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Musculoskeletal disorder (MSDS) risk factors in construction workers at PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project in 2024

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ARTICLE INFO	ABSTRACT
<i>Article history:</i> Received May 30, 2025 Revised Jun 5, 2025 Accepted Jun 11, 2025 <i>Keywords:</i> Construction Ergonomics Musculoskeletal Disorders	Musculoskeletal disorders (MSDs) are a major contributor to disability worldwide, being the leading cause of disability in 160 countries. A review of 9,482 workers in 12 regions found that MSDs were the leading impact on workers in 16%. To analyze the most important factors on the risk of MSDs in construction workers of PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project in 2024. Analytical observational research with a cross-sectional study approach. aims to see the relationship between independent variables and dependent variables, namely individual characteristics (age, length of service, BMI/body mass index, smoking), ergonomic factors such as work posture (Total Back Exposure Static, Total Back Exposure Moving, Shpulder Arm Exposure, Wrist & Hand Exposure, Neck Exposure, Driving Exposure, Vibration Exposure, Work Pace Exposure, & Stress Exposure), workload, and duration of work time on complaints of musculoskeletal disorders (MSDs). The results of the study showed no relationship between individual characteristics (Age, Length of Service, BMI and Smoking Status) with MSDs complaints in Construction workers with P Value of age = 0.110; length of service = 0.597; BMI = 0.228; smoking status = 0.451. There was no relationship between ergonomic factors of body posture (Total Back Exposure Static, Total Back Exposure Moving, Total Wrist Hand Exposure, Total Driving Exposure, Total Vibration Exposure, Total Work Pace Exposure, Total Stress Exposure) & duration of work of construction workers with MSDs complaints in Construction workers of PT. Lumina Green Aluphi with p value Total Back Exposure Static = 0.960; Total Back Exposure Moving = 0.286, Total Wrist Hand Exposure = 0.344; Total Driving Exposure = 0.512; Total Vibration Exposure= 1,000, Total Work Pace Exposure= 1,000, Total Stress Exposure= 0.316. There is a significant relationship between Total Shoulder Arm, Total Neck Exposure, & Workload of construction workers with MSDs complaints in construction workers of PT. Aluphi Hijau Lumina with Total Shoulder Arm p value= 0.005, Total Neck Exposure p value= 0.040, & Workload p value= 0.005. The most influential variable on MSDs complaints is neck exposure with a P value of 0.026, OR = 6.9. The risk of experiencing pain complaints in construction workers' activities with neck positions is 7 times more at risk of experiencing MSDs complaints. There is a need to be modified of work equipment with a working position with a bent neck condition, which can be done with engineering control on changes to work stations or work methods or setting the time for work exposure with an awkward position that is too long.

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INTRODUCTION

Construction work is a unique thing because its level and field are generally specific, with limited time, construction project work includes many experts, various types of materials, equipment and fluctuating fields and which generally have the potential to cause risks (working in high places, closed places, underground and others) (Mesra & Salem, 2023)(Sudiantini & Hadita, 2022). The intense real-world demands of work and the fatigue that result from chronic debilitating conditions can raise the stakes for well-being among construction workers (Cook, Rosecrance, & Zimmermann, 1996). Most construction work is actually demanding and workers often report feeling completely drained at the end of the day (Mukhtar, 2021)(Mulyasa, 2021). Work-related musculoskeletal disorders are caused by various factors (Punnett & Wegman, 2004). This is in line with the high prevalence of gotrak (Musculoskeletal Disorders) in construction workers due to high work demands (Ardiansyah & Widanarko, 2021).

Economic losses due to work-related injuries and diseases vary between 1.8 and 6% of GDP (Gross Domestic Product) which is the market value of all jobs and products created in a country and had a median value of 4% of Gross Domestic Product worldwide in 2016. (PRINCESS, 2024),(da Conceição Savio et al., 2025). Construction workers in developing countries face health and safety hazards 10 to 20 times greater than those in industrialized countries (Saleh & Yanti, 2021)(Hasid, SE, Akhmad Noor, Se, & Kurniawan, 2022).

With the significant contribution of the construction industry to the economy and the large population, the occupational health of construction workers has become a major research concern (Tjahjono, Zebua, & Mita, 2023)(Triyawan & Fendayanti, 2021). Work Related Musculoskeletal Disorders (WMSDs) are common occupational health problems among construction workers and pose a major threat to workers' quality of life and physical health (Chairunisa Mas'um, 2023)(Kurniawidjadja, Ok, Ramdhan, Km, & KKK, 2019).

Based on information from the Global Burden of Disease (GBD) in 2019, approximately 1.71 billion people in the world experience the adverse effects of MSDs, including neck pain, rheumatoid arthritis, low back pain, fractures, other injuries, amputations, and osteoarthritis. Globally, MSDs are responsible for the leading cause of disability (Wahyuni, 2021) (Atjo Wahyu, Salmah, Syafar, Muhammad Ashar, & Yanti, 2024).

Musculoskeletal disorders (MSDs) are a major contributor to disability worldwide, with low back pain being the leading cause of disability in 160 countries. Disability associated with MSDs has been increasing and is expected to increase rapidly in the coming decades due to population growth and aging (Alisha, Halim, Syukri, Aswin, & Hidayati, 2021). MSDs are considered work-related musculoskeletal disorders (WMSDs) if an event or exposure at work contributes to the resulting disorder or significantly worsens an existing disorder (Astuti, 2024). In the US, there were 272,780 cases of WMSD reported in 2018, with a WMSD incidence rate of 27.2 per 10,000 full-time workers, which is about 30% of all work-related injuries and illnesses that occur during days off work.

In Korea, 9601 cases of WMSD were reported in 2020, of which low back pain accounted for about 43.5% (4177 cases) (Joseph, Sumampouw, & Kandou, 2023)(Santa, 2021). MSDs are the most common workplace health problem among 27 countries with cases of disorders such as respiratory disorders and musculoskeletal disorders (MSDs), according to the International Organization for the Study of Occupational Diseases Program (Hitman, Hengky, Umar, & Haniarti, 2023)(Handayani, 2011). Approximately 7,779 cases of speech-related diseases were reported in Japan in 2011, mainly lower back problems. In addition, data from 59% of all disease problems announced in Europe in 2005 were caused by external factors. In Korea, the number of MSDs cases increased from 1,634 cases in 2001 to 5,502 cases in 2010. Similar to the UK, MSDs estimated that from 2011 to 2014, almost 40% of all cases were shown by Sholicha, et al, in.

According to the International Labor Organization (ILO) or ILO (2018) in Indonesia. The spread of musculoskeletal complaints shows that workers experience back muscle injuries (20%), neck (80%), back (20%), back (40%), shoulders (20%), stomach (40%), thighs (40%), knees (60%) and calves (80%). Riskesdas information (2018) states that the picture of injuries that interfere with various daily activities is 9.2%, the area of the body affected by injury is 32% in the upper part (Budi, Sinaga, & Tinggi, 2022)(Apriliyantomo, 2020).

Approximately 470,000 workers experienced new or previous job-related musculoskeletal problems in 2020-2021, according to a report from the Labor Force Survey (LFS). There is a 28.9 percent incidence of musculoskeletal disorders in the construction industry. According to the Bureau of Labor Statistics (BLS) (2021), the industrial sector accounts for fifty percent of all worker injuries and illnesses. Based on the 2018 Riskesdas report on MSDs cases in Indonesia, 7.9% of these complaints depend on analysis from workers. The shoulder (64.52%) is the most dominant body part in the past year, this is shown from information on MSDs complaints experienced by construction workers from Kusmasari et al. 2019 research in (Pratiwi et al., 2022)(Septiani, 2017).

In addition, occupational diseases are a fairly common problem in Indonesia. The results of a review of 9,482 workers in 12 regions or cities showed that MSDs were the main disturbing impact that occurred in workers by 16%. Construction work is a vital and important perspective. A project cannot run without labor. However, in the field, workers are directly faced with the risk of accidents. Ida Fauziyah as Minister of Manpower said, based on information from the Pension Supervisory Agency (BPJS) supported by the Government, the number of work accidents in the construction sector increased from 114,000 in 2019 to 177,000 in 2020. Workers who experience work accidents can be at risk of experiencing work-related musculoskeletal disorders (WMSD). This WMSD can make the performance of all construction workers worse, work cannot run as expected due to muscle pain, and the ability to continue working cannot be achieved because the ability to survive is not achieved. become short. according to Lop et al 2019 in.

The perspective related to external muscle complaints is age. Usually this complaint will be felt when you enter working age, namely between the ages of 25 and 65 years, where the underlying complaint will generally only be able to when you are 35 years old. Strong capacity can eventually decrease and the level of inhibition continues to occur with age. Increasing weakness of the disease is closely related to the term and strength of a person's smoking. Muscle disorders will occur more frequently if they are longer and more frequent (Juleha et al., 2023).

Several known risk factors for WMSD in construction workplaces due to highly physically demanding tasks include repetitive motion, high exertion, awkward postures, vibration, and contact forces. Among these factors, awkward postures refer to body segment positions that deviate from neutral postures, such as hunched or twisted backs to lift materials, overhead work, bending, and squatting. Awkward postures can result in higher muscle activation and muscle overload because they cause less efficient force production in skeletal muscles compared to neutral postures (Ouyang et al., 2023).

Workers with long working periods (≥ 5 years of work experience) have a higher potential risk of developing WMSD when compared to workers with less work experience. This may be

because long working periods cause more exposure to risk factors than short working periods. This means that work-related musculoskeletal disorders are basically cumulative trauma or repetitive strain that develops gradually due to overuse (Yang et al., 2023).

The development target demands that workers must be in good condition, something that is most dependent on skilled construction workers is good condition. Most construction workers come from elementary school graduates who work 8 hours a day with routine activities that can cause muscle injuries or bone injuries (Mustafa & Pd, 2021). Based on Law Number 1 of 1970 concerning Occupational Safety, it is seen that every worker has the right to receive safety protection in carrying out work for the welfare of life and for increasing national results and productivity, that every other person in the work environment must also have their safety guaranteed, that every source of production needs to be safe and efficient.

Ergonomic steps that can be taken to prevent MSDs include preparation, balancing work with rest time, improving work management. There are several factors associated with MSDs complaints, including age, work orientation, weight, and tendencies to exercise and smoke. Other variables that are basically also related to MSDs complaints are work period and length of work. Judging from the research of Puspitasari and Arifin (2020), the development of external muscle problems is influenced by long-term exposure to taking risks with various factors, for example, workplaces with anthropometric disparities, non-ergonomic and measurable work positions, length of work time. repetition of similar work and high work tempo (Ilhamuddin, 2024).

PT. Aluphi Hijau Lumina is a company that works in the field of development that has been established for quite a long time. In the work cycle supervised by each work area at PT. Aluphi Hijau Lumina which cannot be separated from the potential dangers that can cause crises, work accidents, fires, explosions, chemical spills, ergonomics, lightning strikes, landslides, floods, electric shocks, and other potential threats are examples of this emergency. Continuously following the ecological factors of work so that they are always within safe and healthy limits is part of the occupational safety and health (K3) effort. This ensures that workers do not get sick or injured in the workplace and stay healthy.

Therefore, it is important to measure ergonomic hazards for workers so that we can find out how workers perform in the field so that we can limit the impact of the risk of external muscle disease or Musculoskeletal Disorders (MSDs) which can harm workers and companies. Based on surveys and observations conducted by researchers on a number of construction workers in the site area, there are several workers experiencing musculoskeletal discomfort, the symptoms include factors such as drowsiness, lack of concentration, unhealthy, back pain, headaches, stiffness when moving repetitive work, prolonged static sitting positions, fatigue, work stress, inappropriate tools, workplace, then working hours of more than 8 hours per day, etc.

These risk factors cause pain and discomfort in various parts of the body, such as the lower back, neck, shoulders, wrists, and lower legs. Therefore, a technique for controlling and preventing ergonomic hazards is needed for the risk of Musculoskeletal Disorders (MSDs). So in relation to this, the author is interested in studying and analyzing the risk factors that influence Musculoskeletal Disorders (MSDs) discomfort in construction workers at the PT. Aluphi Hijau Lumina project at the Dhoho Kediri International Airport Project.

Based on the above foundation, Musculoskeletal Disorders (MSDs) are a condition that is at risk of causing pain and even potentially causing injury and is a medical problem for workers because it can reduce the quality of work, ultimately reducing production and company losses. Musculoskeletal Disorders (MSDs) attack people who mostly work with their bodies, such as porters or construction workers. This incident can also increase the workload in the future for the company if the risk of the incident occurs. The formulation of the problem in this study is "is there a relationship between worker characteristics (age, length of service, body mass index) and job factors (work posture, workload, duration of work time) with the risk of Musculoskeletal Disorders

(MSDs) in construction workers at PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project in 2024".

RESEARCH METHOD

The type of research used is analytical observational research with a cross-sectional research method. It aims to test the relationship between independent variables and dependent variables, namely demographic factors, ergonomic risk factors and work factors on musculoskeletal disorders (MSDs) discomfort in construction workers of PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project in 2024. The research was conducted on construction workers of PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project in 2024. The research time was from November 2023 to June 2024.

The population obtained in this study were construction workers at PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project. The population in this study was 53 people and the sample taken was 48 people on musculoskeletal disorders (MSDs) discomfort in construction workers of PT. Aluphi Hijau Lumina at the Dhoho Kediri International Airport Project in 2024. This research was conducted in 3 main stages consisting of: (a) Collection of information and data used using primary data and interview data from demographic information of respondents directly with a questionnaire. (b) Evaluation of Musculoskeletal Disorders (MSDs) using the Nordic Body Map (NBM) method. (c) Measurement of the respondent's body position was carried out using the Quick Exposure Check (QEC) Technique (d) Assessment of the respondent's workload was carried out using the 10 pulse measurement method using a Stopwatch.

$$\text{Pulse Rate} = \frac{10 \text{ Beats} \times 60}{\text{Calculation time}}$$

The way to estimate the pulse is to use the 10-beat strategy, which is to place the tips of the second, third, and fourth fingers on the outer layer of the wrist skin. When the estimation begins, the stopwatch is turned on for 10 seconds, then raised by 60 to obtain the results of one moment, and for 10 seconds the stopwatch is turned off, after which the next heartbeat is recorded.

RESULTS AND DISCUSSIONS

Univariate analysis was performed on each research variable. Univariate analysis in this study includes the frequency distribution and percentage of each variable, namely age, length of service, BMI, smoking status, Work posture, length of service, workload with complaints of discomfort Musculoskeletal Disorder (MSDs) PT. Aluphi Hijau Lumina on the Dhoho Kediri International Airport project in 2024. The results obtained from 48 respondents who were <35 years old were 27 (56.3%) respondents and those who were ≥ 35 years old were 21 (43.89%) respondents. The results obtained from 48 respondents who had a new work period of <9 years were 25 (52.1%) respondents and those who had a long work period of ≥ 9 years were 23 (47.9%) respondents. The results obtained from 48 respondents who had a BMI value of less than 4 (8.3%) respondents, Normal as many as 29 (60.4%) respondents and those who had a BMI value of more than 15 (31.3%) respondents.

The results obtained from 48 respondents who had a smoking status value of 40 (83.3%) respondents, and those who had a habit of not smoking as many as 8 (16.7%) respondents. The results obtained from 48 respondents who had Low Total Back Exposure as many as 28 (58.3%) respondents, and those who had High Total Back Exposure as many as 20 (41.7%) respondents. The results obtained from 48 respondents who had Low Total Back Exposure moving as many as

44 (91.7%) respondents, and those who had High Total Back Exposure Moving as many as 4 (8.3%) respondents.

The results obtained from 48 respondents who have Low Total Shoulder Arm Exposure are 22 (45.8%) respondents, and those who have High Shoulder Arm Exposure are 26 (54.2%) respondents. The results obtained from 48 respondents who have Low Total Wrist Hand Exposure are 34 (70.8%) respondents, and those who have High Wrist Hand Exposure are 14 (29.2%) respondents. The results obtained from 48 respondents who have Low Total Neck Exposure are 17 (35.4%) respondents, and those who have High Neck Exposure are 31 (64.6%) respondents. The results obtained from 48 respondents who have Low Total Driving Exposure are 46 (95.8%) respondents, and those who have High Driving Exposure are 2 (4.2%) respondents. The results obtained from 48 respondents who had Low Total Vibration Exposure were 42 (87.5%) respondents, and those who had High Vibration Exposure were 6 (12.5%) respondents.

The results obtained from 48 respondents who had Low Work Pace Exposure were 47 (97.9%) respondents, and those who had High Work Pace Exposure were 1 (2.1%) respondents. The results obtained from 48 respondents who had Total Moderate stress exposure values were 12 (25.5%) respondents, and those who had High stress Exposure values were 36 (75.0%) respondents. The results obtained from 48 respondents who had heavy load values were 27 (56.3%) respondents, and those who had heavy load values were 21 (43.8%) respondents.

The results were obtained from 48 respondents who had a working duration in one week of more than 40 working hours. Of the 48 respondents, namely those who had a working duration of 48 (100.0%) respondents. The results were obtained from 48 respondents who had complaints of Musculoskeletal Disorder (MSDs). Of the 48 respondents, namely those who had MSDS complaints were 19 (39.9%) respondents and there were no MSDs complaints as many as 29 (60.4) respondents.

Bivariate analysis was conducted to obtain an overview of the value and also the magnitude of the relationship between independent variables and dependent variables. Dependent variables (musculoskeletal disorders complaints) and independent variables (age, length of service, BMI, smoking, work posture, workload and duration of work time). Relationship between Age and Musculoskeletal Disorder Complaints (MSDs) In construction workers, the results obtained from 48 respondents were 27 respondents who were <35 years old with 19 (70.4%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 8 (29.6%) experiencing Musculoskeletal Disorder (MSDs) complaints.

While from 21 respondents who were > 35 years old with 10 (47.6%) not experiencing any Musculoskeletal Disorder (MSDs) complaints and 11 (52.4%) respondents experiencing Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, the P value was obtained at 0.110 (P value > 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between the age of workers and complaints of Musculoskeletal Disorders (MSDs) in construction workers at PT. Aluphi Hijau Lumina in 2024.

Relationship between Length of Service and Complaints of Musculoskeletal Disorders (MSDs) In construction workers, the results obtained from 48 respondents were 25 respondents who had a work period of <9 years with 16 (64.0%) respondents not experiencing any complaints of Musculoskeletal Disorders (MSDs) and 9 (36.0%) experiencing complaints of Musculoskeletal Disorders (MSDs). Meanwhile, from 23 respondents who have a working period of > 9 years, 13 (56.9%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 10 (43.5%) respondents experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.5970 was obtained (P value > 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between the length of service of workers and Musculoskeletal Disorder (MSDs) complaints in construction workers at PT. Aluphi Hijau Lumina in 2024.

The relationship between BMI and Musculoskeletal Disorder Complaints (MSDs) in Construction Workers, the results obtained from 48 respondents were 4 respondents who had a BMI of less than 4 (100.0%) respondents did not experience any Musculoskeletal Disorder (MSDs) complaints, then there were 29 respondents who had a normal BMI of 16 (55.2%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 13 (44.8%) experienced Musculoskeletal Disorder (MSDs) complaints, while out of 15 respondents who had a BMI of more than 9 (60.0%) did not experience any Musculoskeletal Disorder (MSDs) complaints and as many as 6 (40.0%) respondents experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0 was obtained.228 (P value > 0.05) then it can be concluded that statistically at the alpha value $\alpha = 5\%$ there is no significant relationship between BMI and Musculoskeletal Disorder (MSDs) complaints in construction workers of PT. Aluphi Hijau Lumina in 2024.

The relationship between Smoking Status and Musculoskeletal Disorder (MSDs) complaints in construction workers obtained results from 48 respondents, there were 40 respondents with smoking status as many as 23 (57.5%) respondents did not experience any Musculoskeletal Disorder (MSDs) complaints and 17 (42.5%) experienced Musculoskeletal Disorder (MSDs) complaints.

Meanwhile, from 8 respondents who did not smoke, 6 (75.0%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 2 (25.0%) respondents experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.451 was obtained (P value> 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between the smoking status of workers and Musculoskeletal Disorder (MSDs) complaints in PT construction workers. Aluphi Hijau Lumina in 2024. The relationship between Static Back Exposure work posture and Musculoskeletal Disorder (MSDs) complaints in construction workers, there were 48 respondents, the results obtained from 28 respondents were Low Back Exposure Static respondents with 17 (60.7%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 11 (39.3%) experiencing Musculoskeletal Disorder (MSDs) complaints.

While from 20 respondents who had High Back Exposure Static with 12 (60.0%) not experiencing any Musculoskeletal Disorder (MSDs) complaints and 8 (40.0%) respondents experiencing Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.96 was obtained (P value> 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between Static Back Exposure of workers and complaints of Musculoskeletal Disorders (MSDs) in construction workers at PT. Aluphi Hijau Lumina in 2024.

The relationship between Back Exposure Moving work posture and complaints of Musculoskeletal Disorders (MSDs) was obtained from 48 respondents, there were results from 44 Low Back Exposure Moving respondents with 28 (60.7%) respondents not experiencing any complaints of Musculoskeletal Disorders (MSDs) and 16 (36.4%) experiencing complaints of Musculoskeletal Disorders (MSDs). Meanwhile, from 4 respondents who have High Back Exposure Moving, 1 (25.0%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 3 (75.0%) respondents experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.286 was obtained (P value> 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between Back Exposure Moving workers and Musculoskeletal Disorder (MSDs) complaints in PT construction workers.

Aluphi Hijau Lumina in 2024. The relationship between Shoulder/Arm Exposure work posture and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 22 respondents with low Shoulder/Arm Exposure with 18 (81.8%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 4 (18.2%) experiencing

Musculoskeletal Disorder (MSDs) complaints. Meanwhile, of the 26 respondents who had High Shoulder/Arm Exposure, 11 (42.3%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 15 (57.7%) respondents experienced Musculoskeletal Disorder (MSDs) complaints.

From the results of the bivariate analysis using the chi square test, a P value of 0.005 was obtained (P value < 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is a significant relationship between workers' Shoulder / Arm Exposure and Musculoskeletal Disorder (MSDs) complaints in construction workers at PT. Aluphi Hijau Lumina in 2024 and workers with High Shoulder / Arm Exposure have a 6.1 times chance of experiencing MSDs complaints. the relationship between Wrist & Hand Exposure work posture and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 34 Low Wrist & Hand Exposure respondents with 22 (64.7%) respondents not experiencing Musculoskeletal Disorder (MSDs) complaints and 12 (35.3%) experiencing Musculoskeletal Disorder (MSDs) complaints. Meanwhile, from 14 respondents who had High Wrist Hand Exposure, 7 (50.0%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 7 (50.0%) respondents experienced Musculoskeletal Disorder (MSDs) complaints.

From the results of the bivariate analysis using the chi square test, a P value of 0.344 was obtained (P value > 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between workers' Wrist & Hand Exposure and Musculoskeletal Disorder (MSDs) complaints in PT construction workers. Aluphi Hijau Lumina in 2024. The relationship between Neck Exposure work posture and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 17 Low Neck Exposure respondents with 15 (88.2%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 2 (11.8%) experiencing Musculoskeletal Disorder (MSDs) complaints.

Meanwhile, of the 31 respondents who had High Neck Exposure, 14 (45.2%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 19 (54.8%) respondents experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.008 was obtained (P value < 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is a significant relationship between worker Neck Exposure and Musculoskeletal Disorder (MSDs) complaints in construction workers at PT. Aluphi Hijau Lumina in 2024 and workers with High Neck Exposure have a 9.1 times greater chance of experiencing MSDs complaints. the relationship between Driving Exposure work posture and Musculoskeletal Disorder (MSDs) complaints obtained results from 48 respondents there were results from 46 Low Driving Exposure respondents with 27 (58.7%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 19 (41.3%) experiencing Musculoskeletal Disorder (MSDs) complaints.

While from 2 respondents who had High Driving Exposure with 2 (100.0%) did not experience any Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.512 was obtained (P value > 0.05) so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between Driving Exposure workers and Musculoskeletal Disorder (MSDs) complaints in PT construction workers. Aluphi Hijau Lumina in 2024. The relationship between Vibration Exposure Work Posture and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 42 Low Vibration Exposure respondents with 25 (59.5%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 17 (40.5%) experiencing Musculoskeletal Disorder (MSDs) complaints. While from 6 respondents who had High Vibration Exposure with 4 (66.7%) not experiencing any Musculoskeletal Disorder (MSDs) complaints and 2 (33.3%) respondents experiencing Musculoskeletal Disorder (MSDs) complaints.

From the results of the bivariate analysis using the chi square test, a P value of 1,000 was obtained (P value > 0.05), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between worker Vibration Exposure and Musculoskeletal Disorder

(MSDs) complaints in construction workers at PT. Aluphi Hijau Lumina in 2024. The relationship between Work Pace Exposure Work Posture and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 47 Low Work Pace Exposure respondents with 28 (59.6%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 19 (40.4%) experiencing Musculoskeletal Disorder (MSDs) complaints.

Meanwhile, from 1 respondent who had High Vibration Exposure with as many as 1 (100.0%) did not experience any complaints of Musculoskeletal Disorders (MSDs). From the results of the bivariate analysis using the chi square test, a P value of 1,000 was obtained ($P \text{ value} > 0.05$), it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between Work Pace Exposure workers and complaints of Musculoskeletal Disorders (MSDs) in construction workers at PT. Aluphi Hijau Lumina in 2024. The relationship between Work Posture Stress Exposure and complaints of Musculoskeletal Disorders (MSDs) was obtained from 48 respondents, there were results from 12 Low Stress Exposure respondents with as many as 9 (75.0%) respondents did not experience any complaints of Musculoskeletal Disorders (MSDs) and 4 (25.0%) experienced complaints of Musculoskeletal Disorders (MSDs).

Meanwhile, from 36 respondents who have High Stress Exposure with 30 (55.6%) not experiencing any Musculoskeletal Disorder (MSDs) complaints and 16 (44.4%) respondents experiencing Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis using the chi square test, a P value of 0.316 was obtained ($P \text{ value} > 0.05$), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is no significant relationship between worker Stress Exposure and Musculoskeletal Disorder (MSDs) complaints in PT construction workers. Aluphi Hijau Lumina in 2024. the relationship between Workload and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 27 Workload respondents with 21 (77.8%) respondents not experiencing any Musculoskeletal Disorder (MSDs) complaints and 6 (22.2%) experiencing Musculoskeletal Disorder complaints (MSDs). Meanwhile, of the 21 respondents who had a heavy workload, 8 (38.1%) did not experience any Musculoskeletal Disorder (MSDs) complaints and 13 (61.9%) respondents experienced Musculoskeletal Disorder (MSDs) complaints.

From the results of the bivariate analysis using the chi square test, a P value of 0.005 was obtained ($P \text{ value} > 0.05$), so it can be concluded that statistically at an alpha value of $\alpha = 5\%$ there is a significant relationship between worker workload and Musculoskeletal Disorder (MSDs) complaints in construction workers at PT. Aluphi Hijau Lumina in 2024 and workers with heavy workloads have a 5.7 times greater chance of experiencing MSDs complaints.

The relationship between Work Duration and Musculoskeletal Disorder (MSDs) complaints was obtained from 48 respondents, there were results from 48 respondents who had a duration of > 40 hours, 29 (60.4%) respondents did not experience any Musculoskeletal Disorder (MSDs) complaints and 19 (39.6%) experienced Musculoskeletal Disorder (MSDs) complaints. From the results of the bivariate analysis with the chi square test, it cannot be done because of the abnormal data distribution between the duration of worker time and complaints of Musculoskeletal Disorders (MSDs) in construction workers at PT. Aluphi Hijau Lumina in 2024.

In the multivariate analysis test by connecting several independent variables with one dependent variable at the same time. From the multivariate analysis, it can be seen which independent variables have the most influence and variables that influence each other but are influenced by other variables. Bivariate screening, variables that have a p value ≤ 0.25 are entered into the model to be tested multivariately with logistic regression test.

Table 1. Bivariate candidate screening

Variables	p value	Caption
Age	0.110	Candidate
Years of service	0.597	Not a Candidate
IMT	0.228	Candidate

Variables	p value	Caption
Smoking Status	0.451	Not a Candidate
Static Back Exposure	0.960	Not a Candidate
Back Exposure Moving	0.286	Not a Candidate
Shoulder/ Arm Exposure	0.005	Candidate
Wrist/ Hand Exposure	0.344	Not a Candidate
Neck Exposure	0.004	Candidate
Driving Exposure	0.512	Not a Candidate
Vibration Exposure	1,000	Not a Candidate
Work Pace Exposure	1,000	Not a Candidate
Stress Exposure	0.316	Not a Candidate
Workload	0.005	Candidate

Based on the table above for the variables selected based on the pValue < 0.250 are Age, BMI, Shoulder/ArmExposure, Neck Exposure and Workload. The final result of multivariate modeling: issued gradually according to the largest p value (> 0.05) then the change in Coef B is seen.

CONCLUSION

Based on the results of the study, data analysis and discussion conducted on 48 respondents or construction workers of PT. Aluphi Hijau Lumina on the Dhoho Kediri Airport Project in 2024, the following conclusions can be drawn: There is no relationship between the Age of construction workers and MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the Length of Service of construction workers and MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the Body Mass Index of construction workers and MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the Smoking Status of construction workers and MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project.

There is no relationship between the ergonomic factor of Total Back Exposure Static body posture and MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the ergonomic factor of Total Back Exposure Moving body posture of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is a significant relationship between Total Shoulder Arm, Total Neck Exposure of construction workers with MSDs complaints in construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project.

There is no relationship between the ergonomic factor of Total Wrist Hand Exposure of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is a significant relationship between Total Neck Exposure of construction workers with MSDs complaints in construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the ergonomic factor of Total Driving Exposure of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the ergonomic factor of Total Vibration Exposure body posture of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project.

There is no relationship between the ergonomic factor of Total Work Pace Exposure body posture of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is no relationship between the ergonomic factor of Total Stress Exposure body posture of construction workers with MSDs

complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project. There is a significant relationship between the Workload of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport. There is no relationship between ergonomic factors of body posture, duration of work of construction workers with MSDs complaints in Construction workers of PT. Aluphi Hijau Lumina Dhoho Kediri International Airport Project Related to the most influential variable on Musculoskeletal Disorder (MSDs) Complaints is Neck Exposure with a P value of 0.026, OR = 6.9

Suggestion: For Companies, There needs to be a modification of work equipment with a work position with a bent neck condition, which can be done with engineering control on changes in work stations or work methods or setting the time of work exposure with an awkward position that is too long. So that it can reduce or reduce the risk of fatigue or pain in body parts. Carrying out K3 training for workers related to manual handling, Operation Tools, Ergonomic Position, Basic Safety Behavior and Safety Awareness. For Workers, Workers with conditions that do not allow them to work overtime are advised to maintain their sleep quality and health. Prioritize health aspects while working and avoid work fatigue. For Researchers, For further researchers, further observations and research can be carried out to determine and research the route cause of MSDs complaints in construction workers in 2024.

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