J-Kesmas: Jurnal Fakultas Kesehatan Masyarakat
(The Indonesian Journal of Public Health)
Available at http://jurnal.utu.ac.id/jkesmas
p-ISSN: 2355-0643, e-ISSN: 2355-0988
Vol. 11, No. 02, October, 2024
Open Access
TYPE OF ARTICLE

Relationship between Individual and Occupational Factors with Musculoskeletal Disorders on Drinking Water Refill Depot Workers in Padang, West Sumatra

Fea Firdani[1], Vivi Sutia Desmalinda[1], Azyyati Ridha Alfian[1]

[1]Faculty of Public Health, Andalas University, Padang, Indonesia
Corresponding author: Fea Firdani, feafirdani@ph.unand.ac.id
Co-author : VSD: vivisutia01@gmail.com, ARA: azyyatiridaalfian@ph.unand.ac.id
Submitted:15/09/2024 **Revised:** 27/11/2024 **Accepted:** 02/12/2024 **Published online**: 06/12/2024

doi: https://doi.org/10.35308/j-kesmas.v11i2.10361 **How to cite this article**: Firdani, F. Desmalinda, VS., Alfiani, AZ. (2024). Relationship between Individual and Occupational Factors with Musculoskeletal Disorders on Drinking Water Refill Depot Workers in Padang, West Sumatra. *J-Kesmas: Jurnal Fakultas Kesehatan Masyarakat (The Indonesian Journal of Public Health)*. 11 (2): 27-35

Abstract

Refill Drinking Water Depot workers rely on physical strength to work, so they are at risk of experiencing Musculoskeletal Disorders (MSD) complaints. Based on the initial survey, 13 out of 15 workers (86.7%) experienced MSD. This research aims to determine the relationship between individual and work factors and MSD complaints among refill drinking water depot workers in Padang City. The study used a cross-sectional design. We collected data from November 2022 to July 2023 with a population of 347 people and a sample using the Proportional Random Sampling Technique of 83 people. The dependent variable in this study is complaints of Musculoskeletal Disorders (high risk if NBM score > 20). The independent variables are age (at risk ≥ 35 years), work period (at risk ≥ 5 years), smoking habits (at risk if IB values ≥ 200), working posture (at stake if REBA score ≥ 7), physical workload (at risk if ≥ 100 beats/minute) and BMI (at risk if < 17 and > 25). Data analysis uses univariate and bivariate analysis (chi-square test). The results of the study showed that 71.1% of workers experienced MSD complaints, 34.9% of workers with a risky age, 19.3% of workers with a problematic work period, 32.5% of workers had a smoking habit, 9.6% of workers with a risky BMI, all workers are not at risk of physical workload and 56.6% of workers work with dangerous work postures. The bivariate test results showed that there was no significant relationship between the variables age (p=0.954), years of service (p=0.192), smoking habits (p=0.233), BMI (p=0.330), and work posture (p=0.499) with complaints of MSD. There was no relationship between age, length of service, smoking habits, BMI, and work posture with MSD complaints. We recommended that business owners collaborate with the Community Health Center to provide education about ergonomics when working for refill drinking water depot workers.

Keywords: Individual factors; Job factors; MSD

Introduction

Musculoskeletal Disorders (MSD) are health problems related to bones, joints, muscles, tendons, ligaments, and nerves that a person experiences, ranging from mild complaints to very severe complaints that occur due to excessive physical activity, repetitive movements, wrong posture, balance between physical activity and rest as well as poor ergonomics (Tarwaka, Soluchul HA Bakri, 2004). According to WHO, MSD are disorders of the skeletal structure, including bones, joints, muscles, ligaments, tendons, nerves, and blood vessels, characterized by pain (often persistent)

This article is licensed under CC BY- SA 4.0 License

and limited mobility, thereby reducing a person's ability to work (WHO, 2022). Based on Global Burden of Disease (GBD) data in 2019, around 1.71 billion people worldwide experienced MSD. The highest figures were found in developed countries, with a prevalence of 441 million cases, followed by countries in the Western Pacific region with 427 million cases, and Southeast Asian countries with 369 million cases (Cieza et al., 2020). In Indonesia, based on Riskesdas data from the Ministry of Health in 2018, the prevalence of MSD in Indonesian population over 15 years was 7.30%. The highest prevalence was in Banda Aceh Province at 13.26%, followed by Bengkulu Province at 12.11% and Bali Province at 10.46%, while in West Sumatra Province, the prevalence of MSD was 7.21% (Kemenkes RI, 2018). Based on data from the Padang City Health Service in 2022, 2,161 cases of occupational diseases (PAK) were found. Found PAK cases in 3 working areas of the community health center, namely 487 cases in the Lubuk Begalung Community Health Center, 181 cases in the Andalas Community Health Center area, and 146 cases in the Nanggalo Community Health Center area. However, there was no specific data on the type of PAK experienced by workers related to MSD.

Occupational diseases arise due to work relationships involving the work process of lifting, lowering, and carrying goods directly without the help of tools. Lifting and carrying work is one of the oldest activities in the informal sector of daily life activities and is a part of society that needs attention because the work processes carried out contain many risks to health status. In general, workers use their bodies as a means of transportation, such as lifting, carrying, or transporting (Tarwaka, Soluchul HA Bakri, 2004). Refill drinking water depots are one of the informal sectors of the type of drinking water facilities. The community widely uses this sector because the prices are affordable and not too expensive (Sugriarta, 2018). Based on the development of refill drinking water depots in Padang City, it was recorded that in 2021, there were 804 units with the most extensive distribution in the working area of the Andalas Community Health Center with 69 depots, the functional area of the Pauh Community Health Center with 66 depots and the operational area of the Pengambiran Community Health Center with 56 depots (Dinas Kesehatan, 2021). Based on previous research conducted by Wulandari (2016), workers lifting gallons at refill drinking water depots experienced MSD complaints of 67.7% with a prevalence of MSD risk factors in workers with a work posture of 48.8%, with a workload of 61.3%, at age >35 years it is 41.9%, at work period ≥ 3 years it is 54.8% and risky exercise habits are up to 71% so that the presence of complaints Musculoskeletal disorders can conclude work posture, workload, age and work period and there is no relationship between exercise habits and MSD complaints (Wulandari, 2016). This refill drinking water depot has workers who lift the gallons. This gallon lifter relies on physical strength to carry gallons from one place to another with a load weighing ± 20 kg, allon lift workers usually work with unnatural attitudes and body positions for long periods with repeated lifting frequency, giving rise to complaints of musculoskeletal disorders. (Wulandari, 2016). In line with research by Arum et al. (2022) regarding the relationship between manual material handling and MSD complaints in gallon delivery people, there is a relationship between time, body position, and the risk of manual material handling in MSD complaints (Pratiwi, 2022).

Based on observations and initial survey results conducted at the Lubuk Begalung Health Center, Andalas Health Center, and Nanggalo Health Center, we found that 13 out of 15 workers experienced musculoskeletal disorders, with a percentage of 86.7%. Complaints are often encountered in several body parts, such as 86.7% on the waist, 66.7% on the back, 86.7% on the calf, 93.3% on the left wrist, and 66.7% on the lower neck. As a result of interviews with the Community Health Center, it was discovered that the Occupational Health Effort Post had not carried out supervision

This article is licensed under CC BY- SA 4.0 License

p-ISSN: 2355-0643, e-ISSN: 2355-0988
Vol. 11, No. 02, October, 2024

regarding occupational health and safety (OHS) in the informal sector, including at refill drinking water depots, especially for refill drinking water depot workers. The community health center only supervises depot sanitation hygiene, while occupational safety and health issues have yet to be addressed. Drinking water depot workers are known to work with a bent body position when lifting and lowering gallons and an unnatural body posture when pushing or pulling, carrying, and holding the weight of gallons, which can cause complaints of musculoskeletal disorders. It is known that the measurements of environmental temperature and humidity at the drinking water depot show results below the threshold value (NAB), namely a temperature of 25˚C and humidity of 85%. At the same time, there are no problems with the lighting and vibration factors. From the survey results, it is necessary to carry out research regarding the relationship between individual characteristics and work factors with complaints of MSD among refilled drinking water depot workers in Padang City.

Methods

The type of research used is a quantitative method with a cross-sectional design. This research was carried out on Refill Drinking Water Depot workers in the Lubuk Begalung, Andalas, and Nanggalo Community Health Center working areas. The research population was 347 people, and the research sample was 83 people, selected using a proportional random sampling technique. The dependent variable in this study is complaints of Musculoskeletal Disorders (high risk if NBM score > 20), The independent variables are age (at risk ≥ 35 years), work period (at risk ≥ five years), smoking habits (at risk if IB values ≥ 200), Working posture (at stake if REBA score ≥ 7), physical workload (at risk if ≥ 100 beats/minute) and BMI (at risk if < 17 and > 25). Data processing uses univariate analysis and bivariate analysis using the chi-square test. This study passed the ethical clearence and received ethical approval from the Research Ethics Commission, Faculty of Public Health, Universitas Andalas with Certificate Number : 19/UN16.12/KEP-FKM/2023.

Results

This research was conducted at refill drinking water depots in three working areas of Lubuk Begalung, Andalas, and Nanggalo health centers. It has average working hours starting at 08.00 WIB and closing at 22.00 WIB. In this case, the owner of the drinking water refill depot does not apply work shifts. The drinking water processing process starts from the raw water reservoir, which is then transported and transferred to the pool, then goes to the filtering stage using 80% min silica (SiO2) grains and a fine filter measuring 10 microns. The next disinfection stage uses ultraviolet (UV) light and ozone to kill pathogenic germs. Clean the gallon using a gallon brush and soap to clean the gallon from dirt and moss that has settled inside and outside the gallon. Fill the gallon with water and cover the gallon with the cover provided. Finally, the gallon is ready to be delivered to consumers.

Table 1. Frequency Distribution of MSD complaints, Age, Years of Work, Smoking Habits, Body Mass Index, Physical Workload, and Work Posture

Variable	Frequency (f)	Percentage (%)
MSD Complaints		
Low Risk	24	28.9
High Risk	59	71.1

This article is licensed under CC BY- SA 4.0 License

p-ISSN: 2355-0643, e-ISSN: 2355-0988
Vol. 11, No. 02, October, 2024

Variable	Frequency (f)	Percentage (%)
Age		
No Risk	54	65.1
Risky	29	34.9
Working Time		
No Risk	67	80.7
Risky	16	19.3
Smoking Habit		
No Risk	56	67.5
Risky	27	32.5
Body Mass Index		
No Risk	75	90.4
Risky	8	9.6
Physical Workload		
No Risk	83	100
Risky	-	-
Work Posture		
No Risk	36	43.4
Risky	47	56.6

Based on the research results, it shows that 71.1% of workers experienced MSD complaints, 34.9% of Refill Drinking Water Depot workers with age (≥35 years) were at risk, 19.3% of Refill Drinking Water Depot workers with years of service (≥ five years) were at risk, 32.5% of workers Refill Drinking Water Depot with smoking habits are at risk, 9.6% of Refill Drinking Water Depot workers with BMI are at risk, all workers are not at risk of physical workload and 56.6% of Refill Drinking Water Depot workers with risky work postures.

Table 2. Relationship between Age, Working Period, Smoking Habit, Body Mass Index, Physical Workload, and Work Posture with MSD complaints

Variable	MSD Complaints				*p-value*
	Low		High		
	f	%	f	%	
Age					
No Risk	15	27.8	39	37.7	0.954
Risky	9	31.0	20	20.3	
Total	24	28.9	59	69.9	
Working Time					
No Risk	22	32.8	45	67.5	0.192
Risky	2	12.5	14	87.5	
Total	24	28.9	59	71.1	
Smoking Habit					
No Risk	19	33.9	37	66.1	0.233
Risky	5	18.5	22	81.5	
Total	24	28.9	59	71.1	
Body Mass Index					
No Risk	20	26.7	55	73.3	0.330
Risky	4	50.0	4	50.0	
Total	24	28.9	59	71.1	
Work Posture					
No Risk	12	34.3	23	65.7	0.499
Risky	12	25	36	75	
Total	24	28.9	59	71.1	

This article is licensed under CC BY- SA 4.0 License

p-ISSN: 2355-0643, e-ISSN: 2355-0988
Vol. 11, No. 02, October, 2024

Based on the results of the bivariate test, it shows that there is no relationship between age and MSD complaints (p=0.954). There was no relationship between length of service and MSD complaints (p=0.134). There was no relationship between smoking habits and MSD complaints (p=0.233). There was no relationship between BMI and MSD complaints (p=0.330). There is no relationship between work posture and MSD complaints (p=0.499).

Discussion

Musculoskeletal Disorders (MSD) complaints were assessed using the Nordic Body Map (NBM) questionnaire scoring. The research results on 83 refilled drinking water depot workers showed that 59 (71.1%) workers experienced complaints of Musculoskeletal Disorders (MSD) in the high-risk category. From the results of the NBM assessment, it was found that the complaints frequently felt by workers were 68.7% of the back, 63.9% of the waist, 50.6% of the left forearm, 47% of the right forearm, and in the right upper arm 45.8%. Based on the research results, 54 (65.1%) workers in the age category <35 years were not at risk of experiencing MSD complaints, and 29 (34.9%) workers in the age category ≥ 35 years were at risk of experiencing MSD complaints. This is in line with research by Wulandari (2016) on gallon lift workers in the Ulak Karang Community Health Center work area, which showed that 58.1% of workers classified as aged <35 years were not at risk of experiencing MSD complaints and 41.9% of workers classified as aged ≥35 years were at risk sharing experiencing MSD complaints (Wulandari, 2016). According to Tarwaka (2004), those aged 35 years and over will experience various complaints, which can decrease bone elasticity. This is because maximum muscle strength is in the age range of 20-29 years, and then there will be a decline, and at the age of 50-60 years, muscle complaints increase, and over 60 years, the muscle strength decreases by up to 20% (Dellemann et al., 2004; Tarwaka, Soluchul HA Bakri, 2004). It is known that most of the workers at refilled drinking water depots are of an age group that is not at risk of experiencing MSD. This is caused by other factors, such as work positions involving repetitive activities that cause muscle complaints even though they are not in the at-risk age group. In this study, there was no relationship between age and MSD complaints, but the risk of experiencing MSD complaints can occur in every age group. This is because MSD complaints felt by DAMIU workers in each age group have a high-risk category. The results of this study also showed that (37.7%) of workers aged <35 years had experienced high-level MSD complaints, meaning that in this study, age <35 years did not rule out the possibility of experiencing MSD complaints, and 20.3% were felt by the age group ≥35 years. This is influenced by the large number of workers under 35.

Based on research results, of the 83 refilled drinking water depot workers in Padang City, 67 (80.7%) workers with <5 years of service were not at risk, and 16 (19.3%) workers with ≥5 years of service were at risk. This is not in line with research by Wulandari (2016) on gallon lift workers in the Ulak Karang Community Health Center work area, which showed that 17 (54.8%) workers with long service periods and 14 (45.2%) workers with new service periods (Wulandari, 2016). As the working period continues to increase, the risk of experiencing Musculoskeletal Disorders (MSD) increases (Tarwaka, 2015). Research results show that of 83 refilled drinking water depot workers in Padang City, 56 (67.5%) workers had non-risky smoking habits, and 27 (32.5%) had risky practices. This is not in line with Arum's (2022) research on gallon delivery, which showed that 78 (61.4%) workers had a smoking habit and 49 (38.6%) workers did not have a smoking habit (Pratiwi, 2022). Smoking habits are activities related to a person's smoking behavior as measured by smoking intensity, time spent smoking, and the function of tobacco in daily life (Aghnia, 2017).

This article is licensed under CC BY- SA 4.0 License

The longer and higher the frequency of smoking, the higher the level of muscle complaints felt (Tarwaka, Soluchul HA Bakri, 2004). Based on research results, out of 83 Refill Drinking Water Depot workers in Padang City, 75 (90.4%) workers with a Body Mass Index (BMI) were not at risk, and 8 (9.6%) workers with a Body Mass Index were at risk. From the results of statistical tests, it was found that workers with a BMI of 14.52 were in the thin category, and workers with a BMI of 31.14 were in the fat category with an average BMI of 20.63 in the normal category. This is in line with research by Umam (2020) on gallon workers showing that the body mass index of workers is in the normal category with a BMI value of 21.00, in the thin category with a BMI value of 19.53 and the fat category with a BMI value of 24.00 (Umam et al., 2020). Body Mass Index (BMI) is the result of calculating body weight and height expressed in units of kg/m2 (Tjahayuningtyas, 2019). The influence of nutritional status on the occurrence of MSD complaints can be seen that the fatter a person is, the greater the risk of experiencing MSD complaints (Tarwaka, Soluchul HA Bakri, 2004).

Based on the research results, of the 83 workers at the refill drinking water depot in Padang City, all 83 workers (100%) had a workload that was not at risk. This is because the worker's pulse is still in the light category. This is not in line with research by Wulandari (2016) on gallon lift workers in the Ulak Karang Community Health Center working area, which showed that 61.3% of workers had a high workload and 48.4% of workers with a low workload (Wulandari, 2016). The physical workload can be associated with complaints of musculoskeletal disorders (MSD) if it causes excessive muscle contraction due to constant additional tension, muscle fatigue, and discomfort, muscle pain due to lack of oxygen (Wiranto, 2019). Based on the research results, of the 83 workers, 36 (43.4%) had a non-risky body posture, and 47 (56.6%) had a risky body posture. In line with research by Wulandari (2016) on gallon lift workers in the Ulak Karang Community Health Center work area, it shows that 48.4% of workers have a very high category of work posture, and 51.6% of workers have a high category of work posture so that almost half of the workers have a working posture of risky (Wulandari, 2016). According to Chaffin, work posture, repetitive movements, static work, and work that requires exertion are risk factors that can cause Musculoskeletal Disorders (MSD) complaints (Dellemann et al., 2004). Based on the results of the bivariate test on age, it shows that workers who experienced high levels of musculoskeletal disorders (MSD) complaints in the non-risk category (<35 years) amounted to 39 people (37.7%), with a p-value (p=0.954), So there is no relationship between age and MSD complaints. This is different from research by Wulandari (2016) on gallon lift workers, who stated that there was a significant relationship between age and MSD complaints (Wulandari, 2016). Based on the theory put forward by Tarwaka (2013), which states that MSD complaints are generally felt at the age of 35-65 years. This can happen as a person ages so that a person's endurance and muscle strength decrease, resulting in an increased risk of experiencing muscle fatigue (Chaffin, 1973; Tarwaka, 2013).

Based on the results of bivariate tests during the work period, it shows that workers who experienced high levels of musculoskeletal disorders (MSD) complaints in the non-risk category (<5 years) amounted to 45 people (67.2%), with a p-value (p=0.192). There is no relationship between work period and MSD complaints. This is not in line with research by Wulandari (2016) on gallon lift workers, who stated that there was a significant relationship between length of service and MSD complaints p=value 0.001(Wulandari, 2016). Working period is the accumulation of a person's work activities over a long period, giving rise to MSD complaints due to unergonomic worker attitudes that must be carried out continuously (Suma'mur, 2009). Because MSD complaints felt by refill drinking water depot workers with long periods of work are in the high-risk category.

This article is licensed under CC BY- SA 4.0 License

Based on the results of bivariate tests on smoking habits, it shows that workers who experienced high levels of musculoskeletal disorders (MSD) complaints in the non-risk category numbered 37 people (66.1%) with a p-value (p=0.233), so there is no relationship between smoking habits with complaints of MSD. This study's results align with research conducted by Devi (2017) on lift workers, who stated that there was no significant relationship between smoking habits and MSD complaints with a p-value = 0.747 (Devi, 2017). This is influenced by workers who do not smoke and inhale cigarette smoke from workers who smoke so that active and passive smokers are at risk of experiencing MSD complaints. This study's results align with the survey conducted by Devi (2017) on lift workers, stating that there is no significant relationship between smoking habits and MSD complaints with a p-value = value of 0.747. The similarity of this study with previous studies is that the lifting process uses physical strength, and the variables used in the study are almost the same (Devi, 2017). Based on the results of bivariate tests on body mass index, it shows that 55 workers experienced high levels of musculoskeletal disorders (MSD) in the non-risk category (BMI<25) with a p-value (p=0.330), then there is no relationship between BMI and MSD complaints. This study's results align with research conducted by Devi (2017) on lift workers, who stated that there was no significant relationship between body mass index (BMI) and MSD complaints with a p-value = 0.854 (Devi, 2017). This is because, on average, refill drinking water depot workers have relatively good nutritional status so that muscle energy needs are still adequately supplied. This is what makes it possible that there is no relationship between BMI and MSD complaints among workers. Tarwaka (2004) stated that Body Mass Index (BMI) can influence the occurrence of MSD complaints by showing that the fatter a person is, the greater the risk of experiencing MSD symptoms (Tarwaka, Soluchul HA Bakri, 2004).

Working posture shows that workers who experience high levels of musculoskeletal disorders (MSD) complaints in risk category workers (REBA ≥7) amount to 36 people (75%) with a p-value (p=0.499), so there is no relationship between working posture and MSD complaints. The results of this study are not in line with Wulandari's (2016) research on gallon lift workers, stating that there is a significant relationship between work posture and MSD complaints with a p-value = 0.004 (Wulandari, 2016). This is because the worker's body can still tolerate the lifting distance. Work posture is a risk factor for Musculoskeletal Disorders (MSD), including poor posture, static work, and repetitive movements. A mismatch between the dimensions of tools and workstations and the size of the human body mainly causes unnatural work postures at work. This condition can cause forced or awkward postures when doing work (Rivai, 2014).

Conclusion

Based on the research results, it is known that 71.1% of refill drinking water depot workers experience complaints of Musculoskeletal Disorders (MSD) in the high-risk category, as many as 34.9% of workers in the risk age category, as many as 19.3% of workers in the risk work period category, as many as 32.5% of workers in the smoking habits category are at risk, as many as 9.6% of Refill Drinking Water Depot workers are in the BMI category at risk, there are no workers with a physical workload in the risk category. As many as 56.6% of workers are in the at-risk category. There is no relationship between age, length of service, smoking habits, body mass index, and work posture with MSD complaints among refilled drinking water depot workers in Padang City. We hope that workers regularly have their health checked and can carry out correct lifting work to avoid MSD complaints. We recommended that business owners collaborate with the Community Health Center to provide education about ergonomics when working for workers.

This article is licensed under CC BY- SA 4.0 License

Daftar Pustaka

(WHO), W. H. O. (2022). *Musculoskeletal Health*. World Health Organization.

Aghnia, A. D. (2017). *Pemetaan Keluhan Muskuloskeletal Disorders Berdasarkan Faktor Pekerjaan Pekerja Produksi Bakso CV Unique Mandiri Perkasa Bekasi Tahun 2017*. Universitas Islam Negeri Syarif Hidayatullah.

Chaffin, D. B. (1973). A Longitudinal Study of Low-Back Pain as Associated with Occupational Weight Lifting Factors. *American Industrial Hygiene Association Journal*, *34*(12), 513–525. https://doi.org/10.1080/0002889738506892

Cieza, A., Causey, K., Kamenov, K., Hanson, S. W., Chatterji, S., & Vos, T. (2020). Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, *396*(10267), 2006–2017. https://doi.org/10.1016/S0140-6736(20)32340-0

Dellemann, N. J., Haslegrave, C. M., & Chaffin, D. B. (2004). *Working posture and movements: Tools for evaluation and engineering*. CRC Press.

Devi, T. I. P. M. L. (2017). Risk Factors Of Musculoskeletal Disorders (Msds) Complaints On Rice Transportation Activities at Pt. Buyung Poetra Pangan Pegayut Ogan Ilir. *Jurnal Ilmu Kesehatan Masyarakat*, *8*(2), 125–134. https://doi.org/10.26553/jikm.2016.8.2.125-134

Dinas Kesehatan. (2021). Profil Kesehatan Kota Padang 2021. In *Dinas Kesehatan Kota Padang* (Vol. 4, Issue 1).

Kemenkes RI. (2018). *Riset Kesehatan Dasar (RISKESDAS)*.

Pratiwi, A. D. (2022). MATERIAL Hubungan Pekerjaan Manual Material Handling Dengan Keluhan Musculoskeletal Disorders The Relationship Between Manual Handling And Musculoskeletal Disorders Complaints. *Jurnal Ilmu Kesehatan Masyarakat*, *18*(1). https://doi.org/10.19184/ikesma.v18i1.23851

Rivai, W. T. E. S. J. (2014). Hubungan Tingkat Risiko Ergonomi dan Masa Kerja Dengan Keluhan Muskuloskeletal Pada Pekerja Pemecah Batu. *Jurnal Kesehatan Masyarakat*, *2*(3), 227–231.

Sugriarta, E. (2018). Hygiene Sanitasi Depot Air Minum. *Jurnal Sehat Mandiri*, *13*(1), 51–55. https://doi.org/10.33761/jsm.v13i1.57

Suma'mur. (2009). *Higiene Perusahaan dan Kesehatan Kerja (Hiperkes)*. Sagung Seto.

Tarwaka, Soluchul HA Bakri, L. S. (2004). *ERGONOMI : Keselamatan, Kesehatan Kerja dan Produktivitas*. UNIBA PRES Surakarta.

Tarwaka. (2013). *Ergonomi Industri Dasar - Dasar Pengetahuan Ergonomi dan Aplikasinya : Cetakan 2*. Harapan Press Solo.

Tarwaka. (2015). *Ergonomi Industri Dasar Dasar Pengetahuan Ergonomi dan Aplikasi di Tempat Kerja* (II). Harapan Press Solo.

Tjahayuningtyas, A. (2019). Faktor Yang Mempengaruhi Keluhan Musculoskeletal Disorders (Msds) Pada Pekerja Informal. *The Indonesian Journal of Occupational Safety and Health*, *8*(1), 1.

This article is licensed under CC BY- SA 4.0 License

https://doi.org/10.20473/ijosh.v8i1.2019.1-10

Umam, U. K., Siswiyanti, & Luthfianto, S. (2020). Perancangan Troli sebagai Alat Bantu Angkut Galon Air dengan Metode Antropometri. In *Prosiding Seminar Nasional Teknik Industri Universitas Pancasakti Tegal "Sistem pemasaran Produk Home Industri di Era Digital."* Universitas Panca Sakti.

Wiranto, A. I. M. R. D. L. (2019). Faktor Yang Mempengaruhi Keluhan Musculoskeletal Disorder Pada Pekerja Penggiling Padi Kabupaten Panajam Paser Utara. *Jurnal Husada Mahakam*, *IV*(8), 439–452.

Wulandari, R. (2016). *Hubngan Faktor Pekerjaan dan Faktor Individu dengan Keluhan Musculoskeletal Disorders (MSDs) pada Pekerja Antar Jemput Galon DAMIU di Wilayah Kerja Puskesmas Ulak Karang Padag tahun 2016 [Skripsi]*.

This article is licensed under CC BY- SA 4.0 License