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Work Position and Low Back Pain in Batik Stamped Craftsmen in Cipocok Jaya

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ABSTRACT

Background: Working positions in the manual stemped of batik production process involve static body posture, either sitting or bending over for a long time are contributing factors of cause Low Back Pain (LBP). The prevalence of Low Back Pain in Indonesia between 7.6% - 37% in individuals aged 30-50 years, with risk factors including physical activity involving lifting heavy objects and in cases of obesity. Complaints of LBP among the populations of stamped batik craftsman in Cipocok Jaya Subdistrict have not been previously study, thus it is necessary to understand the relationship between working positions and the incidence of LBP. Objective: Identify the relationship between work position and the incidence of LBP in batik stamped craftsman in Cipocok Jaya. Method: This analytical observational research with a cross-sectional study approach using purposive sampling method involving 42 participants. The exclusion criteria were related to analgesic consumption, the use of vertebral support devices, systemic disease, and pregnancy. Work position risk levels were assessed using the Rapid Entire Body Assessment (REBA) instrument while LBP complaints were based on the Nordic Body Map (NBM). Bivariate analysis was done using the Chi-square test. Result: The research results showed that 21 craftsmen (50%) had LBP, while 21 others did not had LBP. A total of 15 craftsmen (35.7%) were classified as mild–moderate risk (REBA 7) while the others 27 people (64.3%) were classified as high–very high risk (REBA >7). Bivariate analysis showed a moderate correlation between REBA scores and LBP complaints (p=0.001; contingency coefficient=0.480). Conclusion: There was a relationship between work position and the incidence of LBP among stamped batik craftsmen in Cipocok Jaya Subdistrict. Therefore, improvements in the ergonomic aspects of work positions that have the potential to cause LBP complaints are needed by performing muscle stretching activities before working and receiving support from the management of the central batik center in providing work facilities that promote health.

1. INTRODUCTION

Musculoskeletal disorders are complaints in the skeletal muscle parts that are felt from mild to severe. Muscles receiving static loads repeatedly over a long period can cause complaints such as damage to joints, ligaments, and tendons (Wijanarka, 2018). Musculoskeletal disorders can be caused by factors from work design, work environment, work equipment, machines, and other tools. These factors will cause problems if there is a surface height that does not match the work position (Etika, 2019). Static positions for long periods in a job can be observed from the work activities of stamped batik Craftsmen. The entire process of making stamped batik in the Cipocok Jaya batik centre still uses manual techniques. To meet their work targets within a certain timeframe, batik Craftsmen need hours to create batik. Based on the researchers' observations, batik Craftsmen in Cipocok Jaya work in static positions, sitting and bending, especially during the stamping process.

The work position maintained for long periods and repetitively can cause lower back pain, also known as Low Back Pain (LBP). This is caused by maintaining a static position, which requires continuous muscle contraction. Continuous muscle contraction leads to reduced blood flow due to the narrowing of blood vessels, resulting in ischemia. Prolonged muscle contraction also produces a buildup of lactic acid, causing pain (Hayati & Imron, 2019). Additionally, excessive

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muscle effort in maintaining a work position can cause muscle spasms, making it very risk to experience lower back pain (Andini, 2015).

Low Back Pain (LBP) is one of the musculoskeletal disorders resulting from poor ergonomics. A bent working position can increase the risk of Low Back Pain (LBP) by 2.68 times compared to workers with an upright posture (Samara, 2017). The prevalence of Low Back Pain (LBP) incidents worldwide varies significantly each year, reaching figures between 15-45%. The percentage of people who have experienced back pain in England is around 17.3 million, and from that number, approximately 1.1 million people suffer from paralysis caused by back pain. Meanwhile, 26% of American adults are reported to experience LBP for at least one day within a three-month period (Wijanarka, 2018).

The prevalence of Low Back Pain in Indonesia varies between 7.6% - 37% in the age group of 30-50 years, with risk factors including physical activities such as lifting heavy objects and cases of obesity (Panduwinata, 2014). It is estimated that 40% of the population in Central Java aged 65 years have experienced back pain, with a prevalence of 18.2% in men and 13.6% in women. This prevalence continues to increase with age, with incidence rates based on post-visit data from several hospitals in Indonesia ranging from 3% to 17% (Etika, 2019). Meanwhile, the assessment of LBP incidence among batik craftsmen in Cipocok Jaya has not yet been studied or observed to understand the conditions of complaints experienced by workers in static work positions while sitting and bending for long periods. The impact of LBP complaints on stamped batik craftsmen in Cipocok Jaya, who work in static positions while sitting and bending for long hours, especially during the batik stamping process, will significantly affect work productivity, attendance, quality of life, increased healthcare costs, and the risk of disability among workers. This research is expected to contribute to the improvement of ergonomic aspects of work positions that have the potential to cause LBP complaints by conducting muscle stretching activities before work and support from batik centre management in providing health-supportive work facilities. Therefore, this research aims to determine the relationship between work posture and the incidence of LBP among stamped batik craftsmen in Cipocok Jaya Village.

2. METHOD

This research is an analytical observational type with a cross-sectional study design approach involving the entire population of stamped batik craftsmen in Cipocok Jaya Village in 2021. The sampling technique is non-probability sampling with a purposive sampling approach involving 42 respondents. All subjects who agreed to the informed consent were included in this study. Meanwhile, subjects who were absent during data collection, were consuming analgesics, using back support devices, had a history of rheumatic or other systemic diseases, or were pregnant were excluded from the study. The respondent selection process was carried out during the research period by collecting data according to the inclusion and exclusion criteria until the required number was reached.

The data obtained are primary data thru research instruments for assessing the risk level of work positions using the Rapid Entire Body Assessment (REBA) and LBP complaints based on the Nordic Body Map (NBM). REBA is used to assess the risk category of work positions, and the REBA score is obtained by summing the observation results using a specific formula. This work position assessment method is conducted to evaluate the overall body disorder risk factors (Stanton et al., 2005). The REBA assessment is divided into 2 groups based on the body parts being evaluated. Group A consists of the trunk, neck, and legs. Group B consists of the upper arm, lower arm, and wrist. Each body part mentioned above will be scored according to its respective indicators. The REBA score is a combination of score A, score B, load score, coupling score, and activity score using a specific formulation. The standard REBA score classifies into 5 risk categories, namely 1) negligible risk (score 1); 2) low risk (score 2 – 3); 3) moderate risk (score 4 – 7); 4) high risk (score 8 – 10); 5) very high risk (score >10). For the purposes of this study, a reclassification was conducted based on the original REBA score categories into 2 groups as follows: 1) low – moderate risk (REBA score ≤7) and 2) high – very high risk (REBA score >7).

Nordic Body Map (NBM) questionnaire to identify LBP complaints in respondents. The completion is done by shading or marking on the body map image according to the complaints or musculoskeletal disorders felt. This questionnaire can be easily understood by respondents from various levels of education and knowledge due to the presence of the illustrated images. This can also minimize misunderstandings, although the information obtained is likely to be subjective depending on each respondent's perception of pain. Respondents are defined as experiencing LBP complaints by selecting the "yes" option and shading or marking the item in the lower back section of the NBM questionnaire sheet.

Subject characteristics are displayed based on age, gender, length of work, duration of work, trauma history, obesity measured by Body Mass Index (BMI), REBA score, and LBP status. Descriptive data is presented in the form of relative frequency distribution. Bivariate analysis used the chi-square test on data that met the chi-square test requirements, while for data that did not meet the requirements, an alternative test, namely Fisher's Exact Test, was used. A statistical test is considered significant if the P value is < 0.05. The correlation between variables in this study is indicated by the contingency coefficient (C). The measurement of data analysis uses SPSS software.

3. RESULT AND DISCUSSION

Result

This research has received ethical approval with reference number 009/KEPK/PE/XII/2021 from the Research Ethics Committee of the Faculty of Medicine, Jenderal Soedirman University. In this study, a total of 42 subjects were included as respondents. The stamped batik craftsmen in Cipocok Jaya who are under 30 years old were reported to be 18 (42.9%), while the remaining 24 people were over 30 years old. The majority of stamped batik Craftsmen are women, total 25 people (59.5%). As many as 21 Craftsmen (50%) spend less than 8 hours working each day, while the other 21 (50%) spend more time. Twenty-five Craftsmen (59.5%) have been working for 5 years or more. Based on the body mass index, 25 craftsmen fall into the obese category (59.5%), while the rest are non-obese (40.5%). The group of craftsmen with LBP complaints and those without LBP complaints were reported to be equal in number, with each group consisting of 21 individuals (50.0%). The characteristics of the subjects are described in Table 1.

Table 1. Characteristics of Research

Characteristic	Subjects Number (N = 42)	Percentage (%)
Age		
<30 years old	18	42.9
≥30 years old	24	57.1
Gender		
Female	25	59.5
Male	17	40.5
Working Hours		
<8 hours	21	50,0
≥8 hours	21	50,0
Work Experience		
≤5 years	17	40,5
>5 years	25	59,5
Trauma History		
No	29	69,0
Yes	13	31,0
Obesity		
Yes	25	59,5
No	17	40,5
REBA		
Low – Medium Risk	15	35,7

High Risk – Very High Risk	27	64,3
Status LBP		
LBP	21	50,0
Non-LBP	21	50,0
Total	42	100,0

Bivariate tests showed differences in LBP levels according to age and length of service. A higher incidence of LBP was found in workers aged ≥30 years compared to those working <30 years (66.7% vs 27.8%; C=0.36; p=0.029). A higher incidence of LBP was also found in workers with more than 5 years of service compared to those with ≤5 years of service (68.0% vs 23.5%; C=0.40; p=0.012). No differences in LBP levels were found according to the variables of gender (p=0.209), daily working hours (p=1.000), trauma history (p=0.504), and obesity status (p=1.000). Table 2 shows the bivariate analysis of the various variables mentioned above.

Table 2 Bivariate Analysis of LBP Factors

Variable	*Low Back Pain*		P - Value	Contingency Coefficient
	No	Yes		
Age, n (%)			0,029	0,359
<30 years old	13 (72,2%)	5 (27,8%)		
≥30 years old	8 (33,3%)	16 (66,7%)		
Gender, n (%)			0,209	0,236
Female	10 (40,0%)	15 (60,0%)		
Male	11 (64,7%)	6 (35,3%)		
Working Hours, n (%)			1,000	0,048
<8 hours	11 (52,4%)	10 (47,6%)		
≥8 hours	10 (47,6%)	11 (52,4%)		
Work Experience, n (%)			0,012	0,400
≤5 years	13 (76,5%)	4 (23,5%)		
>5 years	8 (32,0%)	17 (68,0%)		
Trauma History, n (%)			0,504	0,153
No	16 (55,2%)	13 (44,8%)		
Yes	5 (38,5%)	8 (61,5%)		
Obesity, n (%)			1,000	0,048
Yes	13 (52,0%)	12 (48,0%)		
No	8 (47,1%)	9 (52,9%)		
Total	21 (100%)	21 (100%)		

The main result of this study shows that 15 batik craftsmen fall into the low to moderate risk category for LBP complaints, with 2 of them (13.3%) experiencing LBP. Twenty-seven other craftsmen fall into the high to very high risk category, with an LBP rate of 70.4% in this group. A bivariate test using Chi-square concluded that the difference in LBP levels between these two groups is significant (p=0.001) with a contingency coefficient of 0.480, indicating a moderate correlation strength. The main bivariate analysis in this study is shown in Table 3.

Table 3 Bivariate Analysis of REBA Score on LBP Incidence

Variable	*Low Back Pain*		P - Value	Contingency Coefficient
	No	Yes		
REBA, n (%)				
Low – Medium Risk	13 (86,7%)	2 (13,3%)	0,001	0,480
High Risk – Very High	8 (29,6%)	19 (70,4%)		
Total	21 (100%)	21 (100%)		

Discussion

Based on the research data, all subjects have REBA scores ranging from 6 to 10. This indicates that batik stamp Craftsmen in Cipocok Jaya Village have a risk of musculoskeletal complaints ranging from mild to moderate to very high. As many as 15 (35.7%) batik Craftsmen

fall into the category of having a mild to moderate risk of LBP measured by a REBA score of ≤7, while the other 27 (64.3%) are at high to very high risk of LBP with a REBA score of >7. Additionally, there is a significant relationship between work position and the occurrence of LBP among batik stamp Craftsmen in Cipocok Jaya Village, with a meaningful value (p=0.001) and a contingency coefficient of 0.480, indicating a moderate correlation strength.

The main findings of this study are supported by research conducted by Savitri et al. (2015), which showed that poor working positions can lead to musculoskeletal complaints (p=0.008). (Savitri et al., 2015). Another study by Harahap et al. (2018) is also consistent with the findings of this research. The results of the study on batik craftsmen workers in Jambi City showed a significant relationship between work position and length of service with LBP complaints (p=0.007; p=0.040) (Harahap et al., 2018).

Each batik production work process has a different REBA score range. The highest REBA score is observed in the dyeing process, which involves a squatting position, while the lowest score is observed in the stamping process. The clear differences in positions in each batik working process are consistent with the differences in the REBA scores obtained. Batik craftsmen in the stamping process have the lowest risk of LBP complaints due to a better working position compared to craftsmen in other batik-making processes, namely a sitting position. Noor (2017) mentioned that the best sitting posture, which does not adversely affect body posture and the spine, is sitting with a slight lordosis in the lower back and a slight kyphosis in the upper back. However, maintaining a sitting position for a long time also has the potential to affect musculoskeletal complaints. Yusuf (2014) mentioned that sitting for more than 4 hours is related to LBP complaints. Therefore, a rest period of at least 15–30% of the total working hours in a day is required (Yusuf, 2014).

The high level of LBP among batik Craftsmen during the dyeing and “ngelorod” processes is due to the work positions of bending or squatting, combined with repetition. This is done for 5 days in one work week. The researchers also found several batik Craftsmen who work more than 8 hours per day, which can increase the workload on the body's supporting muscles. If this awkward position is maintained every day during work, it can cause the body to create tension in the lumbar muscles, leading to complaints of lower back pain (Noor, 2017).

Static positions for long periods in a job are sometimes unavoidable; one example is stamped batik Craftsmen. The entire process of making stamped batik in the Cipocok Jaya batik centre still uses manual techniques. To meet their work targets within a certain timeframe, batik Craftsmen need hours to create batik. Based on the researchers' observations, batik craftsmen in Cipocok Jaya work in static positions, sitting and bending, especially during the batik stamping process. This position, over a long period and repeatedly, can cause lower back pain. This is caused by maintaining a static position, which requires continuous muscle contraction. Continuous muscle contractions cause a decrease in blood flow due to the narrowing of blood vessels, resulting in ischemia. Prolonged muscle contractions also result in the accumulation of lactic acid, causing pain (Hayati & Imron, 2019). Additionally, excessive muscle effort in maintaining a working position can cause muscle spasms, making it very risk to experience lower back pain (Andini, 2015).

Stimulation of the dorsal ganglion will trigger the production of substance "P". The production of substance "P" can stimulate an inflammatory reaction. Severe pain can cause a reflexive reaction in the lumbodorsal muscles, especially the erector spinae, leading to an increase in localized muscle tone (spasm) as a form of "guarding" against any movement. Prolonged muscle spasms will tend to experience tightness. A state of tightness in the erector spine muscles will exacerbate the perceived pain due to ischemia, causing abnormal spine alignment and potentially leading to significant stress/compression loads on the injured intervertebral disk. The main issues of pain and tightness in the lumbodorsal muscles, particularly the erector spinae, are that the dominant movement and functional disturbances are the limitation of lumbar flexion, with slight limitations in lateral flexion and lumbar rotation. These movements are functional movements in the lumbar region (Sudaryanto, 2013). It is this biomechanical mechanism that causes an increase in intradiscal pressure, fatigue of the erector spinae muscles, increased load on the lumbar ligaments, and microtrauma due to static posture maintained for a long time.

The cause of LBP complaints is strain on the muscles or soft tissues such as ligaments and tendons associated with the spine. Muscle injuries can arise due to muscle strain (Yonansha, 2012). This muscle strain can be acute or chronic, and if it occurs continuously, it can cause progressive pain. Additionally, the muscle tissue will experience damage, swelling, and even bleeding. Basically, the cause or factors of low back pain are difficult to diagnose accurately. Low back pain is caused by two factors, namely mechanical and non-mechanical factors (Helmi, 2014). Factors that influence the occurrence of low back pain complaints can include internal, external, and physical environmental factors. Internal factors consist of physical activity, body weight, gender, length of service, medical history and trauma, age, and mental or psychological condition. External factors include workload, duration of work, work position, repetition, and work environment.

Other variables controlled in this study include work experience, work duration, obesity, and trauma history. Meanwhile, the variables that were not controlled are the levels of anxiety and depression. This is because there are still difficulties in finding direct evidence of the psychosocial and psychological factors related to the occurrence of LBP. LBP can manifest alongside mental health issues, particularly depression and anxiety. This psychogenic LBP pain cannot be traced back to any underlying organic abnormalities, so factors such as pain perception and somatization may be involved in this case (Bener et al., 2013).

Although it successfully demonstrated a significant relationship between work position and LBP complaints, this study also found the involvement of other variables, namely work experience and the age of the research subjects. A batik working period of more than 5 years is associated with an increased risk of LBP occurrence (p=0.012). Low Back Pain was experienced by 17 people (81.0%) in the ≤5 years' work experience group and 4 people (19.0%) in the >5 years work experience group, with a contingency coefficient value of 0.400, indicating a moderate correlation strength. Work experience reflects a chronic process and the accumulation of postural errors in the workplace. Heavy physical work can affect muscle function. If the work continues for a long time without sufficient rest, the body's ability to adapt will decrease and may cause pain in the limbs. The findings of Coenen et al. (2014) support the LBP etiologic model of cumulative load due to the accumulation of micro-damage or fatigue (Coenen et al., 2014).

Age factor over 30 years is also known to have a significant influence on the occurrence of LBP (p=0.029). Bivariate analysis thru the Chi-square test concluded that there is a significant difference between age and the occurrence of LBP, supported by a contingency coefficient correlation value of age and LBP occurrence of 0.359, although it is weakly correlated. Humans around the age of 30 will experience degeneration in the form of tissue damage, tissue replacement with scar tissue, and fluid reduction, which causes a decrease in the stability of bones and muscles. The older a person gets, the higher the risk of experiencing a decrease in bone elasticity, which can trigger the onset of low back pain (Kantana, 2010). General complaints of pain are commonly found among the Craftsmen population and encompass all ages. In fact, LBP is found in craftsmen who are still relatively young, specifically in their third decade of life. A systematic review shows a significant increase in prevalence among the age group over 60 years. The prevalence in this group varies between 21.7% and 75.0% (de Souza et al., 2019). Other sources state that the increased risk of LBP in the general population has already occurred since the 4th decade of life, or in the 30s (World Health Organization, 2014). Researchers believe that the increase in LBP prevalence is related to occupational exposure in working-age adults or age-related changes in pain perception or resilience (Wong et al., 2017).

The batik production centre is commonly found in the Cipocok Jaya Village. Researchers found that the average age of batik Craftsmen in Cipocok Jaya Village is 35.59 ± 10.17 years. The youngest Craftsmen is 23 years old, while the oldest is 56 years old. The batik-making process in Cipocok Jaya Village involves both female and male Craftsmen. However, the majority of batik Craftsmen are women, with 25 people (59.5%), and the rest (40.5%) are men. The batik production process runs from Monday to Saturday every week. On average, batik Craftsmen spend 6.86 ± 1.32 hours working each day, ranging from 5 to 8 hours. The work experience reported varies among batik Craftsmen, ranging from the shortest being 2 years to the longest being 20

years. The average work experience spent by batik Craftsmen in Cipocok Jaya Village is reported to be 7.88 ± 4.80 years.

The lack of attention to ergonomics can lead to the emergence of ergonomic problems. The common symptoms that arise due to work are musculoskeletal disorders (Jum & Jaji, 2016). As observed in the research conducted on stamped batik craftsmen in Cipocok Jaya Village, there is a need for attention to make work positions more ergonomic, avoiding static sitting or bending for long working hours. Muscle stretching activities before working can help reduce or even prevent complaints of LBP. Therefore, support from the batik centre management is needed to provide work facilities that promote the health of the batik Craftsmen.

4. CONCLUSION

Based on the findings of this study, there was a significant relationship between work posture and the occurrence of Low Back Pain (LBP) among stamped batik craftsmen in Cipocok Jaya. Most craftsmen were classified as having a high to very high risk of musculoskeletal disorders based on the REBA score (>7), and this group had a higher proportion of LBP complaints than those with low to moderate work-posture risk. The relationship between work posture and LBP was statistically significant, with a moderate strength of association (p=0.001; contingency coefficient=0.480). In addition to work posture, age ≥30 years and work experience >5 years were also significantly associated with LBP, whereas gender, daily working hours, history of trauma, and obesity status were not significantly associated with LBP. Therefore, the implementation of ergonomic work practices, reduction of prolonged static or bending postures, muscle stretching before work, and provision of more ergonomic work facilities are recommended to help reduce the risk of LBP among stamped batik craftsmen in Cipocok Jaya.

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