Assessment of Work Posture on Woven Bamboo Craftsmen

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ABSTRACT

Introduction: The industry in Indonesia is still experiencing a rapid development. Woven craft one of the thriving informal sector businesses in Tasikmalaya Regency. Each stage of work on making bamboo woven crafts is done in a way that is not ergonomic, especially in the working position, namely how to sit or squat on the floor with the head and back bent. This condition can cause musculoskeletal disorders. The results of risk analysis showed that the job position that belongs to a high-risk category must be controlled immediately. The aim of this study is to assess the working posture of woven bamboo craftsmen. Methods: This research is descriptive research. The object under study was the 20 stages of production of woven bamboo handicraft products. The variables studied were work positions, including individual characteristics and musculoskeletal complaints. Data were collected through passive participant observation using observation sheets. Work position data analysis was carried out using the RULA assessment table. Results: Work postures at thirteen stages of work were at action level 2, three stages of work were at action level 3, and two stages of work were at action level 4. In general, the craftsmen complained of aches in the waist (28%), hand pain (19%), leg pain (16%), and back pain (12%). Conclusion: Priority control should carried out at the coloring and drying stages because they have an action level 4 that must implement the changes now.

Keywords: bamboo weaving crafts, musculoskeletal disorders, RULA, work posture

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INTRODUCTION

An industrial sector in Indonesia is still experiencing a rapid development. It was recorded that there were 137,91 million labour forces in February 2020 and 74,04 million people (56.50 %) who worked in informal activities. Informal sector businesses are activities of individuals, families or several people who carry out joint business to carry out economic activities based on trust and agreement, and the activities are not legal entities (BPS, 2020).

A woven crafts industry is a home industry that belongs to the informal sector, whose development is growing rapidly in Tasikmalaya Regency. Nearly 90 % of local people of Tasikmalaya Regency are engaged in woven crafts. There are at least three types of materials used for ingredients of superior craft products. The materials used are bamboo, mendong, and pandanus. Leuwisari District is a centre for woven bamboo handicrafts. There were 20 small and medium industries engaged in the woven bamboo sector in 2019. In general, people there make a living as bamboo craftsmen, but there are at least about 430 craftsmen who are still loyal to woven bamboo (BPS Kabupaten Tasikmalaya, 2020).

Compared to other materials, bamboo itself is a potential hazard that can cause accidents. Bamboo has very sharp edges. If craftsmen are not careful, they run the risk of being slashed by the bamboo-part. In addition, there are other sources of danger that come from the position of the craftsmen. Almost every stage is conducted by sitting or squatting on the floor with the head and back bent. The position is carried out for a long time, and several tasks are carried out repeatedly (Prabawati, 2016; Sriagustini and Supriyani, 2021). Awkward positions for a long time and repetitive work are risk factors for work-related musculoskeletal disorders (Lop *et al.*, 2019).

Musculoskeletal conditions are a major contributor to disability worldwide, with low back pain being the leading cause of disability in 160 countries. Musculoskeletal conditions are usually characterized by pain (often persistent) and limitations in mobility, dexterity and overall level of functioning, reducing the person's ability to work. Therefore, musculoskeletal disorders (MSDs)

Cite this as: 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.

 doi:10.20473/ijosh.v11i2.2022.295-306
Received September 17, 2021, received in revised form November 10, 2021, Accepted March 10, 2022, Published: August 2022

are also the major contributor to years living with disabilities (YLDs) worldwide with approximately 149 million YLDs, accounting for 17% of all YLDs worldwide (World Health Organization, 2021).

There are no reports on the prevalence of MSDs among woven bamboo craftsmen. However, the incidence of musculoskeletal disorders is an unavoidable problem in the informal sector. Production activities in the informal sector generally still use human labour as a production machine, so the possibility of an awkward position while working is always there. This condition is shown in Ramdhani's (2018) research, where craftsmen who worked in the position of sitting on the floor experienced pain in the neck, back, and waist. The assessment of body posture was at level 6. This means that the posture needs an investigation of changes that must be carried out immediately. Restuputri (2019) also showed several uncomfortable positions for batik workers who carried out work in a sitting position. 100% of workers complained of pain in the upper neck and back pain, 87.5% complained of pain in the upper left arm and back, and 75% of workers complained of pain in the lower neck, left shoulder, right shoulder, right upper arm, and the upper hand.

Research by Mallapiang *et al.* (2019) on brick craftsmen doing their job by bending and standing showed the same problem. The results of the assessment showed a high level of risk in both positions, so further action is needed. This position causes craftsmen to complain of pain in the back. These complaints may also be felt by woven bamboo craftsmen. The risk analysis explained that the awkward position at each stage of making woven bamboo is included in the high-risk category. Thus, it must be controlled immediately. Changing work positions is a control measure that can be taken (Sriagustini and Supriyani, 2021). Ergonomic risk assessment is also needed to ensure proper work position changes so that it can be seen which part of the work position is most at risk. Therefore, the purpose of this study is to assess the working posture of craftsmen at all stages of making woven bamboo crafts.

METHODS

The type of research used is descriptive research. The research subjects were all craftsmen who worked at every stage of making woven bamboo crafts. The objects under study were the 20 stages of production of woven bamboo handicraft products. Serumpun Bamboo Small and Medium Enterprises (SMEs) had 6 permanent craftsmen to complete 20 stages of making woven bamboo crafts.

The variables observed were individual characteristics, including age, gender, education, nutritional status, length of work, work position, length of the work process, and subjective musculoskeletal complaints. The variable assessed was work position.

Work position data were collected through passive participant observation, where the researchers came to the place where the craftsmen were doing their work but were not involved in the activity. The researchers only recorded what was seen during the craftsmen's work using an observation sheet containing observation guidelines. Individual characteristic data were collected through questionnaires distributed to workers to fill out.

Work position data were processed by determining the posture value of the craftsmen when doing work at all stages of the bamboo woven craft activity by completing the Rapid Upper Limb Assessment (RULA) table. The data were then analysed by determining the grand RULA score compared to the level of action as described in Table 1 (Middlesworth, 2017), so that the level of work position risks could be identified. Meanwhile, the data on individual characteristics data were processed by calculating the frequency and percentage of answers of each respondent.

The research was conducted in August 2021 at a bamboo craft business in Jayamukti Village, Leuwisari District, Tasikmalaya Regency. This research has received an ethics certificate from the Health Research Ethics Committee BTH STIKes Tasikmalaya, with certificate number 117/kepk-bth/V/2021.

Table 1. Grand Score RULA

Action level	Score	Explanation
1	1-2	Negligible risk, no action required
2	3-4	Low risk, change may be needed
3	5-6	Medium risk, further investigation, change soon
4	> 7	Very high risk, implement change now

RESULTS

The stages of making woven bamboo crafts are generally divided into two stages, namely the stage of making woven materials and the stage of making woven bamboo crafts. The manufacturing stage will be different depending on the products. The difference will appear especially in the preparation of additional materials and product assembly.

This study observed the working process of making woven bamboo with the final product in the form of parcel holders. There are 20 stages with different working positions involved in producing woven parcel holders. The work process includes the stages of making woven bamboo consisting of cutting bamboo, splitting bamboo, making bamboo strands, coloring and weaving. The stage of making woven bamboo handicraft products consists of three processes, namely the preparation of additional materials, assembly of the products, and finishing.

The process of making additional materials consists of making wengku, jarugjug, jangka, and handle. Menawhile, the stages of assembling the products consist of making the ebeg pattern, installing the lower wengku, installing the jarugjug, weaving the jarugjug, installing the upper wengku, installing the jangka, and installing the handle. The finishing stage consists of ngarerab, gluing, drying, and polishing.

wTable 2. Characteristics of Craftsmen

Variable	Frequency
Age (years old) (n =5)	51.17 + 6.47
Youngest	32
Oldest	71
Gender (n =5)	
Man	3 (50 %)
Woman	3 (50 %)
Boby MAss Index (n=5)	
Normal	5(83.33 %)
Overweight	1 (16.67 %)
Length of work (years) (n =5)	13.67 + 3.67
Shortest	5
Longest	25
Position of work (n =20)	
Standing	2
Sitting	14 (67.08 %)
Sitting in squatting	4
Length of work process (n =20)	2.5 + 0.26
Shortest	1
Longest	6

Individual Characteristics

A craftsman does not only do one stage of work, but one craftsman can do 1-4 stages of work at once. Therefore, Serumpun Bamboo SMEs had 6 permanent craftsmen to complete the 20 stages of making woven bamboo crafts. The craftsmen had the characteristics as shown in Table 2 as follows:

Based on Table 2, the average age of craftsmen was 51 + 6.47 years old with an age range of 32 years old to 71 years old, the gender of craftsmen consisted of males (50%) and females (50%), Craftsmen also had normal nutritional status (83.33%), and had worked on average of 13 + 3.67 years with a range of 5 years to 25 years. In addition, craftsmen did a lot of work in a sitting position (67.08%) for an average of 2.5+ 0.26 hours with a range of 1-6 hours.

Risk Assessment of Work Position

The results of the analysis of work posture using the RULA method at each stage of the process of making woven bamboo crafts can be seen in Table 2. Based on Table 2, it can be seen that 13 stages of work had action level 2, which was a low risk, and change may be needed. 2 stages of activity were at action level 4, which was very high risk and thus the implementation of change must be conducted now. The work stages under the observation were the drying stage and coloring stage.

Figure 1. Making Handle

Each work section had different action levels, starting from level 2 to level 4. The results of the positioning analysis of the job sections can be seen in figure 1-4. RULA's grand score with action level 2 was detected at the stage of splitting bamboo, making bamboo strands, making wengku, making jarugjug, making jangka, making handles, installing the lower wengku, installing the jarugjug, weaving the jarugjug, installing wengku above, installing handles, ngarerab and gluing.

Table 3. Work Position Risk Assessment Results Using the RULA Method

Stage	Work Section	RULA Score	Action level
Making Woven Materials	Cutting bamboo	5	3
	Splitting bamboo	3	2
	Making bamboo strands	3	2
	Coloring	7	4
	Weaving	6	3
Making Woven Bamboo Crafts	Additional Materials Consist		
	Making wengku	4	2
	Making jarugjug	4	2
	Making jangka	4	2
	Making handle	4	2
Bamboo Crafts	Assembling the product		
	Making the ebeg pattern	6	3
	Installing the lower wengku	3	2
	Installing the jarugjug	4	2
	Weaving the jarugjug	3	2
	Installing the upper wengku	3	2
	Installing the Jangka	5	3
	Installing the handle	4	2
	Finishing		
	Ngarerab	3	2
	Gluing	3	2
	Drying	7	4
	Polishing.	6	3

Figure 1 shows work positions that produce a grand score RULA at level 2. The figure shows the body position at the stage of making the handle in which the position of the upper arm is flexion at 12^0 and acts on the midline of the body. The lower arm is flexion at 85^0 and works on the midline of the body. The wrist position is at an extension at 120 and works on the centreline of the hand. The wrist twist is on the centreline. The neck is in flexion at 20^0 and is slightly bent to the right. The back is at 0^0 and works in the midline of the body. This working process allows more than four movements in 1 minute and loads <2kg.

Figure 2 shows one of the work positions that resulted in a grand score of RULA at action level 3. Apart from the weaving stage, this work position was also identified in the work section of cutting bamboo, making the ebeg patterns, installing jangka, and polishing. The process of weaving bamboo shows that the position of the upper arm is flexion at 62^0 and acts on the midline of the body. The lower arm is flexion at 48^0 and works on the midline of the body. The wrist position is flexion at 13^0 and working on the centreline of the hand. The wrist twist is on the centreline. The neck is in extension at 20^0 and works in the midline of the body. The back is flexion at 47^0 and works in the midline of the body. This working process allows more than four movements in 1 minute and loads <2kg.

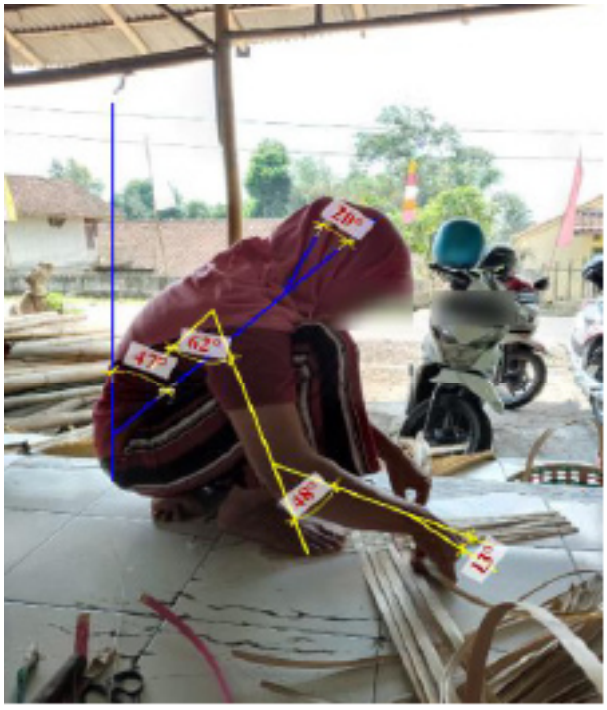

Figure 2. Weaving

Figure 3 shows one of the work positions that resulted in a grand score of RULA at action level 4. The process of coloring shows that the position of the upper arm is flexion at 90^0 and acts on the midline of the body. The lower arm is flexion at 90^0 and works on the midline of the body. The wrist position is flexion at 44^0 and works on the centreline of the hand. The wrist twist is on the centreline. The neck is in extension at 37^0 and works in the midline of the body. The back is flexion at 90^0 and works in the midline of the body. This working process allows more than four movements in 1 minute and loads <2kg.

Figure 4 shows one of the work positions that resulted in a grand score of RULA at action level 4. The position of the upper arm in this process is flexion at 111^0 and acts on the midline of the body. The lower arm is flexion at 36^0 and works on the midline of the body. The wrist position is at extension at 12^0 and works on the centreline of the hand. The wrist twist is on the centreline. The neck is in extension at 21^0 and works in the midline of the body. The back is at 0^0 and works in the midline of the body. This working process allows more than four movements in 1 minute and loads <2kg.

Musculoskeletal Complaints

The results of the questionnaires filled out by craftsmen about any complaints they felt during the making process of bamboo woven crafts can be seen in Figure 5. Based on Figure 5, it was found that most craftsmen complained aches in the waist (28%), followed by pain in the hands (19%), leg pain (16%), and back pain (12%).

Figure 3. Coloring

Figure 4. Drying

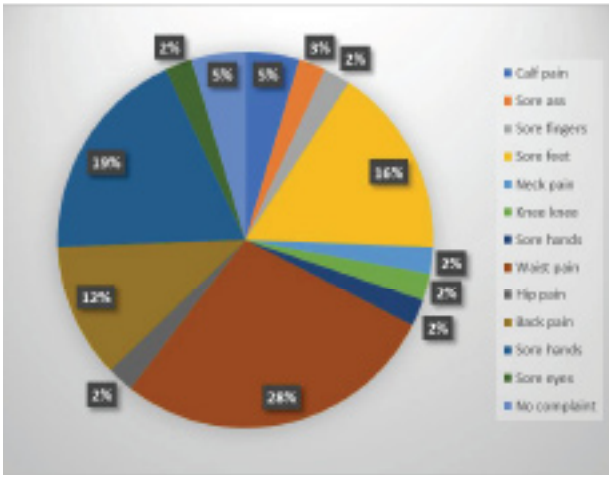

Figure 5. Musculoskeletal Complaints

DISCUSSION

Individual Characteristics

Occupational health efforts are activities carried out to harmonize capacity, workload, and work environment. The goal is that workers can work healthily without endangering themselves or the

surrounding community, so as to create optimal work productivity (Laws of the republic Indonesia, 2009). The work capacity includes age, gender, education, skills, nutritional status, and others. Excellent work capacity is needed so that a worker can do his job well. Supported by an appropriate workload and a safe and healthy work environment, workers can achieve high job performance (Suma'mur, 2019).

Age can affect a person's mental and physical strength. A person has optimal physical strength at a certain age, but it will decrease with age. At the age of 35 years old and over, the maximum oxygen capacity in the body will decrease gradually. At the age of 50-60 years old, the muscle ability will decrease, especially in the body's physical ability to do work (Mukaromah, 2019).

Bamboo woven craftsmen in this study had an average age of 51 + 6.47 years old with an age range of 32 years old to 71 years old. It is no longer at the peak of human muscle strength, which is at the age of 25-35 years for men and women. If a craftsman does work in an unnatural position, he will be very vulnerable to skeletal muscle complaints. Several studies have found that age is an important factor in the incidence of musculoskeletal disorders. One of the studies conducted by Mukaromah (2019) proved that the age of employees in the formal sector of PT Bumi Suksesindo was significantly related to the incidence of Musculoskeletal Disorders (MSDs).

Bamboo woven craftsmen in this study consisted of both males (50%) and females (50%). There are some conditions of work where men are physically stronger than women to do the work. The strength of a woman's muscles is only about 2/3 of a man's strength, so the endurance of men's muscles is higher than that of women. Women's muscle strength is approximately only 60% of men's muscle strength, especially for arm, back, and leg muscles (Tarwaka and Sudiajeng, 2015).

Good nutritional status can also affect the work performance of craftsmen. The observations conducted on artisans showed that they had a normal nutritional status (83.33%). Nutritional status is one of the determinants of human resources and quality of life, and it is determined by food consumption and utilization of nutrients in the body. When the body receives adequate amounts of nutrients which are used properly, the body will achieve an optimal nutritional status that supports high levels of physical growth, brain development, work capacity, and general health (Suma'mur, 2019).

The craftsmen had worked in the Serumpun Bambu SMEs for an average of 13 + 3.67 years with a range of 5 years to 25 years. The average length of time to complete one stage of work was between 2.5 + 0.26 hours with a range of 1-6 hours a day. Length of work is the time calculated from the first time at work and usually occurs because of an employment relationship. A long period of job can provide a worker with work experience, knowledge, and skills in a field of work. Thus, the longer a worker works, the more skilled he will be in doing his job. However, some occupational diseases are affected by working time. Occupational diseases can occur after long exposure to potential hazards in the workplace. Exposure to unreasonable work positions carried out during the working period can also cause pain in skeletal muscles, which eventually will cause musculoskeletal disorders (Tarwaka and Sudiajeng, 2015; Suma'mur, 2019).

Craftsmen do a lot of work in a sitting position (67.08%) in their work stages. The sitting position has the advantage of the absence of loading in the legs and also the reduced use of energy for blood circulation so that fatigue and subjective complaints can be reduced. However, the sitting position can cause abdominal muscles to weaken, and the spine will be at risk of curving so workers can get fatigue quickly.

Risk Assessment of Work Position

Ergonomic hazard factors come from the ways of working, work position, and body posture that are not appropriate when workers are doing their work (Ministry of Manpower of the Republic of Indonesia, 2018). Excessive muscle stretching, repetitive activities, unnatural work postures, and other risks will cause complaints to the muscle structure. Most of the work in the making of woven bamboo crafts is done in a sitting position and uses the upper body. Work-related musculoskeletal disorders affecting the lower extremities are less common than those involving the back, neck, and upper extremities. Head and trunk posture that frequently bends and upper arms, lower arms, and wrist movements that flex or extend from the base of the midsection are adaptations to jobs that require these postures. If left unchecked, these conditions will cause musculoskeletal complaints (Vieira and Kumar, 2016). Research of Meksawi, Tangtrakulwanich and Chongsuvivatwong (2012) stated that ergonomic risk factors (non-neutral position) can increase

complaints of low back pain. This study showed that 52.9% of rubber tappers had complaints of low back pain. It is significantly related to the working position of the rubber tappers. They do their job by high frequencies of twisting, bending, and extension of the trunk.

Ergonomics risks occur during the process of making woven bamboo crafts due to awkward positions and repetitive activities. The body functions best when it is in its neutral posture which is around the middle range of motion of joints for most of the body parts. Meanwhile, awkward posture refers to a body position that deviates significantly from a neutral position when performing work activities. When you are in an awkward position, the muscles work less efficiently and you expand more power to complete the task. Regarding this, repetition can be defined as a cyclical/repetitive work activity that involves repetitive movements in certain body parts. Repetition refers to a task or series of movements performed repeatedly with slight variations over some time (OSHA Academy, 2020). Singh's (2021) research stated that various musculoskeletal disorders in cleaning work are tendonitis, Carpal Tunnel Syndrome, thoracic outlet syndrome, tingling in fingers, etc. Disturbance also occurs due to repetitive movements of body parts and awkward posture when performing cleaning activities.

Awkward postures and repetitive work often occur in several fields of business that use human labour as a production machine. Potential hazards of ergonomics are identified in the convection business. The forms of risk are repetitive activities, awkward work postures, and manual handling (Wati, 2020). The ergonomic potential is also identified in the metal craft business. A total of 15 (32.6%) hazards out of 48 hazards were classified as ergonomic hazards (Widowati and Rahayu, 2018). The same danger is also found in gamelan making. A total of 12 (30.0%) hazards out of 40 hazards were classified as ergonomic hazards. Weight lifting; improper working positions such as twisting the body sideways, lowering the head, sitting for a long time, bending knees , and having static work attitude in the long term; and forging done repeatedly are included as ergonomic risks (Fadhilah, 2020).

Repetitive activities and awkward positions related to musculoskeletal complaints in a workplace can also be seen from the results of observations on stone-crushing work. It was found that there was a relationship between repetitive movements and Carpal Tunnel Syndrome. 40 respondents (62.5%) of 58 respondents who performed repetitive movements > 30 times per minute were positive for Carpal Tunnel Syndrome. Likewise, there was also a relationship between awkward hand postures and Carpal Tunnel Syndrome in stone crusher workers as 41 workers (64.1%) of 60 respondents who performed awkward hand postures were positive for Carpal Tunnel Syndrome (Sekarsari and Farzan, 2017).

Carpal Tunnel Syndrome is compression of the median nerve in the wrist, which can cause numbness, tingling, weakness, or muscle atrophy in the hand and fingers. Carpal Tunnel Syndrome is a common musculoskeletal disorder that targets wrists and causes pain in the hands. It mainly affects those who use their hands in repetitive activities (CDC, 2017).

The results of the ergonomic risk analysis using the RULA method at each stage of the process of making woven bamboo crafts produced two working sections that had an action level of 4. The work sections were the coloring and drying stages. A RULA score with action level 4 is a dangerous work position and requires immediate repair (on the spot). RULA is an ergonomic risk assessment method using body posture targets to estimate the occurrence of musculoskeletal disorders, especially in the upper extremities (Middlesworth, 2017). The back of the craftsmen in the coloring stage forms an angle of 90^0 to cover the workplace which is lower than the position of the craftsmen's body. Similarly, the upper arm must move away from the midline of the body to reach it. The neck position also determines the value generated in the analysis. The neck of the craftsmen at the time of coloring adjusts to the position of the back.

This working position are the same as the working position in the process of changing car oil done by a mechanic. In changing car oil, the mechanic must carry oil that is located far below his body. The mechanic must be right behind the back to reach the surface so that it forms a 90^0. The upper arm is away from the centreline because it has to take the car's oil. This work position produces a RULA value of 6 and is classified as an action level 4. This means that posture when changing car oil is dangerous and requires immediate action in order to change work patterns (Hudaningsih, Rahman and Jumari, 2021). The workers in the leather cutting department also suffer from the same conditions. The workers must bend their back to adjust to the

cutting table. The angle formed by the back is 40^0. The upper arm also moves away from the centre of the body to adjust the back. This position results in the final score of RULA 7 and is classified as an action level 4. This indicates that workers in leather cutting are at risk of experiencing musculoskeletal complaints so that immediate corrective action is needed (Oesman, Irawan and Wisnubroto, 2019).

Another work position that assesses RULA at the most dangerous level of risk or action level 4 is the drying section. On this part, the upper arms go upward to reach the drying place for handicraft products, which are located much higher than the craftsmen's body. It causes the neck to be in an extended position. Changes in work patterns may be needed to prevent musculoskeletal complaints. This work position is almost the same as the position of milling machine operators. The operators raise the hand to operate the milling machine whose valve is higher than the body position. However, the RULA score for that position is 5 and is classified as action level 3. There is a difference in the value of the action level with the drying stage in making woven bamboo. This is because the angle of pressing formed by the hand is more than 100^0 without a lift on the shoulder (Susihono, 2016).

The RULA score for action level 3 or the medium risk category requires an immediate change in work patterns. The weaving part is one of the stages of work that falls into this category. e Craftsmen perform this work by sitting in a squat position with back and neck bent. The woven material on the floor causes the back and neck to be slightly bent. This position is almost the same as the position of welding with a sitting position. The back and neck of the workers are also slightly bent to adjust to the work material placed on the floor. The resulting RULA value is 5 and is classified as an action level 3. The changes and improvements to work patterns are carried out immediately (Akshinta and Susanty, 2017).

The RULA value in the action level 2 category also requires a change in work patterns but is not to levels 3 and 4. One of the parts of work that is in a low-risk category is making a handle. Craftsmen do the work of making this handle while sitting on a chair with a backrest so that it supports upright in a natural position even though the neck is still bent because the work material is not parallel to the direction of vision. The upper arms are not too far away from the straight-line position of the body, although they are slightly crossed into the body line. The RULA score of making a handle is the same as the RULA's score in the work of the Pertamina-Medco JOB operator. The operators work while sitting in a chair with good back support. This position produces a RULA score in the action level 2, which means the operators must change their sitting position immediately (Malik, Alwi and Wolok, 2021).

The RULA score obtained for each stage at the manufacture of woven bamboo crafts will provide an overview of ergonomic risks. Each action level indicates the action that must be taken to prevent the occurrence of musculoskeletal complaints. Excessive muscle stretching, repetitive activities, unnatural work posture, other secondary factors, and combined causes are several factors that cause musculoskeletal complaints (CDC, 2017). Posture is defined as the position of various parts of the body. Awkward postures occur when muscles, tendons, and ligaments can be stressed and under strain in this posture. This work posture or position is considered as one of the occupational risk factors that most often causes musculoskeletal complaints or MSDs (Jaffar and Rahman, 2017).

Musculoskeletal complaints with work posture have a significant relationship. The moderate risk of work posture causes the medium-risk of musculoskeletal complaints. The high-risk work positions may experience higher musculoskeletal complaints. The observation on home industry workers in Surabaya showed that 55% of respondents had a work position with moderate risk. 55% of respondents showed complaints of high category MSDs. Musculoskeletal complaints with work posture had a correlation value of 0.394, which means is the relationship was significant (Permatasari and Widajati, 2018). The same thing happens to batik makers. The working attitude of batik makers in a sitting position had a value in the high-risk category (44.2%). Moreover, 41% of respondents showed musculoskeletal complaints in the high-risk category (Prabarukmi and Widajati, 2020).

The Dimensions and Visual Inspection section had a medium level of risk because it is slightly bent ($> 20^o$), a slightly lowered neck, upper hand movements that form $>45^o$, and activities that are carried out repeatedly for a certain time. If left continuously, the operators will be likely to experience musculoskeletal disorders. Improving work patterns by ensuring that the back is not excessive and other body parts are not far from the

midline is a control effort that can be applied. This suggestion for improvement for Dimensional and Visual Inspection activities is to change the position of the back to a range of 0º - 20º and the position of the upper arm to a range of 10º-20º (Novianti, and Tanjung, 2016).

Working in a neutral position is indeed an ergonomic principle that can be applied to avoid musculoskeletal complaints. Neutral posture is posture in which the body is aligned and balanced when sitting or standing, placing minimal stress on the body and maintaining a balance. When the final RULA score shows a level 4 action, then the correction of the working position must be carried out immediately. The change in work position aims to reduce the RULA score so that the witness level is classified as low risk. RULA measures the upper body consisting of the upper arm, forearm, and hand. Also, it measures the position of the back and neck (Middlesworth, 2017). Therefore, reducing the angle formed by the body part when working will be a solution so that the object is in a neutral posture.

Musculoskeletal Complaints

Craftsmen's health and safety at work is not compromised. Complaints of pain in the skeletal muscles are an indication of health and safety problems for workers. Complaints of skeletal muscles can be divided into temporary and persistent complaints. Temporary complaints are muscle complaints that occur when the muscles receive a static load, but for the sake of interest, these complaints will immediately disappear if the loading is stopped. Meanwhile, persistent complaints are complaints of muscles that continue even though the workload has been stopped, but the pain in the muscles continues. Work position is one of the risk factors that cause skeletal muscle disorders (Tarwaka and Sudiajeng, 2015).

The most common complaint was a pain in the waist (28%). The waist is the part of the body that lies between the hips and the stomach. Back pain due to work will occur if the position of the body while working is not normal. For example, the work is done in a bent position, squatting or sitting on the floor, and an unnatural body position (Tarwaka and Sudiajeng, 2015). The stages of woven bamboo crafts are mostly done in a sitting position (67.08), either sitting on the floor or sitting in squatting accompanied by a bent body condition for about 1-6 hours for one stage of work. Based on research by Refresitaningrum and Paskarini (2018), the most common dentist job positions were sitting with complaints on the waist, back, neck and wrists. In addition, it was found that there was a strong relationship between the dentists' work position and complaints of low back pain.

The next complaints felt by craftsmen were aches on the hands (19%), wrists, and fingers. Aches or pain on hand is caused byimproper hand position during work. From the position of work that has been observed, there were the positions of the hands of craftsmen who worked in the condition of flexion and extension for some time. Craftsmen use their fingers repeatedly to perform several stages of work such as weaning and installing jarugjug. This result is in line with research conducted by Farahdhiya, Jayanti and Ekawati (2020), which explained that there were irregularities in the position of the hands in the form of misaligned shoulder position and the radial position on the left wrist accompanied by repetitive movements for more than 10 seconds. This causes complaints of pain in the parts of the body around the hands, although there is no relationship between the position of the hand and Carpal Tunnel Syndrome.

In addition to hands, the craftsmen also complained of pain in the feet (16%). Craftsmen call more specifically pain in the calves and knees. The standing work position has conditions related to the position of the feet while working. All bodyweight while standing is concentrated on the feet. Pain in the legs is the result of blood clots in the veins because blood flow is associated with gravity, which causes leg discomfort. There are two stages of making woven bamboo crafts which are carried out in a standing position, namely the coloring and drying stages. The work position of the craftsmen at both stages indicates a risk category with level 4 actions that require immediate correction. Based on research by Anggrianti, Kurniawan and Widjasena (2017), the welding mechanic activity of the PT X section was carried out in a standing working position and workers complained of leg pain. Thus, it can be said that there is a significant relationship between standing work position and complaints of leg pain.

Craftsmen in this study also felt sore in the back (12%). This complaint can be felt when the craftsmen are working in a sitting or standing position. Research conducted by Susanti and Kuntowato (2015) showed that there was a relationship between long standing and complaints of myogenic low back pain on cashiers at the

Goro Assalaam shopping center, with the most pain complaints in the less pain category (60%). Craftsmen, on the other hand, perform stages of work between 1-6 hours a day. The category of pain felt by craftsmen during the manufacturing process is not known for certain. Lestaru's research in 2019 showed that the sitting position on the floor of the work carried out by leather manding craftsmen was significantly associated with complaints of low back pain.

CONCLUSION

The craftsmen's work posture in this study was at the level of action 2-4, varying from changes in work positions that may be needed to changes in work positions that must be done now. The working position of the craftsmen at the coloring and drying stages needs to be corrected immediately. Changing the working position from a large angle to a smaller angle is the right thing to do.

Craftsmen in this study felt subjective complaints on the waist, legs, and back. Further research is therefore needed, especially in terms of skeletal muscle complaints and analytical research methods to answer occupational exposures that interfere with skeletal muscles among woven bamboo craftsmen.

ACKNOWLEDGEMENTS

This research is supported by many parties. The researchers would like to thank the Ministry of Research and Technology/National Research and Innovation Agency for the opportunity to get research grants. We would also extend our gratitude to STIKes Respati Tasikmalaya which always supports all Tridharma activities, and the owners and weaving craftsmen of bamboo crafts in Jayamukti Village, Leuwisari District.

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