improving skills and abilities in reducing ergonomic hazards.
Employees participation	Enhancing job satisfaction enhancing motivation creating Team improving communication.
Program evaluation	Auditing of targeted performance evaluating of program efficiency.
Development of solution	Ergonomic hazards identification controlling development to mitigate hazards Appropriate engineering.

The importance of ergonomic

The most importance of ergonomic is:

- **Saves money:** Based on many studies, 1\$ out of 3\$ of worker compensation costs are due to MSDs related problem.
- **Improves productivity:** Increase the workability of labors by fitting the jobs to the workers.
- **Improves quality:** Stress on training courses, emphases on using high quality tools and equipment. This leads to improve the skill of workers.
- **Improves employee engagement:** Employees get interested when the company attempt to compliance with standard of health and safety. This increase morale and labor involvement. As a result, it reduces absenteeism and turnover.
- **Creates a better safety culture:** The cumulative of above points shows the commitment of company or employers and this change employees view towards safety to safety culture.

Ergonomics and work measurement

Another important issue to take into consideration in the workplace design layout is the strict relation between the concepts of work measurement and ergonomics.

Anthropometry

Anthropometry is combined from two words: Anthropos, which means man and metrein, which means measure. Literally, anthropometry means the study of human body dimension. Anthropometry data are used for various needs, such as workplaces design, equipment design, etc., so the measure is suitable with the human body to who will use it. There are two measurement methods, structural body dimensions and functional body dimensions. Structural body dimensions are measured with the body in static, fixed condition, whether functional body dimensions is measured when the body is in a position of work [4-8].

DISCUSSION

As it has been mentioned, this paper is based on the previous paper review to define ergonomic, describe workplace design based on anthropometric data in brief [9-12]. The writer has explored many reliable sources including books, journals, electronic reports and safety guide (Figures 1 and 2) [13-15].

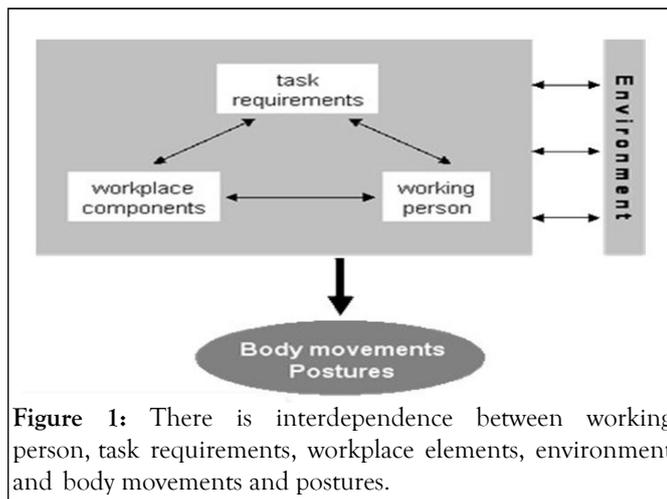


Figure 1: There is interdependence between working person, task requirements, workplace elements, environment and body movements and postures.

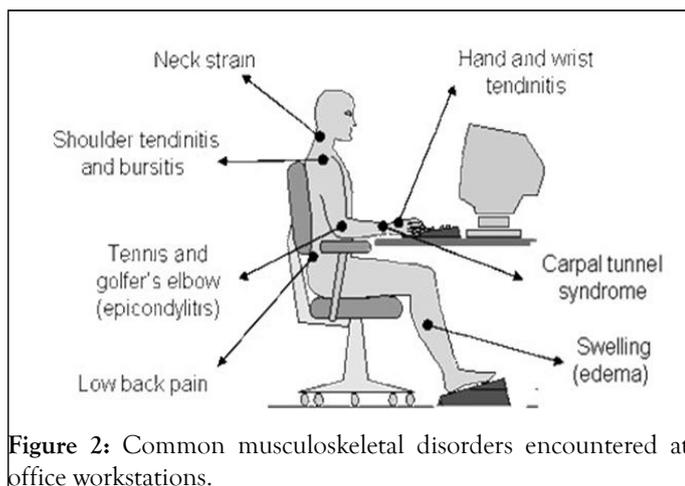


Figure 2: Common musculoskeletal disorders encountered at office workstations.

CONCLUSION

This study was focused on the ergonomics workplace design layout based on anthropometric data. Through the review, it can be concluded that ergonomics mainly can be defined as the relationship between humans, machine systems, job design and the work environment. Generally, the aim of ergonomics is to fit the task to the job and not the job to the task. From previous studies, ergonomic improve the morale of employees and this leads to have a better quality and reduces errors which improves productivity. Knowledge of human abilities, limitations and physiological conditions are also taken into consideration.

REFERENCES

1. Alves Junior CAS, Mocellin MC, Goncalves ECA, Silva DAS, Trindade EBSM. Anthropometric indicators as body fat

- discriminators in children and adolescents: A systematic review and meta-analysis. *Adv Nutr.* 2017;8(5):718-727.
2. Arefi M, Pouya A, Poursadeqiyani M. Investigating the match between anthropometric measures and the classroom furniture dimensions in Iranian students with health approach: A systematic review. *J Educ Health Promot.* 2021;10(1):38.
3. Beevis D, Slade IM. Ergonomics-costs and benefits. *Appl Ergon.* 2003;34(5):413-418.
4. Benos L, Tsaopoulos D, Bochtis D. A review on ergonomics in agriculture. part I: Manual operations. *Appl Sci.* 2020;10(6):1-21.
5. Bravo G, Bragança S, Arezes PM, Molenbroek JF, Castellucci HI. A literature review of anthropometric studies of school students for ergonomics purposes: Are accuracy, precision and reliability being considered? *Work.* 2018;60(1):3-17.
6. Carnauba RA, Chaves DFS, Baptistella AB, Paschoal V, Naves A, Buehler AM. Association between high consumption of phytochemical-rich foods and anthropometric measures: A systematic review. *Int J Food Sci Nutr.* 2017;68(2):158-166.
7. Cimino A, Curcio D, Longo F, Mirabelli, G. Workplaces Effective Ergonomic Design: A Literature Review. Proceedings of the European Modelling and Simulation Symposium. September 17-19, Campora San Giovanni (Amantea, Italy), 2008.
8. Hughes LM, Horn WG. A review and comparison of anthropometric indices applicable to the us navy submariner population. *Invest Biomech Anthr.* 2006.
9. Jaffar N, Abdul-Tharim AH, Mohd-Kamar IF, Lop NS. A literature review of ergonomics risk factors in construction industry. *Proced Eng.* 2021;20:89-97.
10. Lect Haval Salih AM. A literature review of ergonomics programs. 2017.
11. Selki HM. A literature review of ergonomics programs. In 3rd international engineering conference on developments in civil and computer engineering applications 2017;26: 191.
12. Marano D, de Oliveira EC, Amaral YN, da Silva LML, Moreira MEL. Evaluation of anthropometric equations developed to estimate neonates' body composition: A systematic review. *Adv Nutr.* 2020;25(7):2711-2720.
13. Mazhar F, Battini V, Pozzi M, Invernizzi E, Mosini G, Gringeri M, et al. Changes in anthropometric parameters after anti-TNF α therapy in inflammatory bowel disease: A systematic review and meta-analysis. In *Bio Drugs.* 2020;34(5):649-668.
14. Muralidaran M, Siddarth S, Krishna A. Ergonomic considerations for design of industrial workstation: A review. *Int Res J Eng Technol.* 2017.
15. Perez-Gosende P, Mula J, Díaz-Madronero. Facility layout planning. An extended literature review. *Int J Prod Res.* 2021;59(12):3777-3816.