



## Risk Factors Of Musculoskeletal Disorders In Workers In The Drinking Water Home Industry Darussalam Gontor

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### ABSTRACT

**Background:** The production process in the Darussalam Gontor Drinking Water Home Industry is divided into three activities, namely packing, warehousing, and shipping, this process is still carried out manually, so that workers make repetitive movements or wrong work postures that pose a risk of Musculoskeletal Disorders.

**Objectives:** This study aims to determine the picture of MSDs risk factors in workers descriptively.

**Research Methods:** The population in this study is workers at Home Industry AMIDAS totaling 25 people with data collection techniques using Quick Exposure Check questionnaires and Nordic Body Map.

**Results:** The results of the work posture picture show that the majority of workers in the AMIDAS Home Industry are 7 people with a high percentage (28%) experiencing high complaints. In addition, workers have experienced minor complaints as many as 12 people (48%), moderate complaints 5 people (20%), and high complaints as many as 8 people (32%). On average MSDs complaints, the majority experienced high complaints in the back (65%), compared to the lowest complaints in the left ankle (38%).

**Conclusion:** To overcome these posture problems, managers can provide hand pallets to make it easier for workers to do their work and also apply a rolling system.

**Keywords:** AMIDAS, QEC, Work posture.

### INTRODUCTION

During the development of this era of globalization, there has been a very rapid development of various aspects of life that can have a major influence on human life. From the development of the globalization era, it also makes Occupational Safety and Health (K3) a very important need in all sectors of work in the field and indoors. One branch of K3 is ergonomics, which is the science that studies the work environment, work equipment, and humans and the relationship between them in order to achieve a level of efficiency, welfare, and safety in carrying out work activities so as to create a comfortable atmosphere that can support worker work productivity (Primary, 2017). To achieve the needs of human life, supporting equipment is needed, so the demands on workers are also increasing so that the dangers posed are also quite large (Meilani, Asnifatima and Fatima, 2018).

The 2014 Occupational Safety and Health Administration (OSHA) states that occupational diseases are diseases that result from exposure to materials or inappropriate working conditions while working at work. One of these conditions is ergonomic hazards that can have an impact on worker health called Musculoskeletal Disorders (MSDs). Workers can experience complaints in the skeletal muscles that are felt ranging from very mild complaints to very severe complaints. If muscles receive static loads repeatedly over a long period of time, it can cause damage to muscles, nerves, joints, cartilage, intervertebral discs. In addition, MSDs are common outside the work environment and can be exacerbated by work activities. Musculoskeletal disorders (MSDs) are generally caused by work activities (Zhahir, 2012)

According to data from the U.K. Labor Force Survey (LFS), states that the rate of musculoskeletal occurrence in workers is very high, namely 1.144 million cases with a division of 493,000 back diseases, 426,000 upper body diseases, and 224,000 lower body diseases. Similar to the results of research in the United States which found as many as 6 million occurrences of MSDs each year, with a range of 300 to 400 events per 100,000 workers (Sekaaram and Ani, 2017). Based on RISKESDAS in 2018, the number of MSDs cases based on the diagnosis of health workers is 7.9%. The three provinces with the highest prevalence based on diagnosis are in Aceh (13.3%) followed by Bengkulu (10.5%), and Bali (8.5%) (Ministry of Health RI, 2018). According to Pratama, the results of his research show that the most influential factor causing Musculoskeletal Disorders (MSDs) is work attitude and there are other supporting factors such as environmental factors which include work climate, vibration, and individual factors (Pratama, 2017b).

With this data, the Government is responsible for protecting and prospering the community, and entrepreneurs also have an important role in implementing ergonomics in order to reduce ergonomic risks in order to multiply the company's capital/profit (Santoso, 2013).

Home Drinking Water Industry Darussalam (AMIDAS) Gontor is the only industry that produces mineral water located in Ponorogo, East Java. This company is also one of the business units of Pondok Modern Darussalam Gontor Ponorogo which is engaged in the production of bottled drinking water using a state-of-the-art production system with operational standards according to ISO: 9001 with stages of production, packing, warehousing, and delivery which are all carried out by workers. Packing activities are still carried out manually by workers by arranging each glass or bottle into cardboard, so workers in this packing section perform static movements that are carried out repeatedly. When glass bottled water boxes and bottles are fully filled, workers perform lifting motions to tidy them up on wooden boards so that they are easily moved to the warehouse for recording and shipment. In the warehouse section, workers carry out the lifting process neatly arranging glasses and bottles that have been packed in cardboard and arranging gallons prepared for shipment.

From the observations, it was found that there were 3 workers who had experienced complaints due to pain in the shoulders and back. Therefore, it is necessary to conduct research related to MSDs. So this study aims to determine "Description of Risk Factors for Musculoskeletal Disorders (MSDs) in Workers in the Darussalam Drinking Water Household Industry (AMIDAS) Gontor".

## METHOD

This type of research is a descriptive research. This research was carried out in February 2021 – March 2021, which took place at Darussalam Drinking Water (AMIDAS) Gontor located in Ponorogo regency, East Java.

The population in this study is all workers in the Darussalam Drinking Water Home Industry (AMIDAS) which amounts to 25 people. The sampling technique in this study was a total of all workers so that the sample in this study was 25 workers in Darussalam Drinking Water (AMIDAS) Gontor.

In this study using the Quick Exposure Check (QEC) questionnaire is one method in the field of ergonomics to assess posture ranging from the back, shoulders / arms, hands, wrists, and neck. And the Nordic Body Map (NBM) questionnaire is a simple measurement method and is used to assess the severity of disorders or injuries to the musculoskeletal system. The level of complaints in this method is assessed ranging from discomfort (slight pain), pain, to very pain by analyzing the body map. Therefore, you will get an estimate and find out the types of skeletal muscle complaints felt by the workforce.

## RESULT AND DISCUSSION

### MSD's Complaint Overview

The description of MSDs complaints to all workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor along with the percentage of workers who experience complaints in each part of the worker's body can be seen in the table and diagram witht.

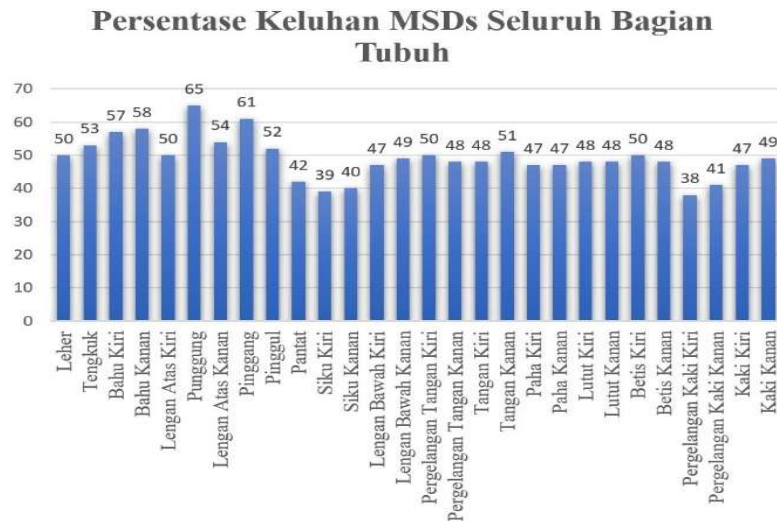
**Table 1.** Overview of MSDs Complaints to Workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor

Characteristic	Frequency (n)	Percentage (%)
Minor Complaints	12	48
Moderate Complaints	5	20
High Complaints	8	32
Very High Complaints	0	0

Total	25	100
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Source: Primary Data, 2021

Based on the results of table 1 shows that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor received minor complaints as many as 12 people with a percentage of 48%, compared to high complaints of 8 people with a percentage of 32%.



**Figure 1.** Percentage of MSDs Complaints Based on Workers' Body Parts

Based on figure 1, observations using the Nordic Body Map (NBM) questionnaire stated that the majority of workers' body parts with the highest complaint level were found in the back (65%), while the lowest complaint level was found in the left ankle (38%). This is because the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor work with a static posture for a long time.

According to Rahma in her research stated that Musculoskeletal Disorders are complaints from very mild to the most severe complaints. Because if the human muscle receives static load continuously and that for a long period of time, it will be able to cause complaints to humans in the form of damage to joints, ligaments, and tendons. These complaints and damage are what we usually term by the name of Musculoskeletal Disorders (MSDs) or injuries to the musculoskeletal system (Rahma, 2012).

Based on the results of table 8, it shows that workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor received the majority of minor complaints as many as 12 people with a percentage of 48%. This is because the majority of workers work more than 4 hours with an automatic static position, workers receive static loads on their muscles. However, workers who experience mild complaints only feel their complaints while working, these complaints will be

overcome if the load received by their muscles is immediately stopped. So these workers include workers who experience temporary complaints (reversible).

Compared to workers who experienced high complaints as many as 8 people with a percentage of 32%. This is because each worker has a different age, some are less than 35 years old and some have reached 35 years or more, because if someone is 35 years old, the average physical condition or physical capacity of a person has limitations in doing his job. (Riningrum, 2016) The next factor is the working period, because each individual worker in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor has different working periods, some are still classified as new working periods, namely workers who have a working period of under 6 years, and workers who are classified as having a long working period, namely workers who have a working period of 6 years or more than 6 years. If someone is doing their work longer, then someone will experience complaints of MSDs.

According to Koesyanto, stating that Musculoskeletal Disorders is a complaint in the form of pain that can only be felt by a person in his skeletal muscles, which starts from mild pain to cause pain to the person. This is because the muscle receives static loads that are often sustained or repeatedly in long-term periodic periods until there is damage to joints, ligaments, and tendons (Koesyanto, 2013).

Based on figure 2, observations using the Nordic Body Map (NBM) questionnaire stated that the average body parts of workers who experienced complaint levels above 50% were found in the neck (50%), nape (53%), left shoulder (57%), right shoulder (58%), left upper arm (50%), back (65%), right upper arm (54%), waist (61%), hip (52%), left wrist (50%), Right hand (51%), left calf (50%). However, the majority of workers' body parts with the highest level of complaints are found on the back (65%). This is because the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor work with a static posture for a long time even more than 4 hours, carry out lifting activities with manual handling by receiving a fairly heavy load, and their lack of concern for the application of a good and correct work posture when doing work.

Compared to the lowest complaint rate, which is found in the left ankle (38%). This is because workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor mostly work with manual handling and static body positions, whose movements are mostly carried out on the upper body such as the neck, back, shoulders, arms / hands, and hips for a long time or more than 4 hours. So that the minority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor experienced complaints on his left ankle.

This research is in line with Nur Fadilah Dewi's research which shows that the results of ergonomic risk research due to musculoskeletal disorders in poly nurses found muscle parts in nurses who are at risk of injury, namely nape with score 1 (56%), 2 (37%) and 3 (7%), neck with score 1 (67%), 2 (27%), 3 (8%), left and right shoulder with score 1 (67%), 2 (30%) and 3 (3%), back with

score 1 (54%), 2 (10%), 3 (33%), 4 (3%) and waist with score ( 1 (47%), 2 (23%), 3 (27%), 4 (3%), and pangggul with score 1 (77%), 2 (13%), 3 (7%), 4 (3%) (Dewi, 2020).

And in line with Tiara Devi's research which shows that the most complaints felt by rice transport workers of PT. Buyung Poetra Pangan is on the lower neck (72%), right shoulder (62.8%), left shoulder (60%), and upper neck (48.5%). There are several symptoms that are often felt in rice transport workers here, including pain, numbness, tingling, stiffness, and sleep disorders. These symptoms are felt 3-4 times a week (Devi et al., 2017).

So to overcome the occurrence of higher complaints to recommend to the manager or section head at the Home Industry Drinking Water Darussalam (AMIDAS) Gontor to roll or change the work section of each worker to reduce the risk of complaints against workers who have experienced complaints with workers who are not at risk of MSDs complaints

#### Variable Characteristics of Respondents Based on MSDs Complaints

The variable characteristics of respondents based on MSDs complaints taken data in this study include age, length of work, body mass index, and work posture. The characteristics and variables of research respondents can be seen in the following table:

#### Worker Age

**Table 2.** Description of MSDs Complaints Based on Age Factors in Workers in Home Industry Drinking

Age		MSDs Complaints			Total
		Minor Complaints	Moderate Complaints	High Complaints	
<35 years	Frequency (n)	12	3	5	20
	Percentage (%)	48%	12%	20%	80%
≥35 years	Frequency (n)	0	2	3	5
	Percentage (%)	0%	8%	12%	20%
Total	Frequency (n)	12	5	8	25
	Percentage (%)	48%	20%	32%	100%

Source : Primary Data, 2021

Based on the results of table 2 shows that the majority of workers in the Home Industry Drinking Water Darussalam (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers under 35 years old as many as 5 people (20%), compared to workers aged 35 years or over 35 years as many as 3 people (12%).

According to Riningrum, that a person's age will be directly proportional to a person's physical capacity to a certain extent. In general, complaints will occur when you are 35 years old and if it is longer, it will continue to increase the complaints you feel. This happens because it is caused by

decreased strength and endurance in the muscles so that muscle complaints that are felt will increase (Riningrum, 2016).

Based on the results of table 5 shows that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers under 35 years old as many as 5 people (20%). This is because based on the results of interviews conducted, that the majority of workers here are relatively young because most of the workers are high school / vocational graduates they immediately work in the Home Industry Darussalam Drinking Water (AMIDAS) Gontor, this tends to be due to economic factors, so they inevitably try to work to help meet the needs of their parents. And it is known that workers aged <35 years they feel unaccustomed to doing their work and do not understand about good and correct work posture at work, in contrast to workers aged  $\geq 35$  years because some of them are experienced and already understand the position of the body and posture that is good and correct in doing their work, So that the majority of workers who often experience complaints of aches at work are workers aged <35 years.

Compared to workers aged 35 years or over 35 years as many as 3 people (12%). This is because at this age a person has limitations in doing work, but they still try to work as much as they can for the needs of their family. According to Anggraeni, stated that in general someone between the ages of 35 years - 65 years feels complaints of MSDs. And the first time the complaint is felt at the age of 35 years and the level of complaint will increase as the person gets older. This happens because at that age muscle strength and endurance have begun to decrease so that there is a risk of increasing muscle complaints (Anggraeni, 2015). There are also study results that state that workers aged  $\geq 38$  years have a high chance of musculoskeletal disorders (Prahastuti, Djaali and Usman, 2021).

This research is in line with previous research conducted on laundry workers on Jalan Prof. Dr. Soepomo Janturan Yogyakarta, laundry workers here the average age of workers is the productive age. At that age the capacity of muscle strength begins to decrease, so at that age there is a risk of experiencing complaints of MSDs (Sari et al., 2017).

Years of service

**Table 3.** Description of MSDs Complaints Based on Working Period Factors in Workers in the

Years of service		MSDs Complaints			Total
		Minor Complaints	Moderate Complaints	High Complaints	
$\geq 6$ Years	Frequency (n)	5	5	7	17
	Percentage (%)	20%	20%	28%	68%
< 6 Years	Frequency (n)	7	0	1	8
	Percentage (%)	28%	0%	4%	32%
Total	Frequency (n)	12	5	8	25

Percentage (%)	48%	20%	32%	100%
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Source : Primary Data, 2021

Based on the results of table 3 shows that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have a working period of 6 years or more than 6 years as many as 7 people (28%), compared to workers who have a working period of less than 6 years as many as 1 person (4%).

According to Anggraeni, the working period is the length of time calculated from the firsttime workers enter to start working until the time this research takes place. This period of work has a strong relationship between muscle complaints and increased complaints of MSDs, especially for workers who use high work strength (Anggraeni, 2015).

According to Rusdimayanti, working period is divided into 2 categories, namely the new working period category and the old working period. A person if he has worked for <6 years, then a person can be declared to be included in the category of new working period, while if someone has worked for  $\geq 6$  years, then someone is included in the category of old working period (Rusdimayanti, 2012).

Based on the results of table 6 shows that the majority of workers in the Home Industry Drinking Water Darussalam (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have a working period of 6 years or more than 6 years as many as 7 people (28%). This is because based on the results of observations made, that the majority of workers do work that is almost done repeatedly in a static position and it takes place every day. If this activity lasts for years, it will certainly be risky for workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor to experience complaints of MSDs. Workers who have worked for a long time, plus have a heavy workload can cause muscle aches and pains because they are burdened continuously (Devi, Purba and Lestari, 2017).

Compared to workers who have a working period of less than 6 years as much as 1 person (4%). This is because the worker is not in accordance with his part of work and with the load he receives. And it is known that workers who have a working period of <6 years they feel unaccustomed to doing their work, in contrast to workers who have a working period of  $\geq 6$  years because the majority of them have been doing their work for a long time, so the majority of workers who often experience complaints of soreness in working are workers who have a working period of  $\geq 6$  years.

This research is in line with previous research conducted on manual handling workers at PT. Source Tirta Surakarta who stated that there is a significant relationship between MSDs complaints caused by length of work, because the longer the work, the more the musculoskeletal complaint system will increase (Erdiansyah, 2014).



## Worker's Body Mass Index

**Table 4.** Description of MSDs Complaints Based on Body Mass Index Factors in Workers in the Home

Body Mass Index		MSDs Complaints			Total
		Minor Complaints	Moderate Complaints	High Complaints	
Thin	Frequency (n)	3	1	0	4
	Percentage (%)	12%	4%	0%	16%
Usual	Frequency (n)	3	3	7	13
	Percentage (%)	12%	12%	28%	52%
<i>Overweight</i>	Frequency (n)	6	1	1	8
	Percentage (%)	24%	4%	4%	32%
Total	Frequency (n)	12	5	8	25
	Percentage (%)	48%	20%	32%	100%

Source : Primary Data, 2021

Based on the results of table 4 shows that the majority of workers in the Home Industry Drinking Water Darussalam (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have the normal category as many as 7 people (28%), compared to workers who have the overweight category as many as 1 person (4%).

Body mass index is one of the factors causing complaints of MSDs although the effect is not too large. Tarwaka in Rosanti (2020), states that the balance in body construction in receiving loads, both body loads and other loads can affect complaints in the body's skeletal system (Rosanti et al., 2020).

Based on the results of table 7 shows that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have normal categories as many as 7 people (28%). This is because the majority of workers who have this normal BMI category do manual handling work with a static posture position, this tends to be if workers work continuously with the weight of the load lifted can cause pain in their neck, back, waist, and hands.

Compared to workers who have an overweight category of 1 person (4%). This is because these workers work in the delivery department which requires high energy in lifting weights with manual handling, According to Rosanti, body mass index affects the risk of MSDs if in overweight individuals or obese individuals there is found to be damage to the musculoskeletal system which manifests as pain and discomfort (Rosanti et al., 2020). Having an abnormal Body Mass Index such as underweight, overweight, and obesity can result in several musculoskeletal disorders (Purnawijaya and I Putu Gede Adiatmika, 2016).

This research is in line with research conducted by Aulia Tjahayuningtyas on Tofu making industry workers in Taman Sidoarjo District, from the results of data analysis, a value of  $\text{sig} = 0.332$  ( $\alpha = 0.05$ ) was obtained, which means that there is no relationship between BMI and the occurrence of musculoskeletal complaints in tofu making workers. Meanwhile, based on the value of coeff (Cramer's) = -0.162 shows that there is a negative relationship between BMI and MSDs complaints. The higher a person's BMI, the lower the level of musculoskeletal complaints experienced (Tjahayuningtyas, 2019).

#### Worker's Work Postur

**Table 5.** Description of MSDs Complaints Based on Work Posture Factors in Workers in the Home

Posture		MSDs Complaints			Total
		Minor Complaints	Moderate Complaints	High Complaints	
<i>Action Level</i> 3	Frequency (n)	6	0	1	7
	Percentage (%)	24%	0%	4%	28%
<i>Action Level</i> 4	Frequency (n)	6	5	7	18
	Percentage (%)	24%	20%	28%	72%
Total	Frequency (n)	12	5	8	25
	Percentage (%)	48%	20%	32%	100%

Source : Primary Data, 2021

Based on the results of table 5 shows that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have level 4 action posture category as many as 7 people (28%), compared to workers who have level 3 action posture category as many as 1 person (4%).

According to Septiani, that work posture is a work process that adjusts to the anatomy of the body and the size of the equipment used when working. Work posture is a regulation of body posture while working. So if different work attitudes will produce different strengths. And when working it is better for posture to be done naturally in order to minimize the incidence of Musculoskeletal Disorders (MSDs) injuries (Septiani, 2017). Work postures that can cause MSDs are improper work postures and are carried out continuously in long time brackets (Sjarifah and Rosanti, 2019)

Based on the results of table 8 shows that the majority of workers in the Gontor Drinking Water Home Industry (AMIDAS) who experience the risk of Musculoskeletal Disorders (MSDs) with high complaints in workers who have level 4 action posture category as many as 7 people (28%), compared to workers who have level 3 action posture category as many as 1 person (4%). This is because workers in the Darussalam Drinking Water Home Industry (AMIDAS) do work using

manual handling, it is almost repeated every day in doing work, and every day they work more than 4 hours.

Based on figure 3, it states that workers who obtain a level 3 action score get high complaints of 4%. Based on the results of the Quick Exposure Check (QEC) questionnaire, this is because the worker can be said to include new workers who work in the production of bottled drinking water, this job very often makes the worker move the shoulder / arm about 12 times per minute or more, and in working the position of his wrist bent. In fact, almost more than 20 times per minute the movement of the work is repeated, and sometimes this work makes the worker have to twist or bend his neck while working. These workers also experience very stress levels in doing the job.

Based on figure 4, it states that the majority of workers who obtained a level 4 action score received high complaints of 28%. Based on the results of the Quick Exposure Check (QEC) questionnaire, the majority of workers work in the production of bottled drinking water, but there are also those who work in the production of glass bottled drinking water, shipping section, warehouse section, and maintenance section. This job requires a slightly twisted or bent back position, and this job makes frequent movements on the back about 8 times per minute and the position of the hands around the shoulders is even higher. This worker very often does shoulder / arm movements about 12 times per minute or more, and in working the position of his wrists bent, even the work movements are repeated about 11 to 20 times per minute. This work sometimes also makes the worker have to twist or bend his neck while working, and the maximum load lifted by this worker is quite heavy around 6-10 kg and this work can be completed on average in about more than 4 hours. Improper posture can increase the risk of MSDs in the neck, chest and lumbar spine at least twofold (Leite et al., 2019)

This research is in line with research conducted by Basri (2020), based on the results of the research found, that the results of the exposure value of workers' body posture at the la-tansa gontor bread factory, showed that the risk level of injury in 7 workers out of 9 workers was at the level of 72.8% - 82.7% (Action Level 4) which means that research and changes must be carried out as soon as possible (Basri & Arifah, 2020).

So to overcome the occurrence of a higher posture score to recommend to the manager or section head ceat the Darussalam Drinking Water Home Industry (AMIDAS) Gontor to provide knowledge about good and correct work posture for workers, one of which can be with a poster of work posture at work, and also reconstruct the work station to be more ergonomic by providing backrests such as cushions on chairs so that Workers become comfortable at work.

## CONCLUSION

The results of the work posture description related to the risk of MSDs showed that the majority of workers in the Darussalam Drinking Water Home Industry (AMIDAS) Gontor were 7 people with a high percentage (28%) experiencing high complaints who received a level 4 action score. In addition, workers have experienced minor complaints as many as 12 people (48%), moderate complaints 5 people (20%), and high complaints as many as 8 people (32%). The average MSDs complaints in workers in the Home Industry Drinking Water Darussalam (AMIDAS) Gontor are the majority of those who experience high complaints found in the back (65%), compared to the lowest complaints found in the left ankle (38%). To overcome the problem of F A work posture that occurs, managers or company managers should provide hand pallets so that they can be used to facilitate workers in doing their work, and apply a rolling system to workers.

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