AN ERGONOMICS WORK SUPPORT TOOLS TO REDUCE MUSCULOSKELETAL DISORDERS ON SEAWEED WORKERS IN TAKALAR, INDONESIA

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ABSTRACT

Purpose: The objective of this research is to reduce the MSDs on seaweed farmers by developing an ergonomics work support tools to help them work ergonomically.

Methods: A qualitative approach used in this research in form of Focus Discussion Group (FGD) and In-depth Interview. The data obtained in the studies became the basis for designing the ergonomics work aid.

Results: This research found that seaweed farmers worked in non-ergonomics postures due to the working condition. This work posture lead them to suffer musculoskeletal disorders. A work support tool is essential to help them to work ergonomically.

Conclusion: An ergonomics work support tools is designed based on the average seaweed farmers anthropometry and developed into a set of table and chairs to support farmers to work ergonomically. The effect of this tool on farmers will be investigated further.

KEYWORDS: Musculoskeletal disorders; Seaweed workers; Anthropometry; Ergonomics; Support tool
INTRODUCTION

The sea in Indonesia has various types of biological resources such as the availability of coral reefs, seaweed, fisheries, and mangrove forests. These resources has become leading commodity in several regions in Indonesia. Takalar Regency is one of center for the development of the seaweed industry in South Sulawesi (1).

In Takalar, there are many people work as seaweed workers. They engaged in the informal sector and can be categorized as informal workers. Informal workers are workers who work in all types of work with no state protection and not be taxed. Although working in the informal sectors, seaweed workers health and safety should be a concern (2). The risk factors seaweed workers for work-related accidents that are influenced by the wrong way and position of work as well as for the occurrence of work-related diseases need to be controlled as low as possible (3).

One of the occupational diseases found in seaweed workers is musculoskeletal disorders (MSDs) (4). MSDs constitutes major occupational health problems globally (5, 6). MSDs is one of the most discussed topics in the health sector of the workforce (7) and have a significant impact on both individuals and economy across the world (8, 9). MSDs can severely affect an individual’s life, particularly physical and mental well-being (9).

Work-related musculoskeletal disorders is a broad term used to describe harmful conditions caused by overuse of some parts of the muscles, tendons, nerves, ligaments, joints, and supporting blood vessels, as an outcome of a work-related activity (10, 11). The prevalence of MSDs was very high among the workers (12). Work related MSDs are a part of ergonomic disorder (13, 14).

Non-ergonomic work postures often occur due to lay out of workplace that are not in accordance with the anthropometry of the worker (7, 15). Consequently, it affects the performance of the workers since the work is carried out in a standing, bending over, twisting
the body when lifting objects and reaching positions. Non-ergonomic work postures such as long standing, squatting, bending, transporting and lifting for a long time will cause discomfort and pain in one of the limbs (8). These work postures causes worker to experience of MSDs, especially in the back, arms, hands, shoulders, hips, waist and legs (16). The inappropriate work position is generally due to the characteristics of task demands, work tools and work stations that are not suitable for the abilities and limitations of workers (17).

Seaweed workers in Takalar Regency experience MSDs due to the work posture they performed (18). The workers performed bent back position, arms pointing up and resting on bent legs and a lowered head position for hours (4). No concern on working posture causes ergonomic problems. Ergonomics intervention by utilizing technological developments and advancements can reduce the risk of this occupational hazards (19).

Based on the background above, a comprehensive examination of the working posture of seaweed workers was conducted to create work support tools that would reduce the risk of MSDs in seaweed worker in Takalar, Indonesia.

**METHODS**

This study applied a qualitative approach. The qualitative approach was carried out by conducting a Focus Group Discussion (FGD) and an in-depth Interview. There were 18 seaweed workers participated in the FGD. The in-depth interviews were conducted by interviewing 3 stakeholders who are the head of three village di Mangngarabombang District; Panyangkalang, Punaga and Laikang village. The data obtained from FGD and interviews then interpreted and presented in the form of a narrative.
RESULTS AND DISCUSSION

Ergonomics problems will arise when ergonomic is not being cared for at workplace (19). In the FGD, participants expressed that they thought their MDSs caused by non-ergonomic work postures they performed every day. As the participant said:

“I use a chair that is too short for me so my legs have to bend during work which makes my legs often hurt.”

“My back hurts a lot, because every time I work, my back is always bent.”

This is consistent with a research conducted by Mallapiang and Muis (20) which found that work posture has a relationship with musculoskeletal disorders. According to an epidemiological study by Gallagher (21), work performed with unusual and restricted postures is associated with a much higher rate of musculoskeletal complaints than work that does not require the posture. In general, work posture is associated with musculoskeletal health and musculoskeletal disorders.

Workers who do not understand work hazards and control measures, as well as non-ergonomic workplace designs, have the potential to increase the burden of MSDs (18). Poor posture and improper ergonomics can cause musculoskeletal disorders (8). This is in line with what was obtained from the results of in-depth interviews:

“I always see that on average they work, the position is not good, because I see that position, the back is always bent, the legs are bent, and they do that for hours.”

“The chairs they use are too short, and they don’t have a table so that when they work their working position becomes less comfortable.”
This result is supported by Bertolaccini, Nakajima (22) who conducted research on the effect of posture on the activity of the superior trapezius and longissimus muscles. Sitting with the body leaning forward at 45° resulted in a significant increase in the activity of both muscles. Over the years, low back pain has been the leading cause of absenteeism from work and the main indication for medical rehabilitation.

Occupational diseases arise due to work relationships or caused by work and work attitudes (16). Good work posture is largely determined by the movement of the body's organs while working. Desai and Vinekar (10) also stated in their research that work-related musculoskeletal disorders are caused by misaligned work postures and rapidly repetitive work movements. The work tools used by seaweed farmers make their work postures not ergonomic. As the information obtained from the FGD participants:

“This chair is too short so my legs have to bend.”

The work postures carried out by seaweed farmers were a bent back position, arms pointing up and resting on bent legs and a bowed head position for a long time (4). Non-ergonomic work postures that are carried out while working can often cause problems for workers, such as musculoskeletal disorders that are felt by workers (6, 10).

Non-ergonomic work posture is able to initiate musculoskeletal disorders. When someone works with an awkward posture, his body will attempt to uphold a working position by sustaining muscle contraction (8). When muscles become fatigued and prolonged contractions occur, it causes ischemia in the muscles (23). Continuous movement for a long time can cause excessive tension in the muscles, decreased circulation to the joints, and compression of nerves and blood vessels. Compression of nerves and blood vessels can lead to musculoskeletal disorders such as pain, numbness, and weakness of the limbs (22). This is corresponding to the participant statement:
“In a day I work more than 8 hours with a work position like this, bent legs, back bent, and hands that go round and round to tie the seeds.”

The seaweed workers have inappropriate work postures due to the work tools used are not suitable for the anthropometry of their bodies. The application of anthropometry is the use of anthropometric data in the design and its use in a very wide variety. Ergonomics designing equipment that is used in everyday life or designing existing in the environment should be adapted to humans and the environment (17). This is consistent with the results of FGDs and in-depth interviews, which stated

“It’s a very short seat, so the legs bend for a long time...”

The workers forced to perform non-ergonomic postures in doing their work. They were working together in wide area. The posture of workers acted when they want to take seaweed that is out of their reach increase the chance of developing musculoskeletal disorders (20). Work posture is a work process determined by anatomy of the body and the size of the equipment used while working (23). This is caused by factors that do not match work equipment so that affect the work posture of workers which will then affect also to musculoskeletal complaints (15). As a confession from a worker:

“There's no table to use when you're breeding, so this has to be bent down and the head's position is down too.”

“The chair used is small and short so it is not confortable to work for a long time..”

Anthropometric data is a prerequisite for designing agricultural tools and equipment that enable jobs to achieve better performance and productivity while providing greater safety and comfort (15). Similar result found in Susana (24) research on fish drying workers that showed that anthropometry that was not in accordance with the work aids used by drying workers caused higher musculoskeletal

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disorders compared to giving new work tools to fish drying workers that matched the anthropometry of workers making musculoskeletal disorders felt by workers decreased. The informant also provided information that he needed work aids, such as a confession from a worker:

“We need chairs and tables that are suitable for use when seeding, so that when we work we no longer have to bend over and bend our legs...”

Providing practical and ergonomically structured working environment can solve ergonomics problem (7, 25), including providing assistive tools for workers. This study developed a work support tools for seaweed workers to reduce their MSDs. The tool is in form of a set chairs and tables that designed based on the average anthropometric of seaweed workers. This is expected to meet the needs of seaweed workers in Takalar.

The work aid consists of adjustable chairs and tables made of iron plates and hollow iron. The chair’s seat is an iron plate with a size of 40x50 cm. The backrest of the chair has height of 90 cm and made from five pieces 50 cm hollow iron that installed in layers. The chair legs also made from hollow iron with default length is 30cm and can be adjusted up to 40 cm. The table is 150 x 70 cm iron plate with legs made of hollow iron with length 70 cm and can be increased up 90 cm (adjustable). The dimension of chair and table are presented in Figure 1 and 2 respectively.

The chairs and table are designed based on the anthropometric measurement of the seaweed workers. The use of iron plate and hollow iron considers some aspects, which are the weight of the seaweed, corrosion resistance, and convenience. The legs of chairs and table are made adjustable so it can be used on uneven ground surfaces. One set of the work aid consists of six chairs and one table. The developed tools are expected to reduce MSDs and pain in some parts of the seaweed workers’ bodies while working.
CONCLUSIONS

Seaweed workers perform monotonous position while working for long hours every day. Furthermore, most of seaweed workers experienced MSDs mainly due to non-ergonomics work posture. This study developed an ergonomics work support tools in form of adjustable chairs and tables. The tool is designed based on the anthropometric average of seaweed workers and be expected to reduce the MSDs of seaweed workers. Another research will be conducted to examine the effect of the work support tools on the seaweed workers.

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REFERENCES


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Figure 1. The dimension of chair in developed ergonomics work support tool

Figure 2. The dimension of table in developed ergonomics work support tool