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The Relationship Between Backpack Use and Low Back Pain Complaints in Grade VIII Students of Muhammadiyah 1 Middle School, Medan

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Introduction: Carrying books and school supplies is one of the heavy burdens carried by school students every day. Using an inappropriate backpack will cause negative impacts for its users. Students who carry the heaviest backpacks and use backpacks for a long time have a higher risk of suffering from low back pain. Objective: To determine the relationship between backpack use and complaints of low back pain in eighth grade students of Muhammadiyah 1 Medan Junior High School. Method: This study is descriptive analytical with a cross-sectional design. The sampling technique used Purposive Sampling. Determination of the number of samples in this study used the Slovin formula. Results: Of the 78 students who became respondents, it was found that 18 students (23.1%) did not experience pain and 60 students (76.9%) experienced pain. The results of the Chi Square test showed that the p value was 0.019, where this value was smaller than 0.05. Conclusion: It was concluded that there was a relationship between the weight of the backpack and complaints of Low Back Pain in eighth grade students of Muhammadiyah 1 Medan Junior High School.
Keywords: backpack weight, low back pain, junior high school students.

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1. Introduction

Students need a variety of books, stationery, and other supporting equipment to complete their school activities. These supplies are generally carried in the school bag they wear every day. Backpacks are a popular choice for students due to their practicality, ease of carrying, and ability to distribute weight evenly across both shoulders. However, using an inappropriate backpack, especially if it's too heavy or worn for extended periods, can put stress on the body and affect the condition of the student's musculoskeletal system.

Using a backpack with excessive weight can cause changes in body posture, especially in the back. Carrying a bag weighing more than 10% of body weight can increase the risk of back problems for students. In addition to the weight of the load, the duration of use of the bag is also a factor that needs to be considered. Using a backpack for a long period of time can put continuous pressure on the muscles and body structure, potentially causing musculoskeletal complaints, including back and neck pain (1).

Backpacks that carry more than 10% of body weight can be a risk factor for musculoskeletal disorders. Excessive weight can increase pressure on muscles, tendons, and ligaments, leading to tension and pain in the neck and back. Repeated and prolonged use of these backpacks can increase the risk of more serious health problems, including changes in posture (1). Therefore, students should pay attention to their backpack selection, weight, and how and how long they are used.

Besides the weight of the bag, the duration of school bag use is also a factor associated with the onset of lower back pain. School bag use that is at risk of lower back pain occurs when the duration of use exceeds 30 minutes per day. The longer the body is under load, the greater the likelihood of pressure and fatigue on the back muscles. This condition can be a contributing factor to the onset of low back pain in students (2).

Low back pain is a common health problem in many countries and can affect all age groups, including adolescents. By 2022, an estimated 619 million people worldwide will experience low back pain, or nearly 10% of the world's population. The incidence of low back pain in a single year in several countries in Asia and Europe, such as Denmark, the United Kingdom, Kuwait, and Israel, shows an average of more than 18% of the population experiencing this condition. Furthermore, low back pain also has a relatively high recurrence rate, with more than 50% experiencing it within one year of the first incident (3).

The problem of low back pain in adolescents also requires attention because this condition can interfere with daily activities and learning. The prevalence of low back pain in adolescents in Africa is estimated at an average of 12%, while the estimated prevalence in the United States ranges from 5–20% and in Europe reaches 25–45% of the population (5). These data indicate that low back pain is not only a problem in adults but can also occur in school-age groups, so risk factors related to student activities need to be considered.

One factor that can be related to students' back health is backpack use. The weight carried by students every day can put pressure on the body's structure, especially if the weight of the backpack is not adjusted to the student's body weight. Students' back conditions can experience changes due to the load carried continuously. Therefore, backpack weight is one aspect that needs to be considered when assessing students' back health (4).

Research conducted by Ratih (2023) on the relationship between backpack weight and lower back pain complaints in junior high school students showed that 50.6% of students experienced mild lower back pain, 19.5% experienced moderate pain, and 2.6% experienced severe pain. These results indicate that complaints of lower back pain are quite common in junior high school students and can be a concern in efforts to maintain students' musculoskeletal health (1).

Another study conducted by Aeni (2022) also showed a relationship between backpack weight and low back pain. In the study, 68.5% of students used backpacks with excessive weight, while 70.8% experienced low back pain (6). These findings suggest that using a heavy backpack may be a factor associated with the development of low back pain in students.

However, Faturachman's (2022) study found different results, showing no significant relationship between backpack weight and low back pain complaints in students (7). These differences in research findings suggest that the relationship between backpack use and low back pain complaints still needs further study. In addition to backpack weight, other factors such as duration of use, physical activity, body posture, and the individual student's condition may also contribute to the onset of lower back pain complaints.

Based on the description, backpack use is one of the activities that need to be considered in maintaining students' musculoskeletal health. Excessive backpack weight and prolonged use have the potential to put pressure on the back and can be associated with low back pain complaints. The existence of research results that show a relationship or results that do not show a relationship between backpack weight and low back pain further strengthens the need for further research. Therefore, researchers are interested in conducting research on "The Relationship Between Backpack Use and Low Back Pain Complaints in Grade VIII Students of Muhammadiyah 1 Junior High School Medan".

2. Literature Review and Problem Statement

Use of Backpacks by Students

A backpack is a piece of equipment students use to carry books, stationery, and various other school supplies. Backpacks are considered practical because they can be carried on both shoulders, making them easier to carry during daily activities. However, when using a backpack, you need to pay attention to its weight and how it is worn. A backpack that is too heavy can put pressure on the shoulders, back, and spine, potentially causing changes in posture. Several studies have shown that using a backpack weighing more than 10% of body weight can increase the risk of musculoskeletal disorders, especially if used continuously during school activities (1).

Duration and Weight of Backpack Use

The weight and duration of backpack use are important factors to consider because they can affect a student's back condition. Backpacks weighing more than 10% of body weight can increase pressure on muscles, tendons, and ligaments, causing strain on the neck and back. In addition to the weight of the backpack, the duration of use also plays a significant role in the development of lower back pain. Using a school bag for more than 30 minutes a day is considered a high-risk duration for lower back pain (2). Therefore, the heavier the load and the longer the backpack is used, the greater the likelihood of fatigue and back strain.

Low Back Pain Complaints in Students

Low back pain is a complaint of pain or discomfort felt in the lower back and can interfere with a person's activities. Although more often associated with adults, low back pain can also occur in adolescents, including junior high school students. Globally, an estimated 619 million people will experience low back pain by 2022, with prevalence also found in adolescents in various regions of the world (3). This condition requires attention because lower back complaints in school-age students can interfere with students' comfort in participating in the learning process, engaging in physical activities, and carrying out daily activities (5).

Problem Statement

Based on a literature review, using a backpack with excessive weight and long duration of use has the potential to put pressure on the muscle structure and spine, which can cause low back pain complaints. Ratih's (2023) research found that some junior high school students experience low back pain ranging from mild to severe, while Aeni's (2022) research showed a relationship between backpack weight and low back pain complaints (1.6). However, different results were found by Faturachman (2022) who stated that there was no significant relationship between backpack weight and low back pain complaints (7). The difference in research results indicates a research gap regarding the relationship between backpack use, especially in terms of weight and duration of use, with low back pain complaints. Therefore, further research is needed to determine the relationship between backpack use and low back pain complaints in eighth grade students at Muhammadiyah 1 Junior High School, Medan.

3. Method

This study used a descriptive analytical design with a cross-sectional approach that aims to determine the relationship between backpack use and low back pain complaints in eighth grade students of Muhammadiyah 1 Junior High School, Medan. The variables studied consisted of backpack use as the independent variable and low back pain complaints as the dependent variable. Low back pain is defined as

pain complaints in the lower back area that can be related to the structure of the lumbar vertebrae, intervertebral discs, and surrounding tissues. Low back pain complaints were measured using a questionnaire with categories of no pain, mild, moderate, and severe, while backpack weight was measured using a scale and categorized based on the percentage of the student's body weight, namely ≤10% and >10% of body weight. Using a bag with a load exceeding 10% of body weight is known to increase pressure on muscles, tendons, and ligaments and has the potential to cause complaints in the neck and back (1).

The study was conducted at Muhammadiyah 1 Junior High School in Medan with the study population consisting of all eighth-grade students. The sample was determined using a purposive sampling technique, namely the selection of samples based on criteria determined by the researcher (19). The inclusion criteria in this study included eighth-grade students, in good health and without back anatomical abnormalities, and willing to be respondents by returning an informed consent signed by a parent or guardian. Meanwhile, the exclusion criteria included students who were not present at the time of the study, had a history of fracture or lower back trauma, and had an excessive BMI (Body Mass Index). The sample size was determined using the Slovin formula with a level of accuracy determined by the researcher, resulting in a sample size of 78 students (20). The data used consisted of primary data obtained through a validated questionnaire regarding respondent characteristics, backpack use, and complaints of low back pain, as well as secondary data in the form of data on the number of eighth-grade students obtained from the school.

Data collection was conducted by distributing questionnaires to respondents and measuring the weight of backpacks using a scale. After all data was collected, several data processing stages were carried out, namely editing, coding, entry, cleaning, tabulating, and saving. Next, the data were analyzed univariately and bivariately. Univariate analysis was used to describe the distribution of each research variable, such as the incidence of low back pain, backpack weight, and duration of backpack use. Meanwhile, bivariate analysis was used to determine the relationship between the independent and dependent variables. Because the research variables were categorical, the relationship between backpack use and low back pain complaints was analyzed using the Chi-Square test with a significance level determined in the study. The results of this analysis were used to determine whether or not there was a significant relationship between backpack use and low back pain complaints in eighth-grade students of Muhammadiyah 1 Junior High School, Medan.

4. Results and Discussion

Results

The purpose of this study was to prove the relationship between backpack use and low back pain complaints in eighth-grade students at Muhammadiyah 1 Middle School, Medan. This research was conducted through a review and proposal writing. It met the requirements as approved by the Faculty of Medicine's ethics committee. Masked parade teran Univer your location Hammadiyah Sum North Atera ra No: 1463/KEPK/FKUMSU/2025.

Univariate Analysis

The univariate analysis used in this thesis provides a descriptive explanation of each aspect of the variables. This will explain the frequency of low back pain, duration of bag use, and backpack weight. The following explains the frequency distribution of the gender of the research respondents in table 4.1:

Table 4.1 Frequency Distribution of Gender

No	Gender	n	%
1	Man	41	52.6

No	Gender	n	%
2	Woman	37	47.4
	Total	78	100.0

Based on table 4.1 above, it is known that of the 78 students who were respondents in the study, 41 people (52.6%) were male, while 37 people (47.4%) students are female. The following explains the frequency distribution of low back pain among research respondents in table 4.2:

Table 4.2 Frequency Distribution of Low Back Pain

No	*Low Back Pain*	n	%
0	No pain	18	15.4
1	Mild pain	30	38.5
2	Moderate pain	30	38.5
3	Severe pain	0	0.0
	Total	78	100.0

Based on table 4.2 above, it is known that of the 78 students who were respondents in the study, 18 students (23.1%) did not experience pain, 30 students (38.5%) experienced mild pain, 30 students (38.5%) experienced moderate pain, and no students experienced severe pain.

The following is the frequency distribution of the length of time a backpack is used in table 4.3:

Table 4.3 Frequency Distribution of Duration of Backpack Use

No	Duration of Use	n	%
1	< 30 minutes	31	39.7
2	> 30 minutes	47	60.3
	Total	78	100.0

Based on table 4.3 above, it explains that of the 78 students, 31 students (39.7%) used backpacks for less than 30 minutes, while 47 students (60.3%) used backpacks for more than 30 minutes.

Based on the distribution of student backpack weights in table 4.4:

Table 4.4 Frequency Distribution of Backpack Weight

No	Bag Weight	n	%
1	≤ 10%	22	28.2
2	>10%	56	71.8
	Total	78	100.0

Based on table 4.4 above, the results found show that as many as 22 students (28.2%) used backpacks with a weight of≤ 10% and56 students (71.8%) used backpacks with a weight>10%.

Bivariate Analysis

The relationship between the length of time a backpack is used and complaints of low back pain.in table 4.5 below:

Tabell 4.5 The relationship between the length of time a backpack is used and complaints of low back pain.

			No Pain	Painful	Total	*P*
Duration of use of backpack	< 30 minutes	n	12	19	31	
	> 30 minutes	n	6	41	47	0.008
Total		n	18	60	78	

Based on table 4.5 above, it shows that of the 31 students with a duration of backpack use <30 minutes, 12 students did not experience pain and 19 students experienced pain. Meanwhile, of the 47 students with a duration of backpack use >30 minutes, there were 6 students did not experience pain and 41 other students experienced pain. The results of the chi-square test showed that the p value was 0.008, where this value is smaller than 0.05. So there is a relationship between the percentage of duration of backpack use and complaints of Low Back Pain in class VIII students of Muhammadiyah 1 Medan Junior High School.

The relationship between backpack weight and Low Back Pain complaints is shown in table 4.6:

Tabel 4.6 The relationship between backpack weight and low back pain complaints

			No Pain	Painful	Total	*P*
backpack weight	≤10%	n	9	13	22	
	> 10%	n	9	47	56	0.019
Total		n	18	60	78	

The results shown in table 4.6 explain that as many as 22 students use backpacks.≤10% of body weight, of which 9 students did not experience pain and 13 students did. Then, in the other 56 students with a backpack weight >10% of body weight, including 9 students did not experience pain and 47 students experienced pain.The Chi-Square test results show a p-value of 0.019, which is less than 0.05. These results indicate that backpack weight is associated with low back pain complaints in eighth-grade students at Muhammadiyah 1 Middle School, Medan..

Discussion

Based on the distribution of gender characteristics, it is known that of the 78 students who became research respondents, as many as 41 students (52.6%) were male and 37 students (47.4%) were female. Thus, it can be explained that the research respondents in the eighth grade students of Muhammadiyah 1 Medan Middle School were more male than female. This difference in numbers is a characteristic of the respondents in the study and is used as a general description of the sample studied.

Based on the results of the distribution of complaints of lower back pain, it was found that out of 78 eighth-grade students at Muhammadiyah 1 Junior High School Medan, 60 students experienced low back pain. The results of this study are in line with research conducted by Aeni et al. (2022), which showed that out of 89 students who were the study sample, 63 students (70.8%) experienced lower back pain (6). The high incidence of lower back pain in students can be influenced by various non-specific factors, one of which is the use of heavy school bags. The use of heavy bags is associated with complaints in the shoulders, neck, and other extremities. During growth, a child's bone structure is still developing so carrying a school bag with an excessive load can cause physical stress and tension in the back muscles. This condition can be even more risky if the weight of the bag is not distributed evenly across both shoulders, increasing pressure on the back and potentially causing lower back pain (6).

Based on the results of the study regarding the duration of backpack use, it was found that 47 students used backpacks for more than 30 minutes. Of the 47 students, 41 students experienced lower back pain. The results of the analysis using the Chi-Square test obtained a p-value of 0.008. This value is smaller than 0.05 ($p < 0.05$), so it can be concluded that there is a significant relationship between the duration of backpack use and the incidence of low back pain in grade VIII students of Muhammadiyah 1 Medan Junior High School. The results of this study indicate that the longer students carry or use backpacks, the greater the possibility of complaints in the lower back due to the pressure received by the body continuously.

The results of this study are in line with research by Grove et al., which showed that adolescents who used bags for 5–10 minutes per day reported experiencing less back pain compared to adolescents who used

bags for more than 10 minutes (21). The study also showed a relationship between bag use and complaints of back pain with a p value = 0.01. These results support the findings in this study that the duration of bag use is one of the factors that need to be considered in relation to complaints of low back pain. In addition, Dwi's study showed that of 30 respondents, only about 10% had good backpack use, while about 90% of respondents had poor backpack use attitudes (22). Inappropriate backpack use conditions can cause suboptimal load distribution, thereby putting greater pressure on the student's body.

Based on the results of research on backpack weight, it is known that most students use bags weighing more than 10% of their body weight, namely 56 students. Of these, 9 students did not experience lower back pain, while 47 students experienced lower back pain. The results of the analysis using the Chi-Square test showed a p value = 0.019 ($p < 0.05$). Thus, it can be concluded that there is a significant relationship between backpack weight and the incidence of lower back pain in grade VIII students of Muhammadiyah 1 Medan Junior High School. These results indicate that the weight of a bag that exceeds the recommended limit can increase the load received by the body and has the potential to cause complaints in the lower back.

The results of this study are in accordance with the research of Ni'amah et al. which proved a significant relationship between the weight of the backpack and back pain with a p value = 0.001. However, the study did not find a relationship between the duration of backpack use and back pain with a p value = 0.130 (23). In addition, research by Ratih et al. (2023) also showed a significant relationship between the use of heavy backpacks and the incidence of low back pain in students with a p value = 0.0001. These results strengthen the findings of this study that the weight of the backpack is one of the factors related to low back pain complaints in students.

A relatively heavy backpack can affect the curvature of the spine and cause muscle strain. Carrying a heavy school bag for long periods can lead to injuries and repetitive stress on a child's body. When carrying a heavy bag, the body's center of gravity can shift toward the load, causing the child to adjust their posture by leaning in the opposite direction to maintain balance. If this condition persists, it can cause changes in posture, muscle fatigue, and an increased risk of injury and low back pain. Using a school bag weighing more than 10% of body weight can increase the risk of postural changes in the spine associated with fatigue and lower back pain (1).

The results of this study differ from those of Faturrahman, who found no correlation between backpack weight and low back pain, with a p-value of 1.00. This difference in results may be due to differences in the data collection process for backpack weight. In that study, backpack weight measurements were conducted randomly and not systematically every day, so the data obtained may not reflect the overall weight of the bags used by students. Furthermore, the study did not measure Body Mass Index (BMI), so there was no uniformity in comparing students' weight with the weight of the bags they carried. These differences in measurement methods and respondent characteristics may be one of the reasons for the difference in results between Faturrahman's study and this study.

Based on observations during the study, the average student uses a backpack with a relatively heavy load. This condition is caused by, among other things, the large number of textbooks and the need to carry extracurricular activity equipment in one bag. The measurement results show that more than half of the respondents use backpacks with a load of ≥10% of their body weight. In this study, measurements were carried out directly by weighing the students' body weight and the weight of the backpack used. The selection of respondents who use backpacks and direct measurements of body weight and backpack weight are expected to provide a more objective picture of the load carried by grade VIII students of Muhammadiyah 1 Junior High School Medan.

5. Conclusion

Based on the results of the analysis that has been done, it can be concluded that of the 78 eighth grade students of Muhammadiyah 1 Medan Junior High School who became respondents, as many as 18 students (23.1%) did not experience lower back pain, 30 students (38.5%) experienced mild pain, and 30 students (38.5%) experienced moderate pain, while there were no students who experienced severe pain. The results of the Chi-Square test showed that the duration of backpack use had a significant relationship with complaints of low back pain, with a p-value of 0.008 ($p < 0.05$). In addition, the results of the Chi-Square test also showed that there was a significant relationship between the weight of the backpack and complaints of low back pain, with a p-value of 0.019 ($p < 0.05$). Thus, it can be concluded that the duration of use and weight of the backpack are related to complaints of low back pain in eighth grade students of Muhammadiyah 1 Medan Junior High School.

Based on the research results obtained, the researchers suggest that researchers and clinicians can conduct further studies on various other risk factors that contribute to the occurrence of low back pain in students, so that the causal factors can be understood more comprehensively. For future researchers, it is recommended to involve a more diverse research subject from various junior high school grade levels and consider other factors that may influence low back pain complaints, so that the research results obtained can provide a broader picture and can be compared with previous research.

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