

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers



Heni Fa'riatul Aeni¹, Lilis Banowati², Putri Iklimah³

^{1,2}Lecture, Sekolah Tinggi Ilmu Kesehatan Cirebon, Cirebon, West Java, Indonesia

³Student, Public Health of Departement, Sekolah Tinggi Ilmu Kesehatan Cirebon, Cirebon, West Java, Indonesia

ABSTRACT: According to WHO, Musculoskeletal Disorders (MSDs) are the main cause of disability throughout the world. In 2019 around 1.71 billion people had Musculoskeletal disorders. Batik making is a job that is at risk of experiencing Musculoskeletal disorders. One effort to minimize complaints regarding musculoskeletal disorders is through stretching exercise. This study aims to determine the effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers. Methods: This was a quantitative study with Quasi Experimental design and One Group Pre Test Post Test approach. The population of this study involved 31 batik makers at BT Batik Trusmi Cirebon. The study samples were selected using a total sampling technique as many as 31 respondents. The variables in this study included the independent variable of stretching exercise and the dependent variable of Musculoskeletal Disorders (MSDs) complaints. The study instrument used the Nordic Body Map (NBM) questionnaire sheet. Data collection was carried out by interviews. The intervention given was stretching exercise for 5 minutes after 3-4 hours of work, 7 times over a period of 7 days. Data were analyzed statistically using the Paired T-Test. The result that there was an effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers at BT Batik Trusmi of Cirebon.

KEYWORDS: Musculoskeletal Disorders (MSDs), Streching exercise

INTRODUCTION

Musculoskeletal Disorders (MSDs) complaints refer to pains and injuries that affect the Musculoskeletal system or parts of the human body due to continuous exposure to various risk factors in the workplace (Laksana and Srisantyorini, 2020). MSDs are the second largest contributor to disability in the world that limit social activities and skills of workers. Based on data obtained from the International Labour Organization (ILO), it was shown that the MSDs risk factors in the workplace that affect posture may cause serious diseases (Eurofound and International Labour Organization, 2019).

According to the World Health Organization (WHO), in 2019, about 1.71 billion people had Musculoskeletal conditions worldwide (WHO, 2022). Based on data derived from the report of the Ministry of Health of the Republic of Indonesia among workers in 12 cities/districts in 2021, it was revealed that 1,432 people (40.5%) generally had Musculoskeletal Disorders (MSDs) complaints (Directorate General of Disease Prevention and Control, 2021). Musculoskeletal disorders can significantly limit movement and dexterity which further cause workers to retire early from their jobs, have lower levels of welfare, and decreased ability to blend into society (WHO, 2022)

In addition to the problems of non-communicable diseases, infectious diseases, and nutritional problems, informal sector workers can also have risks to occupational safety and health related to their work that can affect their productivity. For example, work environment conditions that have potential hazards and health problems in workers such as skeletal muscle disorders, skin disorders, and eye disorders. Workers in the informal sector who are exposed to workplace hazards tend not to be noticed by business entities or business owners who are directly responsible for their occupational safety and health (Satriawan, Pitoyo and Giyarsih, 2020).

One of the jobs in the informal sector is batik makers. During batik production, there are potential hazards that can be found due to static batik activities, continuous work, high workloads, and a hot work environment. Static work attitude namely sitting on a dingklik or standibg for a long time can increase the workload on static muscles. Such work attitudes often lead to

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers

complaints among batik workers in the form of muscular pain especially in the neck, upper back, waist, and legs (Nahdliyyah et al., 2023).

According to a study conducted by Yamtana, et al in 2022, the complaint commonly experienced by batik makers were pain on the back, neck, waist, right and left upper arms, right and left lower arms, buttocks, right and left calves, right and left thighs (Yamtana et al., 2022). Furthermore, a study conducted by Meisi Wulan in 2020 found that poor working position among written and stamped batik makers could cause complaints regarding the Musculoskeletal Disorders (MSDs) system such as low back pain. Written batik makers generally had a higher risk of LBP compared to stamped batik makers (Wulan, Hilal and Entianopa, 2020). Stretching exercise is a simple physical activity which can act as a counterbalance for stationary and inactive work positions for a long time. Providing regular stretching exercise between work activities can reduce muscle tension, reduce anxiety, fatigue and stress, improve blood circulation, and make workers feel better. In addition, doing muscle stretching movements during leisure time while working can minimize the risk of Musculoskeletal Disorders (MSDs) complaints. Therefore, the provision of stretching movements for 5 minutes after 3-4 hours of work was proven to be effective in relieving Musculoskeletal Disorders (MSDs) complaints (Ismayenti and Wardani, 2022). A previous study conducted by Heni Fa'riatul Aeni and Reza Faudiah in 2019 entitled "Counseling on Sitting Work Position on the Relief in Complaints of Lower Back Pain among Batik Makers" revealed the benefits of stretching/relaxation exercise activities for relieving lower back pain complaints. Such study found that batik makers experienced a relief in the complaints/pain and their body was lighter/less stiff after being given muscle relaxation/stretching activities (Aeni and Faudiah, 2019). According to Priyoto and Binar in 2019, after being given treatment and carrying out a post-test, the significance value in the control group was 0.019, which was higher than the treatment group of 0.005. So, it can be concluded that providing stretching exercise interventions in the workplace was effective in relieving pain due to Musculoskeletal Disorders (MSDs) (Priyoto and W, 2019). Furthermore, a previous study conducted by Nahdliyyah, et al in 2023 with a total of 24 subjects obtained a p value of <0.05. So, it can be concluded that there was a difference in the level of complaints between before and after active stretching exercise with slow deep breathing among batik makers. It was shown by a decrease in musculoskeletal complaints and working pulse rate among batik makers in period 2 or after being given active stretching exercise with slow deep breathing (Nahdliyyah et al., 2023). BT Batik Trusmi of Cirebon is the largest and most complete batik center in Indonesia with the main mission of introducing and preserving the art of batik. The batik produced at BT Batik Trusmi of Cirebon is in the form of written batik and stamped batik. BT Batik Trusmi is one of the batik centers in Cirebon which has a place for the batik making process with the largest number of batik makers by 31 workers (BT Batik Trusmi, 2020). Generally, the written batik makers at BT Batik Trusmi of Cirebon work by sitting and the stamped batik makers work by standing. The chair used for batik making is a short chair called a "dingklik". The chair usually does not have a backrest, so the workers do not have support for the body weight, causing the bend posture while working. Such condition can cause batik makers to have an unnatural working attitude and the potential to experience discomfort while working. A preliminary study conducted by researchers at BT Batik Trusmi of Cirebon on May 29, 2023 using the Nordic Body Map (NBM) questionnaire by interviewing 10 batik makers found that 7 batik makers (70%) experienced moderate level of MSDs complaints and 3 batik makers (30%) experienced low level of MSDs complaints. In addition, batik makers at BT Batik Trusmi of Cirebon spent 8 hours a day working with non ergonomic position and non natural work attitudes. They often did repetitive work in non ergonomic work place designs regarding position, size of tables and chairs, and batik makers rarely did stretching exercise after 3-4 hours of work, which can pose a risk of musculoskeletal complaints such as pain in the neck, waist, lower back and legs. Based on the background description above, this study aims to determine the effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers.

METHOD

This was a quantitative study with Quasi Experimental design and One Group Pre Test Post Test approach. The current study was conducted at BT Batik Trusmi of Cirebon from July 7, 2023 to July 18, 2023. The population in this study involved 31 written and stamped batik workers, who were selected through total sampling technique from a population of 31 people at BT Batik Trusmi of Cirebon. The variables in this study involved the independent variable of stretching exercise and the dependent variable of Musculoskeletal Disorders (MSDs) complaints. Data were collected through interviews. The intervention of stretching exercise were given for 5 minutes after 3-4 hours of work 7 times over a period of 7 days. Stretching exercise movements implemented were based on the protocol in "Reduction of Fatigue and Musculoskeletal Complaints in Garment Sewing Operators through a Combination of Stretching Brain Gym and Touch for Health". Data were analyzed statistically using the Paired T-Test at a significance level of 5% (0.05).

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers

RESULT AND DISCUSSION

A. The Risk Level of Musculoskeletal Disorders (MSDs)

Table 1. Description of The Risk Level of Musculoskeletal Disorders (MSDs)

Variabel	n	(%)
Before		
No risk (≤ 28)	-	-
Low (29-49)	6	19.4
Moderate (50-70)	12	38.7
High (71-91)	13	41.9
Very High (92-112)	-	-
After		
No risk (≤ 28)	-	-
Low (29-49)	24	77.4
Moderate (50-70)	7	22.6
High (71-91)	-	-
Very High (92-112)	-	-

Result of the univariate analysis showed that the risk level of Musculoskeletal Disorders (MSDs) complaints after stretching exercise as many as 19.4% experienced low level, 38.7% of respondents experienced moderate risk level, and 41.9% experienced high risk level. Meanwhile the risk level of Musculoskeletal Disorders (MSDs) complaints after stretching exercise as many as 77.4% experienced low risk level, 22.6% experienced moderate risk level.

B. The Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) complaints among Batik Makers

Table 2. The Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) complaints among Batik Makers

Risk Level of MSDs	Before		After		P Value
	n	(%)	N	(%)	
No risk (≤ 28)	-	-	-	-	
Low (29-49)	6	19.4	24	77.4	
Moderate (50-70)	12	38.7	7	22.6	0.000
High (71-91)	13	41.9	-	-	
Very High (92-112)	-	-	-	-	
Total	31	100	31	100	

Based on table 2, the result of the paired t-test, it was obtained a p value of 0.000 ($p < 0.05$). Thus, it can be concluded that there was an effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers.

C. The Risk Level of Musculoskeletal Disorders (MSDs) before Stretching Exercise

Based on the results of study, it was found that there were 41.9% who experienced high risk level of Musculoskeletal Disorders (MSDs) complaints. Such finding indicated that less than half of respondents experienced Musculoskeletal Disorders (MSDs) complaints in the high category, thus requiring immediate action/efforts to reduce the level of pain complaints.

Such finding is similar to a study conducted by Etika, et al in 2017 regarding the Effect of Ergonomics Exercise on the Risk Level of Musculoskeletal Disorders (MSDs) among Employees at a Cloth Sanitary Napkin Factory in Kediri. It was found that 10 respondents (67%) had a high risk level for Musculoskeletal Disorders (MSDs) before Ergonomics Exercise at the Cloth Sanitary Napkin Factory in Kediri (Etika et al., 2017). Furthermore, according to the study conducted by Irmayani, et al. in 2021 regarding Ergonomic Stretching Exercise to Relieve Musculoskeletal Disorders Complaints among Palm Oil Nursery Workers, 13 respondents (41.9%) had a high risk level of Musculoskeletal Disorders (MSDs) complaints before ergonomic exercise (Irmayani, Sri Meldi Br. Bangun, Anggi Isnani Parinduru, Rosita Ginting, Raisha Octavariy, 2021).

According to Faridah's statement in 2022, the batik making process is carried out in a sitting and standing working posture with simple equipment so that it can result in a bent and static working posture. Such condition shows that the ergonomic aspects of the batik facilities have not been implemented well. Non ergonomic position can cause fatigue, pain and other health problems (Faridah and Junaidi, 2022). Poor working position among written and stamped batik makers can cause Musculoskeletal Disorders (MSDs) complaints such as low back pain. In general, written batik makers have a higher risk of LBP compared to stamped batik makers (Wulan, Hilal and Entianopa, 2020). Meanwhile, in the activity of making stamped batik, workers mostly

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers

experience complaints in their feet because they work by standing for a long time, which can lead to Musculoskeletal Disorders (MSDs) complaints (Safira, Ekawati and Kurniawan, 2022).

The high percentage of respondents who experienced Musculoskeletal Disorders (MSDs) complaints in this study could be due to the high level of work activity while making stamped batik and written batik. In general, written batik workers work by sitting and stamped batik workers work by standing. The chair used for batik making is a short wooden chair without a backrest. Thus, the batik maker's posture tends to be bent, the body turns to the side to collect wax, and there are repetitive hand movements during the eight hours of work. The sitting and standing working postures performed by batik makers during the eight hours of work are static working positions. Poor position is coupled with no stretching exercise before and after work.

In this study, the majority of batik makers had a risk of experiencing Musculoskeletal Disorders (MSDs) complaints in the upper and lower neck, back, waist, right forearm and right hand. This is because work is carried out in a sitting and standing position for a long period of time. A bent sitting position may cause Musculoskeletal Disorders (MSDs) complaints in the neck, back and waist. Repeated work for a long time during writing and stamping batik making can cause Musculoskeletal Disorders (MSDs) complaints in the right forearm and right hand. In a study conducted in 2022, it was found that the body parts that mostly experienced Musculoskeletal Disorders (MSDs) complaints among Batik Makers across Jambi City were the neck, back, waist and hands (Faridah and Junaidi, 2022).

Efforts to overcome Musculoskeletal Disorders (MSDs) complaints in the work environment are very necessary since they are beneficial in terms of saving costs, improving work quality and productivity, reducing the occurrence of work accidents, and improving the health and welfare of workers (Syafrianto, K.H and Zulfa, 2019). One way to manage Musculoskeletal Disorders (MSDs) complaints is through stretching exercise at work. Stretching exercise can be performed with a series of light movements starting from the head, shoulders, hands, waist and legs regularly between work activities. It is useful for relieving muscle tension and as relaxation to overcome boredom at work.

D. The Risk Level of Musculoskeletal Disorders (MSDs) after Stretching Exercise

According to table 1, there were 77.4% who experienced low level of Musculoskeletal Disorders (MSDs) complaints. Such finding indicated that the majority of respondents experienced low level of Musculoskeletal Disorders (MSDs) complaints due to the effectiveness of stretching exercise to flex muscles and obtain muscle comfort.

The study finding is in accordance with a study conducted by Oktaviani, et al in 2022 regarding the Effect of Stretching Movements among Garment Tailors on Musculoskeletal Disorders (MSDs) Complaints. After stretching, as many as 15 respondents (94%) experienced low level of Musculoskeletal Disorders (MSDs) complaints (Oktaviani et al., 2022). Moreover, a study conducted by Sirait, et al. in 2021 regarding the Effect of Ergonomic Exercise on Musculoskeletal Complaints among Brick Lifting Workers in Karang Anyer Village, Serdang Bedagai District found that 33 respondents (100%) experienced low level of Musculoskeletal Disorders (MSDs) complaints after ergonomic exercise (Sirait, Dalianti and Silalahi, 2021)

The current study revealed that the majority of respondents experienced a decrease in the level of Musculoskeletal Disorders (MSDs) complaints after stretching exercise, namely from high and medium MSDs risk levels to moderate and low MSDs risk levels. It is in accordance with a study conducted by Irmayani, et al in 2021 that stretching exercise given to workers was proven to be effective in relieving MSDs complaints experienced by workers. Initially, most workers experienced moderate level of MSDs complaints, but after stretching exercise the respondents experienced low level of MSDs complaints (Irmayani, Sri Melda Br. Bangun, Anggi Isnani Parinduru, Rosita Ginting, Raisha Octavariny, 2021).

The decrease in the level of Musculoskeletal Disorders (MSDs) complaints after giving stretching exercise occurred because stretching exercise could reduce muscle tension and increase flexibility among respondents with Musculoskeletal Disorders (MSDs) complaints. Stretching exercise to workers can be used as an alternative to relieve perceived Musculoskeletal Disorders (MSDs) complaints so as to increase worker productivity and reduce boredom (Oktaviani et al., 2022).

In this study, there was a change in the level of Musculoskeletal Disorders (MSDs) complaints after stretching exercise, wherein most of batik makers experienced a mild level Musculoskeletal Disorders (MSDs) complaints. Therefore, stretching exercise is very effective as an effort to manage Musculoskeletal Disorders (MSDs) complaints which can be given to batik makers, especially those who have symptoms of pain.

E. The Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) complaints

Based on table 2, the Paired T-Test obtained a p value of 0.000 ($p < 0.05$). Thus, it can be concluded that there was an effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers at BT Batik Trusmi of Cirebon in 2023.

The results of this study showed that there was a difference in the level of MSDs complaints between before and after stretching exercise among batik makers. This was shown by a decrease in the level of Musculoskeletal Disorders (MSDs) complaints among batik makers after the intervention. There were 13 respondents at the pre-test and there was not a single

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers

respondent at the post-test who experienced high MSDs risk level, at the moderate MSDs risk level, there was a decrease from 12 respondents at the pre-test to 7 respondents at the post-test, and at the low MSDs risk level there were 6 respondents at the pre-test to 24 respondents at the post-test. The reduction in Musculoskeletal Disorders (MSDs) complaints among batik makers was due to the provision of stretching exercise based on the protocol in "Reduction of Fatigue and Musculoskeletal Complaints in Garment Sewing Operators through a Combination of Stretching Brain Gym® and Touch for Health". Stretching exercise for 7 times over a period of 7 days after 3-4 hours of work with a duration of 5 minutes was proven to be effective in relieving Musculoskeletal Disorders (MSDs) complaints among batik makers. Based on a study conducted by Ismayenti, et al in 2021, it was found that a combination of Brain Gym (BG) and Touch for Health (TfH) stretching movements could relieve Musculoskeletal Disorders (MSDs) complaints found in the left wrist, left hand, and left knee (Ismayenti et al., 2021). Furthermore, a study conducted by Nahdliyyah, et al. in 2023 obtained a p value of 0.000 ($p < 0.05$), which indicated that there was a difference in the level of MSDs complaints between before and after intervention in the form of active stretching exercise with slow deep breathing among batik craftsmen (Nahdliyyah et al., 2023). Such finding is similar to a study conducted by Sirait, et al in 2021 which obtained a p value of 0.000 or $p < 0.05$, which indicated that there was an effect of ergonomics exercise on musculoskeletal complaints among brick lifting workers in Karang Anyer Village, Serdang Bedagai District (Sirait, Dalianti and Silalahi, 2021). Research regarding the provision of stretching exercise based on the protocol in "Reduction of Fatigue and Musculoskeletal Complaints in Garment Sewing Operators through a Combination of Stretching Brain Gym® and Touch for Health" was not only carried out among batik makers, but had also been given to informal sector workers, namely snack makers and album makers. The stretching movement had an impact on relieving Musculoskeletal Disorders (MSDs) complaints in 5 body parts for both groups of workers. The five parts of the body that experienced the most significant relieve in Musculoskeletal Disorders (MSDs) complaints after intervention were the upper and lower neck, waist, back and right hand (Ismayenti and Wardani, 2022).

Relief in Musculoskeletal Disorders (MSDs) complaints among batik makers was due to relaxation resulting in a decrease in muscle tension after being given stretching exercise. Static work positions such as sitting and standing for a long time are the main cause of muscle pain. It is necessary to do stretching exercise to move the muscles throughout the body so that blood circulation runs smoothly. This method is useful so that workers may not experience Musculoskeletal Disorders (MSDs) complaints (Priyoto and W, 2019). The provision of stretching exercise has become a reference for relieving Musculoskeletal Disorders (MSDs) complaints among workers. It has the benefit of preventing and treating muscle pain, since stretching exercise can increase muscle elasticity and relaxation thereby reducing muscle pain and tension that causes discomfort (Nahdliyyah et al., 2023). Providing stretching exercise between work hours was proven to be effective to decrease the level of Musculoskeletal Disorders (MSDs) complaints. Stretching exercise can increase muscle flexibility, provide opportunities for muscles to recover resting length condition, and improve physical fitness (Ismayenti and Wardani, 2022). Stretching exercise can speed up the exchange of oxygen, carbohydrates in cells, reduce lactic acid in muscles, and can also facilitate blood circulation. In addition, it can maintain and increase natural muscle elasticity and flexibility in muscles that experience tension so as not to be easily tired while doing work (Oktaviani et al., 2022). Based on the study finding, there was a significant effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints with a p value of $0.000 < 0.05$. According to the researchers' assumptions, such finding is in line with the result of previous study that stretching exercise was effective in relieving Musculoskeletal Disorders (MSDs) complaints. According to researchers, if more respondents do stretching exercise and practice it regularly during work time, the number of Musculoskeletal Disorders (MSDs) complaints will be minimized.

CONCLUSIONS

Based on the results of study on the effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers at BT Batik Trusmi of Cirebon in 2023, it was found that less than half of respondents or as many as 41.9% experienced high risk level of Musculoskeletal Disorders (MSDs) complaints. Meanwhile, after stretching exercise, the majority of respondents or as many as 77.4% experienced low risk level of Musculoskeletal Disorders (MSDs) complaints. In addition, there was an effect of stretching exercise on Musculoskeletal Disorders (MSDs) complaints among batik makers.

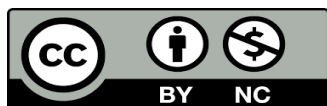
ACKNOWLEDGMENT

The authors would like to express sincere gratitude to the Directors of BT Batik Trusmi Cirebon, the Manager of Minifactory BT Batik Trusmi of Cirebon, as well as the written and stamped batik makers who had given permission and cooperation so that during the implementation of this study, and to Head of Sekolah Tinggi Ilmu Kesehatan Cirebon.

Effect of Stretching Exercise on Musculoskeletal Disorders (MSDs) Complaints among Batik Makers

REFERENCES

- 1) Aeni, H. F. and Faudiah, R. (2019) 'Penyuluhan Posisi Kerja Duduk Dalam Mengurangi Keluhan Nyeri Punggung Bawah Pada Pengrajin Batik Tulis', *Jurnal Pengabdian Harapan Ibu (JPHI)*, 1(2), p. 46.
- 2) BT Batik Trusmi (2020) *ABOUT BT BATIK TRUSMI, BT Batik Trusmi*. Available at: <https://btbatiktrusmi.com/about-us-4/> (Accessed on: June 4, 2023).
- 3) Directorate General of Disease Prevention and Control (2021). *Annual Report in 2021, Ministry of Health of the Republic of Indonesia*.
- 4) Etika, A. N. et al. (2017) 'Pengaruh Ergonomics Exercise Terhadap Tingkat Resiko Musculosceletal Disorder (MSDs) Pada Karyawan di Pabrik Pembalut Kain di Kediri Tahun 2017', *Nsj*, 1(1), pp. 22–29.
- 5) Eurofound and International Labour Organization (2019) *Working conditions in a global perspective*.
- 6) Faridah, F. and Junaidi, A. S. (2022) 'Faktor yang Mempengaruhi Keluhan *Musculoskeletal Disorders* (MSDs) pada Pembatik Seberang Kota Jambi', *Quality : Jurnal Kesehatan*, 16(2), pp. 109–116.
- 7) Irmayani, Sri Melda Br. Bangun, Anggi Isnani Parinduru, Rosita Ginting, Raisha Octavariny, R. A. (2021) 'Peregangan Senam Ergonomis Untuk Mengurangi Keluhan *Musculoskeletal Disorders* Pada Pekerja Pembibitan Sawit', *Jurnal Pengabdian Kepada Masyarakat*, 1(2), pp. 2775–2437.
- 8) Ismayenti, L. et al. (2021) 'Reduction of fatigue and musculoskeletal complaints in garment sewing operator through a combination of stretching brain gym® and touch for health', *International Journal of Environmental Research and Public Health*, 18(17).
- 9) Ismayenti, L. and Wardani, T. L. (2022) 'Program Peregangan di Tempat Kerja untuk Mengurangi Keluhan Muskuloskeletal Pekerja Sektor Informal', *Journal of Industrial Hygiene and Occupational Health*, 7(1), pp. 94–102.
- 10) Laksana, A. J. and Srisantyorini, T. (2020) 'Analisis Risiko *Musculoskeletal Disorders* (MSDs) pada Operator Pengelasan (Welding) Bagian Manufaktur di PT X Tahun 2019', *Jurnal Kajian dan Pengembangan Kesehatan Masyarakat*, 1(1), pp. 64–73.
- 11) Nahdiyyah, A. I. et al. (2023) 'Active Stretching With Slow deep breathing Exercise pada Pembatik Menurunkan Keluhan Muskulosekeletal dan Peningkatan Produktivitas Active Stretchingwith Slow deep breathing Exercise Reduces Musculoskeletal Complaints and Increases Productivity in Batik W', 7(2), pp. 184–190.
- 12) Oktaviani, D. et al. (2022) 'Pengaruh Gerakan Peregangan pada Penjahit Garmen Terhadap Penurunan Keluhan Musculoskeletal', 7(1), pp. 19–24.
- 13) Priyoto and W, B. W. (2019) 'Pengaruh Pemberian Intervensi Senam Peregangan di Tempat Kerja Terhadap Penurunan Gangguan MSDs dan Kadar Asam Urat Darah', *Jurnal Keperawatan*, 12(1), pp. 53–68.
- 14) Safira, I. D., Ekawati, E. and Kurniawan, B. (2022) 'Analisis Tingkat Risiko Ergonomi Terhadap Keluhan MSDs Pada Pengrajin Batik Cap Di Industri Batik Domas', *Jurnal Kedokteran dan Kesehatan : Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya*, 9(3), pp. 299–306.
- 15) Satriawan, D., Pitoyo, A. J. and Giyarsih, S. R. (2020) 'Cakupan Kesehatan Universal (UHC) Pekerja Sektor Informal di Indonesia', *Tataloka*, 22(4), pp. 556–572.
- 16) Sirait, R. A., Dalianti, S. and Silalahi, N. (2021) 'Pengaruh Senam Ergonomi Terhadap Keluhan Musculoskeletal Pada Pekerja Pengangkat Batu Bata Di Desa Karang Anyer Kabupaten Serdang Bedagai', *Jurnal Penelitian Kesmas*, 3(2), pp. 29–35.
- 17) Syafrianto, E., K.H, P. and Zulfa, Z. (2019) 'Pengaruh Workplace Stretching Exercise (WSE) dan Heat Therapy (Hot Pack) terhadap Keluhan Muskuloskeletal pada Perawat Tahun 2019', *Jurnal Ilmiah Universitas Batanghari Jambi*, 19(3), p. 678.
- 18) WHO (2022) *Musculoskeletal health, World Health Organization*. Available at: <https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions> (Accessed on: May 26, 2023).
- 19) Wulan, M., Hilal, S. and Entianopa (2020) 'Perbandingan Keluhan Low Back Pain pada Pekerja Batik Tulis dan Cap di Kecamatan Danau Teluk Kota Jambi Tahun 2020', *Indonesian Journal of Health Community*, 1(1), pp. 1–5.
- 20) Yamtana et al. (2022) 'Evaluasi Gangguan Otot Rangka pada Pembatik di Industri Batik Tulis Kelurahan Wijirejo, Pandak, Bantul, Yogyakarta', *Jurnal Pengabdian Kepada Masyarakat*, 1(11), pp. 3133–3140.



There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.