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A Study of Ergonomic Work Posture on Traditional Fishing Boats Manufacturing in Lhokseumawe

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ABSTRACT

Sailing ships in Aceh are usually conventional, this shipbuilder usually requires 3 people. Sailing ships in Aceh are usually made conventionally. Shipbuilders need 3 workers. Construction time for ships weighing 1 to 3 gross tons (GT) takes 1 - 2 months. Strategies and improvements in shipbuilding methods have been well-studied in the shipbuilding literature. The location and process of making the ship are in the Banda Sakti sub-district, Lhokseumawe city. It has multiple workstations such as measuring and cutting stations and assembly stations. Operators must work 8 hours a day in a variety of postures, including standing, bending, and lifting heavy objects. According to the preamble of the Nordic Body Map, such intense exercise damages the musculoskeletal system. the methods used in these workers' assessment of their working posture were compared to the Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA). In the process of making fishing boats. Results of REBA Labor Calculation: Worker 1 gets a score of 9, Worker 2 gets a score of 11, and Worker 3 gets a score of 5. In RULA, Workers 1 and 2 get the same score of 6, and Worker 3 gets the same score of one Score out of 4. REBA receives a final score of 2 at low-risk level 1 and REBA 2 workers received a final score of 2 at level 1, low-risk, and performance level 1. Working conditions at lifting stations need to be improved to prevent diseases of the musculoskeletal system in employees of the timber lifting station.

1. Introduction

1.1 Research Background

The operator's work posture in every movement has a different body posture, this movement can be influenced by the conditions of the workstation where the operator is carrying out his activities [13,20]. Every operator in his work environment always wants work that can be done with minimum effort but can give maximum results as expected [1,15,16]. The Pusong Lama community in Banda Sakti District, Lhokseumawe City, is a community that lives on the coast. Most of them work

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as traditional fishermen. The various potentials and natural resources around the coast are the main attraction for the community to meet other needs. One of them is the development of the traditional fishing boat industry along the coast. Based on data from the Fish Landing Base Technical Implementation Unit (UPT. PPI) Pusong Lhokseumawe this traditional shipbuilding industry is increasing in Lhokseumawe. The number of ships produced from time to time has increased from a number of existing locations and the number of ships worked has increased by around 5%. The ships that are produced in Pusong are based on orders in the local area and also outside the Lhokseumawe area. Each of the ships being worked on weighs 20 tons, is 20 meters long, 2.5 meters high, 6.5 meters wide, and has 50 GT (gross tonnage) with a construction time of 6 -1 years, because it depends on the supply of raw materials. The cost of shipbuilding for the procurement of engines and other equipment for a ship ranges from $1 billion to $3 billion. The process of making fishing boats in Lhokseumawe Pusong has three operators, namely wood-cutting operators, wood-lifting operators, and ship-building operators. Based on several facts related to working conditions found in shipbuilding workers in Lhokseumawe Pusong, it is found that the dominant work is done standing, bending, and lifting heavy loads for 1 working day (8 hours). Based on the results of the NBM questionnaire for workers, it turns out that there are complaints felt by workers on certain limbs such as the neck, spine, legs, and hands, which if they occur for a long time will endanger the health of works [6]. Based on the existing problems, the purpose of this study was to examine the current working posture of fishing vessel construction operators. To improve work posture, the Rapid Upper Limb Assessment and Rapid Entire Body Assessment methods are used reduce risks arising from the operator's working position, both in the upper body position and all parts of the operator's body [19].

1.2 Literature Review

1.2.1 Ergonomics

Ergonomics is the branch of science that uses information about human nature, capabilities, and limitations to create systems of work that are "effective, comfortable, safe, healthy, and efficient." Ergonomics is an interdisciplinary science that combines several branches of science, such as medicine, biology, psychology, and sociology [2,3]. There is a hierarchy of goals for applying ergonomics [4], with the lowest goal being a system of work that is acceptable within certain limits, provided that this system does not pose a potential threat to health and human life. The overriding goal is the situation, enforcing technical or organizational restrictions that allow employees to accept current working conditions [5].

1.2.2 Rapid Upper Limb Assessment (RULA)

Rapid Entire Body Assessment (REBA) is a method developed in the field of ergonomics to rapidly assess the working position or posture of an operator's neck, back, arms, wrists, and legs. In addition, the method is also affected by coupling factors, external loads carried by the body, and worker activity. The REBA assessment does not take long and performs a general assessment against a list of activities that indicate the need for risk mitigation caused by operator work postures. [7,8,10,12,26]:

i. Action Level 1: Acceptable posture
ii. Action Level 2: Needs further investigation and may need to be changed
iii. Action Level 3: Immediate investigation and change is needed
iv. Action Level 4: Immediate investigation and change is needed for evaluation

1.2.3 Rapid Entire Body Assessment (REBA)

The Rapid Entire Body Assessment (REBA) technique is a posture analysis system that is sensitive to musculoskeletal threats in a variety of tasks, particularly for evaluating work postures in healthcare and other services. The posture classification system, which includes arms, forearms, wrists, torso, neck, and legs, is based on body part diagrams. The method reflects the range of applied external forces, muscle activity through static, dynamic, rapidly changing, or unstable posture, and the feedback effect. REBA, this technique provides five levels of action to assess the extent of corrective action [9,11,14,22]:

i. Action level 0: Further evaluation does not require corrective action
ii. Action Level 1: Action may be required for further evaluation
iii. Action stage 2: Actions required for further evaluation
iv. Action Stage 3: Immediate action is required, including further evaluation
v. Action Level 4: Action required including further evaluation

1.2.4 Nordic Body Map (NBM)

Nordic Body Map (NBM) is a method used to measure muscle pain in operators. Nordic Body Map (NBM) is a method in the form of a questionnaire for knowing which part of the operator's body has complaints, ranging from no pain to very painful [21,24]. This is caused by work posture errors when carrying out work activities. Complaints in the muscles are grouped into two, namely temporary complaints and persistent complaints [9,17,18,23].

2. Methodology

2.1 Research Location and Time

This research was conducted on the process of making traditional fishing boats, which is located on Jalan PPI Pusong, Banda Sakti District, Lhokseumawe City. When the research was carried out starting for 1 month, namely in August 2022. The stages carried out started from the preparation of research proposals, the collection of questionnaire data, data processing, and the writing of the final research report.

2.2 Object of Research

The object of the research that was observed was the process of making fishing boats in Pusong, Lhokseumawe City. Data types, sources, and types of data collected in conducting this research are as follows. Initial Identification at the initial identification stage includes:

i. Embarrassed by the problem and literature study in accordance with the topic taken
ii. Formulate the problem
iii. Determine research objectives
iv. Determine the benefits of research

2.3 *Analysis Method*

The methods of analysis carried out in this study include several approaches. The Nordic Body Map questionnaire is used to determine the workers' complaints and the level of risk of musculoskeletal disorders in workers. Complaints can be identified by giving questionnaires to workers and asking them directly.

Rapid whole body assessment, rapid upper extremity assessment, and ergonomic risk value measurement by the working posture determination method. A proper combination of points will result in a final grade of 1-7. The final score relates to his 4 levels of action and 4 levels of risk. The results, measures, and risk levels of the upper extremity rapid assessment are summarized in Table 1.

Table 1
REBA and RULA score at their respective effectiveness levels

RULA score	Action level	REBA score	Action level	Risk level
1	0	1	0	Negligible
1-2	1	2-3	1	Low
3-4	2	4-7	2	Medium
5-6	3	8-10	3	High
7	4	11-15	4	Very high

In a rapid assessment of the whole body [14,25], the body is divided into segments and divided into two groups. The first is the neck, torso, and legs. The second group includes the indistinguishable right and left forearm, forearm, and wrist. This procedure consists of assigning points to each body segment based on the assumed posture and, via a table or numerical tables, of the musculoskeletal postural strain caused by the combination of the two determined sets of postures. To get two different points to represent degrees. These two values should be added to the handle value. The corresponding load coerce the value to get two new values (Class A and B). You can get a C by using a third chart or table. Add this to your activity score to get your final overall score. Final scores range from 1 to 15 and are associated with 5 actions and 5 levels of risk.

3. Results

Work posture, which is the concept in this study, is the working posture of shipyard employees. The work is carried out every day repeatedly until the ship is finished. At this stage an assessment of work posture was carried out for 3 workers in the shipyard using the Rapid Entire Body Assessment, Rapid Upper Limb Assessment methods. Working posture of the three workers. The operator's position measured is the angle of the neck, back, upper arm, forearm and wrist, the results of these measurements are as shown in Figure 1 -3 below.

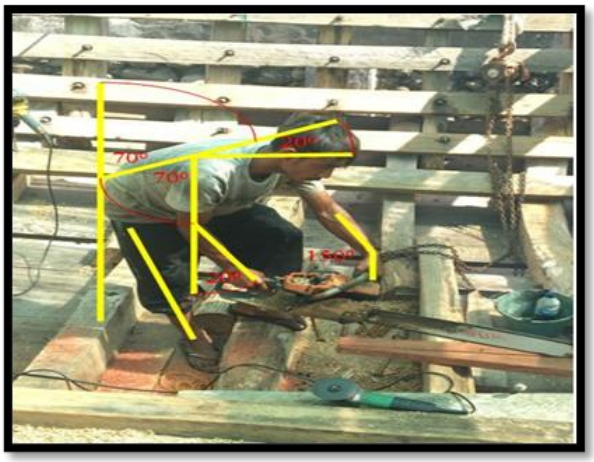

Fig. 1. Measurement of worker work posture 1

Fig. 2. Measurement of working posture 2

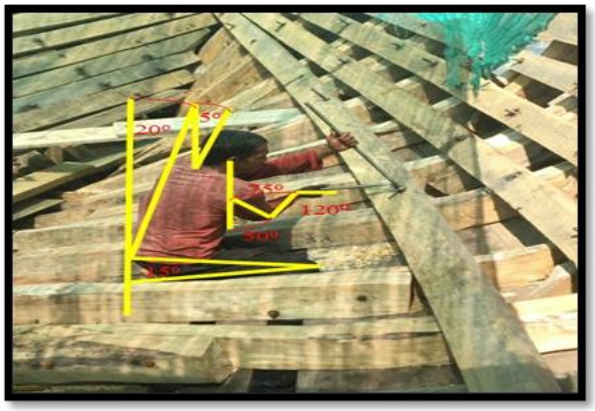

Fig. 3. Measurement of the working posture 3

3.1 Analysis of Work Posture Based on the REBA Method

The working posture, which is the concept in this study, is the condition of the working posture of shipbuilding workers. This work is repeated every day until the ship is finished. At this stage, an assessment of the work posture of 3 workers in shipbuilding will be carried out. At this stage, an assessment of the work posture of 3 workers in shipbuilding will be carried out. Recapitulation of Work Posture Assessment Based on REBA Method is in Table 2.

Table 2
Summary of work posture evaluation based on REBA method

No	Responden	Grand score	Action level	Risk level
1	Worker 1	9	3	High
2	Worker 2	11	4	Very high
3	Worker 3	5	2	Medium

Based on Table 2, the risk level for shipbuilding respondents is obtained. The scores obtained ranged from 4-7 and 11-15. This shows that shipbuilding workers in the center of Lhokseumawe city are at a high level of risk, so immediate action is needed. The highest REBA score occurred in worker 2, the final score was 11 with a very high risk level, for it is necessary to take action immediately. While for worker 1, the final score is 9 with a high level of risk, for this, it is necessary to take action immediately and for worker 3, the final score is 5 with a moderate risk level.

3.2 Analysis of Work Posture Based on the RULA Method

Based on the results of data processing on the manufacture of fishing boats in the city of Lhokseumawe using the RULA method, the recapitulation of work posture assessment based on RULA Method it can be seen in Table 3.

Table 3
Summary of work posture evaluation Based on RULA Method

No	Responden	Grand score	Action level	Risk level
1	Worker 1	6	5 - 6	Medium
2	Worker 2	6	5 - 6	Medium
3	Worker 3	4	3 - 4	Small

Based on Table 2, the risk level for shipbuilding respondents is obtained. The scores obtained ranged from 3-4 and 5-6. This shows that shipbuilding workers in the center of Lhokseumawe city are at a moderate risk level, so immediate action is needed. The highest RULA scores occurred in workers 1 and 2, the final score was 6 with a moderate risk level, for this reason it is necessary to take action in the near future. While for worker 3, the final score is 4 with a small risk level, for this it takes some time is needed. Recapitulation of Work Posture Assessment with 2 methods can be seen in Table 4.

Table 4
Summary of work posture evaluation with 2 methods

No	Metode	Work posture assessment results		
		Worker 1	Worker 2	Worker 3
1	REBA	9	11	5
2	RULA	6	6	4

4. Conclusions

The level of respondents to the risk of fishing boat construction. The scores obtained by REBA ranged between 4-7 and 11-15, and the scores obtained ranged between 3-4 and 5-6. This shows that shipyard workers in downtown Lhokseumawe have a high level of risk, Therefore, urgent action is required to improve work positions to reduce work complaints. The highest REBA score occurred in worker 2, the final score was 11 with a very high level of risk, for that it is necessary to take action now, to improve the operator's work position at work. Whereas for worker 1 the final score is 9 with a high level of risk, for that it is necessary to take immediate action to improve the operator's work position in reducing work complaints, and for worker 3 the final score is 5 with a moderate level of risk, this also needs to be done to improve the operator's work position to reduce complaints.

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