

OVERVIEW OF MUSCULOSKLETETAL DISORDER IN ROOF FACTORY WORKERS IN PEJATEN VILLAGE, KEDIRI DISTRICT, TABANAN REGENCY IN 2016

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Abstract: The purpose of this study was to determine the overview of musculoskeletal complaints in several body parts on the roof factory workers in Pejaten village, Kediri district, Tabanan regency. This research was a descriptive cross-sectional study with sample gathering method using cluster design. The subjects were male and female roof workers with a lifespan of 20-60 years who already worked in the roof factory at least 1 year. Total subjects counted in this study were 52 peoples. To record musculoskeletal disorder in several body parts this study using *Nordic Body Map* questionnaire. The result showed that the prevalence of musculoskeletal complaints among roof factory workers was 100%. Musculoskeletal disorder were complaint among roof workers in several body parts such upper neck, lower neck, shoulder, upper arms, back, upper waist, lower back, buttocks, elbow, forearms, wrist, hand, thigh, knee, calf, ankle, and legs. The five most body parts with musculoskeletal complaint is lower back, upper back, back, shoulder, and ankle

Keywords: Roof workers, musculoskeletal disorder, *Nordic Body Map*.

I. INTRODUCTION

Many companies or small-scale home industries pay less attention to ergonomics at work. Not only by workers, but also by business owners themselves. Not surprisingly, many reports of complaints arising from the musculoskeletal section occur in workers. The term Musculoskeletal Complaints refers to a health problem that occurs in the locomotor consisting of muscles, tendons, bones, cartilage, ligaments and nerves. Musculoskeletal complaints include the entire scale of the disease from mild to severe ¹.

This complaint was obtained because of the main factors such as excessive stretching of muscles, repetition of activities continuously, as well as unnatural work positions. In addition to these factors there are also secondary factors such as putting pressure on work attitude that is done repeatedly, vibration with high frequency, exposure to temperature, or various other combination factors. These risk factors, if kept stacked on a small to severe scale, will cause an injury that is felt such as pain, pain, and aches felt by members of the body ⁷.

Musculoskeletal complaints as a result of risks at work are one of the risk factors causing illness and death globally. WHO 2009 data on risk factors for morbidity and death globally put risks in employment in 13th place. Musculoskeletal complaints, ie back pain of 37%, are one cause of work risk. This complaint is caused by an incorrect body position and excessive transport load ¹.

The making of clay-based roof tiles in Pejaten village, Kediri sub-district, Tabanan district is an effort that has been carried out from generation to generation by the community. In addition to tile, there are also other clay products such as tile, ceramics and earthenware. The majority of residents who live in the village of Pejaten also involved in the tile processing industry. The number of tile factories in the village of Pejaten as a whole amounted to 884 factories spread

over 8 hamlets. The entire tile industry in the village of Pejaten still uses manual material handling with human labour. At work, workers have great potential to complain of pain in the musculoskeletal section. This of course affects the ability of workers to do their jobs. The increase in musculoskeletal complaints that occur to workers as a result of lifting and transferring activities will have a negative impact on the company because it can reduce work productivity. With such facts it is necessary to study a prevalence of musculoskeletal complaints experienced by tile workers.

II. MATERIAL AND METHODS

A. Subject

This research is a cross-sectional descriptive study with a purposive sampling sample collection method, because there are 884 home tile factories spread across 8 hamlets so the research subjects are taken from several tile factories from each Hamlet until the number of research subjects is fulfilled. The total number of research subjects chosen was 52 people whose selection uses inclusion criteria and is spread in 8 hamlets namely Hamlet, Pamesan Hamlet, Pangkung Hamlet, Simpangan Hamlet, Badung Hamlet, Dalem Hamlet, Baleran Hamlet, and Pejaten Hamlet. To see the characteristics of the research subjects, data on age, education, Body Mass Index (BMI), length of work, length of service, and position at work are sought. Before starting the research, the research subjects are invited to fill in the consent form first as a sign of the willingness of tile workers to participate in the research. In the study, the prevalence of musculoskeletal pain complaints among tile workers was 100%.

The age variable used in this study refers to the age division standard set by WHO which divides it into two categories, namely the young age category (under 50 years old) and the old age category (age over 50 years or 50 years equivalent). The proportion of young age is more dominant with a proportion of 67.3% and the rest is old age with a proportion of 32.7%. Women and men aged 15-64 years are in the productive age group. At the age of 25-35 years is the peak period of the highest muscle strength and when the age has entered the age of 50-60 years only 75-85% of the strength that can be achieved by the muscles. Male tile workers were the largest at 71.2% while women at 28.8%. At the highest level of education, tile workers came from elementary and junior high schools at 51.9%, followed by no education at 32.7%, and at the last high and D3 levels at 15.4%. The tenure variable is divided into two, namely tenure more than 10 years and tenure less than 10 years. The highest proportion is a work period of more than 10 years at 53.8% and a work period of less than 10 years at 46.1%¹.

Body Mass Index (BMI) has been believed for a long time as an indicator to measure fat content and has been widely used in daily life because it has advantages such as low cost and easy to do. In one study it was mentioned that BMI has a correlation with direct body fat measurements such as underwater weighing and dual energy x-ray absorptiometry. To find the Variable Body Mass Index is done by calculating body weight (in units of kilograms) divided by height squared (in meters). The classification issued by the CDC in 1998 categorized a BMI below 18.5 into the thin category, a BMI above 23 overweight or overweight categories, and a BMI above 25 as an obesity category. The BMI variable used in this study classified normal BMI into two categories: BMI in the thin and normal categories and BMI in the overweight category covering BMI in excess weight and BMI in the obesity category. Research subjects who had a normal BMI of 76.9% and the remaining 23.1% classified as overweight BMI. BMI excess weight in some tile workers will make it easier for workers to experience musculoskeletal complaints in the form of pain in the knees and ankles, this is caused by the ideal ratio between weight and height to the body's supporting ability⁸.

Variable length of work refers to the literature which suggests that the maximum length of service per day is 8 hours. On observation in the field the majority of tile workers as much as 80.8% work more than 8 hours per day. This fact is not in accordance with the recommendations found in the literature. Seeing such less ergonomic conditions, tile workers will have the opportunity to receive musculoskeletal complaints. To minimize the occurrence of musculoskeletal complaints, a literature review recommends that workers be given a time allocation of 15% of the total work time with 15 minutes of rest time. It is still lacking to restore muscle exhaustion that reaches 90% so that the rest period can be longer than 30 minutes².

Work position variables are divided according to the results obtained at the time of observation in the field. The variable consists of 2 work positions, they are squatting and standing. At the time of the study, 76.9% of standing work positions were obtained, representing the highest proportion of work and squatting work positions of 23.1%. Roof tile workers work in a standing position during the process of filtering clay which will then be processed into a dough, the process of stirring the clay into tile dough, the process of molding the tile into the roof tile, the process of drying the roof, and the process of burning the tile in the furnace. Squatting position can only be found during the tile drying process.

III. RESULT AND DISCUSSION

Subject characteristics are research data which include age, sex, BMI, education level, length of service, length of work, and work position. In table 1 below, you can see the description of the characteristics of the subject.

Table 1: Sample Characteristics

| Variable | f | Percentage (%) |
|--|----|----------------|
| Age | | |
| Young age (<50 years) | 35 | 67,3 |
| Old age (>50 years) | 17 | 32,7 |
| Sex | | |
| Male | 17 | 71,2 |
| Female | 15 | 28,2 |
| Body Mass Index (BMI) | | |
| Normal (18.5-<24,9%) | 40 | 76,9 |
| Overweight (>25,0->27,0) | 12 | 23,1 |
| Level of education | | |
| Non educated | 17 | 32,7 |
| Middle Education (Elementary School, Junior High School) | 27 | 51,9 |
| Higher Education (High School, Diploma) | 8 | 15,4 |
| Years of service | | |
| <10 years | 24 | 46,1 |
| > 10 years | 28 | 53,8 |
| Work Duration | | |
| < 8 hours | 28 | 9,61 |
| > 8 hours | 5 | 80,8 |
| Work Position | | |
| Squat | 12 | 23,1 |
| Standing | 40 | 76,9 |

Musculoskeletal complaints were obtained using the Nordic Body Map questionnaire. At the time of the study tile workers were asked to name the diseased body part in accordance with the mapping of body parts consisting of 27 parts. In table 2 below, the following is a description of the musculoskeletal features on 27 body parts felt by tile workers.

Table 2: Description of Musculoskeletal Complaints

| Painful / Stiff Body Parts | f | Percentage (%) |
|----------------------------|----|----------------|
| Upper Neck | 19 | 36,5 |
| Lower Neck | 16 | 30,8 |
| Left Shoulder | 36 | 69,2 |
| Right Shoulder | 36 | 69,2 |
| Left Upper Arm | 25 | 48,1 |
| Back | 36 | 69,2 |
| Right Upper Arm | 25 | 48,1 |
| Upper Waist | 39 | 75,0 |
| Lower Waist | 39 | 75,0 |
| Buttocks | 16 | 30,8 |
| Left Elbow | 15 | 28,8 |
| Right Elbow | 15 | 28,8 |
| Left Forearm | 20 | 38,5 |
| Right Forearm | 20 | 38,5 |
| Left Hand Wrist | 18 | 34,6 |

| | | |
|------------------|----|------|
| Right Hand Wrist | 18 | 34,6 |
| Left Hand | 13 | 25,0 |
| Right Hand | 13 | 25,0 |
| Left Thigh | 19 | 36,5 |
| Right Thigh | 19 | 36,5 |
| Left Knee | 22 | 42,3 |
| Right Knee | 22 | 42,3 |
| Left Calf | 26 | 50,0 |
| Right Calf | 26 | 50,0 |
| Left Ankle | 25 | 48,1 |
| Right Ankle | 25 | 48,1 |
| Left Foot | 24 | 46,2 |
| Right Foot | 24 | 46,2 |

In table 3 below, there are 5 body parts most commonly complained by tile factory workers.

Table 3: Parts of the body that most often experience musculoskeletal complaints

| Painful / Stiff Body Parts | f | Percentage (%) |
|----------------------------|----|----------------|
| Lower Waist | 39 | 75% |
| Upper Waist | 39 | 75% |
| Back | 36 | 75% |
| Bahu | 36 | 69,2% |
| Calf | 26 | 50% |

Complaints in the lower waist are similar to the back. The lower back and upper waist musculoskeletal complaints are caused by work positions such as the body bent forward, twisted body, standing for a long time, standing while bending, squatting, and lifting and transporting.

Complaints that occur on the back can be caused by muscle tension and not ergonomic body position when lifting weights. Work positions that can cause complaints on the back include bending forward, the body being twisted with lifting and carrying activities, and standing position for a long time. The wrong work position that is carried out continuously and overloading can give specific complaints to the back and shoulders. Musculoskeletal complaints in the back are caused by muscle tension, muscle spasm, and muscle imbalance. Poor movement of the back of the back can cause muscle stiffness and spasm that appears directly on the back muscles so that trauma can cause pain.

Complaints that occur on the shoulder can be caused by work positions such as standing while bending forward, lifting and hauling activities, and pushing activities. Shoulder pain is generally caused by trauma to a group of muscles or tendons surrounding the shoulder joint or the so-called rotator cuff ⁴.

Complaints that occur in the calf can be caused by standing and squatting for too long and lifting and carrying activities. One of the causes of pain is standing for a long time can increase the hydrostatic pressure in the circulation of blood and lymph flow in the legs which can interfere with blood flow back to the heart due to the malfunctioning of the leg muscle pump because the legs are too tired due to prolonged standing. Inadequate blood supply to the calf muscles due to intense contractions without relaxation can cause cramps.

The standing work position is the most dominant work position in the tile manufacturing process. Tile workers who work in a standing position for long periods of time most experience musculoskeletal complaints in the lower waist, upper waist and shoulders. In addition, wrists and backs were also stretched out by several workers. The process of making tile which is done when standing is hoeing clay, filtering clay, making tile dough, molding process of clay dough into tile, drying process, and the process of burning dry tile ⁶.

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During the process of hoeing clay and paras the workers tend to work in a standing position with the body bent forward for a long period of time, lifting and carrying activities, continuous emphasis on the shoulder for a long time, and a static standing position. This position is carried out by workers for 15 minutes and then the hoed land is transported using a large bucket. The work position on the hoeing activity is carried out repetitively until the required amount of land is fulfilled. The process of filtering clay and parasites is done with a tendency in standing position while bending forward for a long period of time, the position of the wrist is bent, and standing in one position is in a static position. The filtering process is carried out by taking clay and sandpit with a bucket or hoe and placing it on the filtering and then moving back and forth while standing. Work activities are carried out repetitively with the aim of uniting clay and paras into one and separating it from gravel ⁶.

This type of work can cause musculoskeletal complaints in several parts of the body. The work position carried out during the ground and filtering of clay and paras is carried out repeatedly in a long period of time. This type of work is not accompanied by adequate rest so that the process of muscle recovery is not fulfilled. Working position by leaning forward can cause musculoskeletal complaints in the upper waist and lower waist as a result of local mechanical pressure on the waist. The unnatural working position of the shoulders with the back and forth movement is carried out when the clay and parasol are carried out and the process of filtering the clay can cause complaints on the shoulder. Work positions that cause the wrist to bend and are accompanied by high pressure during hoeing and filtering can cause wrist complaints. Complaints occur because the work position can trigger inflammation of the local nerves complained by tile workers in the form of a tingling sensation on the hands to pain. Standing position for too long can cause complaints in the knees, calves, ankles, and legs in the form of cramps. Complaints occur because the position causes the muscles to stretch so that it interferes with blood flow in the legs ³.

Tile making is done by inserting the filtered clay and sand into the machine by using a hoe or spade and mixing it with water, palm oil, and lubricant to form a quality tile dough. In the process of making tile dough the work position is done is standing while bending forward for a long time, lifting and carrying, and standing while stepping so that it can cause complaints on the arms, shoulders, back, waist, calves, and legs. At the time of making tile dough, each worker has 3 different types of work, namely workers who are tasked with inserting a mixture of clay and sand into the machine, workers who mix the soil and sand mixture into the machine, and workers who transport the finished tile dough. Workers who put a mixture of clay and face with a hoe have severe complaints on their arms, shoulders and back. That is because workers who work to insert a mixture of clay and sand do lift-carry activities that can put mechanical pressure on the arms, shoulders and back. Workers who stir the clay and sand mixture only use their bare feet to step on the clay and sand mixture so that the material can stir evenly. Workers who are tasked with stepping on a mixture of clay and face have felt complaints on the knees, calves and the heaviest are the feet. This type of work has a high risk of musculoskeletal accidents because it is done without safety so that it can cause the sole of the foot to run over by a dough machine. Complaints felt by workers are the soles of the feet that feel sore due to the local mechanical pressure that is high and long when stepping on the tile dough. This type of work can be at high risk of causing serious injury to the soles of the feet which can lead to infections leading to death if not taken seriously. The last type of work is the removal of the dough that has led to complaints on the shoulders, arms and wrists. That was caused by the high local mechanical pressure and it was done repetitively ⁶.

The process of printing a tile with a tile printing machine is done by inserting the finished tile dough and polishing it with a mixture of oil into the molding machine then rotating the pressure on the tool that will put pressure on the tile dough so that the final result can be formed. After printing the appropriate shape then the tile is placed on a wooden container and stored in a storage area and will go through the first stage of the drying process. The tile molding process is carried out with a working position of transporting, standing static for a long time, twisted body, wrist extension, and shoulder muscles that are used repeatedly for a long time. Lifting and carrying activities are carried out on a pressure device with the support of the hands, wrists, arms, and the most severe is the shoulder so that raises complaints on that part because it is done repeatedly in a long time. During the printing process, workers do this while standing static for long periods of time, creating the heaviest complaints on the knees, calves, ankles and feet because they can exert local mechanical pressure at that location. In this process the body parts on the back and waist are also complained by workers because the printing process is carried out by lifting and twisting while turning so that the body becomes twisted. Giving pressure on the wrist during printing can cause pain felt by tile workers as tingling. The tile printing process is the longest process carried out by tile workers. When printing tiles, the workers do it in a long time intensity with little rest time so that it often raises musculoskeletal complaints in certain body parts ³.

The tile drying process is carried out in the Pejaten village tile industry twice. This is done in order to obtain maximum tile quality. Tile drying process is done by moving and aligning the printed tile stored in a storage area in the open. During the drying process that lasts for 1 full day the drying process requires adequate supervision of rainy weather because drizzling rain can damage the tile surface

During the process of drying the roof, the working positions that play a role are lifting, transporting, squatting in a shifted position, wrist extension, and shoulder muscles that are used repetitively for a long time. Squatting position is most often done during tile drying. Complaints on the body parts that are felt in the work position are the lower waist, shoulders, back, and wrists. Lift-transport activities with objects that have a certain weight when it will be moved require support from one hand and shoulder. Complaints will arise when workers work in unnatural positions. In the open space workers will arrange these tiles by aligning them parallel while squatting so that they can cause complaints on the back and shoulders. In addition, the wrist will be in a dynamic position so that it can raise complaints in that section. The worker's body will be twisted to one side because it can make it easier for workers to arrange tiles, but this can cause complaints in the lower waist. Squatting for a long time during drying will also cause complaints on the calves and legs ³.

The final stage in the process of making tiles is the process of burning dry tiles into a furnace that contains embers. At this stage, dry tiles are first neatly lined up into the furnace, then the combustion process begins by lighting the furnace's fuel, which is fibers, until it becomes an ember. The burning process lasts for 1 day.

In the process of burning the tile the work attitude taken by the worker is a static standing position for a long time, lifting and hauling activities, twisted body and long shoulder support. When inserting and arranging dry tiles into the furnace workers tend to stand too long so that it can cause complaints on the thighs, knees, calves, ankles, and feet. Lifting and carrying activities that require shoulder support require a long time and this attitude can put local mechanical pressure so that complaints arise on the shoulders of the workers. When inserting the tile into the wall I found workers with twisted posture. This attitude can lead to complaints on the back and lower waist of workers ⁵.

IV. CONCLUSION

Through discussion that refers to the literature and the results of direct observations in the field, the conclusion is that tile workers are known to have musculoskeletal complaints in parts of the body that include the upper neck, upper neck, shoulders, arms, back, upper waist, lower waist, buttocks, elbows, forearms, wrists hands, hands, thighs, knees, calves, ankles and feet.

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