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The Industrial Ergonomics Approach Influences Workforce Fatigue and Health and Increases Productivity

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A B S T R A C T

Work should remain safe, comfortable and not tiring, but should result in good work results or good productivity. To achieve this, we need an ergonomic approach in industry so that work is not tiring and productivity increases. In this paper it is planned in a descriptive manner. Data is taken from various opinions in literature or called literature studies. Analysis was also carried out descriptively. Conclusion, Equipment adapted to the user's anthropometry will make the work posture and work range better, and work without bending over, so that work does not get tired quickly. The physical environment of the floor and ventilation that meet the requirements will be free from the occurrence of dizziness and headaches for workers; environment many biological microorganisms especially bacteria, fungi and viruses some occupations are particularly susceptible to contracting pneumonia while carrying out work duties; chemical environment exposure to polluting gases in the form of NOx, Sox, HC, and greenhouse gas particles will affect the health of workers such as damaging blood hemoglobin composition, upper respiratory tract infections, throat irritation, pneumococcal disease, cardiovascular disease and cancer, and exposure to benzene has an effect on hemoglobin and erythrocyte abnormalities. Therefore, if the industrial environment is healthy, the workforce will also be healthy

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INTRODUCTION

In industrial or company production activities are carried out by workers. When working, you should not appear busy and not produce enough results. Work should remain safe and comfortable and not tiring, but should produce good work results or have good productivity. To achieve this, a natural ergonomic approach is needed so that work is not tiring and productivity increases.

Many people still work when they get tired quickly, as Endah Wijayanti (2020) said that "Working is tiring. Working clearly drains energy. It takes time and sometimes also brings its own stress." In line with this, workers in an industry (factory) experience great fatigue, as stated by Heriansyah Rachman (2013) "the energy level of factory workers at PT. Maruki International Indonesia, for the category of workers who lack energy, out of 205 respondents, 111 respondents (54.1%) experienced work fatigue."

Apart from workers in private factories, workers in state services also experience fatigue. As stated by Tiara Rizqi Widyanti et al (2020) stated that "As for the classification of work fatigue in the Samarinda City Fire Department, 70 respondents were found with a percentage of 54.3% who were said to be high work fatigue."

Work fatigue has an impact on performance. As found by Risnawati (2016), "practically it can be said that the contribution of work fatigue to employee performance is 12.1%". Then, working overtime also causes work fatigue. As Bayu Syaputra et al (2019) found that "there is an influence between working time and fatigue in construction workers in the Jakarta Project. "Respondents who carry out overtime work activities are 3,130 times more likely to experience work fatigue."

Another impact of work fatigue, according to Andi Gunawan (2022), is that "the impact of work fatigue can be concluded to be a decrease in work efficiency, a decrease in skills, an increase in anxiety or boredom, and it can also affect the effectiveness, productivity and safety of the workforce in general. High levels of fatigue can cause work accidents caused by human error."

Therefore, working in an industry needs to be designed ergonomically so that it is not tiring and productivity can increase. Ergonomic work means working according to working hours, working energy is not wasteful, equipment is adapted to the reach of the user (workforce), natural musculature and skeletal muscles are appropriate to human working psychology.

LITERATURE REVIEW

The concept of industrial ergonomics is: 1. equipment adjusted to the user's anthropometry, 2. improve the work environment by adjusting threshold values, 3. pay attention to work psychology, 4. ergonomic product design.

By applying the ergonomics concept above, you won't get tired easily when working.

By working without getting tired easily, it will have an effect on increasing productivity

METHODOLOGY

This article is planned in a descriptive way, namely describing working conditions that are tiring and less productive. Then, given treatment using an industrial ergonomics approach, work will make you less tired and productive. Data is taken from various opinions in literature or called literature studies. The analysis was carried out descriptively. Then, conclusions are drawn inductively.

RESULTS

Ergonomics comes from the Greek word, ergo is movement, nomos is natural. So ergonomics is a science that studies tools, the environment and humans so they can move or work naturally.

The goal of ergonomics is to create work efficiency, safety, health, security and comfort. Ergonomics that make ergonomic movements are physiological movements. This physiological meaning is that the moving end of the muscle (insertio) is moved by the base of the muscle/end of the immovable muscle (origo). This physiological movement will cause movement or work that does not get tired easily.

Ergonomics also creates an ergonomic work appearance. Ergonomic work performance is a balance between body capabilities and work tasks. We know that we humans have bodily abilities, and every living human being has work tasks or movement/activities.

In industrial ergonomics, at least four things are studied, namely: related to anthropometry, related to the environment, related to psychology, and related to musculus-skeletal.

1. Industrial Ergonomics Related to Anthropometry Influences Fatigue

Ergonomics related to anthropometry measures and considers a person's vertical reach, a person's horizontal reach. Also study and calculate ergonomic product design.

All equipment or machines used by humans for work must be in accordance with the vertical and horizontal anthropometric range of the human body. Work that can be reached easily means you don't get tired and work quickly. Therefore, ergonomic design related to anthropometry means that products or equipment must be adapted to a person's abilities. Not humans adapted machines or equipment.

Equipment that does not match the body's anthropometry causes fatigue quickly. As Joni Setiawan et al (2014) stated, "many chairs are found to be too short and have a seat that is not large enough. The average height of the "dhingklik" chair in batik is 263.7 mm, the width of the seat cushion is 353 mm, the depth of the seat cushion is 305 mm, without the use of a backrest. This size has an impact on the comfort of craftsmen who often complain of getting tired quickly."

Tools to improve working range will make working posture better. This is as Atik Kurnianto et al (2020) stated from research results that "a good tool for correcting poor work posture during the Repair Stripping Mirrors process is by using an ergonomic work table, so that the tool can adjust to work posture and can improve poor working posture".

Working in a bent position causes the body to tire easily. So, it is necessary to redesign the equipment according to the anthropometric range of the user. In this way, you have to work in a working position where you don't bend over any more. As Torik Husein et al (2009) stated in their design, "the design condition is that the position of the hand and the conveyor are parallel and closer so that the worker no longer bends over".

Based on the opinions above, equipment adapted to the user's anthropometry will make: work posture and work range better, and work will not bend over, so that work does not get tired quickly.

2. Ergonomics Related to the Work Environment Affects Health

In the work environment there are the physical environment, the biological environment and the chemical environment.

The physical environment includes: noise, vibration, dust, workplace, lighting, odors, etc. All of this must be adjusted to the Threshold Value (NAB/Threshold Value). The physical environment, for example the floor and ventilation of the workplace/home that does not meet the threshold standards, will be at risk of being unhealthy resulting in coughing, shortness of breath and dizziness, as research results by Nikie Astorina Yunita Dewanti (2018) state that "The risk of harm to home-based workers in Semarang arises from the conditions of the home environment. House floor conditions that do not meet the requirements contribute to a 2.46 times greater risk of causing coughing and shortness of breath. House ventilation conditions that are <10% of the floor area contribute a 1.35 times greater risk of dizziness and headaches."

Then the biological environment, namely the workplace environment, is free from diseases originating from living things, for example: viruses, bacteria, fungi, fungi, etc. Therefore, in this biological environment you must also know the biological oxygen demand (BOD).

In an unhealthy environment, there are biological microorganisms at risk of developing pneumonia, namely an infection that causes inflammation in the air sacs in one or both lungs, which are filled with fluid. As Pedro Pablo España Yandiola (2022) said, "occupational pneumonia is a disease that originates from outside, is closely related to the workplace environment and is caused by biological microorganisms. The main pathogens are bacteria, fungi and viruses. There are some jobs that are particularly vulnerable to the possibility of contracting pneumonia while carrying out work duties."

Then, for the chemical environment in the workplace to be healthy, it must be free from chemical substances that can cause workers to be exposed to chemicals. For example, exposure to ammonia, etc. Therefore, in a chemical environment, you must know and study chemical oxygen demand (COD).

Air pollutant gases include chemicals that affect the human health of workers, as Sugiarti (2009) states that "The air pollutant gases that most dominantly affect human health are: carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), hydrocarbon (HC) and particulates and greenhouse gases. The air pollutant components mentioned above can pollute the air individually, or can also pollute it together. The influence of air pollutant gases on human health can have direct or indirect consequences such as; damage the

composition of blood hemoglobin, ARI (upper respiratory tract infection), throat irritation, pneumococcal disease, cardiovascular disease and cancer."

Exposure to the chemical benzane also affects the health of the hemoglobin and erythrocytes of workers at the company. As Adji Adji (2017) stated that "non-carcinogenic and carcinogenic health risks due to benzene exposure in the chemical worker population at the oil and gas company PT. A will occur over the lifetime exposure duration. There is a relationship between Benzene exposure and abnormalities in hemoglobin and erythrocytes."

Based on the opinions above, it can be concluded that: the physical environment of the house, floors and ventilation that meet the requirements will be free from the occurrence of dizziness and headaches; the environment contains many biological microorganisms, especially bacteria, fungi and viruses, some jobs are particularly susceptible to the possibility of contracting pneumonia while carrying out work duties; chemical environment exposure to polluting gases in the form of NOx, Sox, HC, and greenhouse gas particles will affect the health of workers such as damaging blood hemoglobin composition, ARI (upper respiratory tract infection), throat irritation, pneumococcal disease, cardiovascular disease and cancer, as well as exposure to benzane affects hemoglobin and erythrocyte abnormalities. A healthy industrial environment means the workforce will also be healthy.

3. Egonomics Related to Psychology Influences Human-Machine Interaction

We know that humans consist of physical and psychological. Therefore, in the workplace/activity the color of the workplace must match the color. Because, psychologically, color affects a person's psychological desires which can also influence motivation in work/activities.

Then, psychologically the eye also has a distance to see. Apart from that, the color will also be easy to see according to the contrast, lighting, color size of the work tool. In work tools or machinery there are colored buttons, and the placement of these buttons must be correct. With buttons that have color, placement and size, the button has a big influence on humans' ability to reach it (button it) so that humans don't get tired easily.

We know that when people experience fatigue, their concentration at work decreases. When working, less concentration often results in errors, damage and work accidents. Therefore, the workplace must be designed ergonomically.

Psychologically, color has a signal that interacts with the observer, namely the workforce. As Novrizal Primayudha et al (2020) concluded research that "the frequency of color use and the function of its application in interior design objects. "In the end, the composition of each color is a population of signs whose function and meaning can be explored, as a signal that interacts with the observer." And, Auria Farantika Yogananti (2015) believes that "color combinations can give an impression".

Monica et al (2011) "... color has a spontaneous effect on the psychology of the person who sees it... Color is one of the most important parts that can make an object, work of art or design attractive. Color provides perfection in a design. Each color has a different psychological effect, so a designer can choose and adapt

the color selection to the product to be advertised. The perception of a color will vary from one person to another...".

Based on the opinions above, color has a psychological impact, creating different perceptions, so it is necessary to choose colors that make the design of a machine attractive, making it easier for humans to communicate with machines.

4. Ergonomics Related to Product Design Influences Productivity

Ergonomics is related to product design in accordance with skeletal muscle physiology (musculus-skeletal). Physiologically, the tip of the muscle (insertion) is moved by the base of the muscle (origo). This physiological work does not tire easily and has stronger power. This physiological work will occur if when the tool is used it causes physiological movements. Therefore, the tool is designed so that it should cause physiological movements when used, not get tired easily and increase productivity.

Agung Kristanto (2016) concluded that "research shows that the standard time in conditions before design was 11.20 seconds/unit with a standard output of 322 units/hour. Meanwhile, the standard time after design was 8.37 seconds/unit with a standard output of 434 units/hour, meaning there was a decrease in standard time of 2.83 seconds/unit or time efficiency of 25.26% and an increase in standard output of 122 units/hour or productivity increased by 34.78% ".

Work design design products can reduce workforce complaints and increase productivity. As I Ketut Simpen (2019) stated, "After implementing ergonomic work facilities, there was a reduction in complaints among workers after finishing work. 70% of workers felt slightly ill and 30% felt pain in the neck, shoulders, arms, back, waist, buttocks, butt. 80% of workers complain of mild pain and 20% have pain in the arms, wrists, thighs, buttocks, knees, calves and feet. "Worker productivity in the packaging section also increased between 15% and 22%."

Based on the opinions above, an analytical conclusion can be drawn that the use of ergonomic design products will make workers less tired and less tired, so that productivity increases at work.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

a. Equipment adapted to the user's anthropometry will make the working posture and working range better, and work without bending over, so that work does not get tired quickly.
b. The physical environment of the floor and adequate ventilation will be free from the occurrence of dizziness and headaches; the environment contains many biological microorganisms, especially bacteria, fungi and viruses, some jobs are particularly susceptible to the possibility of contracting pneumonia while carrying out work duties; chemical environment exposure to polluting gases in the form of NOx, Sox, HC, and greenhouse gas particles will affect the health of workers such as damaging blood hemoglobin composition, ARI (upper respiratory tract infection), throat irritation, pneumococcal disease, cardiovascular disease and cancer, as well as exposure to benzane affects hemoglobin and erythrocyte abnormalities. Therefore, a healthy industrial environment means the workforce will also be healthy.
c. Color has a psychological impact, creating different perceptions, so it is necessary to choose colors that attract the design of a machine, making it easier for humans to communicate with machines.
d. The use of ergonomic design products will make workers less tired and reduce complaints, so that productivity increases at work.

Recommendations

Industry in the production process should incorporate the use of an ergonomic approach. In this way, workers at work do not get tired easily, have no complaints, and remain healthy, ultimately productivity can increase.

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