Subjective complaints and evaluation of work posture on shredded tuna fish floss micro-industry worker

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Abstract. SMEs have an important role in Parepare City's economy and have great potential to be developed. However, this work system has potential hazards and health risks to its workers, one of them is postures. Musculoskeletal disorders are prevalent in many countries at any level of industry. The micro-industry has a higher potential risk related to the limitations of technology and equipment, so the production process is more familiar with human labor. UD Lela Mandiri is located in Parepare City, South Sulawesi. This study aims to identify workers' subjective complaints and analyze work postures in the UD micro-scale food industry. Workers' complaints were collected through interviews, survey, and the REBA to evaluate work posture. The respondents were four tuna-shredded workers, all women with an average age of 44.5 years and an average BMI of 39.0. The discomfort and pain felt by tuna-shredded workers are in the buttocks, back, shoulders, waist, upper arms, elbows, forearms, and hands. At the same time, the evaluation of work postures shows that 23 postures fall into the level 4 category where changes are needed, both in terms of work postures or using work aids to reduce the occurrence of musculoskeletal disorders due to work.

1 Introduction

The ergonomics approach plays a vital role in improving occupational safety and health aspects, one of which is designing work systems to reduce complaints and disorders in the musculoskeletal system. This can significantly increase worker comfort, providing a positive outlook for the future of workplace safety. GOTRAK (1) or work-related musculoskeletal disorders (WMSDs) can be caused or aggravated by various factors, some of which are excessive workload, unnatural postures when working, repetition of movements, and duration of the activity (2,3).

Poor employee posture in Small and Micro Enterprises (SMEs) includes uncomfortable positions (sitting to work at an abnormal angle) for the worker (4), for example with the upper arms raised, the head and body leaning forward, and the ankles and knees relatively poor. Work-related musculoskeletal disorders are pervasive in many countries in large, medium, small, and micro industries, causing high costs and impacting a person's quality of life (5). Posture is the relative position of particular body parts when working, which is determined by body size, work area design, task requirements, and the size of equipment/other objects used when working. This work posture can be a static or dynamic position. Identifying and recording discomfort caused by work postures will help create good work guidelines to reduce worker risks (6–8)

SMEs have an important role in Parepare City's economy and have great potential to be developed. However, this work system which generally produces traditionally, has potential hazards and health risks to its workers. One of them is the risk of ergonomics that awkward work postures and repetitive activities can cause. UD Lela Mandiri is located in Parepare City, South Sulawesi. Every day, as many as 100 kg of tuna are managed to produce 40 kg of shredded tuna as shown Fig.1. This also happened in (9) research, the process of drying fish is traditionally carried out in a squatting working posture, squatting while shifting, twisting and bending. Given that human activities have an important role in the work done in the production process section, there is a need to analyze human work posture to improve posture so as to reduce the risk fatigue.

1.1 Small and Micro Enterprises (SMEs)

SMEs have an important and strategic role in the national economy (10). The Department of Cooperatives and MSMEs stated that active MSMEs in South Sulawesi reached 619,000 businesses. The trade sector is the most dominant of that number, namely the food and clothing industry. Data from the Central Statistics Agency (BPS) shows South Sulawesi's economic growth reached 7.23% throughout 2017. The food industry dominates the processing industry in

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South Sulawesi, namely 50,843 businesses, or around 38.11%. This can also be seen in the most considerable contribution from the micro and small manufacturing industry in South Sulawesi in the fourth quarter of 2017, namely in the food industry at 57.87 percent. This condition can continue by increasing the number of MSMEs by around 3% per year so that they can participate more in driving a people-based economy.

1.2 Tuna-Shredded SMEs

Many households (micro) and small businesses in the city of Parepare still utilize human labor for work. Micro-scale companies/enterprises have a workforce of 1-4 people, and small industries have a workforce of 5-19 people, including the entrepreneur/owner. In 2014 by BPS, the number of small-scale companies in Parepare was 973 businesses with a total workforce of 3184 people and 355 micro-scale businesses with a total workforce of 1060 people. One of the micro-scale businesses in the food processing industry is making fish floss/shredded. Shredded food is a processed food product that is quite widely known. It is defined as a type of dry food made from boiled, sliced, seasoned, fried, and specially packaged meat. Making fish floss is relatively easy, so family members can do it directly.

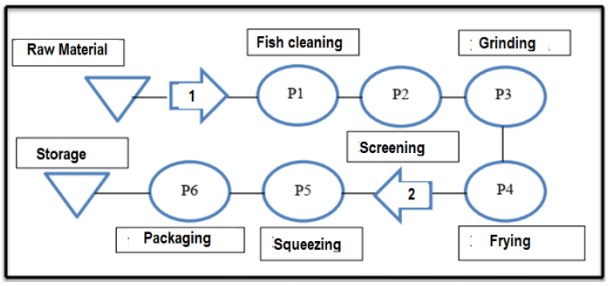

Fig. 1. The process chart for making Tuna-shredded floss.

The equipment used in production is relatively simple, the process is depicted in Fig 1. Therefore, starting this business relatively does not require significant investment costs, so fish floss processing is dominated by traditional processing and is a home industry that reaches 68%. For example, in UD Tuna Fish Floss's home/micro industry Lela Mandiri is located on Jalan Pesang Gerahan, Watang Soreang Village, Soreang District, Parepare City, South Sulawesi.

2 Methods

Data collected at UD. Lela Mandiri (UDLM), is located in Parepare, with field studies and interviews and documenting object problems. This study aims to identify and analyze the working posture at UDLM and analyzing subjective complaints of skeletal muscle disorders during work activities. The objectives of the study are to provide suggestions for improving the work posture of workers at UD. Lela Mandiri. The data is in the subjective survey of complaints from workers by Nordic Body Map in Fig. 2 (11,12) and work postures, using the Rapid Entire Body Assessment (13). Nordic Body Map is a subjective measurement method for measuring workers' muscle pain. Interviews were conducted with superiors in the company and the workers to obtain data including production flow, working hours, and complaints felt by workers.

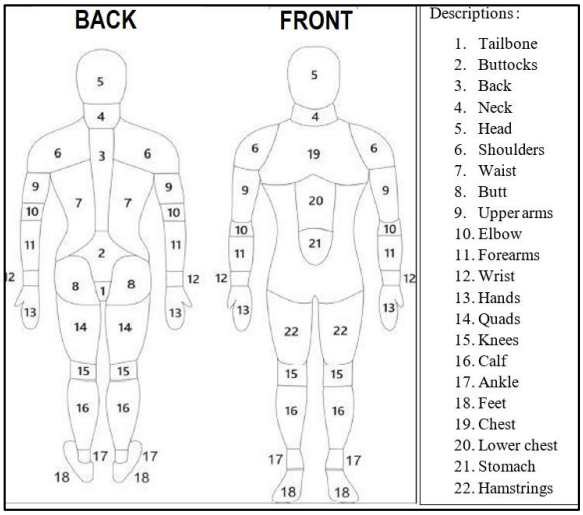

Fig. 2. Nordic Body Map surveys

Rapid Entire Body Assessment (REBA) is a method in the field of ergonomics that is used to quickly assess the posture of a worker's neck, back, arms, wrists, and legs. This method is also equipped with coupling factors, external loads, and work activities. From the REBA score, the level of injury risk can be determined. The resulting output is in the form of posture grouping work according to categories and recommendations for improvement in work posture for those at risk of work-related skeletal muscle disorder.

3 Results

UD Lela Mandiri (UDLM) Tuna-Shredded floss has four women workers. This industry produces every day from 08.00-18.00. They manage 100 kg of tuna fish daily to produce 40 kg of shredded fish. Distributor of this tuna fish floss product outside the region. Material handling in UDLM is mostly done manually (Fig. 3). The respondents were four tuna-shredded workers, all women with an average age of 44.5 years and an average BMI of 39.0.

Fig. 3. Samples of Worker's Posture

This work begins by washing the fish three times, then boiling the fish for ± 20 minutes; then, the boiling results are transferred to a filtering area to remove the

water in the fish. After filtering, the boiled fish is refined. Next, mix the spices and then fry, which takes ± 2 hours. The fried fish is transferred to a pressing machine and then cooled. The final process is the packaging process as seen in Table 1.

Table 1. The process of floss production at UD. Lela Mandiri

Symbol	Activity	Estimated time
-	1. Fish Cleaning	30 minutes
P1	2. Boiling	1-2 hours
P2	3. Grinding	10 minutes
P3	4. Mixing	1-5 hours
P5	5. Frying	1-2 hours
P5	6. Squeezing	7 minutes
P6	7. Packaging	1-3 hours

Feelings of discomfort or the pain felt by tuna shredded workers (station 1 and station 2) namely buttocks, back, shoulders, waist, upper arms, elbows, forearms and hand. The distribution of discomfort of four workers can be seen in Fig. 4.

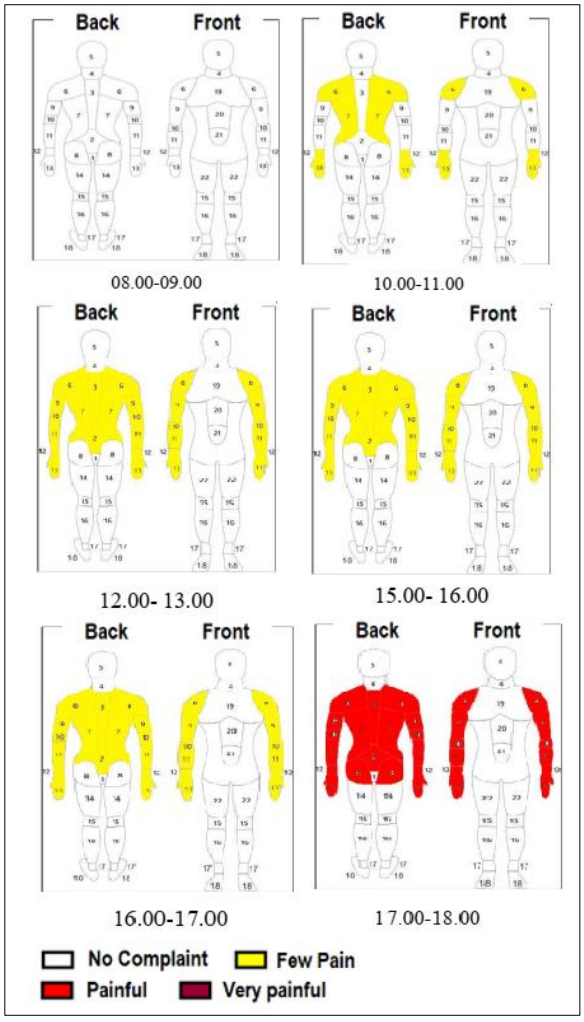

Fig. 4. Nordic Body Map surveys

The results of observation concluded using REBA (Table 2), work postures that have been identified in the process of making Tuna-shredded are 52 work posture, there were: 3 work postures in level 2 which changes in working posture may be possible); 29 postures that belong to in level 3 which changes in work posture must be changed as soon as possible; and 23 postures that are classified as level 4 which change in posture, work must be changed immediately.

Table 2. REBA Score on worker's posture.

Work Stations	Activities	Posture	Score
1 Making Tuna Shredded Floss	1. Fish Cleaning	1	6
		2	8
		3	8
	2. Boiling	1	7
		2	5
		3	5
	3. Grinding	1	9
		2	6
		3	9
	4. Mixing	1	5
	5. Frying	1	7
		2	7
	6. Squeezing	1	8
		2	10
		3	3
		4	6
		5	9
2 Packaging	7 Packaging	1	8
		2	9
		3	6

It is better to change the work posture, using work aids to reduce the occurrence of skeletal muscle disorders due to work activity. The pain and discomfort felt by workers during 7 hours of work continue to increase due to work being carried out continuously and repeatedly without rest and work postures that are at risk of developing musculoskeletal disorders. Work activities at Levels 3 and 4 in the REBA calculation often occur at station 1, so workers experience fatigue. Research by (14) finds that the condition of the workers affects the productivity of the company due to workers' health deficiency. If the workers are exposed to the awkward postures which can leads to the WMSDs.

These are some recommendations including the anthropometry approaches: the basin containing the fish is placed on the surface of a stone table with dimensions (L x W x H): 2m x 1m x 1m. Water faucet with dimensions (Tx D): 20cm x 3⁄4 inch from the table surface. The stove is placed on an iron table with dimensions (L x W x H): 45cm x 60cm x 90cm. The pot is placed on a wooden table with dimensions (L x W x H): 70cm x 70cm x 90cm. The press is placed on a stone table with dimensions (L x W x H): 2m x 1m x 1m. These dimensions are described in the work station design as in the picture Fig. 5.

Fig. 5. Work station recommendations of workstation 1

To reduce worker's musculoskeletal complaints, there are need to change the work station. Changing the workstation will drive the worker to change their posture. However, the health risk is not only the ergonomics problem but also other hazard and risk assessment at the small and medium enterprises (15), for example is work environment. To create ergonomics-based work behaviour, it has to be supported through external factors and internal factors (16). Appropriate worker assignment for shift scheduling and environmental set points for workplace comfort (17). Besides that, these risks can also be reduced by changing and providing work tools.

4 Conclusions

From the results of posture analysis, it can be concluded as follows: Work postures identified in the tuna-shredded floss as many as 52 working postures. Three working postures are classified as level 2 (changes in work posture may be conducted). Then, there are 29 postures belonging to level 3 (change work posture should be changed as soon as possible). At the same time, 23 postures belong to level 4 (changes in work posture must be made at that time). By measuring the Nordic Body Map, complaints were obtained on the worker's body for both stations, discomfort or pain perceived by workers of shredded tuna fish (station 1 and station 2), namely: buttocks, back, shoulders, waist, upper arms, elbows, forearms, and hand. By analyzing work posture using the REBA method, suggestions for improvement are given to work activities level 3 and level 4. Changing the work posture to reduce the risk of musculoskeletal disorders due to work activities is better.

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