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Research

Identification of Ergonomic Hazards in Motorcycle Workers in Maricaya Selatan Village

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ABSTRACT

Ergonomics is an important aspect in creating a safe, comfortable, and productive work environment, but is often overlooked in the informal sector, such as motorcycle repair shops. BPJS Employment data shows a significant increase in work accident cases in Indonesia, reaching 370,747 cases in 2023. One of the biggest contributors is work-related muscle and skeletal disorders (Musculoskeletal Disorders/MSDs), which are often found in jobs with non-ergonomic postures. Research Objective: To identify ergonomic hazards faced by motorcycle repair shop workers in Maricaya Selatan Village. Research Method: The research method employed in this study is a descriptive quantitative approach with an observational research design to identify ergonomic hazards among motorcycle repair shop workers in Maricaya Selatan Village. Research Results: Shows that the informal sector such as motorcycle repair shops face significant ergonomic hazards, but are often not handled systematically due to limited facilities and low worker awareness of the importance of ergonomics, the results of the REBA assessment show high (48.6%) and very high (45.7%) occupational hazards, 48.6% of respondents are in the category "changes must be made immediately", and 45.7% are in the category "action must be taken immediately", based on the NBM assessment 77.1% of respondents stated that the work layout was inappropriate, and 11.4% stated that it was very inappropriate.

1. Introduction

Accidents that occur in the workplace or during the journey to and from work are referred to as work accidents. Hazardous conditions related to work methods, machinery, the work environment, the nature of the work, and the production process can lead to work-related accidents. Work accidents are the result of dangerous actions caused by inadequate knowledge and skills, unsafe attitudes, and behavior. Work accidents can be caused by various factors occurring

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simultaneously in the workplace. According to several studies, experts believe that work accidents occur due to one or more causal factors occurring simultaneously at the same time (Tarwaka, 2017) in (D. N. Putri & Lestari, 2023).

According to Rubiono and Mukhtar (2021), as cited in Muhamad Rizki Chandra (2024), the risk of occupational accidents can originate from human factors, work methods, equipment, machines, and the work environment. In workshop environments, the implementation of occupational health and safety (K3) is often hindered by a lack of knowledge, concern, and operational costs. Sutrisno and Riandadari (n.d.), as cited in Muhamad Rizki Chandra (2024), state that human factors generally involve unsafe actions, such as violations of mandatory occupational safety regulations or insufficient skills. Environmental factors include unsafe conditions in the workplace, such as poorly maintained equipment or machines. Therefore, knowledge of K3 aspects is essential for motorcycle repair shop business owners.

Every year, 2.78 million workers die due to occupational accidents and diseases. Of these, approximately 2.4 million (86.3%) deaths are caused by occupational diseases, while more than 380,000 (13.7%) are caused by work-related accidents, according to the International Labour Organization (ILO, 2018). Data from BPJS Ketenagakerjaan show that 173,415 cases of work-related accidents and diseases occurred in 2018. This number then increased to 210,789 cases in 2019, including 4,007 fatal cases, and further increased to 234,370 cases of work-related accidents and diseases. Work-related accidents (KK) and occupational diseases (PAK) tend to increase when companies or organizations ignore occupational safety and health (K3) aspects in the workplace, which can be detrimental to both organizations and their employees (S. A. Putri et al., 2024). According to the latest information from BPJS Ketenagakerjaan, as of November 2022, there were 265,334 cases of workplace accidents recorded in Indonesia. This number further increased in 2023, reaching a total of 370,747 cases (Ministry of Manpower of the Republic of Indonesia, 2024; Nisma Adelya Melvani, 2024).

According to Rubiono and Mukhtar (2021), as cited in Muhamad Rizki Chandra (2024), the risk of occupational accidents can originate from human factors, work methods, equipment, machines, and the work environment. In workshop environments, the implementation of occupational safety and health (K3) is often hindered by a lack of knowledge, awareness, and operational costs. Sutrisno and Riandadari (n.d.), as cited in Muhamad Rizki Chandra (2024), explain that human factors generally involve unsafe actions, such as violations of mandatory occupational safety regulations or insufficient skills. Environmental factors include unsafe conditions in the workplace, such as poorly maintained equipment or machines. Therefore, knowledge of K3 aspects is essential for motorcycle repair shop business owners. Indirectly, adequate knowledge and implementation of K3 can increase work productivity, which in turn affects customer satisfaction levels and business profits (Dwi Rahayu et al., as cited in Muhamad Rizki Chandra, 2024). The types of industrial accidents vary depending on the materials and work equipment used, work processes, workplace conditions, and the number of workers involved. An unsupportive work environment can reduce employee concentration, which may become one of the causes of occupational accidents in industrial settings (Swaputri, 2010, as cited in Istiqomah & Irfandi, 2022).

Several factors that can cause ergonomic problems in motorcycle repair shops include various aspects related to working conditions. One major factor is unergonomic working positions. Workers often maintain poor body postures, such as bending, squatting, or remaining in static positions for extended periods. This can lead to musculoskeletal injuries or disorders. Furthermore, equipment and work facilities that do not comply with ergonomic principles also contribute to these problems. Tools that are too heavy, inappropriate for the worker's body size, or not designed to reduce physical load can increase the risk of injury. The World Health Organization (WHO) revealed in 2018 that one of the most common occupational hazards experienced by workers is complaints related to Musculoskeletal Disorders (MSDs). Musculoskeletal disorders (MSDs) are the most frequently reported type of occupational disease (PAK) (Desriani, 2017, as cited in Anggraini, 2024).

From the results of initial observations conducted in three motorcycle repair shops with a total of six employees interviewed, they experienced complaints in several parts of the body due to non-ergonomic working positions. During the survey, several workers were found to be in positions such as bending, squatting, and tilted body positions for a long period of time. The cause of work accidents in general is due to unsafe conditions and unsafe actions by workers. Specifically regarding unsafe actions, this is closely related to human factors or occurs due to human error. The impact of unsafe actions is felt by the company, workers, and the community (Jannah, 2024). Based on the above background, the author is interested in conducting research related to "Identification of Work Positions and Work Environments Against Occupational Hazards in Motorcycle Repair Shop Workers in South Maricaya Village".

2. Method

The research method used in this study is descriptive quantitative with observational research type to identify ergonomic hazards in motorcycle workshop workers in South Maricaya Village. Data collection using primary data. The data collection method in this study was carried out through interviews using questionnaires, observation of work postures with the REBA method, documentation, measurement of body angles using the Angle Meter application, as well as collection of secondary data from official sources.

3. Results & Discussion

RESULTS

The motorcycle repair shops focused on in this study are small to medium-sized businesses that provide basic services such as minor servicing, oil changes, engine repairs, and spare parts replacement. This location was chosen due to its relatively high customer volume and its contribution to meeting the community's automotive needs, particularly for two-wheeled vehicles. Respondents were 35 motorcycle repair shop workers from 15 motorcycle repair shops in South Maricaya Village.

Univariate analysis results showed that all respondents in this study were male (100%). By age group, the majority were in the early adulthood category (45.7%), followed by young adults (34.3%), middle adults (14.3%), and teenagers (5.7%). Most respondents worked more than 8 hours per day (74.3%), while 25.7% worked less than 8 hours. The occupational hazard assessment using the REBA

method indicated that respondents were in the high (45.7%) and very high (48.6%) occupational hazard categories, with only 5.7% in the moderate category. Work attitudes were also dominated by high-risk categories, namely, changes must be made immediately (45.7%) and actions must be taken immediately (48.6%). Meanwhile, the results of the work layout assessment using the NBM method showed that the majority of work layouts were inappropriate (77.1%), and some were very inappropriate (11.4%).

The results of the bivariate analysis showed that there was no significant relationship between age and the level of work hazards, indicated by a p-value = 0.448. Similarly, work shifts were not significantly related to work hazards because most workers with work durations of more than 8 hours were indeed in the high-risk category, however, the significance value remained greater than 0.05. The length of service variable also did not show a significant relationship with the work layout category, based on the chi-square test, which produced a p-value = 0.817. In addition, workers' last education did not have a significant relationship with the work layout category, as evidenced by the p-value = 0.373. Thus, all independent variables tested in this study did not have a significant relationship with work hazards or work layouts for motorcycle repair shop workers in South Maricaya Village.



Figure 1 Assessment of the work posture angle of mechanic P1 in workshop A

DISCUSSION

Relationship between Age and Occupational Hazards

Based on age, the majority of respondents were in the Early Adult category (45.7%), followed by Young Adults (34.3%), Middle Adults (14.3%), and a small proportion in the Adolescent category (5.7%). This grouping refers to the World Health Organization (WHO) age classification, in which adolescents are aged 10–19 years, young adults are 20–24 years old, early adults 25–44 years old, and middle adults 45–59 years old (WHO, 2014).

Although all age groups are within their productive years, research results indicate that the highest levels of occupational hazards are experienced by the most dominant age groups, namely Early Adults and Young Adults. The Adolescent category (5.7%), consisting of workers under 20, is at higher risk due to limited work experience and low awareness of the importance of proper work posture. According to Tarwaka (2016), young workers tend to engage in unsafe acts because they are still adapting to the work environment.

In the Young Adult (20–24 years) and Early Adult (25–44 years) categories, which represent the most physically productive ages, the potential for occupational hazards remains high because workers in these age groups are generally assigned the heaviest physical tasks. They are continuously exposed to manual workloads, such as bending and lifting heavy loads without mechanical aids. In the long term, such activities may contribute to joint, ligament, and muscle damage due to the accumulation of micro-injuries. This is reinforced by Rezvanizadeh et al. (2023), who stated that ergonomic injuries are not always acute but often develop gradually as a result of repetitive physical workloads.

Meanwhile, the Middle Adult group (45–59 years old) has a different risk tendency. Despite their greater work experience, physiologically, physical abilities such as muscle strength, flexibility, and endurance begin to decline. This makes them more susceptible to fatigue and injury if workload management is not carried out appropriately. (Tarwaka & Bakri, 2016), human physical capacity begins to decline after the age of 40, including decreased vision, reaction time, and muscle strength, thereby increasing ergonomic risks if workload management is not adjusted.

Relationship between work shifts and work hazards

Based on work shifts, the majority of respondents (74.3%) worked more than 8 hours per day, while the remainder (25.7%) worked less than 8 hours. Workers with longer working hours are at higher risk of ergonomic hazards, particularly due to muscle fatigue, prolonged static postures, and limited physical recovery time.

According to the ILO (2018) and Tarwaka and Bakri (2016), working hours exceeding the normal limit (8 hours/day) can impair physical and psychological work capacity and trigger musculoskeletal disorders due to the accumulated workload. The longer the work duration without adequate rest, the greater the risk of micro-injuries to the joints and muscles (WMSDs).

With the high proportion of workers working more than 8 hours, it is understandable why most respondents experienced occupational hazards in the high to very high category. Therefore, regulating work hours and providing active rest periods is crucial in controlling ergonomic risks..

Relationship between Length of Work and Work Layout

Length of service is a significant factor influencing exposure to ergonomic occupational hazards. Based on Table 5.4, the majority of respondents had worked for 1–5 years (57.1%), followed by workers with more than 5 years of service (34.3%), and the remainder with less than 1 year (8.6%). Workers with longer service periods tend to experience accumulated exposure to unergonomic work postures, thus increasing their risk of developing musculoskeletal disorders compared to those who have just started working.

In the 1-5 year category, even if the duration of service is relatively short, the risk of occupational hazards remains high because unintentionally repeated unergonomic postures can trigger micro-injuries. Meanwhile, in the >5-year category, workers face a greater risk due to the accumulation of long-term workloads, such as bending, lifting, and static work positions.

This finding is consistent with the opinion of Anggraini et al. (2024), who stated that the longer the service period, the greater the risk of musculoskeletal disorders due to repeated injuries that are not treated early. Meanwhile, although workers with less than one year of service have shorter exposure durations, they remain at risk because they have not yet fully adapted to the physical demands of the job.

Lack of experience and ergonomic training can lead to errors in work posture or tool use, resulting in premature injury. Therefore, occupational hazard control should be tailored to the length of service, such as posture training for new workers and long-term ergonomic interventions for established workers.

Relationship between Last Education and Job Layout

Respondents' educational attainment was divided into two groups: junior high school (22.9%) and senior high school (77.1%). Educational attainment significantly influences workers' understanding of ergonomic principles and awareness of the importance of proper workspace layout. Education also influences workers' ability to receive, understand, and apply information related to efficient and safe workspace planning.

Among junior high school graduates, limited formal knowledge tends to result in reliance on direct experience or the imitation of work habits from their surroundings. In terms of workspace layout, they lack a sufficient understanding of the importance of easily accessible equipment, adequate space, and a logical workflow.

According to Tarwaka & Bakri (2016), workers with low levels of education are more susceptible to poor work postures due to a lack of knowledge about ergonomic risks. Unergonomic workspace layouts in this group can lead to inefficient work habits and a high risk of musculoskeletal injuries, as they tend to work in any position without considering long-term comfort.

Meanwhile, senior high school graduates generally have higher levels of literacy and understanding. They are more receptive to basic information or training related to work tool arrangement and ergonomic principles. However, if this understanding is not accompanied by direct training or practical application in the workplace, it may not be applied consistently. In workshop environments with cramped layouts and disorganized tools, even though senior high school graduates may recognize ergonomic inconsistencies, they often still adapt to existing conditions due to limited facilities or an established work culture. Bridger (2003) emphasizes that ergonomic knowledge must be translated into work practice through training and environmental modification, rather than remaining at the level of theoretical understanding.

4. Conclusion

All tested variables showed no significant correlation, so factors such as age, work shift, length of service, and education did not influence occupational hazards or work layout. Ergonomic risks were more influenced by awkward work postures, cramped workspaces, non-ergonomic tool layout, and workshop work habits.

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