

The Musculoskeletal Complaints Based on Work Position in Bamboo Woven Craftsmen

Isyeu Sriagustini, Tita Rosmiati, Subhan Fajri

Study Program of Public Health, STIKes Respati, Indonesia

Jl. Raya Singaparna No.KM. 11, Cikunir, Singaparna, Tasikmalaya, West Java 46418 Indonesia

ABSTRACT

Introduction: Musculoskeletal disorders in Indonesia require attention due to their high prevalence. Woven bamboo craft production involves unnatural body postures at every stage, leading to potential injuries. Assessing musculoskeletal complaints can provide valuable data for ergonomic risk assessment. This study aims to analyze such complaints based on the working positions of bamboo weavers. **Methods:** This research is descriptive. The population in this study was all woven bamboo craftsmen with a total of 430 people. The total sample was 86 craftsmen from 20% of the population for descriptive research. The variables studied included work position and musculoskeletal complaints. Data collection was done by observation and survey. Data were analyzed descriptively by displaying the calculation results of the risk level of work positions and the risk level of musculoskeletal complaints. **Results:** Most of the work positions of craftsmen are in the medium-risk category (54.7%). The working position of the craftsmen who have very high-risk category is at the stage of making woven bamboo and finishing. The highest level of discharge risk is in the low complaint category (60.5%), and the high category of musculoskeletal complaints is at the stage of making the woven. **Conclusion:** The working position of the woven bamboo craftsmen is directly proportional to the complaints they feel. Intervention is needed to reduce the risk of injury and reduce musculoskeletal complaints felt by workers, especially in workers with very high-risk working positions.

Keywords: bamboo craftsmen, musculoskeletal complaints, work position

Corresponding Author:

Isyeu Sriagustini

Email: isyeutnt06@gmail.com

Telephone: +6222290361

INTRODUCTION

Musculoskeletal disorders (MSDs) are injuries or disorders that affect the movement of the human body or the musculoskeletal system. These disorders can be felt in the muscles, nerves, tendons, joints, cartilage, and spinal discs. Musculoskeletal conditions are usually characterized by pain (often persistent) and limitations in mobility, dexterity, and overall level of function, reducing the person's ability to work. According to Global Burden of Disease (GBD) data, there are around 1.71 billion people worldwide who have musculoskeletal disorders. Countries with high levels of economy are the most affected. There are around 441 million people with musculoskeletal disorders in these countries. Then

427 million people come from countries in the WHO West Pacific Region and Southeast Asia Region with 369 million people (Centers of Disease Control and Prevention, 2020; WHO, 2021).

Musculoskeletal disorders in Indonesia are health problems with a prevalence of diseases that need attention. According to RISKESDAS 2018 data, the prevalence of musculoskeletal-related diseases in Indonesia was around 7.3%. This happened to workers, including as much as 9.9% of farmers or farm laborers, 7.5% of PNS/TNI/ POLRI/ BUMN/ BUMD workers, 7.4% of fishermen, 7.3% of self-employed, and 3.59% of private workers (Kementrian Kesehatan RI, 2018). Studies have shown the prevalence of musculoskeletal diseases or disorders in various workplaces in Indonesia, including research by Livandy and Setiadi (2018), showing as many as 78 (96.3%) sewing confectionery workers experienced complaints of musculoskeletal disorders in the

Cite this as: Putri, E. K., Yusvita, F. and Situngkir, D. (2023) 'Safety Maturity Level Assessment at Logistic Service Company in Ancol', *The Indonesian Journal of Occupational Safety and Health*, 12(3), pp. 413-423.

last 12 months. The same thing happened to the 30 tire industry warehouse operators who were participants in a study conducted by Revadi, Gunawan and Rakasiwi (2019), which showed that all the participants studied experienced problems in the lower back with the highest average pain score in the last 12 (twelve) months. Likewise, research on complaints of musculoskeletal disorders in office workers was conducted by Sigar, Suoth and Rattu, (2019). The results of this study showed that of the 47 employees of Bank Sulutgo, 23 respondents (48.9%) experienced low complaints, 22 respondents (46.8%) experienced moderate complaints, and two respondents experienced high complaints (4.3%).

Musculoskeletal complaints are conditions related to pain in the muscles, bones, ligaments, and other connective tissues in the human body. These complaints are caused by an inflammatory response and pain resulting from tissue damage due to risk factors such as heavy workloads, repetitive movements, and poor posture. These complaints can cause pain and discomfort, which can ultimately affect productivity, work attendance, and job performance. Additionally, musculoskeletal pain can trigger a vicious cycle in which pain causes a decrease in activity, which can then cause more pain and further disruption. This can decrease job satisfaction and increase the risk of work-related disorders ((BSN, 2021; Oha et al., 2021). WHO explains that conditions of musculoskeletal disorders are also the biggest contributor to Years Lived with Disability (YLDs) worldwide with around 149 million YLDs, accounting for 17% of all YLDs worldwide (WHO, 2021).

Work-related musculoskeletal disorders are conditions in which the work environment and work performance make a significant contribution to illness and/or are made worse or last longer due to working conditions. Musculoskeletal complaints can occur in workers in the formal and informal sectors as long as there is a source of ergonomic risk factors in the work environment. Ergonomic risk factors are synergistic elements of MSDs, namely repetitive activities, overstretching of muscles, and awkward body postures. Study of Prabarukmi and Widajati (2020) demonstrated a highly significant association between ergonomic risk factors and musculoskeletal complaints. The same result was shown by the research of Evadarianto and Dwiyantri (2017), which showed that there was a very strong relationship between work posture and MSDs complaints (Spearman's correlation coefficient

value was 0.770). Unergonomic or unnatural work postures can cause MSDs complaints. The worse the working posture, the greater the musculoskeletal complaints.

The development of bamboo weaving handicrafts in Tasikmalaya Regency has become a rapidly growing informal sector, significantly contributing to the local economy. However, this growth is accompanied by challenges regarding the well-being of workers, particularly concerning ergonomic aspects during the production process. Several ergonomic hazards have been identified, especially related to unnatural work positions and body postures during bamboo weaving. Craftsmen tend to perform their tasks while being seated for 67.08% of the time. On average, they sit for 2.5 hours, ranging from 1 to 6 hours. Improper body posture combined with relatively long work durations can increase the risk of musculoskeletal disorders among the workers (Sriagustini and Supriyani, 2022).

The results of the ergonomic risk assessment indicate that work postures at thirteen stages of the process are at level 2 action, three stages at level 3 action, and two stages at level 4 action. This demonstrates varying levels of risk throughout the bamboo weaving production process. Subjectively, woven bamboo craftsmen express various discomforts and pains associated with their work. The most common complaint is lower back pain as reported by the majority of craftsmen (28%). They also report experiencing pain in the hands (19%), legs (16%), and back (12%)(Sriagustini and Supriyani, 2022).

Therefore, an assessment of musculoskeletal complaints among woven bamboo craftsmen is essential to gain a deeper understanding of the health impacts resulting from these non-ergonomic work positions. This research aims to examine musculoskeletal complaints among woven bamboo craftsmen, hoping to provide further insight into the severity of disorders or injuries to their musculoskeletal system. This data will be a crucial complement to ergonomic risk assessments and can serve as a basis for designing improvements for better working conditions.

METHODS

This research is descriptive. This research was conducted in June-August 2022 at a location in the center of woven bamboo, Leuwisari Sub-

district, Tasikmalaya Regency. This research has received an ethics certificate from Health Research Ethics Committee BTH STIKes Tasikmalaya, with certificate number 173/ec.01/kepk-bth/VI/2022.

The population in this study were all woven bamboo craftsmen recorded in the Leuwisari sub-district, Tasikmalaya regency. The number of woven bamboo craftsmen recorded in the Leuwisari sub-district until 2020 is 430 people (BPS Kabupaten Tasikmalaya, 2020). The number of research subject samples was calculated using a minimum sample for descriptive research, namely at least 10% of the

population. For relatively small population, at least 20% (Gay, Mills and Airasian, 2012). To obtain a more comprehensive overview of the research findings, the sample size would be determined at the upper range, specifically 20%. This decision was made to ensure a more robust representation of the population, allowing for a more accurate and reliable depiction of the study outcomes. Based on this, the number of research objects in this study was 86 craftsmen (20% of 430). The sampling technique was carried out by random sampling. Overview of some craftsmen's work positions can be observed in Figure 1.

The researchers collected data using observation and surveys. Observation is useful for knowing the stages of work and working positions of craftsmen at each step, while surveys are useful for gathering information about musculoskeletal complaints felt by the craftsmen. Observation is useful for knowing the stages of work and work positions of craftsmen at each stage. The instrument uses the RULA check sheet. Surveys are useful for gathering information about skeletal muscle complaints in



Bamboo Cutting



Bamboo Strads Coloring



Weaving



Making Jangka



Installation of Lower Wengku



Drying

Figure 1. Overview of Some Craftsmen's Work Positions

Table 1. RULA Grand Score

Action levels	Score	Risk Level	Explanation
1	1-2	Low	Negligible risk, no action required
2	3-4	Medium	Low risk, changes may be required
3	5-6	High	Moderate risk, further investigation, change soon
4	> 7	Very High	Very high risk, apply changes now

Table 2. Actions Level of NBM

Action Levels	Score	Complaints Category	Corrective Action
1	28-49	Low	No repair needed
2	50-70	Medium	May need repair at a later date
3	71-91	High	Urgent repair needed
4	92-112	Very High	Required Comprehensive action as soon as possible

workers. The instrument uses the Nordic Body Map questionnaire.

Work position data were processed by determining the value of the craftsmen's posture when doing work at all stages. The collected data were then calculated to determine the RULA score. The results were compared with the action levels as described in Table 1 (Middlesworth, 2017).

Data on musculoskeletal complaints were processed by scoring individuals with a predetermined Likert scale to obtain a total individual score. The results of calculating individual scores were analyzed so as to produce improvement efforts. This was done by comparing individual scores with subjective skeletal muscle risk classifications as shown in Table 2 (Tarwaka, 2010).

RESULTS

Characteristics of Respondents

The characteristics of woven bamboo craftsmen who were respondents in this study can be seen in table 3. Based on Table 3, it is known that the average age of the craftsmen is 46.57 years or rounded up to 47 years, most of whom are female (51.2%), the average body weight of the craftsmen is 56.59 Kg, the average height of the craftsmen is

Table 3. Characteristics of Respondents

Characteristic		F (n=86)	%
Age	Mean	47 Years	
	Min-Max	19-93 Years	
Gender	Male	42	48.8
	Female	44	51.2
Weight	Mean	56.59 Kg	
	Min-Max	40-90 Kg	
Height	Mean	158.17 Cm	
	Min-Max	145-170 Cm	
Stages of Work	Woven Making	39	45.3
	Preparation of Additional Materials	15	17.4
	Product Assemble	24	27.9
	Finishing	8	9.3
Working time	Mean	5.06 hours	
	Min-Max	1-12 hours	

Source: primary data

158.17 cm, most of the craftsmen work at the woven stage (45.3%), the average working time is 5.06 hours and most of the craftsmen work in a sitting position (86.0%).

Work Position

An overview of the working positions of craftsmen based on the stages of work on making woven bamboo crafts can be seen in Table 4. It explains that the working position of the craftsmen when making woven bamboo crafts is mostly sitting (86.0%).

Based on the RULA grand score, it can be seen that the action level category of each craftsman's work position. This level of action can provide important information on possible ergonomic risks associated with working positions during the work process. The results of the RULA grand score categorization can be seen in Table 5.

Table 5 states that most of the work positions of craftsmen are in the medium-risk category (54.7%),

Table 4. Working Position of Craftsmen Based on the Stages of Making Woven Bamboo Crafts

Stages of Work	Work positions					
	Sitting		Standing		Squat	
	F	%	F	%	F	%
Woven Making	33	38.4	3	3.5	4	4.7
Preparation of Additional Materials	12	14.0	0	0.0	0	0.0
Product Assemble	26	30.2	1	1.2	0	0.0
Finishing	3	3.5	2	2.3	2	2.3
Total	74	86.0	6	7.0	6	7.0

Source: primary data

Table 5. Risk Level of Craftsmen's Work Position while Carrying out Work Based on the RULA Assessment Method

Risk Level	F (n=86)	%
Low	0	0
Medium	47	54.7
High	24	39.5
Very High	5	5.8

Source: primary data

and there are also working positions of craftsmen in the very high category (5.8%).

The working position of the craftsmen who have a very high-risk category is at the stage of making woven bamboo, namely the coloring section of the bamboo strands and at the finishing stage, namely the drying section. There is no stage or part of the work that is not at risk. Details of the risk level of work positions at each stage of making woven bamboo handicrafts can be seen in Figure 2.

Musculoskeletal Complaints

The results of the individual assessment showed that the ten body parts that the craftsmen complained about the most, sequentially from the highest, were

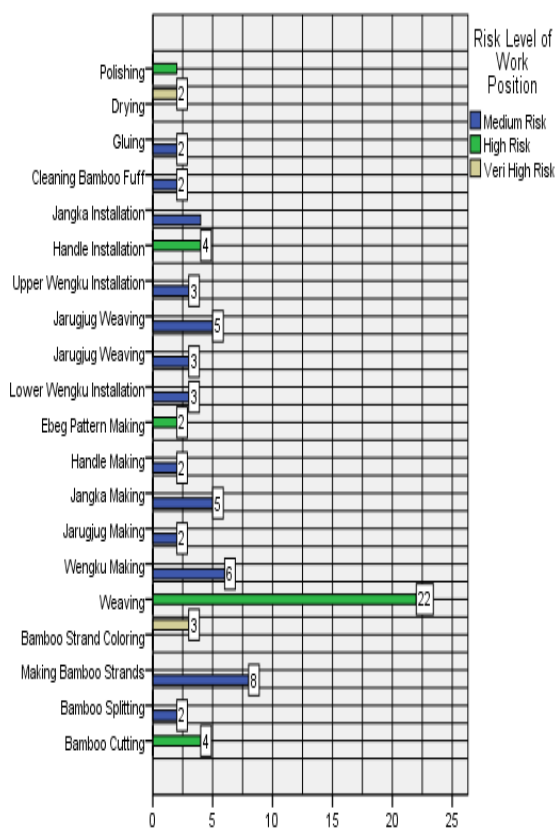


Figure 2. Risk Level of Craftsmen's Work Position Based on Section of Work

Table 6. Craftsmen's Musculoskeletal Complaint Risk Level Based on Individual Score

Complaints Category	F (n=86)	%
Low	52	60.5
Medium	32	37.2
High	2	2.3
Very High	0	0

Source: primary data

the right forearm, lower neck, right upper arm, right shoulder, right hand, left upper arm, right wrist, left forearm, and tip neck. An overview of craftsmen's skeletal muscle complaints based on individual scores which can determine the level of action/remedial action can be seen in Table 6.

Table 6 shows the highest level of discharge risk in the low complaint category (60.5%), and 2.3% of craftsmen feels complaints in the high category. The level of risk of skeletal muscle complaints at the stages and parts of the work of

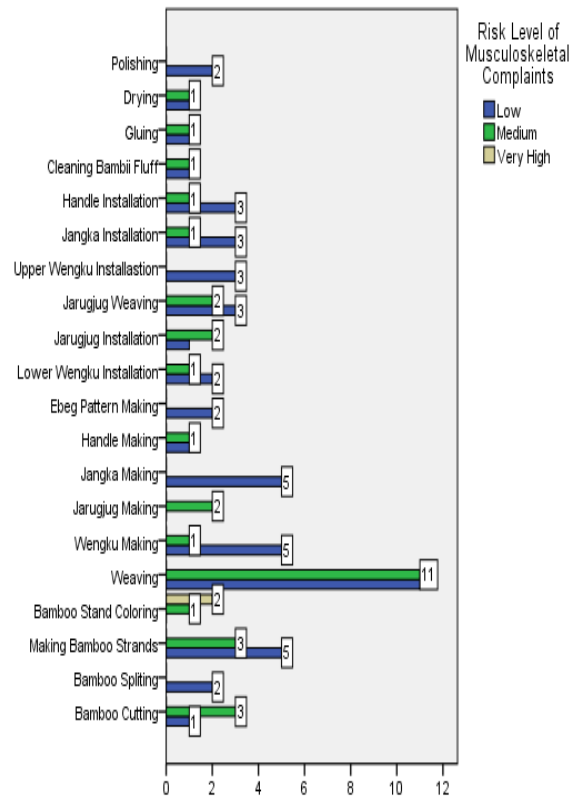


Figure 3. Risk Level of Craftsmen's Musculoskeletal Complaints Based on Section of Work

Table 7. Results of Analysis of the Relationship between Working Position and Musculoskeletal Complaints

Risk Level of Work Position	Risk Level of Musculoskeletal Complaints						p value
	Low High	%	Medium n	%	Very n	%	
Medium-risk	32	68.1	15	31.9	0	0.0	0.584
High-risk + Very High-risk	20	51.3	17	43.6	2	5.1	
Total	52	60.5	32	37.2	2	2.3	

Result of Kolmogorov-Smirnov Test

making woven bamboo crafts can be seen in Figure 3. Based on Figure 3, it can be seen that there were no complaints in the very high category, but there were complaints in the high category at the stage of making the woven, namely in the coloring of the bamboo strands. There is a medium complaint risk category at each stage and part of making woven bamboo crafts.

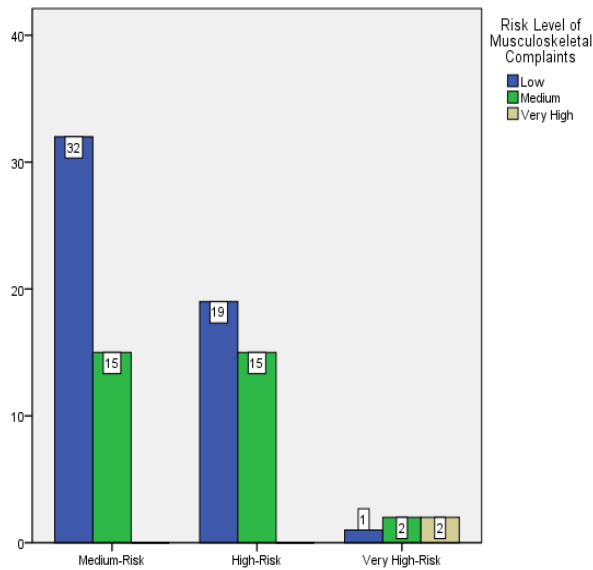


Figure 4. Risk Level of Musculoskeletal Complaints Based on Risk Level of Work Position

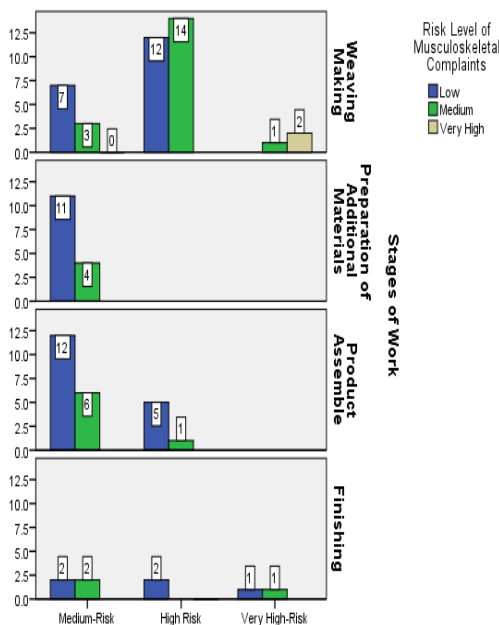


Figure 5. Risk Level for Musculoskeletal Complaints Based on the Risk Level of Work Position at Each Stage of Woven Bamboo Making

Musculoskeletal Complaints Based on Work Position

An overview of the risk level of musculoskeletal complaints based on the level of work risk position can be seen in Figure 4. Based on Figure 4, it can be seen that musculoskeletal complaints in the category of medium-risk work positions and high-risk work positions are medium complaints and high complaints, while in the very high-risk work position category, there are high complaints categories.

It can be seen that exposure to high-risk and very high-risk work positions shows that there is about 51.3% of musculoskeletal complaints at low levels, 43.6% at intermediate levels, and only 5.1% at very high levels. The statistical test yielded a p-value of 0.584, indicating that there was no significant relationship between work position and musculoskeletal complaints. To see the relationship between musculoskeletal complaints and work position can be shown in Table 7.

An overview of the risk level of musculoskeletal complaints based on the risk level of work positions at each stage of making woven bamboo can be seen in Figure 5. Based on Figure 5, it can be seen that the working position in the very high-risk category is at the stage of making woven bamboo, and finishing with skeletal muscle complaints in the high category is at the stage of making woven bamboo.

DISCUSSION

Work Positions

The working position of the craftsmen when making woven bamboo crafts was mostly sitting (86.0%). The method of sitting used by the craftsmen is to sit on the floor without any chair facilities to support the feet, so that they are well positioned, so that the legs are bent in such a way while doing the work. A good sitting position is sitting on a chair that allows variations in body changes, knee flexion forming an angle of 90, feet resting on the floor, and if possible, providing a work desk (Pemerintah Indonesia, 2018).

Working in a seated position gives gives people advantage of loading their legs where they aren't even there. In addition, energy use can also be reduced for blood circulation. However, if the sitting method is not done properly, it will cause disturbances in the skeletal muscles such as injury or pain in parts of the body. Research conducted on

STIKes employees who have seating facilities with chairs and tables shows that 62.5% of respondents do not sit ergonomically. This study also proves that a sitting position that is not ergonomic has a (50.0%) greater risk of experiencing Low Back Pain (LBP) compared to an ergonomic sitting position (Anggraika, Apriany and Pujiana, 2019).

Based on the RULA assessment, most of the work positions for woven craftsmen were in the medium-risk category (54.7%). This category is the result of a RULA assessment with a score of 3 or 4 (action level 2), which means that further investigation is needed, and a change in work position is required. Meanwhile, it is only 5.8% for the very high category. This category is the result of the RULA assessment with a score of 7 (action level 4) which indicates that the investigation and change of position need to be implemented immediately. The riskiest working positions are at the stage of making woven bamboo, in the coloring of the bamboo strands, and at the finishing stage, in the drying section.

The risk category depends on the position of the craftsmen's body which is unnatural or deviates significantly from the normal position when doing work, thus forming a high score in the RULA assessment. Research on masking process operators FR and RR D30D at PT SC Plant 2 at the masking installation stage showed a final score of RULA 7 (action level 4). This is because the operator performs standing activities, the upper arm forms a 35° angle, the forearm forms a 45° angle, the wrist forms a 55° angle, the neck forms a 65° angle and breaks to the right, and the torso forms a 35° angle (Prayitno and Hanum, 2018). The coloring part of the bamboo strands also shows the same position where the working position is done standing, namely the upper arm forms a 90° flexion, angle, the forearm forms 90° flexion, the wrist forms 44° flexion, the neck forms 37° extension, the back forms 90° flexion and the feet stand with palms touching floor and evenly distributed.

Likewise, the drying section addresses standing activities, in which upper arms flex at an angle of 111°, forearms flex at an angle of 36°, wrists extend at 12°, neck extend at an angle of 21°, back forms a flexion of 0°, and feet stand with soles touching the floor and evenly distributed.

The farther the body part is from the midline of the body, the greater the risk of non-ergonomic work positions. In general, the position of the body parts of the woven bamboo craftsmen when doing

their work is the farthest away from the midline of the body, including 2.3% of the position of the arm forming a flexion $> 90^{\circ}$. If the upper arm forms a flexion angle of more than 90° , then the highest score will be obtained, namely 4. Besides, it will increase depending on the state of the shoulder raised or rotated or decreased if the upper arm is leaning or being supported (Middlesworth, 2017). The position of the upper arm can form a flexion angle of $> 90^{\circ}$ because the work object is far from the body, or the material storage area is too high, so the craftsman needs to stretch his/her hands further, so that the work is done. Research conducted on laundry worker X in the city of Semarang in the clothes drying section shows the position of the upper arm that crosses the midline of the body and forms a shrinkage of $> 90^{\circ}$, and the shoulder posture rises. This is because the laundry worker has to lift his/her clothes to be stored on the clothesline, which is located higher (Pramana, Kurniawan and Ekawati, 2021).

As for the process of making woven bamboo work, there is a 3.5% body position in conditions of flexion $> 60^{\circ}$. The highest score indicating the seriousness of the body position on the body is a score of 4 for a body position that forms an angle $> 60^{\circ}$. This score increases when the body bends or twists (Middlesworth, 2017). This condition is due to the place or existence of the object of work that must be taken or done in a bent manner because working is done by standing while the object is below. Research on the working position of nurses when placing infusions on patients shows the same condition where the nurses' body position experiences flexion $> 60^{\circ}$. This is because the working position is standing (Yosineba, Bahar and Adnindya, 2020).

As for the position of the feet, it will have a high value of two if the legs are not supported, or the body weight is not evenly distributed (Middlesworth, 2017). In the process of making woven bamboo handicrafts, 9.3% of the feet are unsupported and unbalanced. This is because the craftsmen work by squatting with a little tiptoe when doing their work. The research was conducted on welding operators in the Bekasi welding workshop who did the work by crouching and slightly tiptoeing. This caused the legs to be unbalanced evenly supporting the load. As a result, the foot position in the raw material welding process is given the highest score, namely 2 (two) (Ahmad, Hidayat and Hamdani, 2021).

Based on this, the farther the position of the body part from the midline of the body, the higher the score will be given, so that it can place the work position of a stage or part of the work in the category of non-ergonomic work positions, both those with low, medium and high risks which in the end will determine action. Work should be maintained in a neutral body position to minimize pressure on the body and keep the joints aligned. Sustaining a neutral body position while working can help reduce the risk of MSDs complaints. Neutral body position refers to keeping the joints aligned, thereby minimizing body pressure. When a worker's body position is good during the work, productivity can be achieved (Dianat, Hasanpour dan Syahravan, 2018).

Efforts made to create an ergonomic work position are to redesign or change the position of body parts in a normal position. The research was conducted in the administration section which works in a sitting manner. The results of the work position assessment get a score of 7, which means the position is very risky. After redesigning the work position, the work position score becomes 4, which means the position is low risk (Ndari and Roesdianto, 2018). The same thing is seen in shoe workshop workers where they have their work done by sitting without tables and chairs, so that it shows exposure level values in the range of 50%-69%. Efforts are made by changing the work position more ergonomically through the design of appropriate tables and chairs, showing values in the range of 40%-49%. Changes in the way it works will change the position of the body closer to the midline of the body (Ilman, Yuniar and Helianty, 2013). Therefore, it is crucial to consider ergonomics in workplace design. For instance, providing adjustable-height work tables or comfortable chairs can help reduce the risk of musculoskeletal injuries. The alteration of work tools such as desks and chairs with a participatory ergonomic approach resulted in a decrease in musculoskeletal complaints by 8.667, indicating a reduction in musculoskeletal complaints by 31.7% from the original design. This was evidenced among the general part finishing operators at PT. Mekar Armada Jaya (Abdillah, 2011)

Musculoskeletal Complaints

Musculoskeletal disorders (MSDs) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. As for work-related musculoskeletal disorders, it is a condition when the

work environment makes a significant contribution, and working conditions can worsen if there are long conditions (Centers of Disease Control and Prevention, 2020). MSDs complaints are complaints felt by workers in the skeletal muscle department, ranging from very mild to severe complaints. These complaints are subjective complaints as measured by the Nordic Body Map (NBM) instrument.

Craftsmen mostly complain of pain in the body around the hands or upper body. The craftsmen use more repetitive hand movements in the process of making woven bamboo crafts, and the work is done in a sitting position. Research on tofu industrial workers who do a lot of repetitive hand movement activities in the work process shows that the hand is a body part that many workers complain about. To be precise, about 86% of workers complained of pain in the right wrist (Tjahayuningtyas, 2019).

The low category is the level of risk of complaints most complained about (60.5%). This shows that the complaints felt by the woven bamboo craftsmen may require corrective action. However, there were 2.3% of very high complaints felt by craftsmen who indicated the need for comprehensive action as soon as possible. In contrast to research conducted on workers in the tofu industry, which showed that most workers (27) experienced complaints in the moderate category, only 6 respondents experienced complaints in the high category, and 5 other respondents experienced MSDs complaints in the heavy category (Tjahayuningtyas, 2019).

Many factors affect MSDs complaints, including work factors which include posture or position, load, frequency, and duration of work; individual factors which include age, gender, years of service, smoking habits, physical fitness, and worker anthropometry; and environmental factors which include pressure, vibration, and temperature (Tarwaka, 2010). Research conducted on ikat workers shows several variables related to MSDs complaints, namely age, length of work, years of work, repetitive activity, and freshness (Shobur, Maksuk and Sari, 2019). Risk factors for other MSDs complaints indicated by research conducted on tea picking workers are namely age, years of service, workload, and duration of work (Nurftah, Rini and Ibnu, 2022).

Based on this, when viewed from the stages of the process of making woven bamboo handicrafts, the category of very high complaints was felt by craftsmen working at the woven stage of making bamboo strands which required immediate repair

efforts. Further investigation of the factors that influence the occurrence of MSDs complaints, one of which is the work position where the section on making bamboo strands is included in the high-risk category. Research conducted to reduce musculoskeletal disorders in the broom manufacturing industry by improving work facilities can reduce the work position score from 7 to 4 and 5 (Kurnianingtyas, 2017).

Musculoskeletal Complaints Based on Work Position

Work should be maintained in a neutral body position to provide minimal pressure on the body and keep the joints straight. Maintaining a neutral body position while working can help reduce the risk of MSDs complaints. Neutral body position is a position that keeps the joints in line, thus providing minimal pressure on the body. If the worker's body position is good during work, productivity will be achieved. (Dianat, Hasanpour and Shahravan, 2018).

The results showed that in the work process section with medium-risk or high-risk work position categories, most workers (32 and 15) complained of skeletal muscle disorders on a medium and high scale (15 and 15). As for the working position in the very high-risk category, the craftsmen complained of disorders of the medium and high-scale skeletal muscles. This means that work positions can determine the complaints felt by workers. Craftsmen with working positions in the medium-risk and high-risk categories (lack of ergonomics) do not put too much pressure on body parts, so the craftsmen do not feel too much pain from their work. Meanwhile, craftsmen with a very high-risk (non-ergonomic) working position can put pressure on parts of the body, so that craftsmen feel significant complaints. This is in line with research on fishermen who have a high-risk work position category who feel the most complaints on a high scale (27.8%), while fishermen in a very high-risk work position category feel the most very high complaints (61.1%) (Sumampouw and Joseph, 2022).

The category of high complaints is at the stage of making woven bamboo in the coloring of the bamboo strands. In this section, the craftsmen work while standing and leaning forward. This is done when inserting bamboo strands into the colored water in a boiling pan. The pan is located lower than the craftsmen's body causing the craftsmen to

adjust their body position. Such work process forces the craftsmen to bend to follow the direction of their work. Thus, the position of the upper arm and forearm will follow away from the body's normal line. Likewise, a slightly stretched neck adjusts to work. It is the position that is not ergonomic that causes the craftsmen to feel complaints from the skeletal muscles. This is also reflected in research of Sumampouw and Joseph (2022), showing a relationship between the work position and musculoskeletal complaints in palm sugar farmers in Rumoong Atas Village, Tareran Sub-district. This is because the farmers are still working in an ergonomic position.

In high-risk or very high-risk work positions, craftsmen often experience minor complaints such as muscle pain, stiffness, or tingling. These complaints tend to develop gradually and are often not considered serious by the craftsmen. Sensitivity to pain varies among individuals; some have higher sensitivity, experiencing more intense discomfort than those with lower sensitivity. Age also affects this sensitivity, as individuals get aged, their pain threshold tends to decrease, making them more susceptible to discomfort (Hamdan, 2021). Similar findings were observed in a study on welders, showing a relationship between age and complaints of Musculoskeletal Disorders (MSDs) (Suryanto, Ginanjar and Fathimah, 2020).

Therefore, the statistical test results indicate that there is no relationship between work positions and MSDs complaints among bamboo craftsmen. This aligns with research in the informal sector, demonstrating no significant relationship between work positions or ergonomic occupations and MSDs complaints (Tjahayuningtyas, 2019). This implies that while work positions may affect the physical comfort of craftsmen, there are other contributing factors to Musculoskeletal Disorders (MSDs). There might be other variables beyond work positions or ergonomics significantly influencing the physical complaints experienced by craftsmen. Research conducted on weavers showed several variables related to MSDs complaints, including age, tenure, duration of work, repetitive activities, and fitness levels (Shobur, Maksuk and Sari, 2019). Other risk factors for MSDs complaints were identified in a study involving tea pickers, including age, work tenure, workload, and duration of employment (Nurftah, Rini and Ibnu, 2022).

In the context of bamboo weaving, the research indicates that while high-risk work positions tend

to lead to more complaints, other factors such as individual posture habits, work intensity, or environmental factors also play a role in the physical complaints experienced by craftsmen. When addressing Musculoskeletal Disorders (MSDs), it is crucial to consider various variables that can affect the physical health of workers, not solely limited to work positions or ergonomics

CONCLUSION

The working position of the woven bamboo craftsmen is directly proportional to the complaints they feel. Part of the work process with the category of medium-risk or high-risk work positions, workers complain of musculoskeletal disorders on a moderate and high scale. Whereas for work positions with a very high-risk category, craftsmen complain of moderate and high-scale skeletal muscle disorders.

Intervention is needed to reduce the risk of injury and musculoskeletal complaints felt by workers, especially in workers with very high-risk working positions. Intervention can be done in various ways. In the short term, it can be done through the provision of relaxing physical activities such as stretching done on the sidelines of work breaks. Long-term interventions can be carried out with the design of the workplace to improve body position while working, especially at the stage of making woven bamboo for coloring the bamboo strands.

ACKNOWLEDGEMENTS

This research is supported by many parties. The researchers would like to thank to STIKes Respati Tasikmalaya who always supports all the Tri Dharma activities, owners and weaving craftsmen bamboo crafts in Jayamukti Village, Leuwisari Sub-district.

REFERENCES

- Abdillah, M. A. A. N. (2011) *Perancangan Ulang Tempat Kerja Operator Dengan Pendekatan Ergonomi Partisipatori Untuk Mengurangi Keluhan Muskuloskeletal dan Kelelahan*. Undergraduate Thesis. Yogyakarta: Faculty of Industria Technology Universitas Islam Indonesia.
- Ahmad, N.P., Hidayat, R. and Hamdani, R. (2021) 'Analisis Postur Kerja Dengan Metode Rula Pada Operator Las Di Bengkel Las Sumber Jaya Bekasi, Jawa Barat', *Bulletin of Applied Industrial Engineering Theory*, 2(1).
- Anggraika, P., Apriany, A. and Pujiana, D. (2019) 'Hubungan Posisi Duduk dengan Kejadian Low Back Pain (LBP) pada Pegawai STIKES', *Jurnal Aisyiyah Medika*, 4(1), pp. 1–10.
- BPS Kabupaten Tasikmalaya (2020) Kecamatan Leuwisari dalam Angka 2020. Tasikmalaya: BPS Tasikmalaya.
- BSN (2021) Keputusan Badan Standardisasi Nasional Nomor 509/KEP/BSN/12/2021 Tentang Penetapan SNI 9011:2011 Pengukuran dan Evaluasi Potensi Bahaya Ergonomi di Tempat Kerja, Badan Standardisasi Nasional . Indonesia.
- Centers of Disease Control and Prevention (2020) Work-Related Musculoskeletal Disorders & Ergonomics, Centers of Disease Control and Prevention. Available at: <https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html> (Accessed: 30 November 2021).
- Dianat, I., Hasanpour, M. and Shahravan, A. (2018) 'Work-related Musculoskeletal Disorders among Iranian Dentists: A National Survey', *Journal of Occupational Health*, 60(2), pp. 183–193.
- Evadarianto, N. and Dwiyantri, E. (2017) 'Postur Kerja Dengan Keluhan Musculoskeletal Disorders Pada Pekerja Manual Handling Bagian Rolling Mill', *The Indonesian Journal of Occupational Safety and Health*, 6(1), pp. 97–106.
- Gay, L.R., Mills, G.E., and Airasian, P.W. (2012) *Educational research: competencies for analysis and applications*. 10th edn. Boston: Pearson.
- Hamdan, M. (2021) 'Pengaruh Usia dan Jenis Kelamin pada Skala Nyeri Pasien Trigeminal Neuralgia', *Jurnal Aksona*, 1(2), pp. 53–56.
- Ilman, A., Yuniar, Y. and Helianty, Y. (2013) 'Rancangan perbaikan sistem kerja dengan metode Quick Exposure Check (QEC) di bengkel sepatu X di Cibaduyut', *Reka Integra*, 1(2).
- Kementrian Kesehatan RI (2018) Hasil Utama RISKESDAS 2018. Jakarta.
- Kurnianingtyas, C.D. (2017) 'Perbaikan postur kerja untuk menurunkan gangguan musculoskeletal pada industri kecil kerajinan pembuatan sapu', *Widya Teknik*, 16(2), pp. 111–116.
- Livandy, V. and Setiadi, T.H. (2018) 'Prevalensi gangguan musculoskeletal pada pekerja konfeksi bagian penjahitan di Kecamatan Pademangan Jakarta Utara periode Januari 2016', *Tarumanagara Medical Journal*, 1(1), pp. 183–191.

- Middlesworth (2017) A Step-by-Step Guide Rapid Upper Limb Assessment (RULA), Ergonomics Plus Inc. Available at: <http://www.ergo-plus.com/>.
- Ndari, P.W. and Roesdianto, R. (2018) 'Analisis Postur Kerja dengan Metode Rula dan Redesign Peralatan Kerja untuk Mengurangi Risiko Musculoskeletal Disorder', *Sinteks: Jurnal Teknik*, 7(2), pp. 20–23.
- Nurftah, L., Rini, W.N.E. and Ibnu, I.N. (2022) 'Analisis Faktor Risiko Musculoskeletal Disorder (MSDs) Pada Pekerja Petik Teh di PT X Kayu Aro', *Jambi Medical Journal: Jurnal Kedokteran dan Kesehatan*, 10(2), pp. 172–185.
- Oha, K. et al. (2021) 'Risk Factors for Musculoskeletal Pain and Disability in Working-Age Adults: A Systematic Review', *Scandinavian Journal of Work, Environment & Health*, 47(2), pp. 75–104.
- Pemerintah Indonesia (2018) Peraturan Menteri Ketenagakerjaan Republik Indonesia Nomor 5 Tahun 2018 Tentang Keselamatan Dan Kesehatan Kerja Lingkungan Kerja. Indonesia: Kementerian Ketenagakerjaan Republik Indonesia .
- Prabarukmi, G.S. and Widajati, N. (2020) 'The Correlation of Ergonomic Risk Factor with Musculoskeletal Complaints in Batik Workers Hubungan Faktor Risiko Ergonomi dengan Keluhan Muskuloskeletal pada Pembatik', *The Indonesian Journal Of Occupational Safety and Health*, 9(3), pp. 269–278.
- Pramana, A.N., Kurniawan, B. and Ekawati, E. (2021) 'Analisis Postur Kerja Dengan Menggunakan Metode Rapid Upper Limb Assessment (Rula) pada Pekerja di Laundry X Kota Semarang', *Indonesian Journal of Health Community*, 2(2), pp. 57–66.
- Prayitno, S. and Hanum, B. (2018) 'Analisa Postur Kerja Dengan Metode Rula Pada Operator Proses Masking FR Dan RR D30D Di PT SC Plant 2', *Penelitian dan Aplikasi Sistem dan Teknik Industri*, 12(1), p. 328408.
- Revadi, C.E., Gunawan, C.S. and Rakasiwi, G.J. (2019) 'Prevalensi Dan Faktor-Faktor Penyebab Musculoskeletal Disorders Pada Operator Gudang Industri Ban PT X Tangerang Indonesia', *Jurnal Ergonomi Indonesia*, 5(1), pp. 10–15.
- Shobur, S., Maksuk, M. and Sari, F.I. (2019) 'Faktor Risiko Musculoskeletal Disorders (MSDs) pada Pekerja Tenun Ikat di Kelurahan Tuan Kentang Kota Palembang', *Jurnal Medikes (Media Informasi Kesehatan)*, 6(2), pp. 113–122.
- Sigar, A.J.G., Suoth, L.F. and Rattu, J.A.M. (2019) 'Hubungan Antara Posisi Kerja Duduk Dan Indeks Masa Tubuh Dengan Keluhan Musuloskeletal Pada Karyawan Di Bank Sulutgo Cabang Utama Manado', *KESMAS*, 8(7).
- Sriagustini, I. and Supriyani, T. (2022) 'Assessment of Work Posture on Woven Bamboo Craftsmen', *The Indonesian Journal of Occupational Safety and Health*, 11(2), pp. 295–306.
- Sumampouw, O.J. and Joseph, G. (2022) 'Hubungan Antara Posisi Kerja dan Usia dengan Keluhan Muskuloskeletal pada Nelayan', *Health Care Jurnal Kesehatan*, 11(1), pp. 34–42.
- Suryanto, D., Ginanjar, R. and Fathimah, A. (2020) 'Hubungan Risiko Ergonomi Dengan Keluhan Musculoskeletal Disorders (MSDs) Pada Pekerja Informal Bengkel Las Di Kelurahan Sawangan Baru Dan Kelurahan Pasir Putih Kota Depok Tahun 2019', *Promotor*, 3(1), pp. 41–49.
- Tarwaka (2010) *Ergonomi Industri Dasar-dasar Pengetahuan Ergonomi dan Aplikasi di tempat Kerja*. Solo: Harapan press.
- Tjahayuningtyas, A. (2019) 'Faktor Yang Mempengaruhi Keluhan Musculoskeletal Disorders (MSDs) Pada Pekerja Informal Factors Affecting Musculoskeletal Disorders (MSDs) in Informal Workers', *The Indonesian Journal of Occupational Safety and Health*, 8(1), pp. 1–10.
- WHO (2021) Musculoskeletal conditions, <https://www.who.int/>. Available at: <https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions>.
- Yosineba, T.P., Bahar, E. and Adnindya, M.R. (2020) 'Risiko Ergonomi dan Keluhan Musculoskeletal Disorders (MSDs) pada Pengrajin Tenun di Palembang', *Jurnal Kedokteran dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya*, 7(1), pp. 60–66.