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Correlation between body mass index with musculoskeletal disorders in employees at Annika Linden Center

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ABSTRACT

Background: Problems that often occur in employees are health problems, especially musculoskeletal complaints. Internal and external factors can cause musculoskeletal complaints in employees. One of the internal factors is body mass index (BMI). Someone with an obese BMI will increase the risk of musculoskeletal disorders because when they want to work, the pressure on the waist usually feels heavy due to weakened muscle tone. This study aims to determine the relationship between BMI with musculoskeletal disorders (MSDs).

Methods: This study used a cross-sectional study design. The sampling technique in this study uses the total sampling method. The number of samples is 50 people. Researchers took place at the Annika Linden Center. The measurement of musculoskeletal disorders using the Nordic body map (NBM).

Results: The analysis of the relationship between BMI and musculoskeletal disorders using the Somers test obtained p=0.001 ($p<0.05$), meaning a significant relationship exists between body mass index and musculoskeletal disorders.

Conclusion: There is a significant relationship between BMI and musculoskeletal complaints in Annika Linden Center employees.

Keywords: body mass index, musculoskeletal disorders.

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BACKGROUND

The musculoskeletal system is one of the systems in the human body with essential functions. Some parts of the musculoskeletal system support the body as a provider of body shape, producing blood cells and storing minerals in the body. A person who experiences disorders in the musculoskeletal system will cause discomfort, affecting movement during activities.[1]

Musculoskeletal disorders (MSDs) is a disorder that results in damage/injury to muscles, bones, joints, tendons, ligaments, blood vessels, and peripheral nerves in the neck, shoulders, back, arms, and legs that cause pain in the area. Musculoskeletal disorders often occur in workers or employees in various fields of work, one of which is the office field, most of which carry out their activities repeatedly and continuously for a long time. Employees at Annika Linden Center more often do routines in the room with a static sitting position. For an extended period with an average of 8 hours per day, it can cause muscle tension, and musculoskeletal disorders will occur.[2]

MSDs are occupational diseases that account for many disabilities worldwide.[3] Labor Force Survey (LSF) survey in 2018-2019 reported that as many as 498,000 workers in the United Kingdom experienced musculoskeletal disorders. These complaints are often experienced in the upper extremities, neck (41%), and lower extremities (19%).[4] Meanwhile, the prevalence of MSDs in Indonesia in 2018, based on Basic Health Research (Riskesdas) results, obtained a musculoskeletal prevalence of 7.3%.[5]

Several factors can influence workers' musculoskeletal complaints (MSDs), namely work, individual and environmental factors. The work factors involved are posture and workload. Work postures that deviate significantly from the normal position when work will cause mechanical stress on the muscles, ligaments, and spine. In addition to causing mechanical stress, the role of the body that moves away from nature will also cause the higher position of body parts from the center of gravity and higher skeletal muscle complaints. The workers usually do forward bending motion and lifting and carrying heavy loads and work in faulty body positions that can increase the risk of myogenic low back pain.[6] In addition, workloads on employees that are too heavy or physical abilities that are too weak can result in disorders of the musculoskeletal system.[7]

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Meanwhile, one of the individual factors involved is body mass index. Obesity is a condition with a body mass index value exceeding 25 kg/m2.[3] Obesity or being overweight can trigger various metabolic diseases that increase the risk of musculoskeletal disorders, such as shortness of breath due to excess fat under the chest wall and even the diaphragm even though the patient is only doing light activity. This respiratory disorder often occurs during sleep apnea (severe breathing disturbances during sleep in which the airways are obstructed due to the loosening and narrowing of the throat walls), so sufferers often feel sleepy during the day. In an exhausted state, the body becomes weak. When you want to work, the pressure on the waist usually feels heavy, resulting in soft abdominal muscle tone caused by excessive body weight (Obesity), which increases the risk of musculoskeletal disorders.[8]

Based on the problems, the presentation of the results of preliminary studies, and the lack of research on factors related to musculoskeletal disorders in employees, this study was conducted to determine The Correlation Between Body Mass Index with Musculoskeletal Disorders in Employees at Annika Linden Center.

METHODS

This study used the analytic observational with a cross-sectional design. Researchers took place at the Annika Linden Center for Research, Bali, Indonesia, in September 2022. The population in this study were all employees at Annika Linden Center who met the inclusion and exclusion criteria. The inclusion criteria are employees aged 25-60 years, female and male, willing to be sampled in this study, and sign informed consent. Meanwhile, the exclusion criteria are pregnant subjects with a history of accidents or fall in the last month. The sampling technique in this study was to use a total sampling of 50 employees. All participants explained the study process and received an informed consent sheet once they agreed to participate.

Furthermore, sample data identification is carried out, such as age, gender, and body mass index. The instrument used in this study is the Nordic body map (NBM) to measure musculoskeletal disorders. In this study, the NBM's original version was simplified from the type of chain question to a single question ("Have you at any time during the last 12 months had trouble (ache, pain, discomfort) in"). In contrast, the answer option was changed from "yes" or "no" to a rating with four scales, i.e., no pain (A) (scale 0), moderate pain (B) (scale 1), pain (C) (scale 2) and very sick (D) (scale 3). NBM Indonesian version Cronbach's alpha intraclass coefficient and the 95% confidence interval (CI) of the point estimation calculated for the whole questionnaire. Cronbach's alpha values>0.70 were considered satisfactory.[9] Data analysis in this study used the Somers test to analyze the relationship between the independent variable (body mass index) and the dependent variable (musculoskeletal disorders) with a significance of $p<0.05$.

Table 1. Characteristics of respondents.

Characteristics	Frequency (n)	Percentage (%)
Age (Year)		
25–35	40	80
36–46	8	16
47–57	2	4
Gender		
Male	23	46
Female	27	54
BMI		
Underweight	5	10
Normal	25	50
Overweight	6	12
Obese	14	28

n, number of participants

RESULTS

Respondents in this study were employees at Annika Linden Center. The sampling technique used was total sampling, and obtained a sample of 50 people who met the inclusion and exclusion criteria. Based on table 1 shows that respondents with an age range of (25-35) years totaled 40 people (80%), an age range of (36-46) years counted eight people (16%), and an age range of (47-57) years totaled two people (4%). Characteristics based on gender obtained from respondents with male gender amounted to 23 people (46%), and respondents with female gender amounted to 27 people (54%). Data on the characteristics of respondents based on BMI obtained from respondents with underweight BMI amounted to 5 people (10%), normal BMI amounted to 25 people (50%), overweight BMI amounted to 6 people (12%), and obese BMI amounted to 14 people (28%).

The distribution of Table 2 shows that the body parts often complained about by Annika Linden Center employees are the waist, thighs, and neck. There were 37 people with low back pain, pain in the thighs in 33 people, and pain in the neck in 32. Of the 37 people who experienced low back pain, 13 suffered mild pain, 23 suffered moderate pain, and 1 had severe pain. Furthermore, 17 people had mild pain in the thigh, and 16 had moderate pain. In the neck, 14 experienced mild pain, and 18 experienced moderate pain.

Table 2. Distribution of musculoskeletal complaints based on Nordic body map (NBM) score.

Body parts	Musculoskeletal disorders based on NBM score			Frequency (n)	Percentage (%)
	Light pain	Pain	Painful		
Pain/stiffness in the upper neck	17	11	0	28	56
Pain in the lower neck	14	18	0	32	64
Pain in the left shoulder	15	13	0	28	56
Pain in the right shoulder	13	16	0	29	58
Pain in the left upper arm	2	7	0	9	18
Pain in the back	13	10	0	23	46
Pain in the right upper arm	14	3	0	17	34
Pain in the waist	13	23	1	37	74
Pain in the buttock	17	10	1	28	56
Pain in the bottom	11	5	0	16	32
Pain in the left elbow	3	1	2	6	12
Pain in the right elbow	4	1	0	5	10
Pain in the left lower arm	3	1	0	4	8
Pain in the right lower arm	13	0	0	13	26
Pain in the left wrist	19	2	0	21	42
Pain in the right wrist	20	5	2	27	54
Pain in the left hand	8	1	0	9	18
Pain in the right wrist	14	2	0	16	32
Pain in the left thigh	15	16	0	31	62
Pain in the right thigh	17	16	0	33	66
Pain in the left knee	11	0	0	11	22
Pain in the right knee	15	2	0	17	34
Pain in the left calf	12	2	0	14	28
Pain in the right calf	19	3	0	22	44
Pain in the left ankle	7	1	0	8	16
Pain in the right ankle	11	0	0	11	22
Pain in the left foot	10	2	0	12	24
Pain in the right foot	9	2	0	11	22

n, number of participants

Table 3. Cross table of body mass index (BMI) with musculoskeletal disorders.

BMI	Musculoskeletal disorders						*P*-value
	Mild		Moderate		Total		
	n	%	n	%	n	%	
Underweight	5	10	0	0	5	10	0.001
Normal	21	42	4	8	25	50	
Overweight	2	4	4	8	6	12	
Obesity	7	14	7	14	14	28	
Total	35	70	50	30	50	100	

n, number of participants

The Somers test determined the relationship between BMI and musculoskeletal disorders in Annika Linden Center employees. Table 3 shows that employees with underweight BMI with mild musculoskeletal complaints are five people, and employees with underweight BMI do not have moderate musculoskeletal disorders. Furthermore, employees with normal BMI have mild musculoskeletal disorders totaling 21 people, and employees with normal BMI with moderate musculoskeletal disorders totaling four people. BMI with overweight categories have mild musculoskeletal disorders totaling two people, and heavy types have moderate musculoskeletal disorders counting four people. The last BMI with the obese category has mild musculoskeletal disorders totaling seven people, and BMI with the obese category has moderate musculoskeletal disorders totaling seven people.

The results of this study using the Somers hypothesis test showed a significant relationship between BMI and musculoskeletal disorders in employees at Annika Linden Center with a *p*-value of 0.001 ($p<0.05$).

DISCUSSION

Office employees often experience MSDs. Employees who work in offices in this study have an age range of 25-57 years, which is an age range that is at risk of experiencing musculoskeletal disorders. As a person ages, degeneration will occur in the form of tissue damage, tissue replacement

into scar tissue, and fluid reduction. This results in reduced stability in the bones and muscles.[10] This aligns with research conducted by Shobur 2019 that musculoskeletal disorders usually begin to be felt in workers aged 30 years and over, and musculoskeletal conditions will continue to increase. The older a person is, the higher the risk of experiencing a decrease in bone elasticity, which triggers the onset of MSD symptoms.[11]

Another factor that can also increase the risk of musculoskeletal disorders is BMI.[12] A person with an above-average BMI will be at risk of musculoskeletal disorders.[13] Increased BMI caused by an increased fat mass in the body can trigger adiposopathy, which is a condition where metabolism in adipose tissue develops into chronic inflammation or metabolic syndrome.[14] A person with a normal BMI has fewer macrophages in their fatty tissue and is inactive. Increasing fat mass can make mast cells, lymphocytes, and macrophages actively enter the adipose tissue.[15] Originally inactive Macrophages will turn active, resulting in metabolic syndrome. Various pain expressions, including MSDs, can characterize metabolic syndrome.

This study shows that musculoskeletal disorders occur in employees who have a thin BMI (10%), overweight BMI (12%), and Obesity (28%) with a Somers test result of 0.001, which means there is a relationship between BMI and musculoskeletal disorders. Most musculoskeletal disorders occur in body parts, namely the waist (74%), right thigh (66%), lower neck (64%), left thigh (62%), and right shoulder (58%). Silva's theory (2013) states that BMI will affect musculoskeletal disorders, especially in body parts such as shoulders, lower back, and upper and lower limbs.[13] This is because someone with a BMI above normal loading on the joints will increase. In contrast, a tall body with a normal BMI generally has a slim bone shape, so biomechanically, it is vulnerable to pressure and bending.[16]

The relationship between BMI and MSDs is that someone with excess weight will try to support their weight by contracting the back muscles. If this is done repeatedly, it causes pressure on the spinal cord pads, increasing the risk of MSDs.[17] This is supported by research by Fistra (2019), where overall, high BMI (overweight and Obesity) is associated with an increased prevalence of musculoskeletal symptoms.[18] This is also in line with research conducted by Viester (2013), which found that the lower extremities are one of the body parts that most often experience complaints. Lower extremities often experience complaints because this part is the hardest part of the work to withstand the gravitational force of the human body weight.[19] Furthermore, MSDs in the upper extremities, such as the neck and shoulders, are usually caused by obese people using their upper extremities as limbs that support the body's weight when they get up from a sitting position, increasing the risk of MSDs.[20,21]

The weakness of this study was a possible bias in assessing the sample using a questionnaire because the perception of pain between individuals differs. Maybe future research can use a measurement instrument that does not cause bias.

CONCLUSION

Based on the results above, it can be concluded that there is a significant relationship between BMI and musculoskeletal complaints in employees, where someone with a BMI above normal will increase the risk of developing musculoskeletal complaints.

CONFLICT OF INTEREST

This research has no conflict of interest.

ETHICAL CONSIDERATION

The authors obtained informed consent that the sample had been approved before conducting the study.

FUNDING

This study received no grant from any institution.

AUTHOR CONTRIBUTIONS

IGASWN compiled the study design, data collection, and data analysis and drafted the manuscript; IAPP and KTAS participated in the literature search and revising of the manuscript; DAG participated in data collection. All authors have read and approved the final version of the manuscript.

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