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# THE EFFECTIVENESS OF INTERACTIVE EDUCATION ON PHYSICAL ACTIVITY AND BODY WEIGHT MONITORING TOWARD DIABETES AWARENESS AMONG ADOLESCENTS AT SMP NEGERI 12 BANJARMASIN

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**Abstract**

Diabetes mellitus among adolescents has become an increasingly important public health issue due to unhealthy lifestyles, including low physical activity, high sugar consumption, and overweight conditions. In addition, limited knowledge and awareness regarding diabetes prevention may increase adolescents' risk of developing the disease. This study aimed to determine the effectiveness of interactive education on physical activity and weight monitoring in improving diabetes awareness among adolescents. This study used a quantitative pre-experimental design with a one-group pretest-posttest approach. A total of 122 seventh-grade students were selected using random sampling techniques. Data were collected using the Diabetes Knowledge Questionnaire (DKQ-24) and analyzed through univariate and bivariate analysis using the Wilcoxon Signed Rank Test. The results showed a significant difference in diabetes awareness scores before and after the intervention, with a p-value of 0.000 ($p < 0.05$). Interactive education on physical activity and weight monitoring was proven effective in increasing diabetes awareness among adolescents. Therefore, school-based health education programs should be continuously implemented as promotive and preventive efforts against non-communicable diseases from an early age.

**Keywords:** Adolescents, Diabetes Awareness, Interactive Education, Physical Activity

## Introduction

Diabetes mellitus (DM) is one of the non-communicable diseases whose prevalence continues to increase in various countries, including Indonesia. This condition not only affects the adult population but is also increasingly found among adolescents due to unhealthy lifestyle changes [1]. Based on the 2018 Basic Health Research (Riskesdas) data, the prevalence of diabetes mellitus among individuals aged ≥15 years in South Kalimantan reached 1.8%, indicating the need for preventive efforts starting from school age [2]. The increasing incidence of diabetes among adolescents is strongly influenced by decreased physical activity, unhealthy dietary patterns, and behavioral changes during the COVID-19 pandemic, which worsened sedentary lifestyles [3,4].

The problem of diabetes mellitus in South Kalimantan is not evenly distributed but is concentrated in certain areas with risky lifestyle, social, and environmental characteristics. The identification of areas with high DM case pressure was conducted through a review of data from the Provincial Health Office and Banjarmasin City Health Office, Riskesdas reports, and mapping of community health center working areas. The findings revealed that West Banjarmasin District, particularly Pelambuan Village, is among the areas with relatively high numbers of diabetes mellitus cases compared to other regions. This condition is associated with population density, urban dietary


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patterns, low daily physical activity, and a high prevalence of obesity [2,5]. These data served as a factual basis for determining the research location, ensuring that the study has contextual relevance and is based on real public health problems in the field.

In the context of diabetes mellitus management, primary prevention through lifestyle modification is the main strategy, particularly in regulating physical activity and monitoring body weight. Physical activity plays an important role in improving insulin sensitivity and maintaining metabolic balance, while body weight monitoring is necessary to prevent obesity as a major risk factor for type 2 diabetes. However, among adolescents, these aspects are often neglected due to sedentary habits, excessive gadget use, and low awareness of non-communicable disease risks [4,6].

The phenomenon of increasing diabetes cases among school-aged children is also supported by data from the Indonesian Pediatric Society, which reported that the incidence of diabetes among individuals aged 0–18 years increased sevenfold over the past ten years [7]. Among junior high school adolescents aged 13–15 years, the risk of diabetes increases due to puberty-related hormonal changes that may reduce insulin sensitivity. This condition is exacerbated by low levels of structured physical activity and the absence of routine body weight monitoring, both within families and schools, causing adolescents to be unaware of their increasing health risks.

SMP Negeri 12 Banjarmasin was selected as the research site because it is located in Pelambuan Village, an area with high diabetes mellitus case pressure. In addition to regional factors, the characteristics of students living in densely populated urban environments with high access to fast food and limited physical activity make this school representative for examining diabetes-related problems among adolescents. Therefore, the selection of SMP Negeri 12 Banjarmasin was based not only on accessibility but also on epidemiological considerations and actual public health issues.

Unhealthy eating habits, low physical activity, and lack of body weight monitoring among adolescents directly contribute to low awareness of diabetes risk. This condition indicates that the main issue lies not only in theoretical knowledge but also in low diabetes awareness, which includes risk understanding, self-awareness, and adolescents' readiness to engage in early prevention efforts [8,9].

Based on the preliminary study conducted on 10 respondents in the research area, it was found that the level of knowledge regarding diabetes remained low. From brief interviews using several items from the Diabetes Knowledge Questionnaire, six respondents did not know that diabetes is not always caused by excessive sugar consumption, and six respondents did not understand the function of insulin in the body. In addition, eight respondents were unaware of the early signs of hyperglycemia, such as excessive thirst and frequent urination. Five respondents believed that diabetes could be completely cured, while six respondents assumed that medication was more important than regulating diet and physical activity. These findings indicate that the majority of respondents had inadequate understanding regarding the causes, symptoms, and management of diabetes, thereby strengthening the urgency of this study to examine public knowledge levels more systematically.

This low level of knowledge is an important concern considering that adolescents are a vulnerable age group prone to unhealthy lifestyle changes, such as low physical activity and increased consumption of foods high in sugar and fat. Lack of early understanding may increase the risk of developing diabetes mellitus in adulthood. Therefore, the findings of this preliminary study reinforce the urgency of conducting research to examine diabetes awareness more comprehensively and to develop effective educational interventions that are appropriate for adolescent characteristics.

This study aims to examine the effectiveness of interactive education on physical activity and body weight monitoring in improving diabetes awareness among adolescents. This is important because obesity is a major risk factor for type 2 diabetes among adolescents [9,10]. Adolescents with obesity are also at risk of developing other non-communicable diseases such as hypertension and

cardiovascular diseases [11,12]. Modern instant lifestyles further increase these risks [4,13]. Therefore, nutrition education, physical activity, and regular body weight monitoring are strategic measures to reduce the prevalence of diabetes and obesity among adolescents [14].

## Method

This study employed a quantitative research method with a pre-experimental design using a one-group pretest-posttest approach. The study was conducted at SMP Negeri 12 Banjarmasin, located in Pelambuan Village, West Banjarmasin District. The population consisted of all seventh-grade students, and 122 respondents were selected through random sampling based on predetermined inclusion and exclusion criteria. The study aimed to determine the effectiveness of interactive education on physical activity and body weight monitoring in improving diabetes awareness among adolescents.

Primary data were collected directly from respondents using questionnaires. The instrument used was the Diabetes Knowledge Questionnaire (DKQ-24), which measures respondents' understanding of diabetes mellitus, including its risk factors, symptoms, prevention, and management. Data collection was conducted in two stages: pretest and posttest. The pretest was administered before the intervention to assess the initial level of diabetes awareness, while the posttest was conducted after the intervention to evaluate changes in awareness levels.

The intervention consisted of interactive health education related to physical activity and body weight monitoring. Educational sessions were delivered through interactive lectures, discussions, question-and-answer sessions, and demonstrations of healthy lifestyle behaviors. This approach encouraged active participation and facilitated two-way communication between researchers and respondents, making the educational material easier to understand.

Data analysis included univariate and bivariate analysis techniques. Univariate analysis was used to describe respondents' characteristics, such as gender, age, and body mass index (BMI), as well as the distribution of diabetes awareness levels before and after the intervention. Bivariate analysis was performed using the Wilcoxon Signed Rank Test to determine differences in diabetes awareness scores before and after the intervention. The analysis showed a p-value of 0.000 ($p < 0.05$), indicating that interactive education on physical activity and body weight monitoring was effective in improving diabetes awareness among adolescents.

## Results

### 3.1 Characteristics of Respondents

Table 1 shows the distribution of respondents based on gender. From a total of 122 respondents, most were male, with 62 students (50.8%), while female respondents accounted for 60 students (49.2%). These findings indicate that the proportion of male and female respondents was relatively balanced.

**Table 1. Frequency Distribution of Respondents Based on Gender (n=122)**

| Gender | Frequency (f) | Percentage (%) |
|---|---|---|
| Male | 62 | 50.8 |
| Female | 60 | 49.2 |
| Total | 122 | 100 |

Table 2 presents the age distribution of respondents. The majority of respondents were 13 years old, totaling 80 students (65.6%), followed by 14 years old with 34 students (27.9%), and 12 years old with 8 students (6.6%). These results indicate that most respondents were in early adolescence.

**Table 2. Frequency Distribution of Respondents Based on Age (n=122)**

| Age | Frequency (f) | Percentage (%) |
|---|---|---|
| 12 years | 8 | 6.6 |
| 13 years | 80 | 65.6 |
| 14 years | 34 | 27.9 |
| Total | 122 | 100 |

Table 3 shows the distribution of respondents based on Body Mass Index (BMI). Most respondents had normal nutritional status, accounting for 107 students (87.7%), while 15 respondents (12.3%) were categorized as underweight. No respondents were classified as overweight or obese.

**Table 3. Frequency Distribution of Respondents Based on Body Mass Index (n=122)**

| Body Mass Index | Frequency (f) | Percentage (%) |
|---|---|---|
| Underweight | 15 | 12.3 |
| Normal | 107 | 87.7 |
| Total | 122 | 100 |

### 3.2. Univariate Analysis

Table 4 presents the level of diabetes awareness before the intervention (pretest). Most respondents had poor diabetes awareness, with 72 students (59.0%), while 44 respondents (36.1%) had moderate awareness, and only 6 respondents (4.9%) had good awareness.

**Table 4. Distribution of Diabetes Awareness Before Intervention (Pretest) (n=122)**

| Diabetes Awareness | Frequency (f) | Percentage (%) |
|---|---|---|
| Poor | 72 | 59.0 |
| Moderate | 44 | 36.1 |
| Good | 6 | 4.9 |
| Total | 122 | 100 |

Table 5 shows the distribution of diabetes awareness after the intervention (posttest). The results demonstrated an increase in diabetes awareness levels after interactive education was provided. Respondents with good awareness increased to 67 students (54.9%), while poor awareness decreased to 13 students (10.7%).

**Table 5. Distribution of Diabetes Awareness After Intervention (Posttest) (n=122)**

| Diabetes Awareness | Frequency (f) | Percentage (%) |
|---|---|---|
| Poor | 13 | 10.7 |
| Moderate | 42 | 34.4 |
| Good | 67 | 54.9 |
| Total | 122 | 100 |

### 3.3. Bivariate Analysis

Table 6 presents the results of the Wilcoxon Signed Rank Test to analyze differences in diabetes awareness before and after the intervention. The findings showed a statistically significant difference between pretest and posttest scores with a p-value of 0.000 ($p < 0.05$). These results indicate that interactive education on physical activity and body weight monitoring effectively improved diabetes awareness among adolescents.

**Table 6. Differences in Diabetes Awareness Before and After Intervention (n=122)**

| Diabetes Awareness | Pretest f (%) | Posttest f (%) | p-value |
|---|---|---|---|
| Poor | 72 (59.0) | 13 (10.7) | 0.000 |
| Moderate | 44 (36.1) | 42 (34.4) | |
| Good | 6 (4.9) | 67 (54.9) | |
| Total | 122 (100) | 122 (100) | |

## Discussion

### 4.1 Discussion of Respondents' Characteristics

The characteristics of respondents in this study showed a relatively balanced distribution between male and female participants. The results indicated that there were 62 male respondents (50.8%) and 60 female respondents (49.2%). This nearly equal distribution demonstrates that the study sample proportionally represented the adolescent population. During adolescence, both males and females have relatively similar risks of experiencing lifestyle changes that may affect metabolic health, including the risk of diabetes mellitus. Several studies have reported that adolescents are vulnerable to unhealthy behaviors such as lack of physical activity, excessive consumption of high-sugar foods, and low awareness of metabolic diseases; therefore, health education should be provided regardless of gender [15].

Based on age distribution, most respondents were 13 years old, totaling 80 individuals (65.6%), followed by 14 years old with 34 respondents (27.9%), and 12 years old with 8 respondents (6.6%). These findings indicate that the majority of respondents were in early adolescence. Early adolescence is an important period in the formation of health behaviors because individuals begin to experience significant biological, psychological, and social changes. At this stage, adolescents begin developing independence in determining their lifestyle, including dietary patterns, physical activity, and other health-related behaviors. Therefore, health education interventions during early adolescence are considered highly effective in increasing awareness of chronic diseases such as diabetes mellitus and in establishing healthy lifestyle habits from an early age. Health education programs provided to school-aged adolescents have been proven to improve knowledge and awareness regarding metabolic disease risk factors [16].

Based on nutritional status measured using Body Mass Index (BMI), most respondents were categorized as having normal nutritional status, totaling 107 individuals (87.7%), while 15 respondents (12.3%) were categorized as underweight. No respondents were classified as overweight or obese. This finding indicates that the majority of respondents had relatively good nutritional status. Normal nutritional status during adolescence is an important indicator in preventing various non-

communicable diseases, including diabetes mellitus. Previous studies have stated that unbalanced nutritional status, particularly overweight and obesity, can increase insulin resistance and raise the risk of type 2 diabetes at a young age. Therefore, body weight monitoring and maintaining an ideal nutritional status during adolescence are important strategies for preventing diabetes in the future [17].

Furthermore, respondent characteristics based on family history of diabetes mellitus showed that most respondents did not have a family history of diabetes mellitus, accounting for 112 individuals (91.8%), while 10 respondents (8.2%) had a family history of diabetes mellitus. Family history is one of the non-modifiable risk factors for diabetes mellitus. Individuals who have family members with diabetes are more likely to experience glucose metabolism disorders compared to those without a family history. Genetic factors may influence insulin sensitivity and glucose metabolism in the body; therefore, individuals with a family history of diabetes require special attention in maintaining a healthy lifestyle. Nevertheless, lifestyle factors such as adequate physical activity, healthy dietary habits, and body weight monitoring continue to play an important role in reducing this risk [18].

The characteristics of respondents were also reviewed based on family history of other diseases. The results showed that most respondents did not have a family history of other diseases, totaling 96 individuals (78.7%). However, several respondents had family histories of certain diseases such as hypertension (14.8%), asthma (4.1%), heart disease (1.6%), and cancer (0.8%). Family history of disease can be an important indicator in identifying the potential risk of non-communicable diseases among adolescents. Chronic diseases such as hypertension and heart disease are often associated with lifestyle and metabolic factors that are also related to the risk of diabetes mellitus. Therefore, identifying family medical history may support early prevention efforts through the promotion of healthy lifestyles and increased health awareness among adolescents. Health education emphasizing the importance of physical activity, body weight management, and understanding chronic disease risk factors is considered a strategic step in improving health awareness among school-aged adolescents [17].

Overall, the characteristics of respondents in this study indicate that most respondents were in early adolescence, had normal nutritional status, and did not have a family history of diabetes mellitus. These findings suggest that respondents were generally a relatively healthy group but still required health education to improve awareness regarding diabetes prevention. Providing education during school age is an important strategy in developing healthy lifestyle behaviors, increasing knowledge about physical activity and body weight monitoring, and preventing the emergence of metabolic disease risk factors in adulthood.

### 4.2 Univariate Analysis

#### a. Level of Diabetes Awareness Among Adolescents Before Receiving Interactive Education on Physical Activity and Body Weight Monitoring

The results of this study showed that the level of diabetes awareness among respondents before receiving health education intervention was mostly categorized as poor, accounting for 72 respondents (59.0%), followed by moderate awareness in 44 respondents (36.1%), while only a small proportion had good awareness, totaling 6 respondents (4.9%). These findings indicate that before health education was conducted, most adolescents did not have adequate understanding regarding diabetes mellitus, its risk factors, and prevention efforts. This condition demonstrates that awareness of non-communicable diseases, particularly diabetes mellitus, remains relatively low among adolescents and therefore requires systematic educational interventions within the school environment.

Based on the results of the univariate analysis, the pretest condition not only described the respondents' initial level of diabetes awareness but could also be associated with respondent

characteristics that potentially influenced their awareness level. Variables such as age, gender, body mass index (BMI), and family history of diabetes mellitus were important factors in explaining the low level of awareness before the educational intervention was provided.

In addition, the univariate analysis was further supported by the results of the Diabetes Knowledge Questionnaire (DKQ-24). Several fundamental misconceptions were still identified among respondents, including poor understanding regarding the causes of diabetes, the role of insulin, early signs and symptoms of diabetes, and prevention strategies through physical activity and body weight control. These findings indicate that low diabetes awareness was not only general in nature but also related to limited understanding of the basic concepts of the disease.

According to the researchers' assumptions, the low level of diabetes awareness before the intervention may have been influenced by several factors, one of which was the adolescent age group itself, which is still undergoing cognitive development and has limited health-related experiences. During adolescence, attention toward chronic diseases such as diabetes mellitus is generally low because these diseases are often perceived as health problems that occur only in adulthood or old age. In addition, adolescents tend to have insufficient exposure to information regarding risk factors, prevention strategies, and the long-term consequences of diabetes. As a result, their understanding of the importance of early diabetes prevention remains limited.

Body mass index (BMI) characteristics may also influence diabetes awareness. Respondents with normal BMI tended to perceive themselves as having a lower risk of diabetes mellitus and therefore were less motivated to seek information or engage in preventive efforts. In contrast, individuals with excess body weight generally demonstrated greater awareness of health risks. This finding suggests that perceptions regarding physical condition contribute to adolescents' health awareness levels.

The questionnaire results also revealed that some respondents still held misconceptions, such as believing that diabetes is solely caused by excessive sugar consumption, not understanding the role of insulin in glucose metabolism, and being unable to recognize early symptoms such as polyuria and polydipsia. Furthermore, several respondents believed that diabetes could be completely cured without long-term management. These misconceptions directly affected adolescents' readiness to engage in preventive behaviors.

Low diabetes awareness among adolescents has been widely reported in various studies. Adolescents often do not comprehensively understand the causes, risk factors, and long-term impacts of diabetes mellitus. This is influenced by limited exposure to health information, low health literacy, and the lack of structured health education programs at school age. Research conducted among Indonesian adolescents showed that most adolescents still had limited knowledge regarding diabetes and its prevention, indicating the need for continuous educational efforts to improve health awareness in this age group [15].

Low awareness regarding diabetes among adolescents is also related to the perception that the disease mainly affects adults or older individuals. In fact, current epidemiological trends show that type 2 diabetes is increasingly found in younger age groups, including adolescents. Limited understanding regarding risk factors such as high-sugar diets, lack of physical activity, and weight gain may cause adolescents to underestimate their own risk. Therefore, increasing awareness through health education is an important strategy for diabetes prevention from an early age [19].

Another contributing factor was family history of diabetes mellitus. Respondents without a family history of diabetes tended to have lower levels of awareness because of limited exposure to information or direct experience related to the disease. Conversely, adolescents with a family history of diabetes were more likely to understand the risks and the importance of early prevention.

Low diabetes awareness before intervention may also be influenced by modern adolescent lifestyles, which tend to involve low levels of physical activity and increased consumption of high-

sugar foods or fast food. These lifestyle changes contribute to the increasing risk of metabolic diseases at a young age. Lack of physical activity and unhealthy eating habits are factors associated with low awareness regarding the importance of diabetes prevention. Therefore, improving knowledge related to physical activity and body weight control is an important component of health education for adolescents [16].

In addition, gender differences may influence diabetes awareness, with female adolescents generally showing greater concern for health compared to males. This difference is related to health information-seeking behavior and greater attention to body condition among females.

The questionnaire analysis also showed that respondents' understanding regarding the role of physical activity in diabetes prevention remained low, as reflected by the high number of incorrect responses on items related to physical activity and body weight control. This finding indicates that adolescents did not fully understand the relationship between healthy lifestyles and diabetes prevention, which consequently affected the implementation of healthy behaviors in daily life.

The findings of this study are consistent with previous studies showing that before receiving health education, adolescents generally have low levels of knowledge and awareness regarding diabetes. Studies on diabetes education among school students demonstrated that before health education was provided, most respondents had poor understanding regarding diabetes risk factors and prevention. After receiving health education, respondents showed significant improvements in knowledge, indicating that health education plays an important role in increasing adolescent awareness regarding metabolic diseases [20].

Overall, the low level of diabetes awareness before intervention in this study indicates that adolescents still require improved health literacy regarding non-communicable diseases, particularly diabetes mellitus. This condition emphasizes the important role of educational institutions and healthcare professionals in providing continuous health education. Educational programs emphasizing physical activity, healthy lifestyles, and body weight monitoring may become effective strategies to improve awareness and prevent diabetes from adolescence.

**b. Diabetes Awareness Levels Among Adolescents After Receiving Interactive Educational Intervention on Physical Activity and Body Weight Monitoring**

The results of this study showed that after receiving an educational intervention through direct health counseling regarding physical activity and body weight monitoring, there was a significant improvement in respondents' diabetes awareness levels. Most respondents after the intervention were categorized as having good awareness, totaling 67 respondents (54.9%), followed by the moderate category with 42 respondents (34.4%), while the poor category decreased to 13 respondents (10.7%). These findings indicate that health education was able to improve adolescents' understanding and awareness regarding diabetes mellitus and the importance of preventive behaviors from an early age.

The improvement in diabetes awareness levels after the intervention demonstrates that health education plays an important role in increasing health literacy among adolescents. Through direct counseling, respondents obtained clearer information regarding the definition of diabetes, risk factors, disease impacts, and prevention strategies such as adequate physical activity and body weight monitoring. The interactive educational process also allowed respondents to ask questions and engage in discussions, making the information easier to understand. Previous studies have shown that health education provided to adolescents can improve knowledge and awareness regarding diabetes and encourage behavioral changes toward healthier lifestyles [21].

In addition, the increase in diabetes awareness among respondents may have been influenced by the intervention method used in this study, namely interactive education involving active communication between educators and respondents. The interaction included interactive lectures, question-and-answer sessions, group discussions, and demonstrations of healthy behaviors related to

physical activity and body weight monitoring. Through this interactive process, respondents did not merely receive information passively but were actively involved in the learning process, which enhanced their understanding of the educational material.

The direct counseling method applied in this study enabled two-way communication between educators and respondents. This condition made information delivery more effective because respondents could clarify topics they did not understand and receive direct explanations. Health education conducted through interactive lectures, discussions, and demonstrations of healthy behaviors has been proven to improve students' understanding of non-communicable diseases and preventive measures. School-based health education programs are also known to be effective in shaping more positive attitudes toward healthy lifestyles, including diabetes prevention efforts from an early age [22].

The findings of this study are consistent with several previous studies showing that health education interventions can improve public knowledge and awareness regarding diabetes. A study using interactive educational media among school students demonstrated a significant increase in students' knowledge about diabetes mellitus after receiving health education. This finding indicates that systematic and engaging health information delivery can improve adolescents' understanding of metabolic diseases and the importance of lifestyle modification for disease prevention [21].

In addition to increasing knowledge, health education may also influence adolescents' attitudes and behaviors toward health. Adolescents with higher awareness regarding diabetes are more likely to adopt healthy lifestyle behaviors such as increasing physical activity, reducing consumption of high-sugar foods, and maintaining an ideal body weight. Diabetes prevention efforts during adolescence are essential considering the increasing trend of type 2 diabetes among younger age groups due to unhealthy lifestyle and dietary patterns. Therefore, improving awareness through health education programs is an important strategy in preventing non-communicable diseases in the future [23].

Overall, the results of this study indicate that health education regarding physical activity and body weight monitoring was effective in improving diabetes awareness among adolescents. The increase in the proportion of respondents with good awareness levels after the intervention demonstrates that appropriate health information can improve adolescents' understanding of diabetes risk factors and the importance of maintaining a healthy lifestyle. With increased awareness, adolescents are expected to adopt healthy behaviors from an early age, thereby reducing the risk of developing diabetes mellitus in the future.

### 4.3 Bivariate Analysis

The results of this study showed that interactive education regarding physical activity and body weight monitoring had a significant effect on improving diabetes awareness among adolescents. This finding was supported by statistical analysis using the Wilcoxon Signed Rank Test, which produced a p-value of 0.000 ($p < 0.05$). This value indicates that there was a significant difference in diabetes awareness levels before and after the educational intervention. Therefore, the hypothesis stating that interactive education is effective in increasing diabetes awareness among adolescents was statistically accepted.

The improvement in diabetes awareness after the educational intervention indicates that health education plays an important role in improving health literacy among adolescents. Interactive educational methods allowed respondents to gain a better understanding of the basic concepts of diabetes mellitus, risk factors, and preventive measures such as increasing physical activity and maintaining body weight control. Previous studies have shown that school-based health education can significantly improve students' knowledge and awareness regarding diabetes, particularly when delivered using engaging and interactive methods [21].

Interactive educational methods also facilitate two-way communication between educators and participants, making the learning process more effective. Interaction through discussions, question-and-answer sessions, and case examples helps participants understand the material more deeply compared to passive learning methods. Several studies have shown that health education interventions conducted in school settings can improve adolescents' knowledge, attitudes, and preventive behaviors regarding diabetes. This occurs because adolescents are in a developmental stage where they are more receptive to new information and the formation of healthy lifestyle habits [16].

In addition, the increase in diabetes awareness after the intervention was associated with improved adolescents' understanding of the relationship between lifestyle and metabolic disease risk. Lack of physical activity and unhealthy dietary patterns are major risk factors for type 2 diabetes at a young age. Therefore, education regarding the importance of physical activity and body weight control is an essential strategy in early diabetes prevention. Research has shown that low levels of knowledge and physical activity among adolescents may increase the risk of diabetes in the future; therefore, sustainable health education programs in schools are necessary [15].

The interpretation of the Wilcoxon test results in this study indicates that the improvement in diabetes awareness was not due to chance alone but was the direct effect of the educational intervention provided. The Wilcoxon test is a non-parametric statistical method used to analyze differences between two paired measurements, such as pretest and posttest data from the same group of respondents. A p-value smaller than 0.05 indicates a significant difference before and after the intervention. Similar studies using a pretest–posttest design also reported a p-value of 0.000 after providing diabetes health education to adolescents, indicating that health education interventions significantly improve respondents' knowledge and awareness [21].

Overall, the results of this study confirm that interactive education regarding physical activity and body weight monitoring is an effective strategy for improving diabetes awareness among adolescents. Schools are highly strategic settings for implementing health promotion programs because adolescents spend most of their time in the school environment. By increasing awareness regarding diabetes risk factors and prevention, adolescents are expected to adopt healthy lifestyle behaviors such as increasing physical activity, maintaining a balanced diet, and regularly monitoring body weight, thereby minimizing the risk of developing diabetes mellitus in the future.

## Conclusion

This study concluded that interactive education regarding physical activity and body weight monitoring was effective in improving diabetes awareness among adolescents at SMP Negeri 12 Banjarmasin. Prior to the intervention, most respondents demonstrated low levels of awareness regarding diabetes mellitus, particularly related to risk factors, symptoms, prevention, and healthy lifestyle behaviors. The findings indicated that many adolescents still had misconceptions about diabetes, including limited understanding of the role of insulin, the importance of physical activity, and the relationship between body weight and metabolic health. These conditions reflected the low level of health literacy among adolescents and highlighted the need for structured educational interventions within the school environment.

After the implementation of the interactive educational intervention, there was a significant increase in respondents' diabetes awareness levels. Most respondents showed better understanding regarding diabetes prevention, especially concerning the importance of regular physical activity, maintaining ideal body weight, and adopting healthy lifestyle behaviors from an early age. The improvement in awareness demonstrated that interactive educational methods involving discussions, question-and-answer sessions, and direct participation were able to facilitate better comprehension among adolescents. The active involvement of respondents during the educational sessions

contributed to the effectiveness of the intervention and enabled the delivery of health information in a more engaging and understandable manner.

The statistical analysis using the Wilcoxon Signed Rank Test confirmed that the increase in diabetes awareness after the intervention was statistically significant. These findings indicate that interactive health education can serve as an effective strategy for increasing adolescents' understanding and awareness regarding diabetes mellitus prevention. The results also emphasized that adolescence is an important developmental stage for establishing healthy behaviors and improving awareness of non-communicable diseases. Providing health education during this period may contribute to the development of long-term healthy lifestyle habits that can reduce the risk of metabolic diseases in adulthood.

Furthermore, this study demonstrated that schools play a strategic role in promoting adolescent health because they provide an accessible environment for implementing preventive health programs. Health education focusing on physical activity and body weight monitoring can become an important component of school-based health promotion programs. Through continuous educational efforts, adolescents are expected to become more aware of the importance of maintaining a healthy lifestyle, increasing physical activity, consuming balanced nutrition, and regularly monitoring body weight as preventive measures against diabetes mellitus.

Overall, the findings of this study suggest that interactive educational interventions are capable of improving diabetes awareness among adolescents and may contribute to the prevention of diabetes mellitus at an early age. Therefore, collaboration between schools, healthcare providers, and families is needed to support sustainable health education programs aimed at enhancing adolescent health awareness and promoting healthy lifestyle behaviors in the community.

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