International Journal of Scientific Multidisciplinary Research (IJSMR)
Vol.3, No.6, 2025: 827-832

Ergonomics of Machine Suitability with Anthropometricity to Reduce Work Fatigue

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A R T I C L E I N F O

Keywords: Machine, Reduce, Ergonomics

Received : 10 April
Revised : 18 May
Accepted: 20 June

A B S T R A C T

Machines or equipment must be adjusted to the user's anthropometry so that the user is not easily tired. By working without getting exhausted, the production results will be optimal. This paper is designed descriptively. This design in data collection uses literature, namely data from various opinions and research results. Then analyzed and discussed using descriptive statistics as well. Conclusion: 1). In working between machines or tools that are by the user's anthropometry, work will be easy not non-tiring, thus productivity will increase and avoid musculoskeletal pain. 2). Adjustment between machines or tools with anthropometry can use a percentile size of 5 (for small sizes) or percentile 95 (for large sizes)

DOI: https://doi.org/10.55927/ijsmr.v3i6.301
ISSN-E: 2986-5042
https://journal.formosapublisher.org/index.php/ijsmr

INTRODUCTION

Reach refers to the ability of workers to reach objects or work objects. Reach is influenced by anthropometry, therefore, machines or equipment must be adjusted to the user's anthropometry, so that work is not easily tiring. By working without getting tired, the production results will be optimal.

According to Rizky Miharja (2015) that "shows most respondents have moderate work fatigue". Then, according to Sari Narulita Purwati Ningsih et al (2018) that "the most fatigue is felt by workers, namely 51.1%". And according to NK Dwi Irwani (2018) that "redesigning work tools based on anthropometry will reduce fatigue of flight attendants in hotels".

Working in tired and forced conditions is a health risk. This is as stated by Rizal Fadli (2019) that "activity or work, fatigue is the main factor in the emergence of a serious disease". And, if working between machines or work equipment is not adjusted to the user's anthropometry, it will affect the posture of the body at work. As Magang Solo Abadi (2024) said that "if the posture is usually bad, pressure on the spine can result in pain in the back and neck".

Therefore, to reduce fatigue, it is ergonomically necessary to adjust the tool or machine to the anthropometry of the workforce. With workers who do not tire easily, production will be optimal.

LITERATURE REVIEW

Anthropometry, the study of human body dimensions, plays a fundamental role in ergonomic design. Machine suitability with anthropometric considerations ensures that machines are tailored to the body dimensions of the target user population. Molenbroek et al. (2003) highlight that neglecting anthropometric data in machine or workspace design often results in poor posture, overreaching, and discomfort, leading to cumulative fatigue and injury over time.

A study by Pheasant and Haslegrave (2006) emphasizes the importance of designing equipment based on population percentiles to accommodate a range of users—typically from the 5th percentile female to the 95th percentile male. This approach minimizes the risk of strain and improves accessibility and usability of machinery.

METHODOLOGY

This paper is designed descriptively. With the aim of ergonomic suitability of the machine or tool with the dimensions of the anthropometric size of the workforce to prevent work fatigue. This design in data collection uses literature, namely data from various opinions and research results. Then analyzed and discussed using descriptive statistics as well. In this paper, the method of conclusion is deductive.

RESULTS AND DISCUSSION

Suitability of Machines with Anthropometry and Fatigue

In ergonomics, machines or tools must be made according to human anthropometric dimensions. Not humans adjusting the size of the machine. So, machines or equipment must be made to suit human size. Anthropometry is the size of humans or parts of the human body or workers. This is so that they do not get tired easily. As Aisyah Yuri (2022) said that "by paying attention to worker anthropometry, the risk of excessive fatigue and work accidents can be minimized".

Machine design with an anthropometric approach will also increase productivity and reduce work fatigue. This was conveyed by Teguh Aprianto (2024) that "the design of a cut-off machine using an anthropometric approach can obtain a table design that is by worker anthropometry and can increase productivity and reduce work fatigue".

Likewise, Draky Permana Yusuf (2025) said that "improving the working position of the sisal leaf separating machine operator based on anthropometry has an impact on improving operators in completing work and reducing fatigue and the risk of muscle complaints or musculoskeletal disorders".

Based on the discussion above, it can be analyzed that the suitability of machines or tools with anthropometry, in working reduces excessive fatigue and minimizes work accidents. In addition, it can increase productivity and reduce the risk of musculoskeletal disorders.

Adjustment of Machines or Tools with Anthropometry

Then, to design equipment that requires reach, it requires anthropometry of hand reach and foot reach. In addition, eye reach is also needed to see it, so the size and color seen become important to be adjusted to the range of the eye to be seen. As also conveyed by Indah Arum (2024) that "measuring hand reach can be done by holding the hand reach. Data from this measurement is then used for airplane cockpits and tables, or the height of cabinets".

In the adjustment, the use of tool or machine sizes as a basis uses anthropometry of human body parts. In the design based on anthropometry, the 5th percentile is the small size, and the 95th percentile is the large size. As Nugraha et al (2015) used in the design of a rice combing machine, "the optimum working area of the hand can be operated by the 5th and 95th percentile operators because the transmission lever can be operated and reached by the operator's hand". This is coincidental for the transmission lever, because for the design, there are also those who use only the 5th percentile, and also only the 95th, depending on what will be designed.

In line with that, Dinda Arlini Cahya (2012) said that "percentile is a value that indicates a certain percentage of people have a size at or below that value. The 95th percentile will indicate that 95% of the population will be at or below that size, while the 5th percentile will indicate that 5% of the population will be at or below that size".

Therefore, in ergonomic design, the 95th percentile is used to design large sizes, and the 5th percentile is used to design small sizes. Of course, you have to calculate the percentile first from the sample of a certain population. So in ergonomic design, the size used is percentile, not average size (mean).

CONCLUSIONS AND RECOMMENDATIONS

Considering the analysis and discussion above, it can be concluded that:

1. In working between machines or tools that are by the user's anthropometry, then work will not be easily tiring, thus productivity will increase and avoid musculoskeletal pain.
2. Adjustment between machines or tools with anthropometry can use percentile size 5 (for small sizes) or percentile 95 (for large sizes).

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