ORIGINAL ARTICLE

**The relationship between individual characteristics and musculoskeletal disorders in tuna fishermen in the hamlet of Pelita Jaya West Seram Regency in 2024**

Short title: Jeremy Theophilus Mailuhu et al, Relationship between individual characteristics and musculoskeletal disorders in tuna fishermen

**Jeremy Theophilus Mailuhu, Parningotan Yosi Silalahi** (https://orcid.org/0009-0003-1612-8252), Samuel Maruanaya (https://orcid.org/0000-0001-8958-4409), **Bertha Jean Que** (https://orcid.org/0009-0003-3990-4285), **Is Ikhsan Hataul, Nathalie Elischeva Kailola, Marthen Yoseph Matakupan**

Faculty of Medicine, Universitas Pattimura, Ambon, Indonesia

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Jeremy Theophilus Mailuhu, Faculty of Medicine, Universitas Pattimura, 85VQ+H7J, Poka, Kec. Tlk. Ambon, Kota Ambon, Maluku, 97233 Ambon, Indonesia, e-mail: [jeremytheophilus26@gmail.com](mailto:jeremytheophilus26@gmail.com)

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**ABSTRACT**

***Background****: Indonesia is a country with vast marine areas. It is also part of the world's coral reef triangle, which means that Indonesia has various types of coral reef species. This gives Indonesia a very strong maritime potential. Consequently, many Indonesians work as fishermen. In Pelita Jaya Hamlet, the majority of people work as tuna fishermen. Fishing is a job with high physical activity, so fishermen have the potential to experience musculoskeletal disorders. Musculoskeletal disorders are problems that occur in the human muscular and skeletal systems, characterized by pain, numbness, and limited movement.*

***Materials and methods:*** *This was an analytical observational study with a cross-sectional design approach, involving a sample of 68 people.*

***Results:*** *Based on the analysis of this study, there was no significant relationship between individual characteristics and musculoskeletal disorders, with a p value of 0.808 for age, 0.190 for BMI, 0.357 for work duration, 0.618 for work period, and 0.733 for smoking habits (> 0.05). However, a significant relationship was found between age and musculoskeletal disorders of the back, with a p value of 0.028.*

***Conclusion:*** *There is no significant relationship between individual characteristics and musculoskeletal disorders, However, there is a significant relationship between age and disorders of the back in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency.*

***Keywords: musculoskeletal disorders, tuna fisherman, Nordic Body Map***

**INTRODUCTION**

Musculoskeletal disorders are one of the factors that cause many people to experience decreased productivity. According to data from the World Health Organization (WHO) [1], in 2019, around 1.7 billion people were affected by musculoskeletal disorders, making them the leading cause of deformity worldwide. Information from the Maluku Provincial Health Office [2] indicates that musculoskeletal disorders rank third among all diseases in Maluku Province, with a total of 4,000 cases reported in 2022. Occupational factors can contribute to musculoskeletal disorders, with the fishing profession occupying the 4th position in terms of prevalence in Indonesia [3].

Indonesia is one of the countries that has great opportunities in the field of fisheries because it has a large marine area and is the largest archipelago in the world [4]. This is one of the reasons why many Indonesians, around 2 million people, work as fishermen [5]. The high fish production in Indonesia is also linked to the fact that it is part of the coral triangle [6].

Maluku is a province located in the center of the coral triangle, giving it great opportunity in the field of fisheries. This is evidenced by the high production of tuna fish in Maluku Province, which ranks second in Indonesia for tuna production [7]. This demonstrates that the fisheries sector in Maluku Province can significantly improve people's welfare, leading many to work as fishermen. Approximately 157 thousand people in Maluku Province are employed as fishermen [5].

The high incidence of musculoskeletal disorders in Maluku Province correlates with the large number of people in Maluku Province who work as fishermen. The same situation exists in Pelita Jaya Hamlet in West Seram Regency. Based on preliminary data,, the majority of people in Pelita Jaya Hamlet are tuna fishermen because the natural resources from the sea are far greater and more abundant than those from land.

People in Pelita Jaya Hamlet who work as tuna fishermen use traditional methods that only use bamboo and hooks. The catch begins by spreading live bait first around the boat, then when the tuna approaches and eats the hooks owned by fishermen, they will quickly pull and throw the fish into the boat. The existence of strenuous physical activity carried out in a certain position for a long time and light physical activity carried out not only once in a long period of time can be a contributing factor to the occurrence of musculoskeletal disorders [8]. In addition, musculoskeletal disorders can also be influenced by individual characteristics that is age, work period, work duration, work environment that does not facilitate ideal body posture, smoking habits. These things make tuna fishers in Pelita Jaya Hamlet have many risk factors for experiencing musculoskeletal disorders [8]. The objectives of this study are to determine the individual characteristics [age, work duration, work period, smoking habits and Body Mass Index (BMI)] of tuna fishers in Pelita Jaya Hamlet, West Seram Regency, to determine the characteristics of the location of musculoskeletal disorders based on the Nordic Body Map (NBM) in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency, to determine the relationship of individual characteristics (age, work duration, work period, smoking habit and BMI) with musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency. The research hypotheses is that there is a relationship between individual characteristics and musculoskeletal disorders in these fishermen.

**MATERIALS AND METHODS**

Respondents in this study totaled 68 people, tuna fishermen in Pelita Jaya Hamlet (one of the hamlets located in West Seram Regency). They only worked as tuna fishermen, ensuring the study results were not biased by other occupations. Respondents were asked to sign a consent form and fill out a questionnaire. The research was conducted at the fish harbor in Pelita Jaya Hamlet from May to June 2024. The questionnaire was divided into 2 parts: the first part recorded individual characteristics (age, BMI, work duration, work period, and smoking habits), while the second part, the Nordic Body Map (NBM) section, recorded the location and intensity of musculoskeletal pain in the patient's body. Respondents answered the questions in the presence of the researcher [9]. The researchers recorded the answers and the results were input into Microsoft Excel. The data were later analyzed using the Statistical Package of the Social Sciences (SPSS) version 25 program, with the chi-square test. For data that did not meet the chi-square requirements, the Fisher test was used.

**METHOD DECRIPTION**

This study aimed to determine whether respondents experienced musculoskeletal disorders, characterized by pain in their muscles, bones or joints, and to investigate the relationship between these musculoskeletal disorders and the individual characteristics of patients (age, BMI, work duration, length of work, and smoking habits). Musculoskeletal disorders in patients were measured using the NBM questionnaire, which assessed the location and intensity of pain felt by respondents after work (performing physical activity as a fisherman). The pain intensity in this questionnaire is categorized into 4 levels: no pain, mild pain, pain and severe pain. The pain location was determined by dividing the body into 28 parts starting from the upper neck to the feet. The data analysis involved correlating the individual characteristics of the respondents with the musculoskeletal disorders they experienced. To fulfill the requirements of the chi-square test, researchers focused on the 3 body parts with the highest incidence of musculoskeletal disorders and combined the categories of mild pain, pain and severe pain.

**ETHICAL CONSIDERATIONS**

Ethical permission to conduct research titled “The Relationship between Individual Characteristics and Musculoskeletal Disorders in Tuna Fishermen in Pelita Jaya Hamlet, West Seram Regency in 2024” was obtained from the Ethics Commission of the Faculty of Medicine, Pattimura University (letter of recommendation for ethical approval to conduct research in Pelita Jaya Hamlet, ref. 038/FK-KOM.ETIK/VII/2024). IX/4040, 05 July 2022).

**RESULTS**

Based on Table 1, respondents were evenly distributed between the two age categories, with 34 people in each. The majority of respondents fell into the obesity category in terms of BMI (29 people). Most respondents worked at least 8 hours a day (63 people), and the majority had been working for 11–20 years (29 people). In terms of smoking habits, most respondents were classified as heavy smokers (39 people).

Based on the Table 2, most tuna fishermen are experienced musculoskeletal disorders in the right shoulder (52 people), followed by the left shoulder (38 people) and the back (23 people).

In this study, the independent variables were individual characteristics (age, BMI, work duration, length of work, smoking habits), while the dependent variable was musculoskeletal disorders in tuna fishermen, based on the three locations with the highest pain frequency according to the NBM. For data analysis, the categories of mild pain, pain and severe pain were grouped into one category.

Based on the Table 3, the results of data tests related to age showed the following p values: p = 0.808 (p > 0.05) the left shoulder, p = 0.190 (p > 0.05) for the right shoulder, and p = 0.028 (p < 0.05) for the back. For BMI, the p values were p = 0.190 (p > 0.05) for the left shoulder, p = 0.104 (p > 0.05) for the right shoulder, and p = 0.204 (p > 0.05) for the back. For work duration the p values were p = 0.357 (p > 0.05) for the left shoulder, p = 0.656 (p > 0.05) for the right shoulder, and p = 0.602 for the back. For work period, the p values were p = 0.618 (p > 0.05) for the left shoulder, p = 0.506 (p > 0.05) for the right shoulder, and p = 0.602 (p > 0.05) for the back. For smoking habits the p values were p = 0.733 (p > 0.05) for the left shoulder, p = 0.894 (p > 0.05) for the right shoulder, and p = 0.279 (p > 0.05) for the back. From this information, it can be concluded that there is no relationship between individual characteristics and musculoskeletal disorders in respondents. However, there is a relationship between one of the individual characteristic variables (age) with one of the musculoskeletal disorder variables (back).

**DISCUSSIONS**

**Characteristics of musculoskeletal disorders based on Nordic Body Map**

Based on observations made by researchers, tuna fishers often perform shoulder flexion movements to lift fish from the sea to the boat. This shoulder flexion and extension movement occurs due to activation of the deltoideus muscle, which pulls the hand from below towards the top. Repeated activation with a high frequency coupled with a load can injure the deltoideus muscle, causing pain in the shoulder. Additionally, the majority of fishermen are right-handed, so the right side shoulder muscles are more at risk of musculoskeletal disorders [10]. Furthermore, fishermen often sit on the side of the boat and lift fish from the sea, which causes compression on the back. This compression can lead to back pain [8].

**Relationship between age and musculoskeletal disorders**

H0 is accepted and Ha is rejected. However, there is a significant relationship between age and back pain, which means H0 is rejected and Ha is accepted. This is in line with research conducted by Aulia Tjahayuningtyas [11], who stated that there was no significant relationship between age and musculoskeletal disorders. Similarly, Ninik Nur Wulandari [12] found no relationship between age and musculoskeletal disorders. However, the relationship between age and back pain is consistent with research conducted by Syalsabila [13], who reported a relationship between age and back pain complaints.

Based on the results of conversations during data collection, there was no relationship between age and musculoskeletal disorders in the shoulder. This could be due to the fact that the majority of tuna fishermen have been engaged in physical activity since a young age, resulting in good muscle endurance. This aligns with Apri Agus [14], who noted that fishermen's habit of performing physical activities from a young age helps maintain muscle and bone endurance. However, as age increases, there is a decrease in bone stability and muscle strength. Unlike the shoulder muscles, which are directly trained by fishermen, the back muscles are not. This leads to weakening of the back muscles with age, causing back pain [13].

**Relationship between Body Mass Index and musculoskeletal disorders**

H0 is accepted and Ha is rejected. The test results indicate that there is no significant relationship between BMI and musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency. This finding is consistent with research conducted by Fanjaniaina Sophia et al. [15], which also found no significant relationship between BMI and musculoskeletal disorders.

Based on theory, BMI can cause musculoskeletal disorders due to the body's inability to support its own body weight [16]. However, discussions with tuna fishermen in Pelita Jaya Hamlet revealed that they consistency eat healthy foods, such as boiled fish and green vegetables, which are high in protein and low in fat. This diet can aid the muscle recovery process and may influence the relationship between BMI and musculoskeletal disorders [17].

**Relationship between work duration and musculoskeletal disorders**

H0 is accepted and Ha is rejected. The test results indicate that there is no significant relationship between work duration and musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency. This finding is consistent with research conducted by Atthariq Wahab [18], which also found no significant relationship between duration of work and musculoskeletal disorders.

Based on the researchers’ observations, the duration of work of tuna fishermen is not related to musculoskeletal disorders due to the variable nature of their working hours. Working hours of more than 8 hours are calculated from the time they leave the dock until they finish unloading. However, if calculated only when fishing activities, the duration of work is only 1–2 hours. This may explain the absence of a significant relationship between work duration and musculoskeletal disorders.

**Relationship between work period and musculoskeletal disorders**

H0 is accepted and Ha is rejected. The test results indicate that there is no significant relationship between work period and musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency. This finding is consistent with research conducted by Faridah F. [19], which also found no significant relationship between work period and musculoskeletal disorders.

Based on the discussions with tuna fishermen, it was found that their bodies adjust to the activities they perform. This is in accordance with Krisdianto’s [20] observation that there is no relationship between tenure and musculoskeletal disorders, due to physical adjustment to prolonged physical activities.

**Relationship between smoking habits and musculoskeletal disorders**

H0 is accepted and Ha is rejected. The test results indicate that there is no significant relationship between smoking habits and musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency. This finding is consistent with research conducted by Krisdianto [20], which also found no significant relationship between smoking habits and musculoskeletal disorders.

Smoking habits can contribute to musculoskeletal disorders. However, based on the results of data collection conducted by researchers, the number of non-smoking fishermen is significantly lower than those who smoke. Most of the fishermen who smoke fall into the mild and moderate categories, with only a small number classified as heavy smokers. This distribution may affect the results of this study. Additionally, the impact of smoking is typically chronic, so the symptoms may not have manifested at the time of the study [20].

**CONCLUSIONS**

The individual characteristics of tuna fishermen in Pelita Jaya Hamlet are mostly in the adult age category with a BMI classified as obesity. Most work duration exceed 8 hours a day, with a work period of around 11–20 years, and the majority of smokers fall into the heavy smoker category. According to the NBM questionnaire, tuna fishermen most commonly experience musculoskeletal disorders in the right shoulder, left shoulder and back. There is no significant relationship between individual characteristics and musculoskeletal disorders in tuna fishermen in Pelita Jaya Hamlet, West Seram Regency, as indicated by a *p* value > 0.05 in the relationship between age, BMI, work duration, work period, and smoking habits with left shoulder, right shoulder, and back. However, there is a significant relationship between age and back pain, with a *p* value < 0,05.

**ARTICLE INFORMATION AND DECLARATIONS**

**Author contributions:** PYS — contributed to the conceptualization, contributed to study methodology, provided advice on data analysis, reviewed and edited the final manuscript; MYM — contributed to the conceptualization, contributed to study methodology; JTM — contributed to study methodology, performed formal analysis, prepared the original draft of the manuscript, contributed to the data analysis and writing of the original draft, reviewed and edited the final manuscript; SM — contributed to study methodology, provided advice on data analysis, reviewed and edited the final manuscript; BJQ — provided advice on data analysis; IH — provided advice on data analysis; NEK — provided advice on data analysis. All authors have read and approved the final manuscript.

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**Table 1.** Individual characteristics of tuna fishermen in Pelita Jaya Hamlet

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristics | | Amount | |
| **n = 68** | % = 100 |
| Age | Adult | 34 | 50.0 |
| Elderly | 34 | 50.0 |
| BMI | Normal | 17 | 25.0 |
| **Fat** | 22 | 32.4 |
| **Very fat** | 29 | 42.6 |
| Work duration | Less than 8 hours | 5 | 7.4 |
| More than or equal to 8 hours | 63 | 92.6 |
| Work period | 1–10 year | 17 | 25.0 |
| 11–20 year | 29 | 42.6 |
| > 20 year | 22 | 32.4 |
| Smoking habits | Non smokers | 8 | 11.8 |
| Light smokers | 21 | 30.9 |
| Heavy smokers | 39 | 57.4 |

BMI — Body Mass Index

**Table 2.** Characteristics of musculoskeletal disorders based on Nordic Body Map from highest to lowest frequency

|  |  |  |
| --- | --- | --- |
| **Characteristics** | **Amount** | |
| **n = 68** | **% = 100** |
| Right Shoulder | 52 | 76.5 |
| Left Shoulder | 38 | 55.9 |
| Back | 23 | 33.9 |
| Waist | 22 | 32.4 |
| Right upper arm | 18 | 26.5 |
| Left upper arm | 13 | 19.2 |
| Upper neck | 9 | 13.3 |
| Hips | 9 | 13.3 |
| Buttocks | 9 | 13.3 |
| Right wrist | 8 | 11.8 |
| Right elbow | 6 | 8.9 |
| Left wrist | 6 | 8.9 |
| Left hand | 6 | 8.9 |

|  |  |  |
| --- | --- | --- |
| Left thigh | 6 | 8.9 |
| Right thigh | 6 | 8.9 |
| Left calf | 6 | 8.9 |
| Right hand | 5 | 7.4 |
| Right calf | 5 | 7.4 |
| Left feet | 5 | 7.4 |
| Left elbow | 4 | 5.9 |
| Left forearm | 4 | 5.9 |
| Right forearm | 4 | 5.9 |
| Left knee | 4 | 5.9 |
| Right feet | 4 | 5.9 |
| Right knee | 3 | 4.5 |
| Left ankle | 2 | 2.95 |
| Right ankle | 2 | 2.95 |
| Lower neck | 0 | 0.0 |

**Table 3.** Relationship between individual characteristics and musculoskeletal disorders in tuna fishermen

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Individual characteristic** | | **Musculoskeletal disorders** | | | | | | | | | | | |
| **Left shoulder** | | | | **Right shoulder** | | | | **Back** | | | |
| **No pain** | **Pain** | **Total** | ***p* value** | **No pain** | **Pain** | **Total** | ***p* value** | **No pain** | **Pain** | **Total** | ***p* value** |
| **Age** | Adut | 17 | 17 | 34 | **0.808** | 8 | 26 | 34 | **0.120** | 29 | 5 | 34 | **0.028** |
| Elderly | 18 | 16 | 34 | 14 | 20 | 34 | 21 | 13 | 34 |
| **Total** | 35 | 33 | 68 | 22 | 46 | 68 | 50 | 18 | 68 |
| **BMI** | Normal | 12 | 5 | 17 | **0.190** | 9 | 8 | 17 | **0.104** | 15 | 2 | 17 | **0.240** |
| **Fat {Overweight???/ Obesity???}** | 10 | 12 | 22 | 5 | 17 | 22 | 16 | 6 | 22 |
| **Very fat {Obesity???/ Severe obesity???}** | 13 | 16 | 29 | 8 | 21 | 29 | 19 | 10 | 29 |
| **Total** | 35 | 33 | 68 | 22 | 46 | 68 | 50 | 18 | 68 |
| **Work duration** | < 8 hour | 4 | 1 | 5 | **0.357** | 2 | 3 | 5 | **0.656** | 3 | 2 | 5 | **0.602** |
| ≥ 8 hour | 31 | 32 | 63 | 20 | 43 | 63 | 47 | 16 | 63 |
| **Total** | 35 | 33 | 68 | 22 | 46 | 68 | 50 | 18 | 68 |
| **Work period** | 1–10 year | 7 | 10 | 17 | **0.618** | 4 | 13 | 17 | **0.506** | 13 | 4 | 17 | **0.787** |
| 11–20 year | 16 | 13 | 29 | 9 | 20 | 29 | 22 | 7 | 29 |
| >20 Year | 12 | 10 | 22 | 9 | 13 | 22 | 15 | 7 | 22 |
| **Total** | 35 | 33 | 68 | 22 | 46 | 68 | 50 | 18 | 68 |
| **Smoking habits** | Non smokers | 3 | 5 | 8 | **0.733** | 2 | 6 | 8 | **0.894** | 6 | 2 | 8 | **0.279** |
| Light Smokers | 11 | 10 | 21 | 7 | 14 | 21 | 18 | 3 | 21 |
| Heavy Smokers | 21 | 18 | 39 | 13 | 26 | 39 | 26 | 13 | 39 |
| **Total** | 35 | 33 | 68 | 22 | 46 | 68 | 50 | 18 | 68 |

BMI — Body Mass Index