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Research Article

Analysis of the Effect of Workplace Stretching Exercise On Musculoskeletal Disorders At Pt. Sucofindo Makassar

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ABSTRACT

Introduction: The ILO reports 2.78 million deaths annually from occupational accidents and diseases, with MSDs affecting 1.71 billion people worldwide. At PT Sucofindo Makassar, workers, especially those with over 3 years of service, face MSD complaints due to poor posture and long hours, highlighting the need for workplace stretching exercises to reduce these issues.

Objectives: This study aims to examine the effect of the implementation of stretching exercises in the workplace in reducing musculoskeletal complaints in workers at PT Sucofindo Makassar.

Methods: This study used a quasi-experimental design with pre-test and post-test control groups, involving 100 workers at PT Sucofindo Makassar, aged 25-65, with MSD complaints, normal BMI, and at least 1 year of work experience, divided into experimental and control groups, using questionnaires and various tools for data collection and analysis with SPSS.

Results: The majority of respondents in both experimental [94%] and control [96%] groups had non-ergonomic postures. In the experimental group, the mean Nordic Body Map score decreased from 58.64 [pre-test] to 49.68 [post-test], while the control group showed minimal change [58.40 to 58.42]. In the experimental group, 98% had moderate MSD complaints pre-test, but post-test complaints decreased, with 52% experiencing moderate complaints, and 0% experiencing high complaints. The paired sample T-test showed a significant reduction in MSDs for the experimental group [p=0.000], but no significant change in the control group [p=0.948].

Conclusions: The implementation of Workplace Stretching Exercise [WSE] can significantly reduce MSDs complaints in workers with non-ergonomic work postures, improving their comfort and productivity. Therefore, companies should consider implementing a routine WSE program as part of their occupational health and safety program to minimize the risk of MSDs.

Keywords: excersie, MSDs, stretching.

INTRODUCTION

According to a report by the *International* Labor Organization [ILO] in the *International Journal of Occupational Safety and Health* [2020], approximately 2.78 million deaths due to occupational accidents and diseases occur each year, indicating that this issue is still a major challenge. The implementation of an effective OHS program can increase company productivity by 9%, reduce accident costs by 40%, and support organizational sustainability through worker protection, regulatory compliance, and financial risk prevention [1]. According to the Directorate of Health and Sport Development [2014], hazards include physical, chemical, biological, ergonomic, and psychological risks that can cause injury, illness, or work disorders. In the work environment, ergonomic hazards have the potential to increase the risk of musculoskeletal disorders [MSDs], so prevention and attention to worker safety are very important [2].

According to Rahayu and Tri [2021], occupational health plays an important role in improving the quality of life of the workforce, which has a positive impact on productivity, income, and welfare [3]. Musculoskeletal health is also a major factor to support an active, productive, and sustainable working life [4]. The World Health Organization notes 1.71 billion people experience musculoskeletal [MSDs], with low back pain as the leading cause of global disability, limiting workers' mobility, well-being and social participation [5]. The prevalence of Musculoskeletal Disorders

[MSDs] in Indonesia reached 11.9%, with farmers, fishermen, and laborers having the highest prevalence [9.90%], and Aceh recording the highest prevalence [13.26%] according to the 2018 Basic Health Research[6].

According to Anuar, et al. [2021], Musculoskeletal Disorders [MSDs] are often experienced by workers in various industrial sectors, with the prevalence in laboratory workers reaching 60% [7]. The main risk factors include awkward postures, repetitive movements, long work duration, and heavy workloads, which result in decreased productivity, increased risk of accidents, and decreased quality of life [8]. According to Pambudi [2021], although office workers are not among the main occupations prone to MSDs, long-term computer use and poor posture can cause complaints such as neck pain, with MSDs accounting for 78.5% of all work-related disorders in India [9]. Research by Ginting, et al. [2020] showed that MSD complaints are often related to ergonomic risk factors, where work position is directly related to muscle pain due to repetitive impact [10]. In addition, personal factors can also influence directly or indirectly the occurrence of musculoskeletal complaints [11].

According to Okezue, et al. [2020], an increase in working hours of more than 8 hours per day can increase MSD complaints, with a prevalence of neck and shoulder pain of 25% and arms of 15% in office workers, which is in line with research at the University Putra Malaysia and the Nigerian Institute of Higher Education [12]. According to Susanti and Septi [2021], muscle contractions that exceed 20% can reduce blood flow and oxygen supply to the muscles, causing lactic acid buildup and musculoskeletal discomfort, especially in workers aged 25-65 years, which requires attention to age-related risk factors [13]. Muscle stretching in the workplace can help prevent and reduce musculoskeletal complaints by increasing muscle flexibility and reducing tension. According to Hartvigsen et al. [2018] muscle stretching also improves the body's smooth metabolism, reduces the accumulation of lactic acid and CO2, and prevents fatigue [14].

Research by Wahyuni, et al. [2020] showed that Workplace Stretching Exercise [WSE] as a non-pharmacological intervention can reduce fatigue, stress, and increase muscle endurance, with significant results on musculoskeletal complaints after 5 and 10 days of implementation [15]. WSE also improves flexibility, blood circulation, and physical performance, and reduces the risk of injury and musculoskeletal disorders. According to Hidayatullah, et al. [2022], stretching three times a week reduces the risk of muscle injury and improves recovery [16], while research by Nakamura, et al. [2020] showed that regular stretching improves muscle flexibility and joint range of motion, which is important for reducing the risk of workplace injuries [17]. PT Sucofindo Makassar, which is engaged in inspection, testing, and certification, has potential hazards such as chemical exposure, fire, work accidents in the laboratory, as well as risks from field inspections such as dust, noise, hazardous materials, and falling from heights. Observations of employees at PT Sucofindo Makassar showed that Musculoskeletal Disorders [MSDs] complaints were experienced by both young and old workers, especially with a work duration of >3 years, awkward work positions, and working hours of more than 8 hours.

OBJECTIVES

Several studies have shown the benefits of workplace stretching exercises in reducing musculoskeletal complaints. However, studies specific to office and laboratory workers are limited in number. Given the high risk of musculoskeletal disorders in workers, there is a need for further research to analyze the impact of stretching exercises in the workplace on musculoskeletal complaints in workers. This study aims to examine the effect of the implementation of stretching exercises in the workplace in reducing musculoskeletal complaints in workers at PT Sucofindo Makassar.

METHODS

This study used a quasi-experimental design with a pre-test and post-test control group design. The population of this study were all workers at PT Sucofindo Makassar City totaling 110 people, with samples taken using purposive sampling technique. Inclusion criteria include workers aged 25-65 years who experience complaints of Musculoskeletal Disorders [MSDs], have a minimum working period of 1 year, normal BMI [18.5-24.9], willing to take part in the workplace stretching exercise program, and cooperative in filling out informed consent. Exclusion criteria included workers with a history of severe musculoskeletal injuries, currently undergoing treatment or therapy for musculoskeletal conditions, having chronic medical conditions, pregnant, having limited mobility or significant physical disabilities, or unwilling to participate. The study involved 100 samples, divided into two groups: experimental group [50 people] and control group [50 people]. Data collection instruments included questionnaires, digital scales, microtoise, workplace stretching exercise, REBA [Rapid Entire Body Assessment] sheet, and Nordic

Body Map sheet. Data analysis techniques used SPSS, with Kolmogorov-Smirnov normality test and Paired T Sample hypothesis test to see changes before and after exercise.

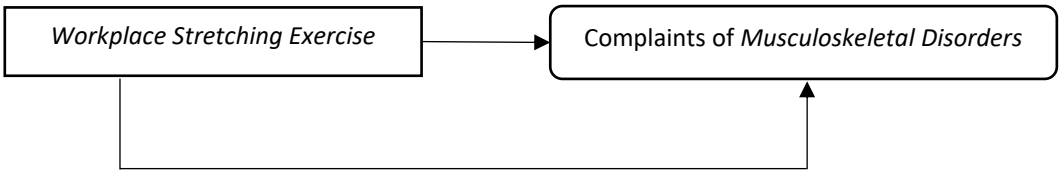

Figure 1. Conceptual Framework.

RESULTS

Characteristics of respondents based on gender showed male dominance in both groups: 60% men and 40% women in the experimental group, and 64% men and 35% women in the control group. Based on age, the majority of workers in both groups were in the early adult category [20-35 years old], namely 60% in the experimental group and 84% in the control group. For tenure, most respondents had a tenure of 1-10 years, 50% in the experimental group and 92% in the control group. Based on the latest education, the majority of respondents in both groups had a Bachelor's degree, with 88% in the experimental group and 90% in the control group. The dominance of respondents in productive age and moderate work experience is also relevant, considering that MSDs complaints often occur in this group due to repetitive physical activity and less ergonomic work postures. Research by Krishnan et al. [2021] showed that maximum muscle strength occurs at the age of 20-60 years, especially in the arms, back and legs, and this muscle strength will decrease with age. This is in line with the finding that early adulthood, which is found in many samples, tends to have good endurance and muscle strength [18].

Table 1. Distribution of Work Posture Assessment

	Not Ergonomic	Ergonomic
Experiment Group	47 [94.0%]	3 [6.0%]
Control Group	48 [96.0%]	2 [4.0%]

The results of the work posture assessment distribution showed that the majority of respondents in both experimental and control groups had non-ergonomic postures, with a percentage of 94% in the experimental group and 96% in the control group. Only a few respondents in both groups had ergonomic postures, 6% in the experimental group and 4% in the control group. According to Septiani [2017], MSDs are complaints in skeletal muscles that vary from mild to severe, which can be caused by factors such as excessive muscle stretching, repetitive activities, unnatural work attitudes, and long duration of work [19]. Measurement of MSDs complaints using the Nordic Body Map [NBM] questionnaire in Udayana University nursing students showed that 78.6% of students experienced complaints in the right shoulder, and one of the efforts to reduce these complaints is to do workplace stretching-exercise [WSE] which is designed to lengthen muscles and provide relaxation [20].

Table 2. Distribution of *Nordic Body Map* Measurements

	N	Min	Max	Mean	Std. Deviation
Experiment Pre-Test	50	48	68	58.64	4.632
Experiment Post-Test	50	41	57	49.68	3.920
Control Pre-Test	50	47	68	58.40	4.953
Control Post-Test	50	47	67	58.42	5.127
Valid N [listwise]	50				

Table 2 shows the distribution of Nordic Body Map measurements in the experimental and control groups. In the experimental group, the mean value of the pre-test was 58.64 with a range between 48 to 68, while the post-test showed a decrease in the mean to 49.68 with a range between 41 to 57. Meanwhile, in the control group, the mean value of the pre-test was 58.40 with a range between 47 to 68, and the post-test showed little change with an average of 58.42, the range between 47 to 67. Based on the pre-test and post-test tables in the experimental group, it shows that out of 50 respondents, all of them experienced a decrease in complaints of musculoskeletal disorders as indicated by the decrease in NBM values from pre-test to post-test.

Table 3. Changes in Msds Complaints of Experimental & Control Groups

MSDs Complaints		*Pre-Test*	*Post-Test*
Experiment Group	Low	0 [0%]	24 [48%]
	Medium	49 [98.0%]	26 [52%]
	High	1 [2.0%]	0 [0%]
	Total	50 [100%]	50 [100%]
	Std. Deviation	± 4.632	± 3.920
	Mean	58.64	49.68
	Delta	-8.96	
	Paired T-Test	0.000	
Control Group	Low	3 [6%]	3 [6%]
	medium	47 [94%]	47 [94%]
	high	0 [%]	0 [0%]
	Total	50 [100%]	50 [100%]
	Std. Deviation	± 4.953	± 5.127
	Mean	58.40	58,42
	Delta	0.02	
	Paired T-Test	0.945	

Table 3 shows changes in MSDs complaints in the experimental and control groups. In the pre-test, the experimental group mostly experienced MSDs complaints with a moderate level [98%] and a few with a high level [2%], while in the post-test, there was a decrease in complaints at a high level to 0% and moderate level complaints increased to 52%. In contrast, the control group showed stability, with the majority of respondents experiencing moderate levels of MSDs complaints [94%] in both the pre-test and post-test, with no change in high or low levels. The results of the study indicate the need for the Workplace Stretching Exercise [WSE] program to be implemented in a sustainable manner with periodic evaluations to ensure long-term effectiveness, as well as the support of ergonomic training programs and supervision of work postures to reduce the risk of MSDs. Respondents reported feeling more relaxed and sleeping better after doing WSE, which improves blood circulation and reduces musculoskeletal pain by optimizing muscle movement, ligaments, tendons, and joints [21]. These results are in line with the research of Freitas et al. [2018] which showed that WSE can reduce MSDs complaints, as well as research by Hardianto et al. [2020] and Thamrin et al [2020], who noted a significant effect of WSE on MSDs complaints with a p-value of 0.001 and 0.007, respectively [22-24].

Untreated MSDs can interfere with work concentration, cause fatigue, and reduce productivity, even causing serious illnesses such as low back pain and neck pain. In addition, MSDs can reduce the flexibility of the body's muscles [21]. Workplace Stretching-Exercise [WSE] as an intervention to reduce musculoskeletal complaints in nurses proved to be effective in 21 days [3 weeks], with the exercise performed once per shift. The exercise was directly supervised by the researcher in the first week, then continued with the supervision of the head nurse. WSE takes about 8 minutes per session and can be done at any time to avoid overuse injuries, with static stretching done 2-3 times a week for 20-30 seconds per session. Based on the above analysis, it can be concluded that there are differences in posture conditions between the experimental and control groups. The experimental group that received the treatment showed better posture condition improvement compared to the control group.

1. Homogeneity and Normality Test

After descriptive analysis, the homogeneity test with the Levene test resulted in a significance value of 0.649 [>0.05], indicating that the NBM pre-test and post-test data were homogeneous.

Table 4. Normality Test

	Kolmogorov-Smirov		
	Statistics	**df**	***Sig.***
Experiment Group			
Pre-Test	0.56	50	0.200
Post-Tset	0.93	50	0.200
Control Group			
Pre-Test	0.68	50	0.200
Post-Tset	0.105	50	0.200

The Kolmogorov-Smirnov normality test results show a significance value of 0.200 for the pre-test and post-test in the experimental group, and 0.200 for the pre-test and post-test in the control group, which is greater than 0.05, indicating that the data in both groups are normally distributed.

2. Hypothesis Test

After the normality test was carried out, hypothesis testing was then carried out using *paired sample T-test*. The test results obtained are as follows.

Table 5. Effect of *Workplace Stretching Exercise* on Msds Complaints

	N	Mean	Std. deviation	P-Value
Experiment Group				
Pre-Test	50	58.64	4.632	0.000
Post-Test	50	49.68	3.920	
Control Group				
Pre-Test	50	58.40	4.953	0.948
Post-Test	50	58.42	5.127	

The results of the paired sample T-test showed that in the experimental group there was a significant difference between the pre-test and post-test with a p-value of 0.000, which indicated a significant effect of Workplace Stretching Exercise on MSDs complaints. Meanwhile, in the control group, the p-value of 0.948 indicated no significant difference between the pre-test and post-test.

Table 6. Drop Out of Research Respondents

Respondent Status	Experiment Group		Control Group		Total
	n	%	n	%	N
Initial Total	50	100	50	100	100
Drop Out	5	10	4	8	9
Final Total	45	90	46	92	91

Distribution of respondents who dropped out during the study. In the experimental group, out of 50 respondents [100%] there were 5 respondents [10%] who dropped out so that the final number of respondents was 45 people [90%]. Meanwhile, in the control group, out of 50 respondents [100%] there were 4 respondents [8%] who dropped out so that the final number of respondents was 46 people [92%]. The total number of respondents who dropped out was 9 people, with a total of 91 respondents who completed the study.

DISCUSSION

These findings suggest that the workplace stretching exercise intervention was effective in reducing musculoskeletal disorders among participants in the experimental group. This is in line with the results of previous studies that have examined the impact of workplace-based physical activity interventions on employee health and well-being. For example, a systematic review by Shariat et al. [2018] found that workplace exercise programs, including stretching exercises, can result in significant improvements in musculoskeletal outcomes, such as reduced pain and disability, among employees [25]. Similarly, a study by Rasotto et al. [2015] showed that a customized workplace exercise program resulted in decreased musculoskeletal symptoms and improved physical function among office workers [26]. The findings of the current study provide further evidence supporting the effectiveness of workplace stretching exercises in reducing musculoskeletal disorders. The significant reduction in MSD scores observed in the experimental group, compared to the control group, highlights the potential benefits of incorporating such interventions into workplace health promotion initiatives. In conclusion, the results presented in the table indicate that the workplace stretching exercise intervention successfully reduced musculoskeletal disorders among participants in the experimental group. These findings contribute to the growing body of literature on the importance of physical activity and ergonomic interventions in improving employee health and well-being in the workplace.

REFRENCES

[1] Hamid, R. A., Majid, M. Z. A., & Singh, B. [2018]. The Importance of Occupational Health and Safety Management Systems for Organizational Sustainability. International Journal of Occupational Safety and Ergonomics, 24[1], 1-11

[2] Sudarsono, N., Setyaningsih, Y., & Adrianto, H. [2019]. Hubungan sikap kerja dengan keluhan muskuloskeletal pada pekerja laboratorium. Jurnal Kesehatan Masyarakat, 15[1], 39-49. https://doi.org/10.15294/kemas.v15i1.16655

[3] Rahayu dan Tri. [2021]. Analisis Faktor Yang Berhubungan Dengan Penyakit Akibat Kerja Pada Karyawan Smelter 'X' Industri Tahun 2020. *Journal of Baja Health Science*, *1*[02], 156–167. https://doi.org/10.47080/joubahs.v1i02.1488

[4] Briggs, A. M., Cross, M. J., Hoy, D. G., Sànchez-Riera, L., Blyth, F. M., Woolf, A. D., & March, L. [2016]. Musculoskeletal Health Conditions Represent a Global Threat to Healthy Aging: A Report for the 2015 World Health Organization World Report on Ageing and Health. *Gerontologist*, *56*, S243–S255. https://doi.org/10.1093/geront/gnw002

[5] WHO.[2022]. *Musculoskeletal Health*. https://www.who.int/news-room/fact- sheets/detail/musculoskeletal-conditions

[6] Kemenkes RI. [2018]. Hasil Riset Kesehatan Dasar Tahun 2018. *Kementrian KesehatanRI*, *53*[9], 1689–1699

[7] Anuar, N. I. M., Abidin, E. Z., & Rasdi, I. 2021. Work related musculoskeletal disorders and associated risk factors among Malaysian manufacturing workers: A review. International Journal of Environmental Research and Public Health, 18[14], 7376. https://doi.org/10.3390/ijerph18147376

[8] Etemadinezhad, S., Daneshmandi, H., Chobineh, A., & Saraj, M. [2023]. Work-related musculoskeletal disorders and their associated risk factors among laboratory workers: A cross-sectional study. Safety and Health at Work, 14[1], 82-87. https://doi.org/10.1016/j.shaw.2022.09.003

[9] Pambudi, M. R. 2021. Efektivitas Stretching terhadap Kejadian Nyeri Leher Akibat Posisi Kerja Statis pada Operator Komputer Narrative Review. Yogyakarta:Unisa Digital Library

[10] Ginting T, Ginting R, Panjaitan TR. Pengaruh Pemberian Peregangan Terhadap Keluhan Muskuloskeletal Pada Pekerja Pabrik Keripik Rumah Adat Minang Di Desa Tadukan Raga Deli Serdang. J Darma Aging. 2020;28[1].

[11] Darvishi, E., Ghasemi, F., Sadeghi, F., Abedi, K., Rahmati, S., & Sadeghzade, G. [2022]. Risk assessment of the work-related *Musculoskeletal Disorders* based on individual characteristics using path analysis models. *BMC Musculoskeletal Disorders*, *23*[1], 1–12. https://doi.org/10.1186/s12891-022-05573-6

[12] Okezue, O. C., Anamezie, T. H., Nene, J. J., & Okwudili, J. D. 2020. Work-Related Musculoskeletal Disorders among Office Workers in Higher Education Institutions: A Cross-Sectional Study. Ethiop J Health Sci. 30[5]:715-724.

[13] Susanti, N., & Septi, A.N. 2021. Penyuluhan Fisioterapi pada Sikap Ergonomis untuk Mengurangi Terjadinya Gangguan Musculoskeletal Disorders [MSDs] di Komunitas Keluarga Desa Kebojongan Kec. Comal Kab. Pemalang, Abdimas, 2[1]: 8–19.

[14] Hartvigsen, J., Hancock, M. J., Kongsted, A., Louw, Q., Ferreira, M. L., Genevay, S. & Karppinen, J. [2018]. What low back pain is and why we need to pay attention. The Lancet, 391[10137], 2356-2367.

[15] Wahyuni, T., Yamtana dan Muryani, S. [2020] "Penerapan Workplace Stretching Exercise untuk Mengurangi Keluhan Nyeri Otor Rangka Pekerja Pembibitan Jamur," Kesehatan Lingkungan, 12[2], hal. 77–85.

[16] Hidayatullah, M. A. R., Doewes, M., & Purnama, S. K. [2022]. The effect of stretching exercises on flexibility for students. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *8*[1], 118-130

[17] Nakamura, M., Ikezoe, T., Takeno, Y., & Ichihashi, N. [2020]. Effects of Stretching on the Range of Motion and Flexibility of Muscle-Tendon Units. Journal of Physical Therapy Science, 32[2], 121-128

[18] Krishnan, K. S., Raju, G., & Shawkataly, O. [2021]. Prevalence of work-related Musculoskeletal Disorders: Psychological and physical risk factors. *InternationalJournal of Environmental Research and Public Health*, *18*[17].https://doi.org/10.3390/ijerph18179361

[19] Septiani, A. [2017]. Faktor-faktor Yang Berhubungan Dengan Keluhan Musculoskeletal Disorders [MSDs] Pada Pekerja Bagian Meat Preparation PT. Bumi Sarimas Indonesia Tahun 2017. In *Skripsi* [Vol. 7, Issue 1].

[20] Tarwaka [2011] Ergonomi Industri: Dasar-Dasar Pengetahuan Ergonomi Dan Aplikasi Di Tempat Kerja. Harapan Press : Solo., 2011

[21] Susanto, N., Lumbantobing, S. G., & Prastawa, H. [2023]. Penilaian Persepsi Risiko Keselamatan Kerja pada Proyek Konstruksi menggunakan Adaptasi Kuesioner Municipal Public Health Rotterdam-Rijnmond. *Teknik*, *44*[1], 46–56. https://doi.org/10.14710/teknik.v44i1.50304

[22] Freitas, S. R., Mendes, B., Le Sant, G., Andrade, R. J., Nordez, A., & Milanovic, Z. [2018]. Can chronic stretching change the muscle-tendon mechanical properties? A review. Scandinavian journal of medicine & science in sports, 28[3], 794-806

[23] Hardianto, Trisnawati, E., & Rossa, I. 2015. Faktor-Faktor yang Berhubungan dengan Keluhan Musculoskeletal Disorders [MSDs] Pada Karyawan Bank X'. JUMANTIK: Jurnal Mahasiswa dan Peneliti Kesehatan, 2[2]: 1–20

[24] Thamrin, Y., Wahyu, A., Russeng, S. S., Wahyuni, A., & Hardianti, A. [2020]. Ergonomicsand Musculoskeletal

Disorders among seaweed workers in Takalar Regency: A mixedmethod approach. *Medicina Clinica Practica*, *3*, 100110. https://doi.org/10.1016/j.mcpsp.2020.100110

[25] Shariat, A., Cleland, J. A., Danaee, M., Kargarfard, M., Sangelaji, B., & Tamrin, S. B. M. [2018]. Efek latihan peregangan dan modifikasi ergonomis terhadap ketidaknyamanan muskuloskeletal pekerja kantor: uji coba terkontrol acak. Jurnal terapi fisik Brasil, 22[2], 144-153.

[26] Rasotto, C., Bergamin, M., Simonetti, A., Maso, S., Bartolucci, G. B., Ermolao, A., & Zaccaria, M. [2015]. Program latihan yang disesuaikan mengurangi gejala gangguan muskuloskeletal yang berhubungan dengan pekerjaan pada anggota tubuh bagian atas pada sekelompok pekerja logam: uji coba terkontrol acak. Terapi manual, 20[1], 56-62