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The Relation of Musculoskeletal Discomfort with Body Mass Index (BMI) For Cleaning Workers, Who Work at an Elevated Place

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Abstract

The purpose of this research was to determine the extent of the influence of Body Mass Index (BMI) Variations on musculoskeletal discomfort. The steps taken are first to calculate the Body Mass Index (BMI), measure the level of musculoskeletal discomfort of each cleaning worker who works in an elevated place by distributing the Nordic Body Map questionnaire, then perform a statistical test with the Chi-Square Test. The results of this research are painful areas of musculoskeletal discomfort is the left shoulder, right shoulder, back, waist, buttocks, right knee and left leg. From the Chi-Square Test results obtained p-value for the left shoulder = 0.006, right shoulder = 0.003, back = 0.00, waist = 0.00, buttocks = 0.00, right knee = 0.001 and left leg = 0.00, because all <0.05 then all null hypotheses are rejected, this fact means there is a relationship between BMI and musculoskeletal discomfort that is felt sick. The conclusion is an un-ergonomic posture in the work will cause the musculoskeletal discomfort area and the higher the person's BMI level will be susceptible to pain complaints, the lower the BMI than the fewer complaints of pain.

Keywords: Body Mass Index (BMI), Musculoskeletal Discomfort, Cleaning Workers, Work in an elevated place.

1. INTRODUCTION

Cleaning workers are cleaners who need physical strength. They need to work not only on the ground floor, but also on the upper floor, or work at heights inside and outside the building. The purpose of this study was to allow participants to work outside the building, clean the high-altitude glass, and use the stairs as a base to work. From the observation results if observed posture when cleaning workers work, body position tilted and bent with angles ranging from 20°-60°, neck bent with an angle of about 20°, cleaning done repeatedly by sliding the left hand and right hand with the upper arm angle > 90° raised for 10 minutes and forearm around 40°, this illustrates the condition of Awkward posture cleaning workers are not ergonomic, the posture that is not ergonomic will cause musculoskeletal disorder (MacLeod, 1995).

Nordic Body Map is a mapping of painful area of musculoskeletal discomfort when working, there are 27 points that are the focus of observation in areas of the human body (Kilroy, N. and Sara, D., 2000), work postures that are not ergonomic will cause the occurrence of musculoskeletal discomfort in areas certain in the body that feels pain (Hayati et al., 2014).

Participants' Body Mass Index (BMI) also varied, Body Mass Index (BMI) averaged 23.14 kg/m² ± 3.88 from the initial survey results related to the relationship with musculoskeletal discomfort describing the different variations of complaints in each participant and according to (Maulana et al. 2016) BMI has a strong relationship with pain in Low Back Pain (LBP), according to (Kridianto et al. 2015) Body Mass Index (BMI) has a significant relationship with musculoskeletal complaints due to work. In this study, we will look for answers to musculoskeletal discomfort to the question of which areas have complained when working at height, and the extent of the relationship of BMI to complaints of musculoskeletal discomfort.

2. METHOD

Cleaning workers used as participants in this tudy are those who work at the National Technology Institute of Malang-East Java- Indonesia, selected participants are all men who do not have a history of high blood pressure, heart disease and diabetes as many as 30 people. Participant demographics: Mean age 35 years ± 7.61; Average body weight 64 kg ± 11.17; Average height 163 cm ± 4.00; Body Mass Index (BMI) averaging 23.14 kg / m² ± 3.88. They work from 7 am to 4 pm with a break from 12.00 to 13.00.

Materials used to clean the glass include: glass cleaner *(spiritus*), used paper to clean the glass surface and cloth rags to clean the glass surface.

The tools used include bed sheet as a place, a ladder as a tool to go up to the area to be cleansed and as a place to foot when working, *kapi* is a tool to wipe *spiritus* water that sprayed on the glass surface of rubber material.

This sudy was first conducted by distributing the Nordic Body Chart questionnaire, which contains 27 questions, of which there are 4 (four) types of complaints selected: No pain, slight pain, illness and very ill to 30 participants who worked cleaning the glass outside the building at a height, then processed by using excel and obtained any musculoskeletal discomfort area which felt to be sickly, for further calculations, the grouping of

complaints will be grouped into 2 (two) groups: Pain and no pain where pain includes rather sickly, sickly and very sick. Furthermore, statistical tests performed with the Chi- Square Test, to determine the relationship of BMI with each area of discomfort felt musculoskeletal pain. In this case, the BMI category: <17 Kg / m² thinner (underweight) 17-18.5 Kg / m² is thin (underweight lightweight), 18.25 - 25 Kg / m² is normal, 25-27 is fat (overweight at a mild level) and> 27 kg / m² is fat (overweight at a heavy level). In the next calculation, it will be simplified into 2 (two) categories, namely fat and not fat, where fat includes overweight and lightweight overweight, then not to fat includes normal and thin.

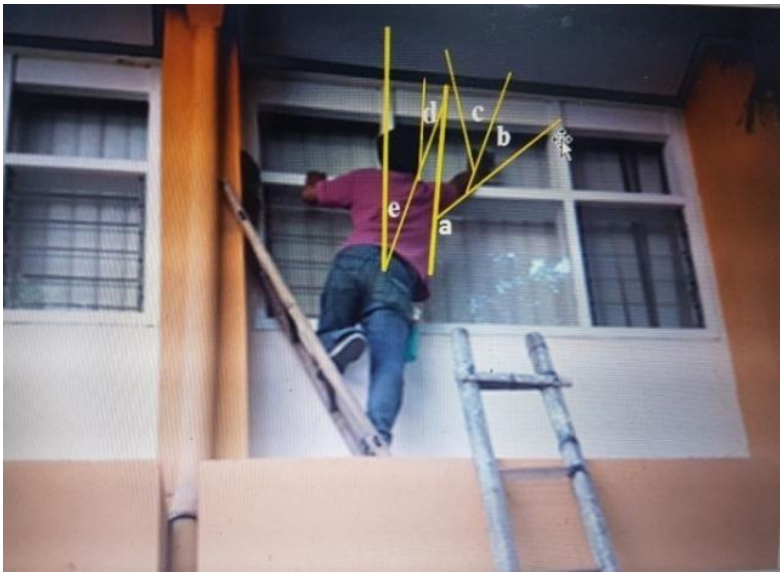

Fig. 1 Body Posture When Cleansing Glass at an Elevated Place

Body postures when working in an elevated place as shown in figure 1. Position the angle of the upper arm (a) = 130°; Forearm angle (b) = 40°, wrist angle = 35°, neck angle = 20°, trunk angle = 30° and position of one leg raised.

3. RESULTS

Table 1. BMI and Participant Categories.

Participant	BMI	Category	Participant	BMI	Category
1	21,48	Not Fat	16	32.89	Fat
2	24,97	Not Fat	17	26,72	Fat
3	25,91	Fat	18	26.72	Fat
4	25,71	Fat	19	26.95	Fat
5	13,67	Not Fat	20	25.25	Fat
6	26,56	Fat	21	21,48	Not Fat
7	23,87	Not Fat	22	24,97	Not Fat
8	23,87	Not Fat	23	25,91	Fat
9	26,72	Fat	24	25,71	Fat
10	18,59	Not Fat	25	13,67	Not Fat
11	25,71	Fat	26	26,56	Fat
12	22.32	Not Fat	27	23,87	Not Fat
13	20.76	Not Fat	28	23,87	Not Fat
14	26.22	Fat	29	26,72	Fat
15	24.50	Not Fat	30	18,59	Not Fat

BMI category grouping as in table 1. is a simplification of 5 (five) BMI groups, into 2 groups, namely the group with fat and not fat categories, where non-fat includes normal and thin categories (underweight and lightweight) with BMI <25, for fat including light and heavy fat wherewith a BMI ≥ 25, found 50% of the participants included in the thin category and 50% in the fat category.

Table 2. Areas of Musculoskeletal Discomfort that are felt sick> 50%.

No	*Musculoskeletal* Pain	Percentage
1	Left Shoulder	80%
2	Right Shoulder	76%
3	Backs	70%
4	Waist	63%
5	Buttocks	67%
6	Right Knee	74%
7	Left Foot	70%

From the results of a questionnaire of 30 participants and from 27 musculoskeletal areas, more than 50% of the area felt was pain in 7 (seven) areas, namely the left shoulder, right shoulder, back, waist, buttocks, right knee and left leg as in Table 2.

Table 3. Summary of Cross tabulation Relationship between BMI and Pain Complaints

Crosstab				
		BMI		Total
		Not Fat	Fat	
Left Shoulder	Painless	6	0	6
	Pain	9	15	24
Total		15	15	30
Right Shoulder	Painless	7	0	7
	Pain	8	15	23
Total		15	15	30
Backs	Painless	9	0	9
	Pain	6	15	21
Total		15	15	30
Waist	Painless	11	0	11
	Pain	4	15	19
Total		15	15	30
Buttocks	Painless	10	0	10
	Pain	5	15	20
Total		15	15	30
Right Knee	Painless	8	0	8
	Pain	7	15	22
Total		15	15	30
Left Foot	Painless	9	0	9
	Pain	6	15	21
Total		15	15	30

Relationship of the spread of pain and no pain in 7 (seven) areas of musculoskeletal discomfort and BMI as shown in table 3. It appears that participants with obese categories all felt pain in 7 (seven) areas of musculoskeletal discomfort and participants with the category of non-obese BMI 57% felt no sick and 43% feel pain.

Table 4. Results of Chi-Square Left Shoulder Tests

	Chi-Square Tests				
	Value	DF	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7,500[a]	1	0,006		
Continuity Correction [b]	5,208	1	0,022		
Likelihood Ratio	9,834	1	0,002		
Fisher's Exact Test				0,017	0,008
Linear-by-Linear Association	7,25	1	0,007		
N of Valid Cases	30				

a. 2 cells (50%) have expected count less than 5. The minimum expected count is 3,00.

b. Computed only for a 2x2 table

In Table 4. Describing the results of Chi-Square Tests, the relationship of BMI with pain in the left shoulder obtained p-value significance of 0.006 and chi-square value of 7.5. Because the significance value 0.006<(0.05) and chi-square count 7.5>3.841 (chi-square table), the null hypothesis rejected, which means that there is a real relationship between BMI and Left Shoulder complaints. This means that the higher the level of BMI, the more susceptible to complaints of pain in the left shoulder.

Table 5. Summary of Chi-Square Tests Results for 7 Musculoskeletal Areas

	Chi-Square Tests			
Musculoskeletal Pain	Pearson Chi-Square Value	Asymptotic Significance (2-sided)	chi-square table	Null Hypothesis
Left Shoulder	7,500	0,006	3,841	Rejected
Right Shoulder	9,130	0,003	3,841	Rejected
Backs	12,857	0,000	3,841	Rejected
Waist	17,368	0,000	3,841	Rejected
Buttocks	15,000	0,000	3,841	Rejected
Right Knee	10,909	0,001	3,841	Rejected
Left Foot	12,857	0,000	3,841	Rejected

In Table 5. Describing the summary of all Chi-Square Tests results for 7 (seven) painful areas of musculoskeletal discomfort, the Chi-Square Tests results show that all null hypotheses rejected, this illustrates that there is a strong relationship between BMI and musculoskeletal discomfort.

If observed in Figure 1, the participant's body posture in doing the glass cleaning work is not Ergonomic due to the angle of the upper arm >90°, hanging hand position as well as left leg bent and resting on a small and narrow surface. This illustrates poor posture (Evadariant and Dwiyanti, 2017) the worse the work posture, the greater the musculoskeletal complaints. Un

Ergonomic work attitudes can also cause musculoskeletal discomfort (Deepak and Ajeesh, 2012).

BMI has a strong relationship with complaints of musculoskeletal discomfort as shown in table 5. It means that if BMI is getting bigger, then musculoskeletal discomfort complaints are also greater according to Figure 1, if left without any improvement or intervention in the workplace and ergonomic work equipment, it can lead to musculoskeletal discomfort (Silva et al, 2013) and can also affect productivity and quality of work (Hutabarat et al, 2013).

4. CONCLUSION

For working attitude is not ergonomic on the work of glass cleaning outside the building and at a height than the musculoskeletal area discomfort located on the left shoulder, right shoulder, back, waist, buttocks, right knee and left leg. Body Mass Index has a strong relationship with the emergence of musculoskeletal discomfort complaints, the greater the BMI then the musculoskeletal discomfort increasingly larger, and if not done repair by giving intervention repair worksite or work equipment ergonomically, it can cause musculoskeletal discomfort.

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