# The Correlation of Working Posture toward Complaints of Musculoskeletal Disorders on Pipeline Installation Workers

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## ABSTRACT

**Introduction:** Unergonomic working posture is one of the causes of musculoskeletal disorders. Musculoskeletal disorders (MSDs) can be affected by factors such as working hours, age, and posture. If the working posture is not done correctly, it may cause disorders of the muscles, bones, tendons, and nervous system. This study aims to analyze the correlation of working posture toward complaints of musculoskeletal disorders (MSDs) on pipeline installation workers of a state-owned water utility company (PDAM). **Methods:** The design of this study was a descriptive qualitative with a cross-sectional design. The sample in the study consisted of 30 workers selected by a total sampling method. The variables in this study were working postures whose data were obtained using the Quick Exposure Checklist (QEC) instrument and musculoskeletal disorders (MSDs) whose data were obtained using the Nordic Body Map (NBM) instrument. The data analysis used in this study was a gamma correlation test. **Results:** According to the results obtained, for actions that need to be investigated further and changed soon, 55.6% had a high category, and 44.4% had a very high category of musculoskeletal complaints. Meanwhile, in the category of acts that need to be investigated and changed immediately, 15.4% had moderate musculoskeletal complaints, 15.4% had high musculoskeletal complaints, and 69.2% had very high musculoskeletal complaints. According to the results of the correlation test between the working posture variable and the symptoms of musculoskeletal disorders (MSDs), the significance value obtained was 0.000 and the coefficient value obtained was 0.752. **Conclusion:** There was a significant and strong positive relationship between the two variables, that is, the higher the working posture value, the higher the main complaints of musculoskeletal disorders (MSDs).

**Keywords:** work posture, musculoskeletal disorders, pipeline installation workers

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## INTRODUCTION

Along with the development of globalization and industrialization as well as the advancement of science and technology, occupational health and safety will also develop. According to Law No. 36 of 2009 on where in Article 164-165 concerning Occupational Health and Safety, all workplaces, both formal and informal sectors, are obliged to implement health efforts including for the state civil apparatus, Indonesian national armed forces and police. Along with all kinds of developments, companies in Indonesia will also start to switch to applying new science and technology that can increase the productivity of the company (Yuliandi and Ahman, 2019).

Occupational safety refers to the safety of equipment, work equipment, materials, processing procedures, workplace foundations, and working conditions, with the nature of the workmanship as the objective. Occupational health is an expertise in health sciences / medicine as well as practices aimed at helping employees or the working groups achieve optimal physical, psychological, and social health through curative and preventive assessments against health disorders due to occupational aspects and the workplace environment (Redjeki, 2016). Ergonomics is a branch of systematic science to utilize information on nature, capabilities, limitations and other human characteristics in designing tools,

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machines, jobs, work systems and environments so that people can work on those systems productively, effectively, safely and pleasantly (Ismara, 2014).

The concept of ergonomics is based on human awareness, limitations, abilities, and capabilities. The alignment between the work environment, work, and people involved in a job is necessary for how to prevent injury, and increase productivity, efficiency, and comfort. The provisions of the law on occupational health are contained in Law No. 23 of 1992 on Health in article 23regarding occupational health including occupational health services and prevention of occupational diseases. Based on this, it is necessary to analyze the ergonomic risks that can interfere with health in the hope of reducing the risk (Subakti and Subhan, 2021).

Poor posture can cause ergonomic problems. One of the common symptoms that arise from work is musculoskeletal disorders. MSDs are medical conditions that affect joints, muscles, tendons, skeletons, cartilage, ligaments, and nerves. Musculoskeletal problems are caused by the demands and intensity of the activity (Mulyati, 2019).

In every job, potential hazards can arise from a variety of causes, including work tasks, materials and equipment, and the working condition. The potential dangers in doing the work consist of health hazards and safety hazards. One of the dangers that can pose a health hazard is the ergonomic hazard that can cause health disorders namely MSDs in workers.

MSDs are complaints in the muscles felt by a person ranging from mild complaints to pain. The causes of MSDs are repetitive activities and unnatural work postures. MSDs cause pain, numbness, tingling, swelling, stiffness, tremors, and sleep disturbances. Muscle problems can be divided into two categories, namely transitory (reversible) and chronic complaints. A transitory complaint (reversible) is a muscular complaint that arises when the muscle is subjected to a static load, but disappears as soon as the stress is removed. A chronic complaint is a muscular problem that remains even after work has ceased and the discomfort in the muscles has subsided (Nuriati, 2017).

One of the main causes of skeletal muscle disorders is awkward posture which occurs when a good posture in a body deviates significantly from its normal position when performing activities. Awkward positions can also cause the inefficient transfer of energy from muscles to skeletal tissue, which easily causes fatigue. Working positions when reaching for objects, pushing, pulling, rotating, tilting, kneeling, squatting, and holding objects in static conditions for a long period of time and repeatedly involve several areas of the body such as shoulders, back, knees, hands. This will increase the risk of MSDs because those parts of the body are the most often injured (Kurnianto, 2018).

According to research conducted by Berek and Setyobudi (2020) regarding the relationship of work period, gender, and work attitude with musculoskeletal complaints to gas station operators in Kupang City, the results showed that there was a relationship between the work attitude variable and musculoskeletal complaints. This is due to the wrong posture of the body when doing work. Body posture can also be a cause of health problems.

The results of a study by the Ministry of of Health on health problems in Indonesia in 2006 showed that about 40.5% of illnesses experienced by workers were related to their work. Moreover, in the Prevention of Occupational Diseases program in Europe in 2009, 59% of musculoskeletal disorders (MSDs) were found (Asali and Widjasena, 2017). Data reported by Labour Force Survey, (2012) stated that out of the 1,143,000 cases of prevalence of MSDs, 493,000 cases attacked the back, 426,000 cases attacked the upper limbs or neck, and 224,000 cases attacked the lower limbs (Pujasakti, Widjasena and Kurniawan, 2019).

Manual work is still widely encountered in various work activities. Manual work carried out by someone performing a tedious task over a lengthy period of time will cause work exhaustion. Muscles that work too hard will experience fatigue, and doing monotonous activities for a long time also causes complaints to the musculoskeletal system (Purwaningsih, P. and Susanto, 2017).

PDAM of Probolinggo Regency is an example of a state-owned water utility company. When providing a clean water distribution service, PDAM needs to install pipelines with specific pipe diameters and excavation depths. This work certainly still requires human labor.

The results of the preliminary data observation using interview techniques showed that complaints of project staff on the muscle pain were caused by a long work duration for more than 8 hours. Workers complained of muscle pain and took time off went to a health center for a doctor treatment. PDAM does not have physical data on musculoskeletal problems

of project personnel. However, PDAM provides health services to project personnel in the form of a BPJS health card. The workers can flexibly seek treatment anywhere, so data about musculoskeletal disorder problems cannot be obtained from PDAM project personnel themselves. Project personnel complained that the problem of musculoskeletal diseases was also caused by workers' non-ergonomic positions. If workers continue to ignore their position at work, they may develop musculoskeletal diseases.

Based on the results of the identification or observations made, it was found that the pipe installation workers had a strange posture. This poor posture is closely related to the activity of digging the ground and closing the excavation, such as stooping, lifting stones on the ground, pushing, and lifting. In addition, the job of the pipe installation workers also involvesbending the body, squatting and twisting the wrists.

Based on these problems, the researchers conducted a study about the correlation between working posture and complaints of MSDs on pipeline installation workers at a state-owned water utility company (PDAM) in Probolinggo Regency. PDAM is one example of a regional owned enterprise (BUMD) dealing with providing services to distribute clean water. In doing their work, PDAM must put pipes in the ground to a certain depth, and this work certainly still requires human labor.

## METHOD

This research was quantitative descriptive research with cross-sectional design. Research was conducted at PDAM in Probolinggo Regency from May to June 2021. The subjects of this research were all pipeline installation workers of PDAM in Probolinggo Regency with a total of 30 people. A sampling technique with total sampling was chosen because the sample was less than 50. The independent variable in this study was working posture. Meanwhile, the dependent variable in this study was a complaints of musculoskeletal disorders.

Data collection was obtained from primary and secondary data. Primary data were obtained from questionnaires filled out by the respondents, and secondary data were obtained from various literature studies. Working posture were obtained from the results of the questionnaires filled out.

The posture questionnaire used a Quick Exposure Checklist (QEC) with an assessment of each limb. The risk level categories in the Quick Exposure Checklist (QEC) questionnaire had 4 levels: low, medium, high, and very high (The Robens Centre for Health Ergonomics, 2017; Li Guanyan, 2003) .

Based on Table 1, the static back is categorized as low (8-15), moderate (16-22), high (23-29), and very high (29-40). Moreover, for the dynamic parts observed on the back, shoulders, arms, wrists, the category scores were categorized as low (10-20), moderate (21-30), high (31-40), and very high (41-56). Meanwhile, the categories for the neck was low (4-6), moderate (8-10), high (12-14) and very high (16-18). Furthermore, the observed sections namely driving, vibration, work pace, and stress had the same category score, namely low (1), moderate (4), and high (9). but the stress section also had a very high value of 16.

Afterwards, the scores based on body parts and work activities were added up. This exposure level was used to find measures related to the workplace observed. Then, the exposure level was calculated, and actions to take based on the calculation results of the total exposure value were determined based on the value generated when calculating the exposure

**Table 1.** QEC Exposure Level Category

| Observed Part | Score | | | |
|---|---|---|---|---|
| | Low | Moderate | High | Very High |
| Back (Static) | 8-15 | 16-22 | 23-29 | 29-40 |
| Back (dynamic) | 10-20 | 21-30 | 31-40 | 41-56 |
| Shoulder/ Arm | 10-20 | 21-30 | 31-40 | 41-56 |
| Wrist | 10-20 | 21-30 | 31-40 | 41-56 |
| Neck | 4-6 | 8-10 | 12-14 | 16-18 |
| Driving | 1 | 4 | 9 | - |
| Vibration | 1 | 4 | 9 | - |
| Work Pace | 1 | 4 | 9 | - |
| Stress | 1 | 4 | 9 | 16 |

**Table 2.** Summary of Exposure Levels

| Total Exposure Level | Action Level |
|---|---|
| <40% | Safe |
| 40-49% | Investigated further |
| 50-69% | Investigated further and changed soon |
| >70% | Investigated and changed immediately |

level (Li Guangyan, 2003) using the following formula:

$$E\ (\%) = \frac{X}{X\ maks} x100\%$$

Where:

E (%) = Exposure Level

X = Total number of points for the risk of injury to the back, shoulders/arms, wrists, neck, driving, vibration, work pace, and stress.

Xmax = maximum number of possible back injuries, shoulders/arms, wrists, neck, driving, vibration, work pace, and stress. For static jobs, the possible Xmax value was 162 and for manual handling task (lifting/pulling objects, handling objects), the possible Xmax value was 176.

Based on Table 2, there are action level categories on the QEC instrument. The total exposure level <40% can be categorized as safe, 40-49% means that the action needs to be investigated further, 50-69% means that the action needs to be investigated further and changed soon, and >70% means that the action needs to be investigated and changed immediately.

Data on the complaints of Musculoskeletal Disorders (MSDs) were obtained from the results of the filled questionnaires. Questionnaires of MSD complaints used Nordic Body Map (NBM) with 4 Likert scales namely low, medium, high, and very high. The NBM method captured 28 skeletal muscles at the left and right side of the body, starting from the upper limbs, neck muscles to the lowest muscles of the legs. The measurements of skeletal muscle diseases using the NBM questionnaire were used to assess the severity of skeletal muscle diseases in a large number of study groups or sample groups, which can represent the general population (Tarwaka, 2020).

Based on Table 3, there are risk level categories in MSDs, namely scores with 0-20 having a risk level code of 0 with a lowrisk category, scores 21-41 having a risk level code of 1 with a moderate risk category, scores 42-62 having a risk level code of 2 with a high risk category, and a score of 63-84 having a risk level code of 3 with a very high risk category.

**Table 3.** Subjective Classification of Risk Level of Musculoskeletal System

| Total Score | Risk Level | Risk Category |
|---|---|---|
| 0-20 | 0 | Low |
| 21-41 | 1 | Moderate |
| 42-62 | 2 | High |
| 63-84 | 3 | Very High |

This research has passed the ethics test conducted in June 2021. The ethics test was conducted by the ethics committee of the Dentistry Faculty at Universitas Airlangga. The result has obtained a certificate of ethics No.278/HRECC. FODM/VI/2021. All workers who became the respondents in this research have also been informed with the purpose of research conducted by researchers and been given a written approval. The researchers also asked the respondents to give real answers.

## RESULTS

This research was conducted in Probolinggo Regency. Respondents in this study were all PDAM workers pipeline workers. This research aims to investigate the relationship of work postures with musculoskeletal disorder (MSDs) complaints.

### Univariate Analysis

Univariate analysis was used to describe work postures and musculoskeletal disorder (MSDs) complaints. The data displayed were in the form of frequencies and values with the most occurence.

Based on the Figure 1-4 above, there are 4 stages of pipe installation: 1) excavation of the soil to the point of the pipe, 2) the cutting of the pipe to be replaced with a new pipe, 3) pipe installation, and 4) the closure of excavation.

It can be seen from Table 4 that the exposure score of workers in process 1 was 145 or 82%, the exposure score of workers in process 2 was 141 or

**Figure 1**. Excavation of Soil

**Figure 2.** Pipe Cutting

**Figure 3**. Installation Pipe

**Figure 4**. Excavation Closure

**Table 4.** QEC Values Recapitulation on Installer Pipe Workers PDAM at Probolinggo Regency 2021

| Observed Part | Values | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Back (Dinamic) | 50 (Very High) | 48 (Very High) | 46 (Very High) | 22 (Moderate) |
| Shoulder/Arm | 40 (High) | 36 (High) | 38 (High) | 39 (High) |
| Wrist | 36 (High) | 36 (High) | 36 (High) | 24 (Moderate |
| Neck | 12 (High) | 14 (High) | 12 (High) | 4 (Moderate) |
| Driving | 1 (Low) | 1 (Low) | 1 (Low) | 1 (Low) |
| Vibration | 1 (Low) | 1 (Low) | 1 (Low) | 1 (Low) |
| Work Pace | 4 (Moderate) | 4 (Moderate) | 4 (Moderate) | 1 (Low) |
| Stress | 1 (Low) | 1 (Low) | 1 (Low) | 1 (Low) |
| Total Exposure Score | 145 | 141 | 127 | 92 |
| Exposure Level | 82% | 80% | 72% | 52% |

**Table 5.** Action Level of Working Postures On Installer Pipe Workers PDAM at Probolinggo Regency 2021

| Research Variable | Frequency | Percentage (%) |
|---|---|---|
| **Work Posture** | | |
| Safe | 0 | 0 |
| Investigate further | 8 | 26.7 |
| Investigate and change soon | 9 | 30.0 |
| Investigate and change immediately | 13 | 43.3 |

80%, and the exposure score of workers in process 3 was 127 or 72%. Hence, it can be said that the exposure level of workers in processes 1, 2 and 3 have an action level that needs to be investigated and changed soon. Moreover, the overall exposure value of workers in process 4 was 92 or 52%, so they had an action level that also needs to be investigated and changed immediately.

Table 5 shows that the frequency of work postures of PDAM project pipeline installation workers which needed further investigation accounted for 8 respondents with a percentage of 26.7%. The frequency of work postures in the category of actions which need to be investigated and changed soon accounted for 9 respondents with a percentage of 30.0%. Meanwhile, the category of actions that need to be instigated and changed immediately accounted for 13 respondents with a percentage of 43.3%.

It can be seen from Table 6 that the MSDs Complaints category on workers in processes 1, 2 and 3 had very significant results. In the work process 1,2 and 3 were in the very high category. Meanwhile, the process of work 4 had a moderate MSDs category.

Table 7 shows the results of the distribution frequency of MSDs complaints. The distribution of the pipeline project workers with moderate MSDs complaints was as many as 9 respondents with a percentage of 30.0%. PDAM project pipeline installation workers with a high category accounted for 8 respondents with a presentation of 26.7%. Meanwhile, the very high category was noted in 13 respondents with a percentage of 43.3%.

**Table 6.** NBM Values Recapitulation On Installer Pipe Workers PDAM at Probolinggo Regency 2021

| Location of MSDs complaints | Respondent | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Neck | 1 | 0 | 1 | 1 |
| Lower neck | 1 | 2 | 1 | 1 |
| Left shoulder | 1 | 2 | 1 | 1 |
| Right shoulder | 3 | 3 | 2 | 1 |
| Left upper arm | 3 | 3 | 3 | 1 |
| Back | 3 | 3 | 3 | 3 |
| Right upper arm | 2 | 2 | 3 | 1 |
| Waist | 3 | 3 | 3 | 1 |
| bottom | 2 | 2 | 2 | 1 |
| bottom of the ass | 2 | 2 | 2 | 1 |
| left elbow | 2 | 2 | 2 | 1 |
| right elbow | 2 | 2 | 2 | 1 |
| left forearm | 2 | 2 | 2 | 1 |
| right arm forearm | 2 | 2 | 2 | 1 |
| left wrist | 1 | 1 | 2 | 1 |
| right wrist | 2 | 2 | 2 | 1 |
| left hand | 2 | 2 | 2 | 1 |
| Right hand | 2 | 2 | 2 | 1 |
| left thigh | 3 | 3 | 3 | 1 |
| right thigh | 3 | 3 | 3 | 1 |
| left knee | 3 | 3 | 3 | 3 |
| right knee | 3 | 3 | 3 | 3 |
| left calf | 2 | 2 | 2 | 1 |
| right calf | 2 | 2 | 2 | 1 |
| left ankle | 2 | 2 | 3 | 1 |
| right ankle | 2 | 2 | 3 | 1 |
| on the left foot | 3 | 3 | 2 | 1 |
| right foot | 3 | 3 | 1 | 1 |
| Total | 63 (Very High) | 63 (Very High) | 62 (Very High) | 34 (Moderate) |

**Table 7.** Category Musculoskeletal Disorder (MSDs) On Installer Pipe Workers PDAM At Probolinggo Regency 2021

| Research Variable | Frequency | Percentage (%) |
|---|---|---|
| **MSDs Complain** | | |
| Low | 0 | 0 |
| Moderat | 9 | 30.0 |
| High | 8 | 26.7 |
| Very High | 13 | 43.3 |

## Bivariate Analysis

### *Gamma Correlation Test*

The test to determine the relationship between the work posture variable (ordinal) and musculoskeletal disease (ordinal) is the gamma correlation test. Table 8 shows the results of data analysis using the gamma gamma test. From the results, it can be seen that the significance value was 0.000 or <0.05, which means that there was a significant relationship between occupational posture variable and MSDs complaints. The results of the study also obtained a coefficient value of 0.752, meaning that the variable of work posture and complaints musculoskeletal disorder (MSDs) had a strong level of relationship (correlation). The strong level of relationship had a correlation coefficient number above positive value, so that the relationship was in the same direction (type of direct relationship). Thus, it can be interpreted that the higher the level of work posture, the higher the level of musculoskeletal disorder (MSD) complaints.

Based on Table 8, it can be seen that for actions that need to be investigated further, as many as 7 workers (87.5%) were had a moderate rate of complaints musculoskeletal disorder (MSDs), and 1 worker (12.5%) had a high rate of musculoskeletal disorder (MSDs) complaints. Moreover, for actions that need to be Investigated further and changed soon, as many as 5 workers (55.6%) had a high category, and as many as 4 workers (44.4%) had a very high category of musculoskeletal complaints.

Meanwhile, in the category of acts that need to be investigate and changed immediately there were as many as 2 workers (15.4%) with moderate musculoskeletal complaints, 2 workers (15.4%) with high musculoskeletal complaints, and 9 workers (69.2%) with very high musculoskeletal complaints.

## DISCUSSION

Working posture is the position of the body during the work activities related to the design of the work area and task requirements. Various conditions of the workstation that are not ergonomic will give rise to unnatural working postures such as squatting, sitting, bending, and so on. The position of the body

**Table 8.** The Correlation of Work Postures toward Complaints of Musculoskeletal Disorder (MSDs) On Installer Pipe Workers (Studi At Perusahaan Daerah Air Minum (PDAM) in Probolinggo Regency 2021)

| Work Posture | MSDs Complaints | | | Total | Values | Sig (p value) |
|---|---|---|---|---|---|---|
| | Moderate | High | Very High | | | |
| Investigate further | 7 (87.5%) | 1 (12.4%) | 0 (0.0%) | 8 (100.0) | 0.752 | 0.000 |
| Investigate further and change soon | 0 (0.0%) | 5 (55.6%) | 4 (44.4%) | 9 (100.0) | | |
| Investigate and change immediately | 2 (15.4%) | 2 (15.4%) | 9 (69.2%) | 13 (100.0) | | |

which is not natural or deviates significantly from the normal position of the body when doing work activities is called awkward posture (Purbasari, 2019).

The result of this research is in line with a study conducted by Cahyani (2019) which stated that there was a significant relationship between working posture and musculoskeletal complaints among packing section workers. The researcher also explained that a large degree of non-ergonomic work positions affected a large level of musculoskeletal complaints in workers.

Based on the results in Table 3, there was a significant result of 0.002 or <0.05 for research conducted on PDAM pipeline installation workers. Thus. it can be concluded that there was a correlation between working postures and complaints of MSDs.

Based on the research results by Khofiyya, and Suwondo(2019) there was a significant relation between working postures and musculoskeletal complaints with a high risk of 73.7% in baggage handling service workers. There are many awkward postures when workers perform activities such as lifting, bending, turning back, making significant hand movements, and crouching. The risk of skeletal muscle complaints increases when the body's position is further away from the body's gravity.

Based on the results of the working posture questionnaire using Quick Exposure Checklist (QEC), the significant values of working posture involved the values of the observed body parts of the back, shoulders or arms, and wrists or hands. The distribution of QEC assessment category for PDAM pipeline project workers show that as many as 5 workers were in a high category with a percentage of 20.0%, and 20 workers were in a very high category with a percentage of 80.0%.

The need for the amount of energy increases at a time when the body is working in an unnatural position. Unnatural posture easily causes fatigue for the body due to the inefficient condition of energy transfer from muscles to skeletal tissue. Activities that include unnatural postures are long duration in twisting body position, tilting, reaching, kneeling, squatting, holding in static condition and clamping with hands (Purbasari, 2019).

The farther the body is from its centre of gravity, the greater the danger of musculoskeletal system problems. Workplace attitudes are generally unreasonable because job expectations, work equipment, and workstations may not match with workers' capabilities and limits (Tarwaka, 2020).

The positions or postures of the PDAM project pipeline installation workers include hoeing, squatting, tilting the body, rotating body, reaching objects, twisting on the wrist when installing pipes, pushing, and pulling. Thus, the activities are very risky for the occurrence of musculoskeletal complaints to workers of PDAM project pipeline installation workers.

Musculoskeletal complaints are caused by decreased muscle or physical work so that a person can experience muscle aches or pains. Musculoskeletal complaints are characterized by reduced muscle ability to lift weights, and contractions and relaxation which become inhibited (Pandey, Doda and Malonda, 2020).

This is in accordance with research of Evadarianto and Dwiyanti (2017), suggesting that work attitude that is not ergonomic or unnatural makes the position of body parts move away from the natural position. For example, the head is raised, the back is too bent and the hands are waving up. Unnatural (unstable) posture is known to be a strong factor which can cause MSDs and leads to complaints on the back.

Based on the questionnaire results using the Nordic body map (NBM), the location of complaints on the limbs of PDAM pipeline installation workers when performing activities were at the bottom of the neck, right and left shoulders, waist, back, right

upper arm, left and right hands, and left and right wrists.

This is in accordance with the findings of Male *et al*.(2019)indicating that there was a significant relationship between working attitudes and musculoskeletal disorders. The attitude of work with high risk done by workers can be related to the fact that the work is done manually so that the movement of the body of many workers are forced through unnatural body positions. The wrong posture of workers will increase the risk of injury to the lower muscle, which shows that the work attitude enlarges the risk of muscle complaints. Hence, it can be said that the attitude of work had a strong relationship with musculoskeletal complaints.

Working posture is a determining point in carrying out one's activities. If the work is done with appropriate posture and ergonomics, the result will almost certainly be great. On the other hand, if the working posture is not really ergonomic, the workers will experience fatigue and musculoskeletal complaints. This can affect worker performance and worker productivity. Unnatural work postures such as long-standing, sitting, or bending for extended lengths of time might cause pain and discomfort in the limbs (Kurnianto, 2018)

Based on the results of research conducted by Viradiani(2018) in turbine mechanical parts workers, it was found there was a strong relationship between work attitudes and musculoskeletal complaints with high complaints. Work in the mechanical part of the turbine is also a job that tends to be static. Static work makes muscles contract, causing stiffness and soreness in the muscles. The longer the muscle contracts. The higher the risk of accumulation of lactic acid. Lactic acid buil dup causes spasms in the muscles.

According to Oakman, Stuckey and Clune, (2019) there are three levels of prevention activities that are considered effective, namely primary interventions which can actively eliminate or reduce hazards and related risks in healthy workers, secondary interventions, which can be used to promote early detection of MSDs at the stage of symptoms, and mild and curative measures which include reactive activities and rehabilitation for patients who are clinically diagnosed with musculoskeletal disorders (MSDs).

## CONCLUSION

In this study, it was found that there was a significant association between working posture and complaints of musculoskeletal disorders (MSDs) in PDAM pipeline installation workers in Probolinggo Regency with a strong association and positive direction. Hence, the activities of workers cannot be limited while doing work using manual methods.

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