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RESEARCH

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Ergonomic Risk Analysis on Traditional Weaving Workers on Semau Island Kupang Regency

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Abstract

Musculoskeletal disorder has caused casualty on traditional weaving workers. With manual equipment that uses no electricity, the workers do not apply anthropometry into their daily labor; resulting in working with bent position. Such condition forces the workers to be in a non-ergonomic work position. The research objective was to determine the relationship between work fatigue, workload, and work attitude with musculoskeletal disorders in traditional weaving workers. This research is an analytic descriptive research with a cross sectional study design. The sample in this study was 38 traditional weavers. The results showed that there was a relationship between work fatigue, workload, and work attitude with musculoskeletal disorders in traditional weaving workers on Semau Island, Kupang Regency with p-value <0.05. Workers can be given counseling and pamphlets regarding ergonomic and comfortable work, so as to avoid occupational safety and health problems.

Keywords: Workload, Ergonomics, Work Fatigue, Musculoskeletal Disorders, Work Attitude.

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1. INTRODUCTION

Musculoskeletal disorders are health problems in the locomotor apparatus, in the form of soft tissue injuries. The causes are sudden or continuous loading of muscles and bones, repeated movements for a long time, exposure to vibration, loading that exceeds capacity, and uncomfortable working positions. This condition can affect muscles, ligaments, nerves, tendons and joints. (Luttmann, et al., 2004).

In Indonesia, the prevalence of musculoskeletal disorders related to occupational factors is quite high. An Indonesian Ministry of Health study concluded that around 40.5% of workers' illnesses are related to work. Health problems experienced by workers based on research conducted on 9,482 workers in 12 regencies/cities in Indonesia showed the highest number of musculoskeletal disorders (16%), followed by cardiovascular disorders (8%), nervous disorders (5%), respiratory disorders (3%) and ENT disorders (1.5%) (Sekaaram & Ani, 2017).

Musculoskeletal disorders have caused considerable losses in both developed and developing countries. This disruption does not only affect the individual workforce but also affects the continuity of the business world such as decreased work productivity, decreased welfare, increased health costs, decreased job satisfaction, degradation of the quality of physical and mental health, and decreased ability to carry out other physical activities (Dinar et al., 2018).

East Nusa Tenggara Province (ENT) is one of the provinces located in Eastern Indonesia. This province consists of several islands, including the islands of Flores, Sumba, Timor, Adonara, Lembata, Alor, Sabu, and Rote (Hartono & Sunarya, 2010). Semau Island is one of the areas included in the working area of Kupang Regency, where Semau Island has about 40 traditional weavers. Apart from farming seaweed, another livelihood for the people on Semau Island is traditional weaving which women mostly do to help support the family's livelihood.

The making of traditional weaving has a lot of uniqueness because it is still attached to the customs of the people on Semau Island. In addition, the weaving crafts made by weavers on Semau Island still use organic materials, both for thread making and for coloring materials, so the colors produced are very natural and have a different beauty from the colors produced by chemical dyes. The manufacturing process is also handmade without the help of any machine. The tools used in the process of making weaving crafts are traditional tools without the help of electricity. Due to the manual process, weaving crafts from Semau Island are unique because no cloth is the same as any other cloth. Unfortunately, traditional looms and seats were designed without considering the anthropometry of workers, so workers must adapt and work with a bent back. It forces workers to be in an attitude and working position that is not ergonomic, which lasts a long time and is static. These conditions can cause health problems, especially in the musculoskeletal system. Moreover, the process of making weaving takes a long time, high precision, as well as patience. One piece of woven cloth can be finished in approximately three to four months (Setiawan & Suwarnigdyah, 2014)

Behind the monotonous manual weaving work, there are ergonomic risks that the workers might experience such as work fatigue, workload, work attitudes, and musculoskeletal disorders. This has an impact on decreasing work performance and the risk of occupational diseases. Behind the long and continuous manual weaving work, the workers are at risk of poor ergonomics. Examples are Work Fatigue, Workload, Work Attitude, and High Musculoskeletal Complaints, which have an impact on decreasing work performance and the risk of other diseases (Maksuk, Shobur & Habibi, 2021).

The research formula is what are the ergonomic risks experienced by traditional weaving workers on Semau Island, Kupang Regency. The purpose of this study was to determine the

relationship between work fatigue, workload, and work attitude towards the musculoskeletal disorders of traditional weaving workers on Semau Island, Kupang Regency.

2. RESEARCH METHOD

The method used in this study is descriptive analytic research with a cross-sectional study design. The population of this study were all traditional weaving workers on Semau Island, Kupang Regency, totaling 58 people. 38 workers were obtained as a research sample using the Slovin formula. The independent variables were work fatigue, workload, and work attitude. Meanwhile, the dependent variable is Musculoskeletal Disorders. Primary data was obtained through interviews with general fatigue questionnaire, Nordic Body Map questionnaire, stopwatch, and the Rula Method assessment form. Secondary data was obtained from documentation in the form of notes and data from the village office on Semau Island. Data processing included editing, coding, entry, and tabulating. Data were analyzed through univariate analysis in the form of distribution and percentage of each variable in the form of frequency tables, added with bivariate analysis to determine the relationship between one independent variable and the dependent variable using the Chi square test. If the p value < 0.05 , then the null hypothesis (H_0) is rejected. Conversely, if the p value > 0.05 , then H_0 is accepted (Wibowo, 2017). If H_0 is rejected, it means that there is no relationship between Work Fatigue, Workload, and Work Attitude with Musculoskeletal Disorders. This research has also received research ethics permit from the Faculty of Public Health, Nusa Cendana University with no. 2022187-KEPK.

3. RESULTS AND DISCUSSION

Weaving, for the people of Semau Island, is seen as a valuable treasure for the family. In the past, woven fabrics were made just as ordinary clothes. As time goes on, the purpose has been developed as customary needs, such as ceremonies, dances, weddings, and parties. Currently, woven fabrics are also commonly used as scarves, sarongs, blankets, and clothing. Weaving, specifically on Semau Island, is the business of informal sector workers and is mostly dominated by women workers to get additional income for the family. The woven fabrics are the result of work using a traditional weaving system. Weaving is a skill that requires precision and patience. Traditional weaving techniques with machine-less tool is unfortunately not in accordance with anthropometry that has the risk of causing work fatigue, workload, and work attitude problems, which are part of Occupational Health and Safety.

Table 1. Distribution of variable data results on Traditional Weaving workers in Semau Island Kupang Regency.

Variable	Musculoskeletal Disorder				n	Total %	p-value
	Not at Risk	%	At Risk	%			
Work Fatigue							
Not at Risk	0	0	7	100	7	100	0.035
At Risk	13	41,9	18	58,1	31	100	
Total	13	34.2	25	65.8	38	100	
Workload							
Not at Risk	13	86,7	2	13,3	15	100	0.00
At Risk	0	0	23	100	23	100	

Total	13	34.2	25	65.8	38	100	
Work Attitude							
Not at Risk	11	73,3	4	26,7	15	100	0.00
At Risk	2	8,7	21	91,3	23	100	
Total	13	34,2	25	65,8	38	100	

Table 1 shows several variables. In the Work Fatigue variable, there were 7 (100%) workers who were not at risk of work fatigue experiencing Musculoskeletal Disorders, 13 (41.9%) workers were at risk of work fatigue but did not have Musculoskeletal Disorders, and 18 (58.1%) workers were at risk of work fatigue and Musculoskeletal Disorders. In the Workload variable, there were 13 (86.7%) workers who were not at risk of workload and Musculoskeletal Disorders, 2 (13.3%) of workers did not have workload risks but were at risk of Musculoskeletal Disorders, and 23 (100%) workers had workload risks work and musculoskeletal disorders. In the work attitude variable, 11 (73.3%) workers were not at risk for work attitudes and musculoskeletal disorders, 4 (26.7%) workers were not at risk for work attitudes but at risk for musculoskeletal disorders, 2 (8.7%) workers were at risk for work attitudes but not at risk of Musculoskeletal Disorders, and 21 (91.3%) workers have a risk of work attitudes and Musculoskeletal Complaints.

Fatigue is the body's protective mechanism to avoid further damage, or it can be said as the body's alarm signaling a person to rest immediately (Permatasari et al., 2017). This mechanism is regulated by the central nervous system which can accelerate impulses that occur in the activity system by the sympathetic nervous system and slow down impulses that occur in the inhibition system by the parasympathetic nerves. Decreased ability and endurance will result in decreased efficiency and work capacity. If conditions like this are allowed to continue, it will certainly affect a person's productivity (Grandjean, 2001) and (Sedarmayanti, 2018).

Table 1 shows a relationship between Work Fatigue and Musculoskeletal Disorders in Traditional Weaving workers on Semau Island, Kupang Regency, where the results of the Chi Square statistical test showed a significant relationship with $p\text{-value} = 0.035$ ($p\text{-value} < \alpha$). There were 18 (58.1%) workers at risk of work fatigue and musculoskeletal disorders.

The results of interviews with workers revealed that most of the workers often complained of pain in the head, fatigue in all parts of the body, feeling heavy in the eyes, staggering when standing, difficulty thinking, stiffness in the shoulders, pain in the back, and feeling unwell. This is because they work an average of 14 hours a day, from 08.00 am to 10.00 pm. In addition, breaks are made at 13.00 noon only for eating and taking a nap. The work on each sheet of woven fabric can be completed within 1 - 1.5 months depending on the complexity of the selected motif. This proves that workers are very vulnerable to experiencing muscle complaints and, if this is allowed to continue, it is very risky to progress to a more serious stage which will certainly seriously affect the health of weaving workers.

This research is in line with research conducted by (Suaebo et al., 2020), which stated that there is a significant relationship between work fatigue and musculoskeletal disorders in 35 pedicab drivers at Balapan Station, Solo. In addition, this study is also in line with other studies (Ngai et al., 2022) where there is a relationship between work fatigue and musculoskeletal disorder in rice-mill workers in Soa District, Ngada Regency. Another study from Patandung and Widowati, (2018) showed that there is a relationship between the level of fatigue and musculoskeletal disorders in bus drivers on the Toraja-Makassar route.

The results of this study are also in line with research from (Deng et al., 2021) where there is a relationship between work fatigue and musculoskeletal disorders in coal mining workers in China.

Workload is very closely related to metabolism. The heavier the workload of workers, the greater the metabolism (Farhati, & Wahyuningsih, 2021). The size of the workload depends on the size of the pulse in units of beats per minute (bpm). In the perspective of ergonomics, every workload received by workers must be appropriate or balanced both in terms of physical abilities, cognitive abilities, and the limitations of the humans who receive the burden (Rizqiansyah et al., 2017). Loads that are too heavy can cause backbone, muscle tissue, and joint injuries due to excessive movement (Grandjean, 2001).

Table 1 shows that there is a relationship between workload and musculoskeletal disorders in traditional weaving workers on Semau Island, Kupang Regency, with the results of the Chi Square statistical test with a p value = 0.00 (p value < α). There are 23 (100%) workers who have a risk of workload and musculoskeletal disorders. In addition, from the results of the interviews, the weaving workers must complete the weaving according to the target so that it can be sold immediately to meet the economic needs of the family. This causes weaver workers to work up to 14 hours per day. This has an impact on the risk of workload so that workers are also at risk of experiencing Musculoskeletal Disorders.

This research is in line with (Rahmawati, 2020) that there is a relationship between workload and musculoskeletal disorders in freight workers at Panorama Market, Bengkulu City. This research is also in line with the results of other studies where there is a relationship between physical workload and musculoskeletal disorder among PT. Maruki International Indonesia, Makassar (Triwati et al., 2021). Research from Aprillia and Rifai (2022) showed similar results where there is a relationship between physical workload and musculoskeletal disorder in workers at the Roof Tile Industrial Center in Sidoluhur Village, Godean District. Putri, (2019) researched that there is a relationship between workload and subjective musculoskeletal disorder in cutting-section workers at a shoe factory in Nganjuk. Likewise, Rahmawati's research, (2020) showed a relationship between workload and musculoskeletal disorder in freight workers at Panorama Market, Bengkulu.

Work attitude is the action taken by the worker and everything that must be done by the worker, the result of which is proportional to the effort made. Work attitude is also interpreted as a tendency of mind and satisfaction towards work. Work attitude is an assessment of the suitability between the work tools used by workers in work with predetermined anthropometric measurements of workers (Ruliati et al., 2017). When working, a balanced work attitude must be paid close attention to in order to work comfortably and last a long time (Suma'mur, 2014).

Improper sitting posture leads to poor circulation in the lower body, which can lead to varicose veins, leg swelling, fatigue, and the risk of blood clots in the legs (Adnyani, et al., 2023). In addition, sitting too long causes muscle tension in the hips. Thus, there are many incorrect sitting positions that are very detrimental to each individual such as health disturbances and cause eye and muscle fatigue (Kozier, 1995). One of the most common ailments suffered from frequent sitting for a long time is lower back pain and eye fatigue (Suma'mur, 2014).

Table 1 shows a relationship between work attitude and complaints of musculoskeletal disorders in traditional weaving workers on Semau Island, Kupang regency. This is caused by workers who sit on the floor without using a backrest, neck that keeps looking down, body that bends forward, and legs that are straight forward. Such a static working attitude can cause various complaints to the neck, back, waist and legs. These complaints are felt by workers while working and after finishing work (Faridah & Junaidi, 2022).

This research is in line with research conducted by (Mallapiang et al., 2021) which showed a significant relationship between work attitude and musculoskeletal disorders in weavers of Lipa'Sa'be Mandar, South Sulawesi. This research is also in line with research conducted by (Krismayani & Muliawan, 2021) on weaving craftsmen in Klungkung Regency which shows various variables of work attitudes on the back which have a relationship with musculoskeletal disorders. There is research with similar results showing a significant relationship between work posture and musculoskeletal disorders in Freight Forwarders at the Komodo Grocery Store, Denpasar (Meliani et al., 2022). Another study that is in line shows a relationship between work posture and musculoskeletal disorders in bus drivers at the Regional Day Terminal, Makassar (Danur et al., 2022). In addition, there is a study that shares similar results of the relationship between work attitude and musculoskeletal disorders in Manual Handling workers at Warehouse X, South Tangerang (Azzahra et al., 2022).

4. CONCLUSION

The conclusion from the results of the analysis and discussion in this study is that there is an ergonomic risk in the form of work fatigue, workload, and work attitude associated with complaints of musculoskeletal disorders in traditional weaving workers on Semau Island, Kupang regency. In order to avoid OSH problems, workers can be given counseling regarding ergonomic and comfortable work, as well as increasing workers' knowledge regarding work fatigue, workload, and ergonomic work attitudes. Apart from counseling, pamphlets can also be given so that workers can work in a healthy, safe and comfortable manner.

Workers are expected to maintain and pay attention to work attitudes, working hours, and carry out stretching activities before and after weaving activities to reduce Musculoskeletal Disorders, as well as to increase work productivity. There are limitations in this study, namely the measurement of work fatigue which is still influenced by psychological work fatigue. Therefore, measuring physical work fatigue using instruments such as reaction timers and recommended for future researchers.

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