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Determinants of Musculoskeletal Disorders in Bamboo Woven Craftsmen in Lamongan, East Java

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ABSTRACT

Background: Musculoskeletal Disorders (MSDs) are significant debilitating conditions and refer to a variety of degenerative or inflammatory conditions affecting the joints, muscles, ligaments, cartilage, and blood vessels. This study aimed to valuate determinants effect of Musculoskeletal Disorders in bamboo-woven craftsmen.
Subjects and Method: This was a cross-sectional study conducted in Payaman village, Solokuro District, Lamongan Regency, East Java, from October to November. A total of 200 bamboo woven craftsmen were randomly selected using a random number generator. The dependent variable was Musculoskeletal Disorders (MSDs). The independent variables were work stress, age, tenure, work duration, and exercise behavior. MSDs was measured using the Nordic Body Map. Other variables were collected using questionnaire. The data were analyzed using a multiple linear regression.
Results: High job stress (b= 0.19, 95% CI = -3.79 to 4.17, p=0.925), working for 5 years or more (b = 3.34, 95% CI = -2.77 to 9.44, p=0.282) were associated with an increased risk of MSDs, but they were statistically non-significant. Workers who were aged ≥40 years old (b= 9.44, 95% CI = 4.70 to 14.18, p<0.001) and works for 5 hours/day (b = 7.12, 95% CI = 3.09 to 11.15, p=0.001) significantly elevated the risk of MSDs. Engaging in regular physical activity was associated with a significant reduction in the risk of MSDs (b= -4.77; 95% CI= -8.47 to -1.07; p= 0.012).
Conclusion: High job stress, working for 5 years or more, age ≥40 years old, and works for 5 hours/day significantly elevate the risk of MSDs. Regular physical activity reduces the risk of MSDs.

Keywords: Musculoskeletal disorder, work duration, tenure, age, exercise behavior

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BACKGROUND

Musculoskeletal Disorders are one of the health problems in workers, where exposure to occupational hazards can cause this disease and can worsen pre-existing disorders (Macdonald and Oakman, 2015). The impact experienced by musculoskeletal disorders can affect productivity at work because this disorder is one of the biggest disorders for workers (Romadhoni et al.,

2021). The International Association for the Study of Pain states that as many as 33% of pain complaints occur in adults. The prevalence of musculoskeletal disorders according to WHO states that this condition increases with age, but can also occur at a young age (Auliya et al., 2021).

Musculoskeletal Disorders (MSDs) are significant debilitating conditions and refer to a variety of degenerative or inflammatory conditions that affect the joints, muscles, ligaments, cartilage, and blood vessels. Musculoskeletal disorders are a major cause of disability among workers (Minetto et al., 2020). Musculoskeletal disorders can also include various inflammatory disorders related to pain as well as functional disorders that work in the body (Mubarok et al., 2022). Crafts, especially woven crafts, are one of the jobs whose craftsmen are often exposed to various work-related risk factors, including static sitting positions and for long periods so they play an important role in developing this occupational health problem (Das and Singh, 2022).

Based on the results of a preliminary survey conducted by the author in September in Payaman Village, Solokuro, Lamongan, and conducting interviews with several woven craftsmen, the woven craftsmen said that in one day the craftsmen carry out weaving activities every day. Craftsmen often complain of pain in parts of the body ranging from neck pain, wrist pain, leg pain and even back pain because they often weave in a bent position. From these problems, the research aims to determine the factors or determinants of musculoskeletal disorders in wicker craftsmen in Lamongan, East Java.

SUBJECTS AND METHOD

1. Study Design

A cross-sectional study was conducted in Payaman village, Solokuro District, Lamongan Regency, East Java from October to November.

2. Population and Sample

The population in this study were bamboo woven craftsmen in Lamongan, East Java. Based on the Lamongan Industrial Information System (SIILA), there are 474 woven craftsmen in Lamongan.

3. Study Variables

The variables in this study are dependent variables and independent variables. The dependent variables were musculoskeletal disorders (MSDs), while the independent variables were work stress, age, work period, work duration, and exercise habits.

4. Definition Operational of Variables

Musculoskeletal disorders: are feelings of pain, soreness, or soreness in the skeletal muscles that craftsmen feel both during work and after work and are aggravated by work factors.

Job stress: is a condition of tension experienced by employees in facing work which causes psychological symptoms, psychological, logical symptoms, and behavioral symptoms.

Age: is the time since a person's existence which can be measured using time units in a chronological context. In normal individuals, the progress of their anatomical and physiological development can be observed.

Working period: is a measure of the length of time or work period that a craftsman has completed in a weaving job

Work duration: is the length of time a person spends carrying out activities or tasks while working. Work duration includes the period during which a person is exposed to risk factors during work.

Sports habits: are exercise routines carried out by craftsmen.

5. Study Instruments

The research instruments used for data collection were the Nordic Body Map questionnaire to determine MSDs scores, work

stress questionnaires and interview techniques to collect data related to age, length of service, work duration, and exercise habit

6. Data Analysis

Univariate analysis was conducted to describe sample characteristics. Bivariate analysis to analyze the influence of independent and dependent variables uses the t-test with a significance level of $p<0.050$, and multivariate analysis uses multiple linear regression analysis.

7. Research Ethics

Research ethics including informed consent, anonymity, and confidentiality, were handled carefully throughout the research process. A letter of approval for research ethics permission was obtained from the Research Ethics Committee of Dr. Moewardi Hospital, Surakarta City No. 1.952/X-/HREC/2023, on October 31 2023.

RESULTS

1. Sample Characteristics

Table 1 reveals that 65.5% of participants were aged ≥40 years. Additionally, 44% of participants had attained a senior high school education. Half of the study participants reported high levels of MSDs (51%), high work stress (53.50%), and engaged in exercise for less than 30 minutes per day (59.50%). The majority of woven craftsmen had worked for more than 5 years (84.80%) and worked for at least 5 hours per day (62.50%).

Table 1. Characteristics of research subjects

Characteristics	Category	Frequency (n)	Percentage (%)
Age	<40 years	69	34.80
	≥40 years	131	65.50
Education	Primary school	38	19.00
	Junior high school	39	19.50
	Senior high school	88	44.00
	Higher Education	35	17.50
Hamlet	Gayam	33	16.50
	Ringin	29	14.80
	Sawo	41	20.50
	Asem	21	10.50
	Palirangan	27	13.50
	Sejajar	29	14.80
	Bango	30	15.00
MSDs Risk Level	Low	98	49.00
	High	102	51.00
Work stress	Low	93	46.50
	High	107	53.50
Years of service	<5 years	31	15.50
	≥5 years	169	84.80
Working duration	<5 hours	75	37.50
	≥5 hours	125	62.50
Exercise habits	<30 minute/ a day	119	59.50
	≥30 minute/ a day	81	40.50

2. Bivariate Analysis

Test results Bivariate analysis using the t-test in this study was carried out to determine whether there was an influence on work stress, age, length of service, duration of work, and exercise habits on the risk of

developing. Based on Table 2, shows the results for low stress (Mean= 21.75; SD= 14.83), while for high work stress (Mean= 27.43; SD= 14.42). From the analysis, there is a significant difference was obtained (p= 0.006). It can be concluded that high stress can increase the risk of musculoskeletal disorders in woven craftsmen.

The results at age <40 years were (Mean=16.74, SD= 10.90), while at age ≥40 years (Mean= 29.02; SD= 14.72). From the analysis, a significant difference was obtained (p<0.001). It can be concluded that age ≥40 years can increase the risk of musculoskeletal disorders in woven craftsmen. Table 2 shows that the results for working periods <5 years are (Mean= 14.13; SD=10.64), while for working periods ≥5 years (Mean= 26.74; SD= 14.54). From the analysis, there is a significant difference was obtained (p<0.001). It can be concluded that a work period of ≥5 years can increase the risk of musculoskeletal disorders in woven craftsmen.

The results for work duration <5 hours (Mean= 20.99; SD= 12.88), while for work duration ≥5 hours (Mean= 31.11; SD= 15.47). From the analysis, a significant difference was obtained (p<0.001). It can be concluded that working duration ≥5 years can increase the risk of Musculoskeletal disorders in woven craftsmen. the results for the exercise habit <30 minutes/ day are (Mean= 26.27; SD= 15.08), while the exercise habit ≥30 minutes/day is (Mean= 22.61; SD= 13.95). It can be concluded that the habit of exercising≥30 minutes/day cannot increase the risk of musculoskeletal disorders in woven craftsmen.

Table 2. Bivariate test results of differences in MSDs scores with work stress, age, length of service, duration of work, and exercise habits

Variable	N	Mean	SD	p
Work stress				
Low	93	21.75	14.83	0.006
High	107	27.43	14.42	
Age				
<40 years	69	16.74	10.90	<0.001
≥40 years	131	29.02	14.72	
Years of Service				
<5 years	31	14.13	10.64	<0.001
≥5 years	169	26.74	14.84	
Work Duration				
<5 hours	75	31.10	15.47	<0.001
≥5 hours	125	20.99	12.88	
Exercise				
<30 minutes/a day	119	26.27	15.08	0.085
≥30 minutes/a day	81	22.60	13.95	

3. Multivariate Analysis

Table 3 shows that there is a positive relationship between work stress in woven craftsmen and the risk of experiencing musculoskeletal disorders, with this relationship not being statistically significant. Wicker craftsmen who have high work stress on average have a musculoskeletal disorder score 0.19 units higher than those with low work stress (b= 0.19; 95% CI= -3.79 to 4.17; p=0.925).

Table 3 shows that there is a positive relationship between the age of the woven craftsman and the risk of experiencing musculoskeletal disorders, with this relationship being statistically significant. Wicker craftsmen aged 40 years and over on average had a musculoskeletal disorders score 9.44 units higher than those aged less than 40 years (b= 9.44; 95% CI = 4.70 to 14.18; p<0.001). There is a positive influence between the length of work of woven craftsmen and the risk of experiencing musculoskeletal disorders, with this relationship not being significant. Wicker craftsmen who have worked for 5 years or more on average have a Musculoskeletal disorder score 3.34 units higher than those who have worked for less than 5 years (b= 3.34; 95% CI= -2.77 to 9.44; p=0.282). There is a positive influence between the duration of work of woven craftsmen and the risk of experiencing musculoskeletal disorders. Wicker craftsmen who have a work duration 5 hours/day and above on average have a musculoskeletal disorder score 7.12 units higher than those with a work duration of less than 5 hours/day (b= 7.12; 95% CI = 3.09 to 11.15; p=0.001).

There is negative influence between the exercise habits of woven craftsmen and the risk of experiencing musculoskeletal disorders, with this relationship being statistically significant. Woven craftsmen who have an exercise habit of 30 minutes/day and above on average have a score of -4.77 units higher in reducing the occurrence of musculoskeletal disorders, than woven craftsmen's exercise habit of less than 30 minutes/day (b= -4.77; 95% CI= -8.47 to -1.07; p=0.012).

Table 3. Multiple linear regression analysis of the relationship between MSDs and work stress, age, length of service, duration of work, and exercise habits

Variable	Regression Coeff (b)	CI (95%)		p
		Lower Limit	Upper Limit	
Work stress	0.19	-.3.79	4.17	0.925
Age	9.44	4.70	14.18	<0.001
Years of Service	3.34	-2.77	9.44	0.282
Working Duration	7.12	3.09	11.15	<0.001
Exercise	-4.77	-8.47	-1.07	0.012
N Observation = 200				
Adjusted R^2= 22.71				
p<0.001				

DISCUSSION

The characteristics of respondents in this research are a description of the identity of the research subject which differentiates one research subject from another research subject. The characteristics of the research subjects observed included age, where the research subjects lived and their highest level of education. The research subjects in this study were 131 woven craftsmen aged over 40 years and 69 woven craftsmen aged under 40 years. The largest number of research subjects resided in Sawo, namely 41 research subjects. And the highrisk level was 102 research subjects.

Work stress is something that occurs from the body, both from outside the body and from the body itself, which will cause various kinds of detrimental impacts, including the emergence of diseases, decreasing

performance, efficiency and work productivity (Hamming, 2020). Levels of work stress can also be a response to the body which causes mental stress to grow in life and can result in muscle tension caused by stress hormones, resulting in the risk of musculoskeletal disorders (Romadhoni et al., 2018). Based on the results of the analysis in Table 3, show that there is a positive influence between work stress and the risk of experiencing MSDs, with a statistically insignificant relationship, for every 1 unit increase in high work stress, the score is 0.19 units higher than those aged <40 years (b= 0.19; 95%CI= -3.79 to 4.17; p=0.925). In this analysis, it can be interpreted that the higher the work stress, the more susceptible you are to experiencing musculoskeletal disorders. Based on table 3, it shows that high stress levels show a greater frequency than low stress, namely, high stress is 107 with a percentage (53.50%), while low stress is 93 with a percentage (46.50%). This research is in line with (Triwati et al., 2022) which state that there is no significant relationship between work stress and the risk of developing musculoskeletal disorders (b= 0.09; p= 0.391) and that there is a positive influence but there is no statistically significant relationship and There is high work stress which increases by 0.09 units compared to low work stress.

Older people experience low muscle or bone mass which can influence the occurence of complaints of musculoskeletal disorders, whereas as they get older there is a degeneration process in the form of tissue damage, which causes the stability of bones and muscle to decrease making them susceptible to musculoskeletal disorders, especially in woven craftsmen. carry out weaving movements repeatedly every day (Pasco et al., 2017). Based on the results in Table 3, the age variable for woven craftsmen over 40 years old shows that there is a positive influence between age and the risk of experiencing musculoskeletal disorders, with a statistically significant relationship, those aged over 40 years and above have a higher score of 9.44 units than those aged less than 40 years. from 40 years (b= 9.44; 95% CI = 4.70 to 14.18; p<0.001). In this analysis, it can be interpreted that the older you get or are over 40 years of age, the more susceptible you are to experience musculoskeletal disorders compared to those under 40 years of age.

This research is in line with research (Darvishi et al., 2016) conducted on 200 bank staff, with older bank staff experiencing musculoskeletal disorders at a higher rate. In this study, age has a statistically significant correlation so that as age increases, complaints of musculoskeletal disorders will increase more, and will add to other complaints in the human body. Working period is something that is related to the length of time a person works in a certain place, where working time can cause musculoskeletal disorders over a long period so that they can develop and manifest in the body, which when someone works for a long working period will increases the prevalence of musculoskeletal disorders (Alghadir et al., 2015).

Based on the results of the analysis in Table 3, the variable length of service for woven craftsmen over 5 years shows that there is a positive influence between work experience and the risk of experiencing musculoskeletal disorders, with a statistically insignificant relationship, work experience over 5 years and above has a higher score of 3.34 units. than work experience of less than 5 years (b = 3.34; 95% CI = -2.77 to 9.44; p=0.282). In this analysis, it can be interpreted that the longer the work period or the work period of more than 5 years, the more susceptible they are to experiencing musculoskeletal disorders compared to

those with a work period of less than 5 years, or that there is a significant influence between the work period and the risk of musculoskeletal disorders.

Based on research (Das and Singh 2022) conducted on 111 metal craft workers, the prevalence of the risk of musculoskeletal disorders in metal craftsmen was determined by the length of a person's work period, in this study there was an influence between work period and the risk of musculoskeletal disorders, which increased. The longer they work, the longer they are exposed to the time and type of work. Breaks are recommended to reduce the bad effects of working for long durations. Scheduled breaks can prevent the emergence/ development of cumulative trauma disorders in the work environment, which can cause complaints due to the work. Breaks themselves can be defined as stopping work for a moment because the work duration is too long. Long periods without rest are not very good for the body (Yan et al., 2018).

Based on the results of the analysis in Table 3, the work duration variable for woven craftsmen above 5 hours shows that there is a positive influence between the work period and the risk of experiencing musculoskeletal disorders, with a statistically significant relationship, work duration above 5 hours and above has a higher score of 7.12 units than work duration less than 5 hours (b= 7.12; 95% CI = 3.09 to 11.15; p<0.001). In this analysis, it can be interpreted that the longer the work duration or the work duration of more than 5 hours, the more susceptible they are to experience musculoskeletal disorders compared to work less than 5 hours, or has a significant influence between work duration and the risk of musculoskeletal disorders.

This research is in line with (Younis et al., 2022), this research was conducted with dentists in Pakistan, research shows that dentists experience musculoskeletal disorders because they often do work with long work durations and do heavy work while maintaining posture. the same work with a long work duration, so that research show that there is a relationship between work duration and the occurrence of musculoskeletal disorders. It can be concluded that the longer the work duration, the greater the risk of developing musculoskeletal disorders, so workers need adequate rest. Physical activity is one of the most important characteristics for maintaining health and one of them is the habit of exercising every day, which is an intervention with few side effects. When doing it, exercising habits have the benefit of increasing the quality of life, if the exercise habit is reduced it will be the main factor in the development of various diseases, one of which is musculoskeletal disorders (Micheletti et al., 2019).

Based on the results of data analysis in Table 3, it shows that the exercise habit variable which is done >30 minutes/day has a negative and statistically significant influence, where the more often you do the exercise habit, the risk of developing musculoskeletal disorders will decrease, which is why woven craftsmen who have this habit exercising 30 minutes/day and above on average had a score of -4.77 units higher in reducing the occurrence of musculoskeletal disorders, than the exercise habit of woven craftsmen of less than 30 minutes/day (b = -4.77; 95% CI = -8.47 to -1.07; p= 0.012). This analysis shows that the more frequently you engage in exercise habits, the less frequent the occurrence or complaints of musculoskeletal disorders.

This research is in line with research (Rafie et al., 2015) conducted on dentists, where this research shows that musculoskeletal disorders occur less frequently in dentists who regularly do exercise, the exercise itself that is often done is aerobic exer-

cise and stretching. where this sport is key in preventing and damaging and strengthening the muscle and bone systems.

AUTHOR CONTRIBUTION

All authors have made significant contributions to data analysis as well as preparing the final manuscript

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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