

# Analysis of Risk Factors Affecting Musculoskeletal Disorder in Workers

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**Abstract**— Skeletal muscle complaints felt by a person ranging from very mild complaints to very painful are called musculoskeletal disorders. This happens because of excessive muscle contraction due to giving too heavy work with a long duration of loading. Several risk factors for musculoskeletal disorders are age, gender, Body Mass Index, exercise frequency, history of muscle compliance, working hours, type of activity at work, and years of service. These risk factors need to be identified to look for risk factors that are most associated with musculoskeletal disorders in workers. This aim of the research was to identify risk factors associated with these disorders. A descriptive correlational study was used in this study. Respondents were workers who can communicate well, are able to read and write and were willing to be research respondents. The number of respondents in this study was 101 people obtained by proportional random sampling. Questionnaires were used to collect data for this research. **Results:** This study showed that there was a significant relationship between all these risk factors and the fear of falling ( $p < 0.05$ ). Age and history of muscle compliance were the risk factors most closely associated with musculoskeletal disorders ( $p = 0.000$ ). Age and history of muscle complaints were the strongest risk factors that influenced musculoskeletal disorder in workers.

**Keywords**— Workers; Musculoskeletal Disorders

## I. INTRODUCTION

Almost all workers who work in offices have experienced Musculoskeletal disorders (MSDs), the effects of these disorders are very detrimental to the health and productivity of workers [1]. Health problems that occur in MSDs are muscles, tendons, bones, ligaments, and nerves. The most common complaint that appears is pain [2] which begins with fatigue. Most of the symptoms that appear are not noticed by sufferers, because they think that this is a normal thing [3].

Office workers are occupations that have a high prevalence of MSDs. Several factors that cause MSDs are old age, gender, type of work, length of work in a day, length of work, and history of previous musculoskeletal complaints. MSDs can occur in the hands, neck, arms, shoulders, and wrists of office workers [4].

Based on the International Labor Organization (2017), as many as 860,000 workers worldwide encounter work-related accidents and diseases every day [5]. The prevention of Occupational Diseases informs that MSDs have a prevalence of 59% of the total disease records found

in Europe [6]. According to data obtained from the Labor Force Survey (LFS) in the UK, proving that MSDs occur in workers is very high, namely 1,144,000 cases with a distribution of 493,000 cases affecting the back, 426,000 upper limbs or neck, and 224,000 upper limbs. MSDs cases in Malaysia based on a report from the Social Security Organization (SOCSO), increased rapidly to 675 incidents seen from 2005 to 2014 (7). Based on the results of basic health research, the percentage of MSDs is 11.9% examined by health workers in Indonesia and the results of the examination or signs are 24.7% experiencing MSDs (6).

Based on the results of a study conducted by observing and interviewing employees at the Indonesian Ministry of Health's Personnel Bureau, which was conducted in March 2020, there were 18 employees out of 20 employees who experienced MSDs due to working with an unnatural sitting posture due to the non-ergonomic chair design with sitting time long enough in front of a computer or laptop, most of the complaints that occur are pain in the neck, shoulders, lower back, and other parts at work (8). This affects the productivity of workers in carrying out their work activities. Seeing the existing problems, the researcher feels the need to conduct a study with the title "Analysis of Risk Factors Affecting Musculoskeletal Disorder in Workers" to find out which factors are the strongest that cause MSDs so that they can determine the appropriate intervention.

## II. LITERATURE REVIEW

Age was the first factor investigated in this study. Old age causes a worker to be more at risk of developing MSDs. Physiologically, young workers have good muscle performance until the age of 33 years. In addition, recovery time for musculoskeletal injury in young people is relatively short. In a study, it was shown that the prevalence of MSDs was higher among older workers than young workers, especially complaints on the lower back because the elderly will experience degenerative changes in muscles, tendons, ligaments and joints contribute to the pathogenesis of musculoskeletal disorders [9]. Isabel et al. [10] explain in his study that age was factors that influenced MSDs. 46 years old people or older were 3.48 times more susceptible to injury than younger people (<29 years). Other studies showed that people over 49 years old and more experienced workers were more susceptible to become MSDs compared

to young people because apart from aging, another thing that can lead to MSDs is self-confidence which results in underestimating potential work hazard. Other studies showed that there was no difference in the incidence of injury between old and young people. Furthermore, Peek-Asa et al.[11] reported that there is no significant relationship between age and the incidence of injury or risk level of MSDs among young workers compared with older workers. People over 55 years old had the same risk of injury as those under 55.

The next factor is gender. Some study showed that men were less at risk of developing MSDs when compared to women. Another study also explained that female office workers was greater prevalence of MSDs[12–14]. Study conducted by Ardahan and Sismek showed that the incidence of MSDs was higher in women, because women have difference in physiology and anthropometry and it makes them more susceptible than men[15]. In addition, culture in Indonesia emphasizes that women have an obligation to organize their homes on the sidelines of busy work so this causes physical tension that can trigger MSDs. Some studies noted that men posed a risk of MSDs in several parts of the body [16], and also showed pain more often than women[17,18]

The next factor is the working hours. Everyone who works in an office can spend about 8 hours or more a day during his work. Working hours caused MSDs in workers, especially those who spent more time in front of the computer [16]. Study conducted by Celik et al. explained that spent time at work was highly correlated with MSDs, and this study was also accompanied by an analysis of sitting duration affecting multiple body regions [13]. Lee et al. also revealed that long working time increased the MSDs prevalence because the body must have carry out activities for a long time[19]. Another study was explained that people who work for long time a day, they can lost the time for recovery and stress relief from fatigue [20], which can harm the body and cause MSDs.

The period of work also affects the occurrence of MSDs. Based on the results study conducted on pottery craftsmen in Minahasa, Indonesia, it was explained that between period of work and musculoskeletal complaints in pottery craftsmen was correlated in a statistical calculation. Factor that influence the emergence of musculoskeletal complaints is the period of work. This theory based on the conducted by Tarwaka, namely, musculoskeletal complaints are chronic diseases that require a long period of time in development and manifestations [21]. Tarwaka said that when muscles receive excessive workloads that are carried out repeatedly and for a long period, grievance will arise caused by injury of joints, ligaments, and tendons, these complaints are called musculoskeletal complaints[22]. Based on an initial survey conducted by researchers, it was found that some pottery craftsmen often felt pain or pain while working, of which pain most often appeared in the hands, followed the shoulders, back of the neck, back, and legs. Meanwhile, some craftsmen complain of aches or pains that arise due to their long working period and arise when their workload increases. In another study conducted with 103 respondents, it can be seen that there are 41 employees or (55.4%) with MSDs complaints, base on that situation a conclusion can be

drawn that there is a relationship between period of work and MSDs grievance in employees at the Indonesian Civil Service Bureau with the results of the p-value analysis test by 0.020. Research conducted by [23] obtained the results of the chi-square test with a significant value of 0.000 (p-value <0.05). So conclusion can be drawn that there is a relationship between tenure and MSDs complaints in Giriloyo batik, Bantul Regency. Based on study conducted by Sulistyoe et al. obtained a p-value of 0.002. MSDs will occur because tenure is a risk factor that can influence individuals to be at risk of musculoskeletal complaints. If the worker is not on ergonomically position for a long time, there will be an increased risk because the muscles get repetitive static loads and for a long time period, so that it can lead to complaints such as damage to joints, ligaments, and muscles[24].

Risk factors for a history of musculoskeletal complaints also influence the occurrence of MSDs. Workers who have a history of MSDs tend to experience MSDs complaints 9,818 times compared to workers who do not have a history of MSDs. It is known that the history of MSDs as an affects of the occurrence MSDs complaints. So conclusion can be drawn that the history of MSDs is one of the important factors that influence the occurrence of MSDs. Every workers who have a history of MSDs take various ways to overcome the disease. Most of them do massage and get enough rest to deal with it. In addition, some workers also check with doctors and take medicine to overcome them. However, many of the respondents complained that the MSDs still recurred (not fully recovered). This triggers workers to often experience complaints in their muscles and bones[25].

### III. RESEARCH METHOD

This study was conducted in both private and government institutions. Ethical clearance was approved by the ethical committee on health research STIKES Katolik St. Vincentius a Paulo Surabaya. A descriptive correlational study was used in this study. The total respondents was 101 workers determined by a simple random sampling technique. All of the respondents signed the Informed consent. Age, gender, Body Mass Index, exercise frequency, history of muscle complaints, working hours, type of activity at work, and work period as the independent variables, and musculoskeletal disorder as a the dependent variable. Online questionnaire was used to obtained the data. The questions in questionnaire were about age, gender, Body Mass Index, exercise frequency, history of muscle complaints, working hours, type of activity at work, and work period. Question about age in the questionnaire, respondents had to fill in year. For the data of working hours in “hour/day” and work period in “year”, respondents completed data regarding their weight in kilograms and their height in meters. BMI was calculated by the researcher by means of the respondent's weight (in kilograms) divided by the respondent's height (in meters). For the data of the muscle complaints, respondents had to choose "yes" or "no" in the questionnaire. To obtain the musculoskeletal Disorder's data, the Nordic Scale Questionnaire was used with Cronbach's alpha value = 0.885. Spearman test and Contingency Coefficient were used to identify the

correlation between Independent variables and musculoskeletal disorder. Binomial logistic regression was used to identify the risk factor.

#### IV. RESULT AND DISCUSSION

The average age of the respondents was late adulthood (37,6 years old) and 69.3% were male. Of the 101 respondents, it was found 54.5% had BMI with overweight. Most of the respondents (56.4%) were more than 10 years of service, 42.6% was fewer sports activities. Most respondents worked 5-8 hours a day and 81.2% of respondents experienced muscle complaints in the last 1 year. According to the data found, as many as 87.1% of respondents was in a low risk of MSDs (Table 1).

Table 1: Characteristics of respondents

Variable	Sub Grup	Total n= 101	(%)
Age (Year)	Average	37.62	
Gender	Female	31	30.7
	Male	70	69.3
BMI	Underweight (17-18,4)	1	1.0
	Normal (18,5-25)	45	44.6
	Overweight (25->27)	55	54.5
Occupations	Office Workers	61	60.4
	Medical Workers	35	34.7
	Housewife	5	5.0
Length of work (years)	1	8	7.9
	>1-5	12	11.9
	>5-10	24	23.8
	>10	57	56.4
Exercise Time	Nothing	41	40.6
	1-2 hours a week	43	42.6
	> 2-5 hours a week	14	13.9
	> 5 hours a week	3	3.0
Length of work in a day	< 5 hours	8	7.9
	5-8 hours	64	63.4
	> 8 hours	29	28.7
History of previous musculoskeletal complaints	Yes	82	81.2
	No	19	18.8
MSDs	Low Risk (28-49)	88	87.1
	Moderate Risk (50-70)	13	12.9

Spearman test and Contingency Coefficient were used to identify the correlation of Independent variables with musculoskeletal disorder. The analysis correlation showed that there was a correlation between age and MSDs and muscle complaints with MSDs.

Binomial logistic regression test was used and indicate that age and muscle complaints were the strongest risk factor for MSDs (Cox & Snell R Square = 0.108).

MSDs became a problem among young workers (<25 years) and elderly workers (>55 years). Old-aged workers were more risky to MSDs than younger workers because older workers were decreased in physical capacity. Occupational injuries could occur in older workers due to work needs and physical work capacity(25).

Table 2: Correlation about the variable with MSDs

No		rs	Takut Jatuh C	p
1	Age	0.595		0.042 <sup>a</sup>
2	BMI	0.912		0.492 <sup>a</sup>
3	Occupations		0.067	0.506 <sup>b</sup>
4	Length of work (years)		0.135	0.177 <sup>b</sup>
5	Exercise Time		0.013	0.896 <sup>b</sup>
6	Length of work in a day		0.135	0.179 <sup>b</sup>
7	History of previous musculoskeletal complaints		0.422	0.000 <sup>b</sup>

<sup>a</sup> : Uji statistik Spearman'Rho

<sup>b</sup> : Uji statistik Contingency Coefficient

Table 3: Multivariat Analysis result

	B	Sig.	Cox&Snell R Square
Age	1.017	0.000	
History of previous musculoskeletal complaints	1.331	0.001	
			0.108

This study showed that the average age of the respondents was 37, 62 which is included in late adulthood. The result of correlation test was  $p = 0.042$ , which means that there was a correlation between age and MSDs. A multivariate test was performed afterward and showed that age had the strongest relationship with MSD with Cox & Snell R Square = 0.108. Respondents who had a moderate risk of experiencing MSDs were respondents aged >35 years old. According to research conducted by Shobur, one of the factors that affects muscle work is age, because as a person ages, muscle strength decreases. The results showed that there was a correlation between age and musculoskeletal complaints and workers who were above 30 years old had 4.4 times risk of experiencing high levels of musculoskeletal complaints than workers aged <30 years[27]. Other studies also showed the same result that respondents had high complaints of MSDs in the age category which is dominated by the age of respondents >37 years (66.0%). Results Based on statistical tests, it was known that age is related to MSD complaints in worker at the Ministry of Health's Personnel Bureau (p-value 0.001) [8]. Furthermore, study conducted by Tambuwun, et al, indicate a significant relationship between age and musculoskeletal complaints in workers p-value = 0.002 ( $\alpha = 0.05$ ) [28].

The strongest factor influencing the occurrence of subsequent MSDs was a history of musculoskeletal complaints. In this study, it was stated that 81.2% of respondents had a history of musculoskeletal complaints. The correlation test stated that a history of musculoskeletal complaints had a relationship with MSDs ( $p = 0.000$ ). Respondents in this study described that most had MSDs risk even though it was low (87.1%). This is comformable with the study conducted by Wita regarding the relationship between a history of MSDs with MSDs complaints in workers in the Polishing section of PT. Surya Toto Indonesia. Tbk in 2011 as shown in the following table, there are 64.7% do not have a history of musculoskeletal complaints but have MSDs. The results of statistical tests signify that there was a significant correlation between a history of musculoskeletal complaints and MSDs in Polishing workers PT. Surya Toto Indonesia. Tbk in 2011.

In addition, there was an OR value of 9.818 which means that workers who had a history of MSDs tend to experience MSDs complaints [25]. This is due to a static work position. As many as 60.4% of respondents were people who work in offices, where working in an office has a dominant position when working is sitting for a long time and standing for a long time. This position causes several muscles in the body to work continuously which will result in muscle fatigue. This muscle fatigue causes complaints of muscle pain and cramps which are included in musculoskeletal complaints. Under the research that has been done on workers, the value of  $\text{sig} = 0.000$  ( $\alpha = 0.05$ ) showed that there was a correlation between the work position obtained by workers and perceived musculoskeletal complaints. The next cause is exercise habits. This study illustrated that as many as 83.2 had minimal exercise habits (0-120 minutes/week). Exercise habits are said to contribute to the incidence of MSDs. Where according to the theory, the minimum frequency of exercise for an untrained person is 150 minutes/week. Results of the analysis study that has been carried out, it was found that the correlation between habits of exercise and MSDs complaints in workers showed that most of the 29 respondents did not have exercise habits and only 9 workers had exercise habits. Based on the level of complaints, it is known that the level of complaints of MSDs in the high category is mostly experienced by workers who do not have the habit of exercising as many as 4 respondents (know). Sport is a structured, planned, and repetitive body movement carried out by a person in maintaining or improving physical fitness. Exercise habits will affect the level of freshness of a person's body. The high risk of musculoskeletal complaints, especially muscle complaints, is influenced by the level of body freshness. Musculoskeletal complaints will increase due to lack of muscle flexibility due to increased physical activity without being followed by sufficient physical fitness. The next cause is BMI where most (54.5%) respondents had a BMI in the overweight category. Having an abnormal BMI such as being underweight, overweight, and obesity can lead to several musculoskeletal disorders [29]. Examples include knee osteoarthritis due to excessive stress on the knee, lower back pain due to mechanical stress on the spine, and heel pain due to excessive loading of the plantar fascia when standing or walking.

## V. CONCLUSIONS

Strong predictors of musculoskeletal disorders in workers are age and muscle complaints. To prevent the occurrence of MSDs in workers, business owners should give time to exercise and provide education on ergonomic positions at work to reduce musculoskeletal complaints. The correct implementation of exercise and how to determine the ergonomic position for workers is the domain of physiotherapists who are health workers who deal with problems of movement and function. So, business owners can work with physiotherapists to arrange a physical activity and design ergonomic positions for workers to avoid musculoskeletal disorders. This study has limitations, one of which is the number of risk factors studied, for further research, it would be better if more risk factors were studied.

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## REFERENCES

- [1] Mahmud, N., Kenny, D. T., Zein, R. M., & Hassan SN. Ergonomic Training Reduces Musculoskeletal Disorders among Office Workers: Results from the 6-Month Follow-Up. *Malaysian J Med Sci* [Internet]. 2011;2(18):16–26. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3216214/pdf/mjms-18-2-016.pdf>
- [2] Krisdianto D. Hubungan Faktor Individu dan Faktor Pekerjaan dengan Keluhan Muskuloskeletal Akibat Kerja (Studi Pada Nelayan di Desa Puger Wetan Kecamatan Puger Kabupaten Jember) The Relationship Between Individual Factor and Work Factor With Work district Puger Distr. *Artikel Ilmiah Hasil Penelitian Mahasiswa. Universitas Jember*; 2015.
- [3] Handoko Aziz J. Analisis Risiko Keluhan Muskuloskeletal dengan Metode RULA di Perusahaan Bidang Kimia. *Politeknik Perkapalan Negeri Surabaya*; 2018.
- [4] Valipour Noroozi, M., Hajibabaei, M., Saki, A., & Memari Z. Prevalence of Musculoskeletal Disorders Among Office Workers. *Jundishapur J Heal Sci* [Internet]. 2015;1(7):1–5. Available from: <https://doi.org/10.5812/jjhs.27157>
- [5] Dewi. Hubungan Antara postur Kerja dengan Keluhan Muskuloskeletal Disorders pada Pegawai Administrasi di Kantor Pusat Universitas Jember. *Universitas Jember*; 2019.
- [6] World Health Organization. *Protecting Workers Health*. World Heal Organ. 2013;
- [7] Luan, H. D., Hai, N. T., Xanh, P. T., Giang, H. T., Van Thuc, P., Hong, N. M., & Khue PM. Musculoskeletal Disorders: Prevalence and Associated Factors among District Hospital Nurses in Haiphong, Vietnam. *Biomed Res Int* [Internet]. 2018;1(5). Available from: <https://doi.org/10.1155/2018/3162564>
- [8] Rahayu PT, Setiyawati ME, Arbitera C, Amrullah AA. Hubungan Faktor Individu dan Faktor Pekerjaan terhadap Keluhan Muskuloskeletal Disorders pada Pegawai Relationship of Individual and Occupational Factors to Complaints of Musculoskeletal Disorders among Employees. 2020;11:449–56.
- [9] Adishes A. *Muskuloskeletal Disorders*. 2012.
- [10] Nunes I, McCauley P. Work-Related Musculoskeletal Disorders Assessment and Prevention. *Ergon - A Syst Approach*. 2012;(April).
- [11] C. Peek-Asa DLM and JFK. Incidence of acute low-back injury among older workers in a cohort of material handlers. *J Occup Environ Hyg*. 2004;1(8):551–557.
- [12] Quemelo P, Gasparato F VE. Prevalence, risks and severity of musculoskeletal disorder symptoms among administrative employees of a Brazilian company. *Work*. 2015;3(52):533–540.
- [13] Celik S, Celik K, Dirimese E, Tasdemir N, Arik T, Büyükkara İb. Determination of pain in musculoskeletal system reported by office workers and the pain risk factors. *Int J Occup Med Environ Health*. 2018;31(1):91–111.
- [14] Soroush M HH. Musculoskeletal complaints associated with computer use and its ergonomic risks for office workers of a medical sciences university in Tehran. *Ann Heal Sci Res*. 2015;1(13):2–6.
- [15] Mani. Ergonomics education for office computer workers: An evidence-based strategy. In: Orhan Korhan, editor. *Anatomy, posture, prevalence, pain, treatment and interventions of musculoskeletal disorders*. London: InTech. 2018;1(1):47–62.
- [16] Ardahan M SH. Analyzing musculoskeletal system discomforts and risk factors in computer-using office workers. *Pak J Med Sci*. 2016;6(32):1425–1429.
- [17] Dunmade O, Adegoke F AA. Assessment of ergonomic hazards and techno stress among the workers of Obafemi Awolowo University Ile-Ife, Osun State, Nigeria. *Aust J Bus Manag Res*. 2014;1(4):27–34.
- [18] Labeodan T, Olaseha I OA. Computer ergonomic practices and musculoskeletal complaints among computer users in a Nigerian University community 2013;16(1):1–9. *Niger J Med Rehabil*. 2013;1(16):1–9.
- [19] Lee Jae-Gwang, Kim Guang Hwi JS, Won, Kim Sang Woo, Lee June-Hee L, Kyung-Jae. The association between long working hours