



# Relation of body mass index and work posture to musculoskeletal disorders among fishermen<sup>☆</sup>

Yahya Thamrin<sup>a,\*</sup>, Syahrir Pasinringi<sup>b</sup>, A. Muflihah Darwis<sup>a</sup>, Irawan S. Putra<sup>a</sup>

<sup>a</sup> Department of Occupational Safety and Health, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

<sup>b</sup> Department of Hospital Management, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

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## ABSTRACT

**Objective:** In this study, we researched to determine the relationship between body mass index (BMI) and work posture/position with the musculoskeletal disorders (MSD) in fishermen.

**Method:** This type of research is analytic survey research with a cross-sectional study. There were 224 people as the population in this study with 56 samples as respondents. Nordic Body Map (NBM) and Rapid Entire Body Assessment (REBA) were used as a questionnaire instrument.

**Results:** The result of the Chi-square test shows that the BMI variable has a  $p$ -value of  $p = 0.848$  where the  $p$ -value is  $p > 0.05$ . This means BMI has no significant relationship with MSD. Meanwhile, the work posture/position variable has a  $p$ -value of  $p = 0.000$  where the  $p$ -value is  $p < 0.05$ , which means that there is a significant relationship with MSD.

**Conclusions:** BMI was not associated with MSD. This is possible because fishermen who have normal and abnormal BMI both have complaints of MSD. Meanwhile, work posture/position has a significant relationship with complaints of MSD in fishermen. This is because the posture of fishermen when working with tools when doing research looks very risky.

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## Introduction

The application of occupational safety and health in informal sectors is still less noticed by the government. The application of occupational safety and health is intended to protect the workers to avoid the risk of occupational diseases as well as the risk of being exposed to the potential hazard in the workplace.<sup>1</sup> One of the government's program in the health sector in eliminating or reducing the incidence of both occupational diseases and occupational accidents, especially in informal workers, is by establishing an Occupational Health Effort Post.

Data from the Maros District Health Office, the amount of Occupational Health Efforts for informal workers is 50 Post, which does not rule out an increase in line with the increase in the number of informal workers. There are 7 fishermen occupational health care posts in Maros Regency. Intervention activities are carried out by health personnel, in this case, the health center work health program, namely data collection, guidance, and health checks. The results of medical examinations carried out, musculoskeletal disorders (MSD) are the most common diseases suffered by fishermen's Occupational Health Efforts members including pain/pain in the muscles, back, waist, knees, calves, legs, myalgia/body aches, joint pain, and neck tension.

The MSD pathology has always been related to physical risk factors, like doing a lot of repetition of tasks, exposure to vibration, incorrect position while working, and static work position, which increases the physical load on joints and soft tissues, toward injury. This is especially happening for fishermen who are already exposed to an unfavorable combination of exposure, including boat movement, cold, noise, heavy lifting, uncomfortable working hours, long working time, and excessive tension.<sup>2</sup> Specific risky activities associated with traditional fishing as a job are trawl fishing (long nets), fishing nets, traditional spear catchers, and stage fishing.<sup>3</sup>

However, the severity of the injury depends on several factors, such as the intensity, frequency, and duration of exposure. Furthermore, body mass index (BMI) is also known to be associated with the development of MSD. People with increased body weight (high BMI) tend to experience more musculoskeletal pain than people with lower body weight. BMI is an independent risk factor for developing MSD, and it can also increase the prevalence of MSD over 12 months.<sup>4</sup> The objective of this study was to determine the relation between MSD with BMI and work posture in fishermen at the Occupational Health Efforts Post in Maros Regency.

## Method

This method of research is analytical survey research with a cross-sectional study. The population is all members of the fishing Occupational Health Efforts Post in Maros Regency totalling 224 fishers and 56 workers as the sample. Sampling when this research was taking place was carried out by accidental sampling by taking respondents who happened to be at the research location. This study uses the Nordic Body Map (NBM), Rapid Entire Body Assessment (REBA) questionnaire instrument, scales, and stature meter

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\* Corresponding author.

E-mail addresses: [yahyathamrin@yahoo.com](mailto:yahyathamrin@yahoo.com), [pmc@agri.unhas.ac.id](mailto:pmc@agri.unhas.ac.id) (Y. Thamrin).

tools. The method of data collection in this study was carried out by asking for basic data regarding the number of fishermen's Occupational Health Efforts Post in Maros Regency through the Health Office and Public Health Center, then asking for assistance from the participation of managers of the Public Health Center occupational health program and the head and cadres of the Occupational Health Efforts Post to meet with members of the Occupational Health Efforts Post fisherman.

The data of this research were obtained from observations and measured by taking pictures of the respondents while doing activities with various models of work posture, then the results of the shots were measured using the image meter application. The measurement results are entered in the REBA instrument and then the total score is calculated on the instrument. After the total score is obtained, it is then adjusted for the level of risk. Low-risk category results have 1–7 REBA score, and high-risk category results have 8–15 REBA score. For BMI, the objective criteria are not normal (for fishermen that have  $\leq 18.4$  and  $\geq 25.1$  BMI score) and normal (for fishermen that have 18.5–25.0 BMI score). Processing and data analysis in this study was carried out using computerization through the SPSS) program. Data analysis in this study using the Chi-square analysis technique.

**Results**

*Distribution of respondents based on musculoskeletal complaints*

MSD were obtained from the results of measurements using NBM, then categorized into two groups, with no complaints category (no pain with 0 as score) and with complaints (mild pain = 1, moderate pain = 2, and severe pain = 3). The data presentation of the distribution of respondents based on MSD can be shown in Table 1.

The results showed that the MSD category of 56 respondents, which were included in the no complaints category, was higher, namely as many as 29 respondents (51.8%) than those included in the no complaints category as many as 27 respondents (48.2%).

**Table 1**  
Respondents musculoskeletal complaints.

Musculoskeletal disorders category	Frequency (n)	Percentage (%)
There are complaints	27	48.2
No complaints	29	51.8
Total	56	100

Source: Primary Data, 2020.

**Table 2**  
Body mass index distribution of workers.

BMI category	Frequency (n)	Percentage (%)
Not normal	19	33.9
Normal	37	66.1
Total	56	100

Source: Primary Data, 2020.

**Table 3**  
The relationship between body mass index and musculoskeletal disorders.

BMI	Musculoskeletal disorders				Total		p-value
	There are complaints		No complaints		n	%	
	n	%	n	%			
Not normal	10	52.6	9	47.4	19	100	0.848
Normal	17	45.9	20	54.1	37	100	
Total	27	48.2	29	51.8	56	100	

Source: Primary Data, 2020.

**Table 4**  
Work posture/position distribution of workers.

Work posture/position	Frequency (n)	Percentage (%)
High risk	40	71.4
Low risk	16	28.6
Total	56	100

Source: Primary Data, 2020.

*Analysis of the relation between body mass index and musculoskeletal disorders*

The BMI of fishermen who were respondents ranged from 17.4 to 38.3. The distribution results show that in the BMI category of 56 respondents, the highest is in the normal BMI category as many as 37 respondents (66.1%) compared to the abnormal category of 19 respondents (33.9%) (Table 2).

The results of the analysis showed that of the 19 respondents who were included in the abnormal BMI category, there were 10 respondents (52.6%) who had complaints and 9 respondents (47.7%) who had no complaints. Of the 37 respondents who were included in the normal BMI category, there were 17 respondents (45.9%) who had complaints and 20 respondents (54.1%) who had no complaints.

Based on the results of statistical analysis using the Chi-square test in the Chi-square test table, the value of continuity correction = 0.037 with a value of  $p = 0.848$  where the value of  $p > 0.05$ . So it can be concluded that the BMI does not have a significant relationship with MSD in fishermen (Table 3).

*Analysis of the relation between work posture/position and MSD*

Work posture/positions are obtained from the measurement of work positions when doing work using REBA. REBA scores for fishermen who were respondents ranged from 7–13. Based on the data obtained, it was found that in the posture/work position category of 56 respondents, the highest was in the high-risk category as many as 40 respondents (71.4%) compared to those in the low-risk category of 16 respondents (28.6%) (Table 4).

Based on the research results, data is obtained regarding the relationship between work posture/positions with MSD in fishermen. The results of the analysis are that of the 40 respondents who fall into the high-risk category, there are 26 respondents (65%) who have complaints and 14 respondents (35%) who have no complaints. Of the 16 respondents who fall into the low-risk category, there is 1 respondent (6.3%) who has complaints and there are 15 respondents (93.8%) who have no complaints.

Based on the results of statistical analysis using the Chi-square test on the Chi-square test table, Fisher's exact test value with a value of  $p = 0.000$  where  $p$ -value  $< 0.05$ . So it can be concluded that work posture/positions have a significant relationship with MSD in fishermen at the fishermen Occupational Health Efforts Post in Maros Regency in 2020 (Table 5).

**Table 5**  
Result of the analysis of the relation between work posture and musculoskeletal disorders.

Work posture/position	Musculoskeletal disorders				Total		p-value
	There are complaints		No complaints		n	%	
	n	%	n	%			
High risk	26	65	14	35	40	100	0.000
Low risk	1	6.3	15	93.8	16	100	
Total	27	48.2	29	51.8	56	100	

Source: Primary Data, 2020.

## Discussion

Based on observations when researching that fishermen who have a BMI both normal and abnormal are still productive, carrying out fishing activities as usual. There is no correlation between BMI and MSD in fishermen at the fishermen's occupational health care post in Maros Regency, possibly because the number of fishermen who have a normal BMI is more than fishermen who have an abnormal BMI, but the fact is that there are fishermen who have a normal BMI but have MSD.

Similar results were found by research conducted on Gemstone Craftsmen in Keramat Village, East Martapura Regency regarding the relation between BMI and MSD with the results of data analysis obtained a value of  $p = 0.390$  where  $p > 0.05$  which indicates that the BMI is not has a significant association with MSD.<sup>5</sup>

There is also the possibility that it is caused by the habit of doing work with a workload that exceeds the limit of muscle strength. Also, the work posture factor is odd and their body parts move away from their natural position which is carried out continuously and for a long time because the work environment is in the water so that the space for movement is limited and the equipment used is still traditional or still uses human power.

Muscle contraction occurs when the body moves using ATP (Adenosine triphosphate) and calcium energy. When ATP is used by muscles for contraction, it will be directed by anaerobic metabolism, namely fuel metabolism without oxygen, then fuel damage is not optimal and lactic acid is formed. The accumulation of lactic acid is responsible for muscle complaints. If the muscles continue to contract there is no chance for relaxation, then muscle complaints arise. This is not following the theory that an increase in BMI is related to the severity of musculoskeletal function. Relating to the balance of the frame structure in accepting loads and other loads.<sup>6</sup>

This study indicates that work posture has a significant relationship with MSD among fishermen at the fishermen Occupational Health Efforts post in Maros Regency. The results of this study have similar results with the existing theory that work posture/position is one of the factors that can affect MSD.

This research is in line with research Laregang in Alo Utara Village, Rainis District, Talaud Islands Regency. The data they obtained from the results of their research had a value of  $p = 0.002$  where  $p < 0.05$ , this indicates that work posture/position has a significant relationship with MSD.<sup>7</sup>

Some of the risky work postures are when starting the engine on the "Jolloro" boat by turning and the "Katinting" boat by pulling. When pulling the fishing gear both the net and the tap using both hands and requires strength and by doing it in an awkward position. Each activity was repeated and took more than one hour. The highly repetitive movements during the performance of the worker's activity are also considered one of the main causes of the appearance of MSD. Highly repetitive activities can directly injure the tendons using repeated contractions and stretch.<sup>8</sup> Jolloro and Katinting are quite a small boat. Limited space for fishermen could lead to high occupational risks.<sup>9</sup> The fishermen work posture when

doing their work is done with an odd posture, where the body position deviates significantly from a neutral position when doing activities. This position is influenced by the limitations of the body and space to move when fishing because the work environment is above water and on small/traditional boats.

Besides, the position is based on movement, which is done in a static position where most of the body has little movement, most of which occur in the hands, waist, and neck. In the movement of some of the body parts, it lasts quite a while depending on the size of the fishing gear of the fishermen. In the results of active observation, where the researcher participates in the process of catching marine products, the time required for one fishing gear takes 1–2 h, on average fishermen have two fishing gear. Based on the explanation above, the work posture of fishermen when doing their work is far from the natural position, carried out in a static position for a long time which can cause continuous muscle contraction and pressure on the limbs.

Giving an education for fishermen about how to work properly to avoid MSD could be useful. One of the research there was a difference in knowledge of fishermen pre and post knowing how to work in a good position. After being given counseling, there was an increase in knowledge and a decrease in complaints of MSD. Complaints of a mild, medium and high MSD decreased, and the amount of fishermen who did not have complaints of MSD increased.<sup>10</sup> Redesigning tools and work processes in accordance with ergonomic principles are also suggestions to decrease MSD for workers.<sup>11</sup>

## Conclusions

BMI does not have a significant relation between MSD. But working posture/position has a significant relation with it. Further research is needed on this topic, such as using a medical examination of MSD not only using a questionnaire so that the accuracy of the disease complaints is more accurate.

## Conflicts of interests

The authors declare that they have no conflict of interest.

## References

- Daika N. Correlation between working postures and the complaints of musculoskeletal diseases of the fishermen in Tanjung Village, Sumenep District. *Indones J Occup Saf Heal.* 2019;8, <http://dx.doi.org/10.20473/ijosh.v8i3.2019.259-266>.
- Øren SASAU-TTAU-IMHAU-A. Work environment and health in the fishing fleet: results from a survey amongst Norwegian fishers. *Work Environ Heal Fish fleet results from a Surv amongst Nor Fish;* 2017. p. 203–10, <http://dx.doi.org/10.5603/IMH.2017.0038>.
- Fonseka M, Karunaratne A, Senanayake S, et al. Risk activities related to traditional fishing activities leading to musculoskeletal problems among Sri Lankan fishermen. *Physiotherapy.* 2015;101:e396–7.
- Sayed AT, Asma AR, Maryam AA. The relationship between the development of musculoskeletal disorders, body mass index, and academic stress in Bahraini University students. *Korean J Pain.* 2017;30:126–33, <http://dx.doi.org/10.3344/kjp.2017.30.2.126>.

5. Setyaningrum R, Hikmah N, Pujianti N. Correlation Between Tenure, BMI and musculoskeletal disorders complaints among gemstone craftsman in keramat village East Martapura District. *Adv Sci Lett.* 2017;23:3411–3.
6. Widodo RS, Nurarinda W, Mauliku NE. The correlation age, body mass index. Work period and work position with musculoskeletal disorders in workers packing part of pt. Sanbe Farma Unit II in 2019. In: *The 3rd International Seminar on Global Health*, vol. 3. 2019. p. 330–4.
7. Larenggam AK, Kawatu PAT, Adam H. Hubungan antara posisi kerja dengan keluhan mukuloskeletal pada nelayan di desa alo utara kecamatan rainis kabupaten kepulauan talaud. *KESMAS.* 2018;7.
8. Fragoso JR, Borges G, Carvalho MO, Ramos MS. Musculoskeletal disorders in countryside fishermen of Amazonas-Brazil. Brazil: *Revista O Mundo da Saúde;* 2018.
9. Álvarez-Casado E, Zhang B, Sandoval ST, Pedro M. Using ergonomic digital human modeling in evaluation of workplace design and prevention of work-related musculoskeletal disorders aboard small fishing vessels. *Hum Factors Ergon Manuf Serv Ind.* 2016;26:463–72.
10. Sholihah Q, Hanafi AS, Bachri AA, Fauzia R. Ergonomics awareness as efforts to increase knowledge and prevention of musculoskeletal disorders on fishermen. *Aquat Proc.* 2016;7:187–94.
11. Thamrin Y, Wahyu A, Russeng SS, Wahyuni A, Hardianti A. Ergonomics and musculoskeletal disorders among seaweed workers in Takalar Regency: a mixed method approach. *Med Clin Pract.* 2020;3, <http://dx.doi.org/10.1016/j.mcpsp.2020.100110>, 100110.