



Original article

Ergonomics and musculoskeletal disorders among seaweed workers in Takalar Regency: A mixed method approach[☆]Yahya Thamrin^{a,*}, Atjo Wahyu^a, Syamsiar S. Russeng^a, Andi Wahyuni^a, Andi Hardianti^b^a Occupational Safety and Health Department, Faculty of Public Health, Hasanuddin University, Indonesia^b Epidemiology Department, Faculty of Public Health, Hasanuddin University, Indonesia

ARTICLE INFO

Article history:

Received 29 May 2019

Accepted 15 July 2019

Keywords:

Ergonomics

Musculoskeletal disorders

Seaweed

ABSTRACT

Objective: As a maritime country, Indonesia has diverse biodiversity. Recently in coastal area, the industry that manages marine products has been grown rapidly and one of them is the seaweed industry. Takalar Regency has become one of center of seaweed industry development in Indonesia especially in South Sulawesi. However, there is lack of concern about health and safety problems particularly ergonomics and musculoskeletal disorders (MSDs) among seaweed farmers.

Method: The study uses a mixed method design combining quantitative and qualitative approach. The sample were taken from four districts; Mangarabombang, Mappakasunggu, Sanrobone and North Galesong.

Results: More than 50% of the workers mentioned that they often work in bending position and almost 45% of the workers mentioned that they often work sitting sideways or twisting. self-reporting symptoms of MSDs include pain/sore particularly in lower back area 66.5%, fever 5.6%, sprain 8.7%, numb 3.1% and strain more than 60%.

Conclusion: This research found that large number of employees performed their job in nonergonomics positions that might be associated with MSDs. The research revealed as well the number of farmers who suffer from MSDs symptoms. It is suggested to apply ergonomic rules and principles by redesign tools and the work process.

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Introduction

Indonesia is a maritime as well as an archipelago country. Indonesia has the largest number of islands (17.499) in the world with 81.000 km coastline. Furthermore, about 70% of Indonesian territory is covered by waters. The area even larger when Exclusive Economic Zone (ZEE) is added 3.1 km² from the coastline to the sea that comprises 5.8 million km².¹ Due to this, it is reasonable for some provinces in Indonesia including South Sulawesi building their economy from maritime sector of industry.

Seaweed industry is highly developed and become one of commodities that attract many people to involve the workplace. Seaweed extracts are widely used for food, beverages, pharmaceut-

icals, textiles, paint, and graphic photo papers.² Due to the demand export market of dried seaweed from USA, UK, China, Australia, Japan and other countries considerably increase, seaweed cultivation recently become major job of farmers in many coastal area including Takalar Regency, South Sulawesi. This regency produced 996.550 tons in 2017 from about 17.448 hectares' harvest area.

However, in Takalar Regency this industry is still predominantly as home industries. As informal sector, it is generally assumed that employees in these industries are vulnerable to experience injuries or other occupational health and safety problems. The workers possibly face all kind of hazards such as physical, chemical, biological, ergonomic and psychosocial hazards. Furthermore, seaweed workers are required to perform many types of jobs such as cultivation of seeding, planting, maintenance, harvesting, processing and drying. All type of jobs is physical demanding.

Drying job for instance requires excessive force. The job comprises lifting the seaweeds from harvest and spreading it on the ground covered by plastic sheet. Stooping, bending and squatting are the main work posture that potentially produce MSDs and work fatigue.^{3,4} In addition, during the process of drying, the farmers

[☆] Peer-review under responsibility of the scientific committee of the International Conference on Women and Societal Perspective on Quality of Life (WOSQUAL-2019). Full-text and the content of it is under responsibility of authors of the article.

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Table 1
Seaweed workers demographic.

Variable	n	%
<i>Age</i>		
10–19	13	8.07
20–29	35	21.7
30–39	38	23.6
40–49	39	24.2
50–59	19	11.8
60–69	13	8.07
≥70	4	2.4
<i>Gender</i>		
Male	63	39.1
Female	98	60.9
<i>Marital status</i>		
Single	17	10.6
Marriage	144	89.4
<i>Number of family members</i>		
1–4	95	59.0
≥5	66	41.0
<i>Work period (years)</i>		
1–5	46	28.5
6–10	68	42.3
11–15	11	6.8
16–20	26	16.1
21–25	3	1.8
≥26	7	4.3
<i>Working hour</i>		
1–4	38	23.6
5–8	53	32.9
9–12	70	43.4
<i>Total</i>	105	100.0

are being exposed by direct sun for the long period without regular break that increase the possibilities to experience work fatigue, dehydration, heat cramps or even heat stroke.

There is paucity of research conducting among seaweed workers particularly for the study that focusing on ergonomics among this sub group of workers. This paper explores nonergonomics working positions and self-reported symptoms of MSDs among seaweed farmers in Takalar Regency as center of seaweed development industry in South Sulawesi Indonesia.

Design and method

The study uses a mixed method design combining quantitative and qualitative approach. All seaweed workers in Takalar Regency become the population of the study. The sample were taken from four districts; Mangarabombang, Mappakasunggu, Sanrobone and North Galesong. Among nine districts in Takalar Regency, those four districts have the highest number of people who work seaweed farmers. Qualitative approach was done by Focus Group Discussion and In Depth Interview to stake holders in 4 districts.

Questionnaires survey were distributed among 161 workers between August 2018 and March 2019. To examine the association between variables, this study performed Chi Square test together with Odds Ratio analysis and qualitative study was employed using focus group discussions method.

Result

This part explores information related to the distribution of seaweed farmer's characteristics, distribution of awkward position during performing job, and the distribution of self-reported symptoms of low back pain.

Table 1 presents demographic data of seaweed workers based on age, gender, marital status, number of family members, work

Table 2
Nonergonomics working positions.

Variables	Often		Sometimes		Never		Total
	n	%	n	%	n	%	
Bending	90	55.9	61	37.9	10	6.2	161
Sit sideways/twisting	68	42.2	73	45.3	20	12.4	161
Monotone bending > 15 min	64	39.8	74	46.0	23	14.3	161
Monotone twisting > 15 min	50	31.1	74	46.0	37	23.0	161
Repetitive movement	131	86.3	21	13.0	1	0.6	161
Excessive force	90	55.9	45	28.0	26	16.1	161

Table 3
Self-reported symptoms of MSDs.

Variables	Yes		No		Total
	n	%	n	%	
Pain/sore	107	66.5	54	33.5	161
Fever	9	5.6	152	94.4	161
Sprain	14	8.7	147	91.3	161
Numb	5	3.1	156	96.9	161
Inflammation	1	0.6	160	99.4	161
Strain	102	63.4	59	36.6	161

period, number of working hours per day. As can be seen from the table almost 70% of workers were at the age group between 20 and 49 years old while female workers were more than male (60.9% and 39.1% respectively). Regarding marital status, there were 17 (3.8%) workers were single. And concerning number of family who live together with the workers, more than 40% of the workers had five or more families. Turning to work period, more than 65% of the workers have been working as seaweed farmers for above 5 years. Regarding working hours, there were 70 (43.4%) seaweed farmers worked more than 8 h a day.

Table 2 explores awkward working positions of the workers when they perform job in the workplace. More than 50% of the workers mentioned that they often work in bending position and almost 45% of the workers mentioned that they often work sitting sideways or twisting. Interestingly, those awkward positions sometimes they had for more than 15 min without changing to other positions. For monotone bending position, more than 80% of the farmers maintained that they often or sometimes have that position during the job. Furthermore, 31.1% of the farmers claimed that they often perform monotone sitting sideways (twisting) and 46% of the workers maintained for sometimes.

Table 3 depicts self-reporting symptoms of MSDs include pain/sore particularly in lower back area 66.5%, fever 5.6%, sprain 8.7%, numb 3.1% and strain more than 60%. There was one farmer reveal for having inflammation on her back.

Discussion

According to Baron et al.,⁵ the leading causes of work related musculoskeletal disorders mainly from physical stresses and awkward working positions such as lifting, forceful gripping, twisting, bending, squatting, kneeling and vibrating equipment. Working process as a seaweed worker involves planting, harvesting, drying, and sorting seaweed. At the times of working the worker bend, sitting and stand for a long time. Sorting seaweed is done manually and repetitive in bad sitting position/twisting for hours. This study found that almost 50% of the farmers performing their job in bending and twisting position. Hence, it is highly likely for them to experience MSDs particularly for those who have been working for long period of time. As the informant said in indepth interview: “Yes there is an influence, like a seaweed farmer that he sat continuously end up hurt his back”

"... I think they (worker) doing the work habitually like that and feel comfortable. But the problem is if they (worker) sit for a long time it can cause pain/sore in the back"

Similar findings were highlighted by maintained that workers suffer from MSDs due to it can occur in all category of work, from very heavy category, heavy, moderate, and even light job.^{6,7}

Furthermore, MSDs complaints can be caused by not only from working position but also from many other factors include work organization, psychosocial, tools, individual, and the workplace itself.⁶ Process of drying seaweed can result Musculoskeletal complaints by stooping, squatting and bending work posture especially when drying used a plastic sheet the farmer force to lift seaweed with excessive lifting weight.⁷ Worker who work with nonergonomics work posture have 12 times the chance of experiencing MSDs than worker with ergonomic work posture.⁸ As the informant said in focus group discussion:

"The most hard thing I feel is bending position and squatting position for a long time while working..."

Most of seaweed farmers are working outdoors and they are being exposed by the sun.⁹ explained MSDs complains will be raised from the workers who perform their job while being exposed by direct sun light, using excessive force to lift heavy workload and without rest in regular basis. This situation is happening when seaweed workers in the process of harvesting and drying the seaweed. Traditional practicing during drying seaweed for instance, the workers needs to force energy lifting the harvest to drying spot and or spreading it on the ground covered by plastic sheet. Stooping, bending, twisting and squatting are the main work posture that potentially produce musculoskeletal disorders and work fatigue.^{3,4} As the informant said in focus group discussion:

"I feel strain at arm. We lift around 50 kilo per sack. We lift that for about 200 m at seashore..."

"I bear the seaweed directly without tools to the sun-dried place, I lift around 100 kilo with a friend..."

Some research and publications have revealed that the best practice to decrease work related MSDs. They categorized the simple solutions into two ways; redesign the equipment or tools and redesign the work process.^{5,7} Concerning MSDs among seaweed workers, Previous research states that limiting heavy lifting load, providing the workers a regular break and redesign of seaweed dryer will reduce work fatigue and MSDs complaints among farmers.⁷ Some research stated that to reduce exposure to hazardous occupational agent among aquaculture worker divided into hazard control at source, hazard control along path and hazard control at the worker.¹⁰

In addition, the application of ergonomics principles as soon as possible will create safe, healthy, safe, and comfortable workplaces.^{11,12} The quality of workers' safety and health will be disrupted and will lead to be contra productive to reduce workers' physical and mental health and wellbeing if application or

ergonomics are being ignored.¹³ As a result, the productivity of the workers is declined. Hence, healthy and safe conditions, effective, convenient, and efficient will be taking place when ergonomic rules and principles are being applied in the workplace especially when it is based on local wisdom.¹³

Conclusions

This study suggests that the number of seaweed farmers who performed nonergonomics working position were relatively large. Bending and twisting were two main positions that sometimes and even often they perform without any break. Even though there is limitation of this research where the symptoms were just self-reported without any clinical examination. However, this research highlights some symptoms that were likely to be MSDs that can be used as evidence for further research.

Thus, it is recommended to other research to explore more about this area. Ergonomics rules and principles for better tools and work practices for seaweed farmers should be applied as solutions for the problems that have been identified through this research.

Conflict of interest

The authors declare no conflict of interest.

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