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DETERMINATION OF CRITICAL WORK STATIONS USING NORDIC BODY MAP METHOD

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ABSTRACT

The development of the industry is in line with technological advancements applied in the company. However, utilization of human labor in the industrial world in Indonesia is still needed, especially for manual material handling activities. This can cause a decrease in work productivity due to cumulative work injuries felt by the operator for a long period of time. This study aims to determine the critical work stations in causing muscle fatigue in the company XYZ by using the Nordic Body Map method. Based on the results of the study, the critical work station is the Blowing Work Station, which obtains an average score of 7. This indicates that the work station is critical to be repaired.

Keywords: Muscle Fatigue, Critical Workstation, Nordic Body Map.

I. INTRODUCTION

The development of the industry is currently growing rapidly. Every company produces every day to meet the needs of an increasingly diverse and diverse community. One of them is XYZ company, where the company produces plastic bottles every day to meet the needs of the community. The development of the industry is in line with technological advancements applied in the company. However, the use of human labor in the industrial world in Indonesia is still very needed, especially for material handling activities manually or Manual Material Handling [1].

XYZ company has two main work stations, namely blowing with 16 operators and injection with 10 operators. In carrying out these activities, the company requires physical operator. Physical work (physical work) is work that requires physical energy of human muscles as a source of energy. Physical work is

often referred to as hard work or manual labor that requires strong physical effort during the work period [2].

At this time, XYZ companies found many complaints from operators in carrying out their work due to excessive physical labor, such as complaints of aches in the hands and back pain. This complaint occurs because every day the operator does repetitive work, moves things manually, and performs work with an extreme attitude that will increase pressure on the muscles. This, if often occurs over a long period of time, will result in cumulative work injuries that are hazardous to the health of the operator and can cause a decrease in work productivity.

Based on these problems, we need a way to improve the work stations in XYZ companies. In overcoming these problems, methods are needed that identify subjectively the symptoms of muscle fatigue felt by the operator. More operators complained of aches or pains, indicating that the work station was increasingly critical to be repaired. The method that can be used is Nordic Body Map (NBM). This method is a way to find out the parts of the muscle that are experiencing complaints with the level of complaints ranging from discomfort (somewhat pain) to painful [3].

II. LITERATURE REVIEW

Work Related Fatigue

Fatigue is a body's protective mechanism so that the body is protected from further damage resulting in recovery after rest. The term fatigue usually indicates different conditions of each individual, but all lead to a loss of efficiency and decreased work capacity and endurance [4]. In general, the symptoms of fatigue are closer to the understanding of physical fatigue (physical fatigue) and mental fatigue (mental fatigue). Fatigue can be divided into two types, namely muscle fatigue (muscular fatigue) and general fatigue (general fatigue). Muscle fatigue is shown through pain, extraordinary pain such as muscle tension and the area around the joint. Conversely general fatigue is seen in the emergence of a number of complaints in the form of feelings of slowness and unwillingness to do activities [1].

Nordic Body Map

Nordic Body Map is a simple ergonomic method that is most often used in assessing discomfort in the body, where the source of the complaint is related to the musculoskeletal system [3, 5]. According to Kuorinka et al., 1987 in [6], initially, there were 9 areas of the body that were examined in the Nordic Body Map. These body areas are the neck, shoulders, upper back, elbows, low

backs, hands, thighs, knees, and feet. But as they progress, complaints are currently being reviewed covering 27 parts of the secular muscles on both sides of the body, right and left starting from upper limbs namely neck muscles to the muscles in the legs [3]. Body areas examined in NBM, can be seen in Figure 1.

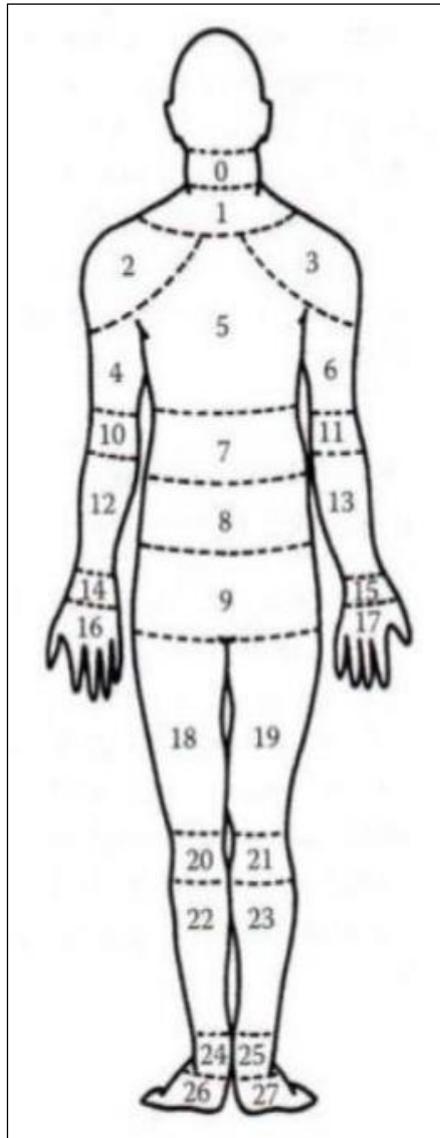


Figure 1. Body Area in the Nordic Body Map[3, 7]

Table 1. Explanation of Body Areas in the Nordic Body Map

No.	Type of complaint
0	Pain / stiffness in the upper neck
1	Pain / stiffness in the lower neck
2	Pain in the left shoulder
3	Pain in the right shoulder
4	Pain in the left upper arm
5	Back pain
6	Pain in the right upper arm
7	Low back pain
8	Pain in the bottom
9	Pain in the lower bottom
10	Pain in the left elbow
11	Pain in the right elbow
12	Pain in the left forearm
13	Pain in the right forearm
14	Pain in the left wrist
15	Pain in the right wrist

16	Pain in the left hand
17	Pain in the right hand
18	Pain in the left thigh
19	Pain in the right thigh
20	Pain in the left knee
21	Pain in the right knee
22	Pain in the left calf
23	Pain in the right calf
24	Pain in the left ankle
25	Pain in the right ankle
26	Pain in the left leg
27	Pain in the right leg

III. METHODOLOGY

The completion of the questionnaire to measure the operator's subjective complaints was carried out by interview. Interviews were conducted on 16 people at the preform blowing work station and 10 people at the injection work station. The interview process is carried out after the operator has finished working. In this study, in collecting data on body parts, as many as 11 body parts were taken to study complaints of pain or stiffness, namely the neck, left and / or right shoulders, left and / or right upper arms, left and / or right forearms, left and / or right hand, back, waist, hip, buttocks, left and / or right thighs, and left and / or right calf. In the questionnaire given a value of 1 if the operator feels pain or stiffness in the specified area. If the operator does not feel pain or stiffness, the questionnaire is given a value of 0 [8]. The results of data collection are then processed by adding up the complaints felt by everyone. Then the sum results are averaged to produce an average score of complaints at the work station. The next process is to determine the critical work station based on the highest average score of complaints at the work station.

IV. DATA COLLECTION

The results of interviews regarding complaints related to the inconvenience of all operators were then recapitulated. The recapitulation regarding complaints that occur to operators at blowing and injection work stations can be seen in Tables 3 and 4.

Table 2. Recapitulation of the Nordic Body Map Questionnaire in Blowing Work Station

Workstation	Participant No.	Number of Complaints
Blowing	1	7
	2	6
	3	6
	4	6
	5	7
	6	6
	7	6
	8	7
	9	7
	10	6
	11	6

	12	6
	13	5
	14	7
	15	7
	16	5
	Sum	100
	Average	6,25 ≈ 7

Average Blowing Workstation Score = Total Complaints / Number of Operators

$$= 100 / 16$$

$$= 6,25 \approx 7$$

Table 3. Nordic Body Map Questionnaire Recapitulation in Injection Station Work

Workstation	Participant No.	Number of Complaints
Injection	1	5
	2	6
	3	4
	4	4
	5	5
	6	5
	7	4
	8	5
	9	4
	10	5
	Sum	47
	Average	4,7 ≈ 5

Average Injection Workstation Score = Total Complaints / Number of Operators

$$= 47 / 10$$

$$= 4,7 \approx 5$$

IV. RESULTS AND DISCUSSION

The results of the average score of complaints at the work station can be seen in Figures 2 and 3.

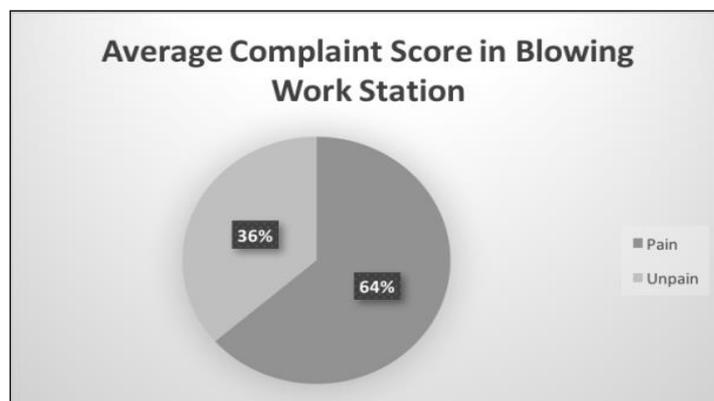


Figure 2. Average Complaint Score in Blowing Work Station

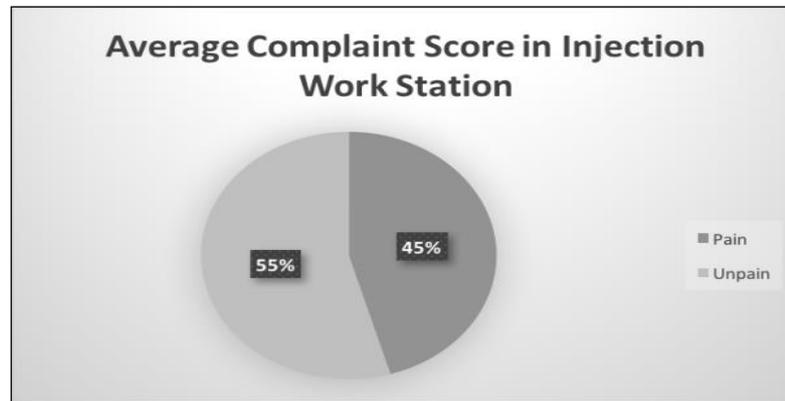


Figure 3. Average Complaint Score in Injection Work Station

Overall on both workstations, all operators experience muscle pain. But the critical work station is the Blowing Work Station, because the highest average score of complaints at the work station.

That is because the work on blowing uses more physical human energy. In addition, the air temperature at the blowing work station reaches 30 degrees Celsius. According to [4], hot temperatures can interfere with the coordination of taste and motor nerves.

V. CONCLUSION

Based on the results of the study, the critical work station is the Blowing Work Station. This indicates that the work station is increasingly critical to be repaired.

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