The Effect of Working Posture on Musculoskeletal Disorders Complaints Moderated By Smoking Copra Workers in Tanjung Balai, Asahan Regency

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Abstract

Musculoskeletal complaints refer to discomfort or pain in the musculoskeletal system, ranging from mild to severe. One type of job that is particularly prone to musculoskeletal disorders is copra work, primarily due to poor working posture. This study aims to analyze the effect of working posture on musculoskeletal disorder complaints among copra workers in Tanjung Balai, Asahan Regency. The study is an analytical survey with a cross-sectional design, conducted in Bandar Jawa Village, Tanjung Balai Subdistrict, Asahan Regency, from December 2023 to February 2024. The study population consisted of all 139 copra workers in Bandar Jawa Village, and a sample of 104 workers was selected using the Slovin formula. The sampling technique employed was simple random sampling. Data were collected through surveys and questionnaires administered to respondents. The research instruments used were the Nordic Body Map and the Rapid Entire Body Assessment (REBA) evaluation sheet. Data analysis was performed using SPSS version 24, with three stages: univariate analysis using frequency, bivariate analysis using simple linear regression, and multivariate analysis using Moderated Regression Analysis (MRA) with a significance level of 95% (α=0.05). The results showed that working posture significantly affected musculoskeletal disorder complaints, moderated by smoking habits, with a p-value of 0.001. It can be concluded that smoking exacerbates the negative effects of poor working posture on musculoskeletal health, increasing the risk of injury and slowing recovery. It is recommended that copra workers take preventive measures against musculoskeletal disorder complaints by improving their work environment, paying attention to rest periods, engaging in light relaxation exercises, and that employers provide education on worker safety and health to copra workers.

Keywords: Musculoskeletal disorders, Smoking, Work posture

INTRODUCTION

According to National Institute for Occupational Safety and Health (NIOSH) (2023), Musculoskeletal disorders (MSDs) are one of the occupational diseases who experience chronic disorders of the resulting nerves, muscles and tendons by awkward posture, duration of work, frequency of repetitive movements. Factors of work environment that can cause MSDs complaints include ergonomic factors such as repetitive activities, excessive stretching, body stress levels, posture or working posture, repetitive tasks, vibrating equipment, and long working hours (Soesilo et al., 2023).

According to International Labor Organization (ILO) (2015), Musculoskeletal disorders occupy the highest position, namely around 40% in terms of expenditure cost compensation Which paid company For worker as consequence from work-related accidents

and illnesses (ILO, 2015). According to ILO (2018) in Labor Force Surveys (LFS) report on year 2017-2018 report There are 469,000 workers in the UK who suffer from MSDs.

Consequential disease work in Indonesia too is problem Which pretty much found. Based on data from the Social Security Administering Agency for Employment, in 2020, there were 221,740 reported cases of workplace accidents, followed by 234,370 cases of workplace accidents in 2021. In 2022, the number increased to 297,725 cases of workplace accidents (BPJS Ketenagakerjaan, 2023). Results of laboratory studies of the Center for Health Studies and Ergonomics Bandung Institute of Technology report complaint MSDS as much 40% - 80% after work.

The location of facilities that are not suitable for workers' anthropometry can result in unnatural work attitudes. This can affect workers' performance in carrying out work (Mallapiang et al., 2019) . Examples of unnatural work postures are: work postures that are always standing or always sitting, squatting, bending and lifting for long periods of time which can cause discomfort and pain in one of the body parts (Adriansyah et al., 2019) .

Early fatigue in workers can also lead to occupational diseases and workplace accidents, resulting in disability or even death (Saputro & Suryati, 2023; Angriawan et al., 2024). Generally, skeletal muscle complaints begin to be felt at working age, namely 25-65 years. At the age of 35 years, most workers experience their first episode of back pain and the level of fatigue will continue to increase with increasing age because in middle age, muscle strength and endurance begin to decline so that the risk of muscle complaints increases. Other studies have found the influence of age on neck and shoulder muscle complaints, and some experts even state that age is the main cause of muscle complaints (Isnaeni et al., 2020).

Copra is the flesh of coconuts which is dried. The majority of community work in Bandar Java Village, namely manage copra or normal called pealing (peeling). Poking or knocking Coconut work is done by handing copra to the worker other workers to strip the coconut skin, after the coconut skin Already clean meat coconut along with skin coconut transported by worker other For Wash the coconut flesh and skin for approximately 2 hours. Copra workers are one of the jobs carried out by workers at informal sector jobs. Although the informal sector has contributed a lot both in the economy and in providing jobs, but cannot denied that condition health para his workers Still worrying (Tjahayuningtyas, 2019) .

Based on survey introduction to 15 copra workers in Tanjung Balai, Asahan Regency, that there were 13 people (87%) experiencing complaints of musculoskeletal disorders , copra workers said that they often experience Sick back, neck pain and also disorders such as muscle, joint and bone pain the back and parts of the body that respondents felt most painful are the

shoulders, fingers and back. Worker copra done with position Sit down bow in a way Keep going continuously during do his job. No fixed rest periods are applied and Workers don't think about their rest time, only when they feel tired do they take a short break because you are chasing the target of the number of coconuts measured in depth unit The kg of produce obtained by copra workers is at least 60 kg/person .

Results from meat fruit coconut Which has peeled can made material standard main making flour and peeling means peeling the skin ari on meat fruit coconut. Time Work taking place Enough long that is 5-8 O'clock in a day. Their work posture is not ergonomic (sitting hunched over, repetitive activities and lifting weights) is one of the causes of complaints of musculoskeletal disorders in copra workers. Research conducted by Dyana et al. (2023), fish porters at Mina Karya Karangasem Trading Business in show that working posture has a very strong correlation with musculoskeletal complaints.

METHODS

This study is an analytical survey using a cross-sectional design. The research was conducted in Bandar Jawa Village, Tanjung Balai Subdistrict, Asahan Regency, from December 2023 to February 2024. The population of this study consists of all copra workers in Bandar Jawa Village, totaling 139 people. The sample size was calculated using the Slovin formula, resulting in a sample of 104 workers. The sample distribution includes 9 workers in the roles of delivery, weighing, and washing, while 95 workers are involved in copra peeling. The sampling technique used was simple random sampling. The inclusion criteria for this study were copra workers aged 18-65 years, with a work tenure of more than 1 year, and who were willing to participate as respondents. The exclusion criteria were workers with medically diagnosed congenital abnormalities or spinal trauma, as well as extremities causing lower back pain and other musculoskeletal disorders.

Data collection procedures were carried out through surveys and questionnaires. Data on individual characteristics such as name, age, gender, last education, work duration, tenure, and smoking habits were collected through questionnaires. Musculoskeletal complaints among workers were obtained using the Nordic Body Map Questionnaire, which includes 28 items related to musculoskeletal complaints. The working posture of copra workers was assessed using the REBA (Rapid Entire Body Assessment) method, which consists of 13 steps related to working positions.

Data analysis was performed using SPSS version 24 statistical software. The data analysis process involved three steps: first, univariate analysis using frequency; second,

bivariate analysis using simple linear regression; and third multivariate analysis using Moderated Regression Analysis (MRA) with a significance level of 95% ($\alpha = 0.05$).

The principal investigator received an ethical approval certificate from the Health Research Ethics Committee University of North Sumatra Number: 435/KEPK/USU/2024. Additionally, permission from academic administrators and relevant authorities was obtained before data collection, with the aim of securing informed consent from respondents prior to the distribution of questionnaires.

RESULTS

Table 1 Characteristics of Respondents

Variable	n	%
Age		
Young (< 40 years)	46	44.2
Old (≥ 40 years)	58	55.8
Gender		
Man	11	10.6
Woman	93	89.4
Smoking habit		
Not smoking	41	39.4
Smoking	63	60.6
Body Mass Index		
Normal (18,5- 24,9 kg/m^2)	84	80.8
Abnormal (< 18,5- 24,9 kg/m^2)	20	19.2

Based on the table above, research conducted on copra workers in Tanjung Balai, Asahan Regency produced important findings regarding the prevalence of *musculoskeletal disorders* (MSDs) complaints and the factors that influence them. Of the 104 workers studied, in the demographic context 55.8% or 58 workers were in the old (≥ 40 years) age category, and 44.2% or 46 workers were in the young (< 40 years) age category, showing a diverse age distribution among workers. In terms of gender, female workers dominate with 89.4% or 93 workers, while only 10.6% or 11 workers are male.

Regarding smoking habits, it was found that 60.6% or 63 workers were smokers, which may contribute to an increased risk of MSDs and 39.4% or 41 workers were non-smokers. These habits may affect muscle endurance and blood circulation, two important factors in reducing the risk of musculoskeletal disorders. Lastly, in terms of body mass index (BMI) 80.8% or 84 workers had a normal BMI (18,5- 24,9 kg/m^2), while 19.2% or 20 workers had an abnormal BMI (< 18,5- 24,9 kg/m^2), adding another dimension to the risk factors for MSDs.

Table 2 Distribution of work posture assessments using the REBA method

Work Posture	n	%
Medium	13	12.5
High	50	48.1
Very High	41	39.4

Based on the table above, the distribution of respondents' categories regarding work posture as seen through the REBA method, only 12.5% or 13 workers have medium work posture, while 48.1% or 50 workers have high work posture and 39.4% or 41 workers have very high posture, indicating a large potential for poor working conditions on musculoskeletal health.

Table 3 Frequency Distribution of Musculoskeletal Complaints

Complaints Musculoskeletal Disorders	n	%
Medium	14	13.5
High	54	51.9
Very High	36	34.6

Based on the table above, research conducted on copra workers in Tanjung Balai, Asahan Regency produced important findings regarding the prevalence of *musculoskeletal disorders* (MSDs) complaints and the factors that influence them. Of the 104 workers studied, MSDs complaints were quite serious with 51.9% or 54 workers experiencing high levels and 34.6% or 36 workers experiencing very high levels. Only 13.5% or 14 workers reported medium level complaints, indicating that the majority of workers experienced complaints of musculoskeletal disorders and corrective action was needed as soon as possible.

Table 4. Simple Multiple Linear Regression Test Results between Work Posture and Complaints of Musculoskeletal Disorders in Tanjung Balai

Work Posture	Musculoscletal			P-Value
	Medium	High	Very High	
Medium	13	0	13	
High	0	39	60	0.001
Very High	1	15	41	

The results of a simple linear regression test between the work posture variable and musculoskeletal complaints show a P-Value = 0.001 ($p < 0.05$), so Ho is rejected so that there is an influence between work posture and musculoskeletal complaints in copra workers in Tanjung Balai. And those who experienced complaints of musculosceletal disorders in the medium category and work postures with a risk level in the medium category were 13 respondents, and those who experienced complaints of musculosceletal disorders in the very high category and work postures in the medium risk category were 13 respondents. Those who experienced complaints of musculosceletal disorders at a high level and work postures at a high risk level were 39 respondents, There were 60 respondents who experienced complaints of musculosceletal disorders with a very high category level and work postures with a high risk category level. Those who experienced complaints of musculosceletal disorders at a medium

level and working postures at a very high risk category were 1 respondent, 15 respondents experienced complaints about musculosceletal disorders at a high level and work postures at a very high risk category and 15 respondents experienced complaints of musculosceletal disorders at a very high level. very high category and work posture with a risk level in the very high category of 41 respondents.

Table 5 Regression of work posture on complaints of *musculoskeletal disorders* which is moderated by smoking habits

Variable	Significant
Working posture	0.001
Smoking habit	0.001
Smoking habits * Work Posture	0.001

Regression of work posture on complaints of *musculoskeletal disorders* which is moderated by smoking habits. Table 5 provides information about work posture variables for complaints of *musculoskeletal disorders* . From the results of the analysis, the value of work posture on complaints *of musculoskeletal disorders* was 0.001, which means that there is an influence between work posture on musculoskeletal complaints. The results of the analysis between smoking habits and complaints of *musculoskeletal disorders* got a p-value of 0.001, which means that there is an influence between habits. Smoking on complaints *of musculoskeletal disorders* and meanwhile the results obtained between work posture on complaints of *musculoskeletal disorders* which are moderated by smoking habits are p - value 0.001, which means that there is an influence between work posture on complaints of *musculoskeletal disorders* which is moderated by smoking habits. The type of moderation between the work posture variable and the interaction of the smoking habit variable is considered quasi moderation.

Table 6 MRA statistical test results for work posture variables on musculoskeletal disorders complaints with combination factors as moderate variables

Variable	B	Rsquare	F	P-Value
Interaction Smoking habits	0.682	0.480	22,815	0.001

The results of data analysis show that the interaction between work posture variables and smoking habits shows that by including the smoking habit variable as a moderating variable into the regression, it has a positive and significant effect on the incidence of musculoskeletal disorders. It can be seen that the moderating variable as a form of interaction between work posture and smoking habits obtained a significant value of 0.001 with a parameter value of 0.682 so it can be concluded that the smoking habit variable is a moderating variable.

DISCUSSION

The Effect of Working Posture on Musculoskeletal Disorder Complaints

The research results indicate that the simple linear regression test on the effect of working posture on musculoskeletal disorders among copra workers yielded a p-value of 0.001 ($p < 0.05$), indicating a significant correlation between working posture and the occurrence of musculoskeletal disorders among copra workers in Tanjung Balai, Asahan Regency. The process of peeling the coconut skin is done while sitting on a small wooden chair, which is not ergonomic for the task. Working in a seated position for long periods, maintaining the same body posture, can lead to muscle fatigue, reduced blood flow to tissues, and an increased risk of musculoskeletal disorders.

The working posture of copra workers in Tanjung Balai, Asahan Regency is predominantly characterized by a bent posture, which commonly occurs during the work process, with varying degrees of body angle inclination. This forward bending primarily affects the worker's back during their tasks. Another non-ergonomic posture involves the neck; this is particularly evident during the coconut peeling process, where workers sit on low stools. The low seating position forces copra workers in Tanjung Balai, Asahan Regency to tilt their heads downward, creating an angled posture. Such unnatural or extreme body positions, like bending forward, place excessive stress on the musculoskeletal structure, particularly the muscles and skeletal system. This improper posture significantly contributes to the development of musculoskeletal disorders among copra workers.

A working posture that deviates from the normal position (0° body angle) of normal joints, or can be described as an upright stance with minimal muscle exertion, is considered non-ergonomic (Safhira & Satrya, 2022; Martins et al., 2024). The greater the angle of inclination in the posture, the higher the potential for developing musculoskeletal disorders (Yovi & Fauzi, 2021). Working in an improper sitting position can lead to fatigue and a decrease in efficiency due to a slouched posture, which places excessive strain on the spine. This, in turn, triggers muscle disorders, particularly in the abdominal and back muscles (Faridah & Hadi, 2024).

Non-ergonomic postures are significant contributors to musculoskeletal disorders, as they can push the physical limits of the body, compress nerves, and irritate tendons (Russeng et al., 2021; Danur et al., 2022). Global Burden of Disease (2023) also highlights that exposure to job-related risks, such as lifting, bending, awkward postures, vibrations, and physically demanding tasks, is associated with an increased risk of lower back pain.

The results of this study are consistent with research conducted by Wang et al., (2021), which found that working posture affects musculoskeletal disorder complaints with an accuracy of 96.7%. These findings are further supported by a study conducted by Khofiyya et al. (2019), which demonstrated a significant correlation between working posture and musculoskeletal disorder complaints, with a p-value of 0.001. Additionally, another study by Watiningsih & Ani (2022) also confirmed a significant relationship between working posture and musculoskeletal disorder complaints, with a p-value of 0.003.

An ergonomic working posture is the ideal posture that ensures proper alignment of body segments, minimizing the amount of energy required to maintain a desired position (Firdaus & Nugraha, 2023). In this posture, a person can fully and optimally achieve balance, aligning body mass and skeletal structure according to physical limitations, unlike other non-ergonomic positions (Tiogana & Hartono, 2020). According to (Ayu et al., 2022), an unnatural working posture can be referred to as a static posture. A static posture is one where physical work is performed in the same position, with minimal movement, or where a movement is maintained for more than 10 seconds. Maintaining a static working posture for extended periods can increase the risk of muscle pain in various parts of the body and may reduce the functional capacity of muscles (Wijayati, 2020).

The researcher assumes that the non-ergonomic working postures of copra workers in Tanjung Balai, Asahan Regency, such as sitting with a hunched back, can exert excessive pressure on certain muscles and joints. Incorrect sitting or standing positions can impede proper blood circulation, leading to muscle fatigue and an increased risk of soft tissue injury. Poor posture can also cause compression of certain nerves. For instance, sitting with poor posture can result in nerve compression in the lower back, which may lead to lower back pain or sciatica. When someone continuously works in an improper posture, certain muscles may have to work harder to maintain the body's position. This constant muscle tension can cause pain and fatigue, as well as increase the risk of musculoskeletal disorders such as back or neck pain.

Smoking Habits in Moderating the Effect of Working Posture on Musculoskeletal Disorder Complaints

The research results showed that the majority of respondents, 63 people (60.6%) were smokers. The number of cigarettes consumed ranged from 3 cigarettes to two packs per day. Many copra workers have been smoking for a long time, starting from a young age and continuing into old age. The findings revealed that most workers, both men and women, are active smokers, with some even smoking while working. The influence of smoking habits on musculoskeletal disorder complaints is evident, as nearly all workers are active smokers. The

study found that the effect of working posture on musculoskeletal disorder complaints, when moderated by smoking habits, yielded a p-value of 0.001, indicating a significant relationship between working posture and musculoskeletal disorder complaints, moderated by the smoking habits of copra workers.

The negative effects of smoking can moderate the impact of non-ergonomic working postures on musculoskeletal disorder complaints. It was found that smokers are more susceptible to musculoskeletal injuries compared to non-smokers, even when they have the same working posture. This increased risk is due to the reduced tissue elasticity and blood flow caused by smoking, which hinders muscle recovery and elevates the risk of injury.

The results of this study align with the research by Rosemillen & Dwiyanti (2023), which found that smoking habits significantly influence musculoskeletal complaints, with a significance value of 0.028. According to Asnel & Pratiwi (2021), smoking habits reduce lung capacity, thereby decreasing the ability to consume oxygen. When an individual is required to perform tasks that demand exertion, they will become easily fatigued due to low oxygen levels in the blood. This impaired oxygen intake hampers carbohydrate metabolism, leading to the accumulation of lactic acid and resulting in muscle pain (Ajhara et al., 2022).

The results of this study are supported by research conducted by Afro & Paskarini (2022), which also found an association between smoking habits and musculoskeletal disorder complaints, with a significance value of p = 0.009. According to Hanif (2020), noted that smokers are at a higher risk of experiencing back pain compared to non-smokers. This is due to coughing from excessive smoking, which increases abdominal pressure and can lead to tension in the spine or back. According to Amalia & Wahyuningsih (2024), the longer and more frequently a person smokes, the greater the likelihood of experiencing musculoskeletal disorders.

The researcher assumes that the smoking behavior of copra workers significantly contributes to the impact of work posture on musculoskeletal disorders among copra workers in Tanjung Balai, Asahan Regency. Smoking causes the narrowing of blood vessels, reducing blood flow to muscles and other tissues, which hinders the supply of oxygen and nutrients necessary for tissue health and healing. This increases the risk of injury and slows recovery from microtraumas associated with poor work posture. Nicotine and other chemicals in cigarettes can interfere with calcium absorption and decrease bone density, making bones more fragile and prone to injury. Additionally, smoking can damage connective tissues such as tendons and ligaments, making musculoskeletal disorders more likely.

CONCLUSIONS

The effect of working posture on musculoskeletal disorders (MSDs), moderated by smoking habits, among copra workers in Tanjung Balai, Asahan, yielded a p-value of 0.001 ($p < 0.005$). This indicates a significant relationship between working posture and the occurrence of musculoskeletal disorder complaints, with smoking habits exacerbating the negative effects of non-ergonomic postures on MSDs. It is recommended that copra workers take preventive measures against musculoskeletal disorder complaints by improving their work environment, paying attention to rest periods, and reducing or eliminating smoking. Employers are encouraged to provide two rest breaks during work and to educate workers about safety and health, particularly concerning the risks of smoking.

REFERENCES

Adriansyah, M., Mallapiang, F., & Ibrahim, H. (2019). Faktor yang berhubungan dengan keluhan msds pada penenun lipa' sa'be mandar di Desa Karama Kecamatan Tinambung kabupaten Polewali Mandar. *Higiene, 5*(2), 79–84. https://doi.org/10.24252/higiene.v5i2.13910

Afro, H.S., & Paskarini, I. (2022). Hubungan antara imt dan kebiasaan merokok dengan keluhan musculoskeletal disorders pada petani padi di desa doho, kabupaten madiun, jawa timur. *Preventif: Jurnal Kesehatan Masyarakat*, *13*(1), 98-111. https://doi.org/10.22487/preventif.v13i1.249

Ajhara, S., Novianus, C., & Muzakir, H. (2022). Faktor-faktor yang berhubungan dengan keluhan musculoskeletal disorders (msds) pada pekerja bagian sewing di PT. X pada Tahun 2022. *Jurnal Fisioterapi Dan Kesehatan Indonesia*, *2*(2), 150-162.

Amalia, V., & Wahyuningsih, A.S. (2024). Determinan keluhan musculoskeletal disorders (msds) pada pekerja kantoran di PT X. *HIGEIA (Journal of Public Health Research and Development)*, *8*(1), 74-85. https://doi.org/10.15294/higeia.v8i1.72856

Angriawan, B.J., & Panjaitan, T. (2024). Perancangan hirarc (hazard identification, risk assessment, and risk control) pada PT. X. *Jurnal Titra*, *12*(2), 201-208.

Asnel, R., & Pratiwi, A. (2021). Analisis faktor-faktor yang mempengaruhi keluhan musculoskeletal disorder pada pekerja laundry. *Public Health and Safety International Journal*, *1*(01), 45-53. https://doi.org/10.55642/phasij.v1i01.23

Ayu, D., Nasution, A.K., Mardiyah, A., Chairunisa, C., Derina, D., Riyani, D., ... & Sumayyah, S. (2022). Resiko postur kerja terhadap keluhan nyeri leher pada polisi di Polresta Lubuk Pakam. *PREPOTIF: Jurnal Kesehatan Masyarakat*, *6*(2), 1602-1608. https://doi.org/10.31004/prepotif.v6i2.4709

BPJS Ketenagakerjaan. (2023). *Kecelakaan Kerja Makin Marak dalam Lima Tahun Terakhir*. https://www.bpjsketenagakerjaan.go.id/berita/28681/Kecelakaan-Kerja-Makin-Marak-dalam-Lima-Tahun-Terakhir

Danur, S.M.B., Wahyu, A., & Thamrin, Y. (2022). Hubungan postur kerja dan masa kerja terhadap keluhan muskuloskeletal pada pengemudi bus. *Hasanuddin Journal of Public Health*, *3*(2), 166-178. http://dx.doi.org/10.30597/hjph.v3i2.21894

Dyana, I.P.N.A., Rusni, N.W., & Sukmawati, N.M.H. (2023). Faktor-faktor yang berhubungan dengan keluhan muskuloskeletal disorders (msds) pada pekerja pengangkat ikan di

Usaha Dagang Mina Karya Karangasem. *AMJ (Aesculapius Medical Journal), 3*(1), 93-100.

Faridah, & Hadi, P. (2024). Faktor resiko yang berhubungan dengan kejadian low back pain (lbp) pada pembatik. *Jurnal Akademika Baiturrahim Jambi*, *13*(1), 129-138. https://jab.stikba.ac.id/index.php/jab

Firdaus, M.Y.M., & Nugraha, A.E. (2023). Analisis postur tubuh pemotongan daging sapi dengan metode nordic body map dan rapid upper limb assessment. *Jurnal Serambi Engineering*, *8*(1), 4827 - 4836.

Global Burden of Disease. (2023). *Findings from the GBD 2021 Study*. https://www.healthdata.org/research-analysis/gbd

Hanif, A. (2020). Hubungan antara umur dan kebiasaan merokok dengan keluhan musculoskeletal disorders (msds) pada pekerja angkat angkut UD Maju Makmur Kota Surabaya. *Medical Technology and Public Health Journal*, *4*(1), 7-15. https://doi.org/10.33086/mtphj.v4i1.715

International Labor Organization (ILO). (2015). Global Trends on Occupational Accident and Disease. https://webapps.ilo.org/static/english/osh/en/story_content/external_files/fs_st_1-ILO_5_en.pdf

International Labor Organization (ILO). (2018). The Prevention Of Occupational Diseases. https://www.ilo.org/meetings-and-events/prevention-work-related-occupational-diseases.

Isnaeni, L.M.A., Hastuti, M., & Yusma, R.H. (2023). Faktor-faktor yang berhubungan dengan kejadian musculoskeletal disorders (msds) pada pemanen kelapa sawit di PT. Johan Sentosa. *PREPOTIF: Jurnal Kesehatan Masyarakat, 4*(1), 70–77. https://doi.org/10.31004/prepotif.v4i1.649

Jingluan, W., Dengkai, C., Mengya, Z., & Yiwei, S. (2021). Risk assessment for musculoskeletal disorders based on the characteristics of work posture. Northwestern Polytechnical University. https://doi.org/https://doi.org/10.1016/j.autcon.2021.103921.

Khofiyya, A.N., Suwondo, A., & Jayanti, S. (2019). Hubungan beban kerja, iklim kerja, dan postur kerja terhadap keluhan musculoskeletal pada pekerja baggage handling service bandara (Studi Kasus di Kokapura, Bandara Internasional Ahmad Yani Semarang), *Jurnal Kesehatan Masyarakat, 7*(4), 619-625. https://doi.org/10.14710/jkm.v7i4.24970

Mallapiang, F., Azriful, Habibi, Aeni, S., & Ismawati, T. (2019). Analisis postur kerja dan re-desain fasilitas kerja pada pengrajin batu bata di Kelurahan Kalase'rena Kec. Bontonompo Kab. Gowa. *Public Health Science Journal, 11*(1), 49–59. https://doi.org/10.24252/as.v11i1.9419

Martins, D. R., Cerqueira, S. M., & Santos, C. P. (2024). Combining inertial-based ergonomic assessment with biofeedback for posture correction: A narrative review. *Computers & Industrial Engineering*, 110037. https://doi.org/10.1016/j.cie.2024.110037

National Institute for Occupational Safety and Health (NIOSH). (2023). *Musculoskeletal Disorders and Workplace Factors – A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back.* https://www.cdc.gov/niosh/docs/97-141/default.html

Rosemillen, W., & Dwiyanti, E. (2023). Correlation between age and smoking habit with musculoskeletal disorders among gantry luffing crane operators. *Media Gizi Kesmas, 12*(1), 160-164. https://10.20473/mgk.v12i1.2023.160-164

Russeng, S.S., Saleh, L.M., Wahyulianti, W.N., & Palutturi, S. (2021). The effect of age and workload on work posture toward musculoskeletal disorders complain on loading and unloading workers. *Journal of Medical Sciences, 9*(E), 1115-1121.

Safhira, I., & Satrya, C. (2022). Kajian Tingkat Keparahan Postur Janggal yang Berkontribusi kepada Gangguan Sistem Muskuloskeletal (Studi Pustaka Naratif). *National Journal of Occupational Health and Safety*, *2*(2), 1-9. https://journal.fkm.ui.ac.id/ohs/article/view/5835

Saputro, A.P., & Suryati, A. (2023). Peran ilmu ergonomi terhadap keselamatan kerja di sebuah perusahaan. *MUFAKAT: Jurnal Ekonomi, Manajemen, dan Akuntansi*, *2*(2), 1-11. https://jurnal.anfa.co.id/index.php/mufakat.

Soesilo, R., Nirfison, Soerahman, & Sulistyo, S. (2023). *Dasar-dasar ergonomi dan perancangan sistem kerja*. Sumedang: CV. Mega Press Nusantara.

Tiogana, V., & Hartono, N. (2020). Analisis postur kerja dengan menggunakan REBA dan RULA di PT X. *Journal of Integrated System*, *3*(1), 9-25. https://doi.org/10.28932/jis.v3i1.2463

Tjahayuningtyas, A. (2019). Faktor mempengaruhi keluhan musculoskeletal disorders (msds) pada pekerja informal. *The Indonesian Journal of Occupational Safety and Health, 8*(1), 1–10. https://doi.org/10.20473/ijosh.v8i1.2019.1-10

Wang, J., Chen, D., Zhu, M., & Sun, Y. (2021). Risk assessment for musculoskeletal disorders based on the characteristics of work posture. *Automation in Construction*, *131*, 103921. https://doi.org/10.1016/j.autcon.2021.103921

Watiningsih, S., Triyanta, & Ani, N. (2022). Hubungan pencahayaan dan postur kerja serta iklim kerja dengan keluhan musculoskeletal disosders pada pekerja bagian helper di PT. Semarang Autocomp Manufacturing Indonesia (SAMI) Semarang. *Jurnal Ilmu Kesehatan Masyarakat Berkala*, *4*(1), 38-57. https://doi.org/10.32585/jikemb.v4i1.1899

Wijayati, E.W. (2020). Risiko postur kerja terhadap keluhan subyektif nyeri leher pada pekerja industri kerajinan kulit. *JUMANTIK (Jurnal Ilmiah Penelitian Kesehatan)*, *5*(1), 56-64.

Yovi, E.Y., & Fauzi, A. (2021). Penilaian risiko ergonomi dalam kegiatan pemungutan getah pinus: analisis postur kerja statis. *Jurnal Sylva Lestari*, *9*(1), 104-120. https://doi.org/10.23960/jsl19104-120