Proceeding Paper

THE RELATIONSHIP OF BREAKFAST AND CARDIOMETABOLIC RISK FACTORS OF HIGH SCHOOL STUDENTS IN BENGKULU CITY

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Abstract

Skipping breakfast has been reported to be associated with overall unhealthy behaviors, such as poor diet and lower than normal levels of physical activity. This study was an observational study with a cross-sectional design. Data processing and analysis were statistically processed using the chi-square test. The sample in this study were overweight high school students in Bengkulu City. The place of research was SMAN 01 Bengkulu and SMAN 10 Bengkulu. The data were collected by measuring with tools directly to the students of each school, the data measured were weight, height, WHR, blood pressure, blood glucose, blood cholesterol. The results demonstrated no correlation between breakfast consumption and blood sugar, waist-to-hip ratio (WHR), blood pressure, and cholesterol levels.

Keywords: Breakfast, blood sugar, waist-to-hip ratio (WHR), blood pressure, cholesterol levels.

INTRODUCTION

The prevalence of obesity in adolescents has also increased over the past decade. As evidenced by the National Health and Nutrition Examination Survey III (NHANES III) conducted during 1988-1994 and 1999-2000, there was an observed increase in the prevalence of obesity among adolescents, with a 11% rise in the incidence of this condition. In Indonesia, the 2013 Riskesdas data indicated a notable increase in the prevalence of obese adolescents aged 16-18 years, from 1.4% in 2007 to 7.3% in 2013. This consisted of 5.7% overweight and 1.6% obese adolescents (Kemenkes RI, 2013). The prevalence of overweight and obesity among adolescents in Indonesia has increased significantly in recent years. In 2018, the prevalence of overweight and obesity among adolescents aged 13-15 years was 16.0%, while among adolescents aged 16-18 years, it was 13.5% (Kemenkes RI, 2018). Bengkulu is one of the

provinces with a high prevalence of obesity, at 2.9%. In adolescents aged ≥ 15 years in Bengkulu City, the prevalence of central obesity is the highest in the country, at 38.40% (Kemenkes RI, 2018). The proportion of adolescents with central obesity in Bengkulu has increased from 26.6% in 2013 to 31% in 2018 (Bengkulu, 2020).

Fayet-Moore's research in 2019 asserted that breakfast is of significant importance for children and adolescents. Breakfast has the capacity to enhance the daily nutritional intake by fulfilling additional nutrient requirements. Adolescents who adhere to healthy breakfast routines tend to exhibit enhanced physical activity levels, superior cognitive function, and elevated levels of overall health. Adolescents who do not consume breakfast will gradually lose their selectivity when choosing food during the day, ultimately selecting foods with high calorie content but low nutritional value. Additionally, the increased hunger caused by skipping breakfast leads to eating more in the afternoon and evening, resulting in young people consuming more than their daily portion (Annisa & Utami, 2024).

It has been reported that breakfast skipping is associated with a range of generally unhealthy behaviours, including poor dietary habits and lower-than-normal levels of physical activity. The frequency of daily meals has long been suspected to influence health, in particular cardiometabolic risk. Previous epidemiological studies conducted by Farhschi demonstrated that maintaining a normal meal frequency of three meals per day resulted in improved lipid profiles. Treatment Panel III (ATP-III) defined metabolic syndrome based on the criteria of waist circumference, specific treatment of lipid abnormalities, and blood pressure.

As posited by Smith and colleagues in 2010, in addition to the risk of obesity, poor breakfast habits can also contribute to the risk of future cardiometabolic diseases in children and adolescents. A longitudinal study examining the impact of breakfast habits on cardiometabolic disease in children and adolescents revealed that those with poor breakfast habits exhibited lower fasting blood sugar, total cholesterol, LDL, and waist circumference. These are likely to increase in the future.

MATERIALS AND METHODS

This study examined the association between breakfast consumption and cardiometabolic risk factors in a sample of Senior High School students residing in Bengkulu City. This study employed an observational design with a cross-sectional approach. The target population consisted of all adolescents residing in Bengkulu City, specifically Senior High School students. The study sample consisted of obese students residing in Bengkulu City. The research was conducted at two educational institutions in Bengkulu City: SMAN 01 Bengkulu and SMAN 10 Bengkulu. The data utilized in this study are primary data. The primary data set includes weight, height, waist-hip ratio, blood pressure, blood glucose, and blood cholesterol. The secondary data set includes: The names of the students in the high

school were recorded. The primary data were collected by measuring the relevant variables directly with tools used by the researchers to each student at each school. The data were obtained from the student affairs units of each school. The data collection tools used were questionnaires and recall forms. The data were processed statistically with the Chi-Square test. This research has been approved by the ethics committee with no. 0423/KEPK/Adm2/V/2023.

RESULTS AND DISCUSSION

Table 1: Relationship between breakfast and blood sugar

Breakfast	Blood Sugar				Total		*P-value*
	Abnormal		Normal				
	n	(%)	n	(%)	N	(%)	
Breakfast Skipping	1	4.2	24	95.8	25	100	
Breakfast	0	0	6	100	6	100	1.00

Table 1 shows that 4.2% of students who do not consume breakfast have abnormal blood sugar levels, while 95.8% of students who do not eat breakfast have normal blood sugar levels. In contrast, 100% of students who do consume breakfast have normal blood sugar levels. The results of the chi-square test of the relationship between breakfast habits and students' blood sugar levels yielded a p-value of 1.00, indicating that there is no statistically significant relationship between these two variables.

Table 2: Relationship between breakfast and Waist Hip Ratio

Breakfast	WHR				Total		*P-value*
	Abnormal		Normal				
	n	(%)	n	(%)	N	(%)	
Breakfast Skipping	11	44	14	56	25	100	
Breakfast	4	66.7	2	33.3	6	100	0.39

Table 2 shows that 44% of students whom skipping breakfast have an abnormal waist-to-hip ratio (WHR), while 56% of students who do not have breakfast have a normal WHR. Conversely, as many as 66.7% of students who have breakfast have an abnormal WHR, while 33% of students who have breakfast have a normal blood sugar level. The results of the chi-square test of the relationship between breakfast habits and students' WHR yielded a p-value of 0.39, indicating that there is no statistically significant relationship between the two variables.

Table 3: Relationship between breakfast and Blood Pressure

Breakfast	Blood Pressure				Total		P-value
	Abnormal		Normal				
	n	(%)	n	(%)	N	(%)	
Breakfast skipping	20	80	5	20	25	100	0.55
Breakfast	6	100	0	0	6	100	

The results presented in Table 3 demonstrate that 80% of students who do not consume breakfast exhibit abnormal blood pressure, while 20% of students who do not have breakfast have normal blood pressure. Conversely, 100% of students who have breakfast have abnormal blood pressure. The results of the chi-square test of the relationship between breakfast habits and student blood pressure yield a p-value of 0.55, indicating that there is no statistically significant relationship between breakfast habits and student blood pressure.

Table 4: Relationship between breakfast and blood cholesterol

Breakfast	Blood Cholesterol				Total		P-value
	Abnormal		Normal				
	n	(%)	n	(%)	n	(%)	
Breakfast skipping	9	36	16	64	25	100	1.00
Breakfast	2	33,3	4	66,7	6	100	

Table 4 shows that 36% of students who do not have breakfast have abnormal cholesterol levels, while 64% of students who do not have breakfast have normal cholesterol levels. In contrast, as many as 33.3% of students who have breakfast have abnormal cholesterol levels, while 66.7% of students who have breakfast have normal cholesterol levels. The results of the chi-square test of the relationship between breakfast habits and students' blood sugar levels yielded a p-value of 1.00, indicating that there is no statistically significant relationship between breakfast habits and students' cholesterol levels.

The practice of skipping breakfast has been linked to a range of unhealthy behaviours, including poor dietary habits and inadequate physical activity. These actions may contribute to an increased risk of obesity and associated cardiometabolic disorders. Breakfast foods, which typically fall within the core food groups (breads and cereals, dairy products, and fruit), offer a balanced source of nutrients, with a relatively low fat and high carbohydrate content (Souza et al., 2021).

The results of the study, as indicated by the Chi-Square test, demonstrated no statistically significant correlation between breakfast consumption and blood sugar, waist-to-hip ratio (WHR), blood pressure, and total cholesterol. However, the findings revealed that one student exhibited abnormal blood sugar levels. Eleven students (44%) exhibited abnormal RLPP, 20 students (80%) who did not consume breakfast demonstrated abnormal blood pressure, and 9 students (36%) exhibited abnormal total cholesterol levels out of 31 students who responded to the survey.

The omission of breakfast can result in a deficiency of energy reserves, which may impede the capacity to engage in activities, particularly those that require cognitive exertion. This occurs because during the night, the body continues to oxidize to produce energy that supports the function of the heart, lungs, and other muscles. Consequently, blood glucose levels are at their lowest in the morning before a meal is consumed. When breakfast is omitted, the brain's glucose supply is not met as glucose reserves decline after approximately 18 hours without energy intake, particularly in the absence of carbohydrates (Rizkyta & Mulyati, 2014). Additionally, skipping breakfast can elevate the production of stress hormones, such as cortisol. Increased cortisol can result in the constriction of blood vessels and elevated blood pressure. This is why 80% of students who did not eat breakfast exhibited abnormal blood pressure.

A study by Wang et al. (2020) conducted a randomized controlled trial to investigate the effects of breakfast consumption on metabolic markers. Participants were randomly assigned to either a breakfast group or a breakfast-skipping group for 12 weeks. The study found no significant differences in markers of cardiometabolic risk, such as fasting glucose, lipid levels, or blood pressure, between the two groups. The authors suggested that individual metabolic responses to meal timing might vary and that the benefits of breakfast may depend on broader dietary patterns rather than meal timing alone

Adolescents frequently employ a variety of strategies to achieve weight loss or maintain optimal nutritional status. One such strategy is the omission of breakfast. The data indicates that the majority of respondents who do not consume breakfast on a daily basis exhibit sign of overnutrition. This indicates that the regular consumption of breakfast may serve to indirectly reduce the risk of overnutrition (Irdiana & Nindya, 2017). Failing to consume breakfast can result in increased feelings of hunger throughout the day. This frequently results in overeating or the consumption of foods with a high calorie and fat content at lunch or dinner. Adolescents who skip breakfast may substitute fast food or unhealthy

snacks, which are typically higher in calories, fat, and sugar. This is a concern for overweight adolescents or students in Bengkulu City who do not eat breakfast, as it may contribute to cardiometabolic risks, including elevated blood pressure. Routine monitoring of nutritional status, blood pressure, blood sugar, and cholesterol levels is essential for these individuals.

A systematic review and meta-analysis by Liu et al. (2021) examined multiple studies on breakfast consumption and its impact on cardiometabolic risk factors, including obesity, diabetes, and cardiovascular diseases. The review found that while some individual studies suggest a beneficial effect of eating breakfast, the overall evidence does not consistently support a significant relationship between breakfast consumption and reduced cardiometabolic risk. The authors concluded that the quality of evidence is mixed and that other factors, such as overall diet quality and lifestyle, may play more critical roles in cardiometabolic health.

CONCLUSION

The results demonstrated no correlation between breakfast consumption and blood sugar, waist-to-hip ratio (WHR), blood pressure, and cholesterol levels. However, among the 25 students who did not consume breakfast, 44% exhibited abnormal WHR, 80% of whom had abnormal blood pressure, and 36% had abnormal total cholesterol levels.

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