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Fast Food Consumption, Physical Activity, and Knowledge of Diabetes in Relation to Body Mass Index in Urban Adolescents: A Cross-Sectional Study

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ABSTRACT

Urban adolescents tend to increase fast-food consumption and engage in unbalanced physical activity, which may contribute to abnormal Body Mass Index (BMI) and increase the risk of type 2 diabetes mellitus (DM). This study aimed to analyse the relationships among diabetes mellitus knowledge, fast-food dietary patterns, and physical activity with BMI among adolescents. A cross-sectional study was conducted among 290 urban adolescents from public senior high schools in Bekasi City, Indonesia, in December 2025, using stratified cluster sampling. DM knowledge was measured using the Diabetes Knowledge Questionnaire-24 (DKQ-24), fast-food intake using the Food Frequency Questionnaire (FFQ), and physical activity using the International Physical Activity Questionnaire (IPAQ). BMI was calculated from weight and height measurements. Data were analysed using Chi-Square and binary logistic regression tests with a significance level of $\alpha = 0.05$. Fast-food dietary pattern ($\chi2 = 11.237$; $p = 0.010$) and physical activity ($\chi2 = 17.584$; $p = 0.001$) were significantly related to BMI; DM knowledge was not ($\chi2 = 1.838$; $p = 0.934$). Fast-food dietary pattern was the dominant clinical factor for abnormal BMI (OR = 2.447; 95% CI 0.852–7.032; $p = 0.098$). Although fast-food dietary patterns showed a higher odds ratio for abnormal BMI, the association was not statistically significant ($p = 0.098$); however, the finding may still indicate a potential clinical trend that warrants attention. Physical activity was significantly associated with adolescent BMI. Nurses and health professionals should develop school-based nutrition education to reduce fast-food consumption and prevent early type 2 DM.

Keywords: Adolescents; Body Mass Index; diabetes knowledge; fast food; physical activity

INTRODUCTION

The increasing prevalence of type 2 diabetes mellitus (T2DM) and adolescent obesity has become a major global public health concern. The World Health Organization (WHO) reported a substantial rise in overweight and obesity among adolescents over recent decades, contributing to an increased risk of metabolic disorders, including T2DM[1]. Adolescence is a critical developmental period in which unhealthy lifestyle behaviors may persist into adulthood and increase long-term health risks. In Indonesia, the prevalence of overweight and obesity among adolescents continues to increase[2]. Data from Riskesdas 2018 showed that obesity among adolescents aged 13–18 years has risen significantly, particularly in urban areas[3]. Rapid urbanization, technological development, and lifestyle changes have contributed to unhealthy eating behaviors and reduced physical activity among adolescents. These conditions place urban adolescents at greater risk for abnormal Body Mass Index (BMI) and metabolic diseases.

Dietary pattern is one of the major determinants associated with adolescent obesity and T2DM risk. Frequent fast-food consumption is commonly characterized by high levels of calories, saturated fat, sugar, and sodium, while containing limited nutritional value[4]. Previous studies have shown that excessive fast-food intake is associated with overweight, obesity, insulin resistance, and other metabolic abnormalities among adolescents. The increasing accessibility and popularity of fast food among urban youth further contribute to unhealthy dietary habits. Physical activity and diabetes knowledge also play important roles in adolescent health. Regular physical activity can improve insulin sensitivity, maintain energy balance, and reduce the risk of obesity and T2DM. However, many adolescents fail to achieve the recommended level of moderate-to-vigorous physical activity and increasingly engage in sedentary behaviors, including prolonged screen time[5]. In addition, adequate diabetes knowledge may encourage adolescents to adopt healthier lifestyles, although knowledge alone does not always translate into healthy behavior because environmental and social factors may influence daily practices. Previous studies have mostly examined dietary patterns, physical activity, or diabetes knowledge separately in relation to

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obesity and diabetes risk[6]. Limited studies in Indonesia, particularly among urban adolescents, have simultaneously analysed these factors in relation to BMI as an indicator of metabolic risk. Furthermore, evidence regarding the dominant factor associated with abnormal BMI among adolescents remains inconsistent. Therefore, this study aimed to analyse the relationships among diabetes knowledge, fast-food dietary patterns, and physical activity with BMI among urban adolescents[7].

Recent studies have reported emerging findings regarding the increasing shift in adolescent lifestyle behaviors after rapid urbanization and digitalization. Adolescents are now more frequently exposed to online food delivery services, high-calorie processed foods, and prolonged screen-based activities, which contribute to unhealthy dietary patterns and reduced physical activity. Several studies have shown that these behavioral changes are associated with increasing BMI and early metabolic disturbances among adolescents, even at younger ages. This trend indicates that adolescent obesity and T2DM risk are no longer limited to adults but are becoming important adolescent health issues globally and nationally[8]. New evidence also suggests that the relationship between fast-food consumption and adolescent metabolic health is more complex than previously understood. Recent findings indicate that adolescents with frequent fast-food intake often demonstrate clustering unhealthy behaviors, including low physical activity, irregular sleep patterns, and prolonged sedentary time. These combined behaviors may contribute more strongly to abnormal BMI and insulin resistance than single risk factors alone. Therefore, current research increasingly recommends analysing multiple lifestyle determinants simultaneously to better understand adolescent metabolic risk profiles[9].

In the area of physical activity, recent studies have highlighted that not only the duration but also the intensity and consistency of activity influence adolescent metabolic outcomes. Moderate-to-vigorous physical activity has been associated with better BMI control and improved insulin sensitivity, whereas prolonged sedentary behavior remains independently associated with obesity risk[10]. Furthermore, evidence after the COVID-19 pandemic showed a substantial decline in adolescent physical activity levels due to increased screen time and reduced outdoor activities, particularly in urban populations[11]. These findings emphasize the urgent need to evaluate physical activity patterns among adolescents in current urban contexts. Recent research has also expanded the understanding of diabetes knowledge as a behavioral determinant. Although adolescents may possess adequate knowledge regarding diabetes prevention, several studies found that knowledge does not always lead to healthy practices. Social environment, peer influence, family habits, and accessibility of unhealthy foods may weaken the implementation of healthy behaviors[12]. Consequently, researchers now emphasize the importance of integrating cognitive and behavioral factors when assessing adolescent obesity and diabetes risk. However, studies examining diabetes knowledge together with fast-food dietary patterns and physical activity in relation to BMI among Indonesian urban adolescents remain limited, creating an important research gap addressed by this study.

MATERIALS AND METHODS

This study employed a quantitative design with a cross-sectional approach to analyse the relationships among diabetes mellitus (DM) knowledge, fast-food dietary patterns, physical activity, and Body Mass Index (BMI) among adolescents. The study was conducted in senior high schools in Bekasi City, Indonesia, in December 2025. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Bani Baleh with ethical clearance number EC.070/KEPK/FKF-UBS/XII/2025. All respondents received an explanation regarding the study objectives and signed informed consent forms prior to data collection. The study population consisted of adolescents aged 14 –18 years enrolled in public senior high schools in Bekasi City. The inclusion criteria were: (1) active students present during data collection, (2) willingness to participate in the study. The exclusion criteria included: (1) respondents diagnosed with chronic diseases or metabolic disorders, (2) respondents currently following a special diet program, and (3) incomplete questionnaire responses. Respondents were selected using a stratified cluster sampling technique. The population was first stratified based on grade levels (Grade X, XI, and XII), and several classes from each grade were randomly selected as clusters. Eligible students from the selected classes were then recruited as respondents after screening based on the inclusion and exclusion criteria. Based on the sample size calculation and adjustment for possible incomplete data, the minimum required sample size was 290 respondents. The sample size was determined using the Slovin formula with a significance level (α) of 5% and a margin of error (standard error) of 5%. A total of 290 adolescents who met the study criteria were included in the final analysis.

Data were collected using standardized instruments. DM knowledge was assessed using the Diabetes Knowledge Questionnaire (DKQ) Cronbach's $\alpha = 0.73$[13], fast-food dietary patterns were measured using the Food Frequency Questionnaire (FFQ)[14], and physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) Cronbach's $\alpha = 0.884$[15]. Physical activity levels were classified into low, moderate, and high categories based on the official IPAQ scoring guidelines. All instruments had been previously tested for validity in earlier studies. Anthropometric measurements were conducted directly by trained researchers and assistants using standardized procedures. Body weight was measured using a digital scale with 0.1 kg precision, while height was measured using a microtoise with 0.1 cm precision. Respondents were instructed to remove their footwear and wear light clothing during the measurements. BMI was calculated using the formula weight

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(kg)/height (m²) and classified according to the WHO (2000) criteria for adults into categories Underweight (<18,5), Normal (18,5–24,9), Overweight (25–29,9), Obesity (≥30).
Data analysis was performed using SPSS software with a significance level set at α = 0.05. Univariate analysis was used to describe respondent characteristics and study variables in the form of frequencies, percentages, means, and standard deviations. Bivariate analysis was conducted using the Chi-Square (χ^2) test to identify relationships between independent variables and BMI status. Variables with p-values < 0.25 in the bivariate analysis were included in the multivariate analysis using binary logistic regression with the Enter method.

RESULTS

Table 1. Distribution of caracteristic responden

No	Variable	Category	Frequency (n)	Percentage (%)
1	Age	14-18 Years	290	100%
2	Gender	Male	103	35,35
		Female	187	64,65
3	Knowledge (DKQ)	Total score		
		Good	12	4.1%
		Satisfactory	120	41.4%
		Poor	158	54.5%
4	Dietary Pattern (FFQ Fast Food)	Total score		
		Good	24	8.3%
		Not Good	266	91.7%
5	Physical Activity (IPAQ)	Total score		
		Light	0	0%
		Medium	54	18.6%
		Heavy	236	81.4%
6	Body Mass Index (BMI)	kg/m²		
		Underweight (<18,5)	42	14.5%
		Normal (18,5–24,9)	175	60.3%
		Overweight (25–29,9)	50	17.2%
		Obesity (≥30)	23	7.9%

Table 2. The Relationship Between Independent Variables and BMI

No	Variable	χ^2	df	p-value	Result
1	Dietary Pattern × BMI	11.237	3	0.010 *	Significant
2	Physical Activity × BMI	17.584	3	0.001 *	Significant
3	Knowladge × BMI	1.838	6	0.934	Not Significant

* Signifikan pada $\alpha = 0.05$

Table 3. Binary Logistic Regression Results of BMI Risk Factors

Predictor	**B**	**SE**	**Wald**	**p-value**	**OR**	**95% CI for OR**
Dietary Pattern (Poor)	0.895	0.548	2.668	0.098	**2.447**	0.852 - 7.032
Physical Activity (Heavy)	0.449	0.408	1.213	0.270	1.566	0.706 - 3.475
DM Knowledge (Poor)	-0.089	0.234	0.145	0.704	0.915	0.580 - 1.443
Constant	-1.234	0.512	5.809	**0.016**		

Logistic regression test with α = 0.05. OR = Odds Ratio; CI = Confidence Interval

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Table 4. Logistic Regression Model Fit Statistics

Statistic	Value
Hosmer-Lemeshow χ^2	0.483
Degrees of Freedom (df)	8
Hosmer-Lemeshow p-value	0.786
Nagelkerke R^2	0.040
Overall Classification Accuracy (%)	54.9

The results of the Chi-Square test show that there is a significant relationship between fast food consumption and BMI (p = 0.010). This means that the more often teenagers consume fast food, the greater the likelihood of having a BMI above normal. These findings are in line with [16] research, which states that excessive consumption of high-calorie and saturated fat foods increases the risk of obesity, a major risk factor for the occurrence of type 2 diabetes in adolescents. In addition, there is a significant relationship between physical activity and BMI (p = 0.001). Adolescents with low physical activity tend to have a higher BMI compared to physically active adolescents. Physical activity plays an important role in maintaining energy balance and glucose metabolism in the body, so low activity becomes a predisposing factor for weight gain and the risk of type 2 diabetes[17]. Meanwhile, there is no significant relationship between knowledge about type 2 DM and BMI (p = 0.934). This indicates that the level of knowledge among adolescents about type 2 diabetes has not yet fully influenced healthy lifestyle behaviors and nutritional status. It is likely that, although adolescents are aware of the risks of diabetes, this has not been followed by real behavioral changes such as dietary regulation and physical activity. These findings are in line with the research[18], which states that an increase in knowledge does not always lead to lifestyle changes without environmental support and consistent healthy habits.

In the multivariate logistic regression analysis, poor dietary patterns showed a higher odds ratio for abnormal BMI (OR = 2.447; 95% CI: 0.852–7.032). However, the association was not statistically significant (p = 0.098), indicating that dietary pattern cannot be considered an independent predictor of abnormal BMI in this study (Table 3).The logistic regression model demonstrated an acceptable fit to the data. The Hosmer–Lemeshow goodness-of-fit test showed no significant difference between the observed and predicted values (χ^2 = 0.483; p = 0.786), indicating that the model fit the data adequately. The Nagelkerke R^2 value was 0.040, suggesting that approximately 4.0% of the variation in BMI status was explained by the predictors included in the model. Furthermore, the classification table indicated an overall prediction accuracy of 54.9%, demonstrating a modest ability of the model to classify adolescents into normal and abnormal BMI categories (Table 4).

Nevertheless, clinically, it appears that adolescents with heavy physical activity tend to have a greater chance of having a normal BMI compared to those with light physical activity. The insignificance of these results may be due to the variation in the intensity and duration of physical activity among respondents, which was not measured in detail, thus its impact on BMI is not statistically apparent. The variable of knowledge about type 2 DM shows a p-value of 0.704 with an OR of 0.915, indicating that the level of knowledge does not significantly affect BMI. These results illustrate that although some adolescents have a basic understanding of diabetes and its risk factors, this knowledge has not yet been fully translated into tangible preventive behaviors, such as dietary regulation or increased physical activity. Low awareness in implementing health knowledge can be an obstacle in efforts to control ideal body weight. The regression constant value (B = -1.234; p = 0.016) indicates that without the influence of the three independent variables, the likelihood of adolescents having a normal BMI is higher compared to those with excess BMI. This indicates that there are other factors outside the model, such as sleep patterns, psychological stress, and genetic factors, that may also play a role in the nutritional status of adolescents.

Overall, the results of this study indicate that diet is the most clinically dominant factor affecting the increase in BMI, although not yet statistically significant. These findings are consistent with the research results which state that the consumption of fast food and high-calorie foods among adolescents is a major factor that increases the risk of obesity and type 2 diabetes. Thus, health education interventions and the promotion of a healthy lifestyle need to focus on improving eating behaviors and increasing awareness of physical activity as preventive measures to curb the rise in BMI and the risk of diabetes among adolescents.

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DISCUSSION

Lifestyle Behaviors and Adolescent BMI

The present study demonstrated that dietary patterns and physical activity were significantly associated with BMI among urban adolescents, while Diabetes Mellitus (DM) knowledge was not significantly related to BMI status. In the multivariate analysis, poor dietary patterns showed the highest odds ratio for abnormal BMI, although the association did not reach statistical significance. These findings suggest that lifestyle-related behaviors, particularly eating habits and physical activity, remain important determinants of adolescent nutritional status in urban settings[19].

The significant relationship between fast-food dietary patterns and BMI is consistent with previous studies reporting that frequent fast-food consumption contributes to overweight and obesity among adolescents. Research conducted in Indonesia and other countries has shown that adolescents who regularly consume energy-dense foods high in saturated fat, sugar, and sodium are more likely to experience excessive weight gain and metabolic disturbances[4]. Urban adolescents are particularly vulnerable because of easier access to fast food, aggressive digital marketing, and changing social lifestyles that normalize unhealthy eating behaviors. Similar findings were reported indicating that unhealthy dietary habits are strongly associated with increased BMI and obesity risk among adolescents[20].

Mechanistically, excessive fast-food consumption contributes to positive energy imbalance due to high caloric intake combined with low nutritional quality. Fast food is generally low in fiber and micronutrients but high in refined carbohydrates and fats, which may increase adipose tissue accumulation and insulin resistance over time. Adolescents are also more likely to consume fast food in combination with sugar-sweetened beverages and irregular eating schedules, which further increase metabolic risk[21]. In the present study, the odds ratio for poor dietary patterns indicated a higher likelihood of abnormal BMI; however, the association was not statistically significant ($p = 0.098$).

Nevertheless, several limitations should be considered when interpreting this finding. Dietary patterns were measured using self-reported FFQ data, which may be affected by recall bias and underreporting. In addition, the FFQ focused primarily on fast-food frequency and may not fully capture total caloric intake, portion size, or overall dietary quality. The cross-sectional design also limits causal interpretation between dietary behavior and BMI.

Physical Activity and BMI Paradox in Adolescents

This study also found a significant relationship between physical activity and BMI in the bivariate analysis; however, physical activity was not statistically significant in the multivariate model. Interestingly, most respondents were categorized as having high physical activity levels based on IPAQ classification, despite a substantial proportion still presenting abnormal BMI. This finding indicates that high reported physical activity does not necessarily correspond to healthy BMI outcomes among adolescents.

Previous studies have generally demonstrated that regular moderate-to-vigorous physical activity reduces obesity risk and improves metabolic health through increased energy expenditure and insulin sensitivity. However, several recent studies have also reported inconsistent findings among adolescents, particularly when physical activity is measured using self-reported questionnaires[22]. IPAQ-based assessments may overestimate activity levels because adolescents often misinterpret activity intensity or duration. Furthermore, IPAQ was originally developed for adults and has recognized limitations when applied to adolescent populations, particularly in distinguishing structured exercise from routine daily activities[23].

Adolescents with high physical activity may still consume excessive calories through unhealthy dietary patterns, thereby maintaining positive energy balance despite increased activity. Additionally, sedentary behaviors such as prolonged screen time were not specifically measured in this study and may coexist with periods of high physical activity[24]. Thus, adolescents may simultaneously report high activity levels while also engaging in long sedentary periods that negatively affect metabolic health. Another possibility is that some overweight adolescents intentionally increase physical activity as part of weight-control efforts, which may create reverse causality within the cross-sectional design[25].

The interpretation of this finding should therefore be approached cautiously. The use of IPAQ introduces potential measurement bias due to self-reporting and limited sensitivity in adolescent populations. The study also did not assess physical fitness, exercise intensity objectively, or sedentary behavior duration, all of which may influence BMI outcomes[26]. Future studies should consider using accelerometers or wearable activity trackers to obtain more accurate assessments of adolescent physical activity patterns.

Diabetes Knowledge and Behavioral Translation

The present study found no significant relationship between DM knowledge and BMI among adolescents. Although adequate health knowledge is generally considered an important factor in disease prevention, this finding suggests that knowledge alone may not be sufficient to influence adolescent nutritional

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status. Most respondents demonstrated poor or moderate levels of diabetes knowledge, yet this did not directly correspond with BMI categories[2127].

This result is consistent with previous studies reporting that health knowledge does not always translate into healthy behavior. Adolescents may understand the risks of obesity and diabetes but still engage in unhealthy dietary habits and sedentary lifestyles due to environmental influences, peer pressure, family eating patterns, and the widespread availability of fast food. Behavioral theories such as the Health Belief Model and Social Cognitive Theory emphasize that behavior change is influenced not only by knowledge, but also by motivation, self-efficacy, environmental support, and social norms. Therefore, adolescents with sufficient knowledge may still experience difficulty implementing healthy lifestyles in daily life[28].

Mechanistically, the gap between knowledge and behavior may occur because adolescents are strongly influenced by social and environmental contexts. School environments, online food marketing, peer interactions, and family dietary practices can shape eating behaviors more strongly than cognitive understanding alone. In addition, adolescents often prioritize convenience, taste preferences, and social acceptance over long-term health considerations[29]. These factors may weaken the direct association between diabetes knowledge and BMI outcomes.

Several limitations related to this finding should also be acknowledged. The DKQ-24 instrument primarily measures cognitive understanding of diabetes rather than practical health literacy or actual preventive behaviors. The questionnaire may therefore not fully capture adolescents' ability to apply health knowledge in everyday decision-making. Furthermore, psychosocial factors such as parental influence, socioeconomic status, and emotional eating behaviors were not evaluated in this study, although they may significantly influence adolescent BMI. Overall, the findings of this study highlight the importance of integrated school-based interventions that simultaneously address dietary behaviors, physical activity, and health literacy among adolescents. Preventive strategies should not focus solely on increasing knowledge but also on creating supportive environments that encourage sustainable healthy lifestyles.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to determine causal relationships between dietary patterns, physical activity, diabetes knowledge, and BMI among adolescents. Second, the use of self-reported questionnaires, including the Food Frequency Questionnaire (FFQ), Diabetes Knowledge Questionnaire-24 (DKQ-24), and International Physical Activity Questionnaire (IPAQ), may introduce recall bias, reporting bias, and overestimation of responses, particularly in the assessment of physical activity among adolescents. Third, the IPAQ instrument was originally developed for adults and may have limited sensitivity in accurately capturing adolescent physical activity patterns and sedentary behaviors.

In addition, this study did not comprehensively assess other potential factors associated with adolescent BMI, such as total daily caloric intake, sleep patterns, sedentary duration, socioeconomic status, parental influence, and psychosocial factors. Anthropometric assessment was limited to BMI measurement without evaluating body composition or central obesity indicators. Furthermore, the study was conducted only among public senior high school students in Bekasi City, which may limit the generalizability of the findings to adolescents in other regions or educational settings. Future studies are recommended to use longitudinal designs, objective physical activity measurements, and broader behavioral assessments to better understand the determinants of adolescent BMI and metabolic risk.

CONCLUSION AND RECOMMENDATIONS

This study demonstrated that fast-food dietary patterns and physical activity were significantly associated with BMI among urban adolescents, while diabetes mellitus knowledge was not significantly related to BMI status. In multivariate analysis, poor dietary patterns showed a higher odds ratio for abnormal BMI, although the association was not statistically significant, indicating a potential clinical trend. These findings suggest that unhealthy dietary behaviors remain an important factor influencing adolescent BMI in urban settings.Therefore, interventions aimed at preventing adolescent obesity and future type 2 diabetes mellitus should not only focus on increasing health knowledge but also emphasize behavioral modification, healthy eating practices, and supportive school environments. School-based integrated health promotion programs involving nutrition education, physical activity enhancement, and healthy lifestyle monitoring are recommended to support optimal adolescent health outcomes.

Author's Contribution Statement

Indah Puspitasari: Conceptualization, Methodology, Investigation, Writing – original draft, review & editing. **Amzal Mortin Andas**: Conceptualization, Supervision, Data curation, Formal analysis, Validation, Writing – review & editing. **Ashar Prima**: Software, Resources, Investigation, Writing – review & editing. **Maratun Shoaliha**: Formal analysis, Visualization, Writing original draft (certain part). **Andi Tenri Nur Wahidah**: Project administration, Funding acquisition, Writing review & editing

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Conflicts of Interest
The authors declare that they have no competing interests.

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REFERENCES
1. Word Health Organization. WHO EUROPEAN REGIONAL OBESITY REPORT 2022. 2022.
2. Muharram FR, Swannjo JB, Melbiarta RR. Trends of diabetes and pre- - diabetes in Indonesia 2013 – 2023 : a serial analysis of national health surveys. 2025;1–11.
3. Kementrian Kesehatan Republik Indonesia. Laporan Riskesdas 2018 Nasional.pdf. 2018.
4. Nurwanti EH ;Jung SC. Rural–Urban Differences in Dietary Behavior and Obesity: Results of the Riskesdas Study in 10–18-Year-Old Indonesian Children and Adolescents. 2019;1–14.
5. Ramadhany RA, Wahyuningsih U, Sufyan DL, Simanungkalit SF. Determinants of Overweight and Obesity in Adolescent Aged 13-15 Years Old in DKI Jakarta (Analysis of Riskesdas 2018 Data) Determinan Gizi Lebih dan Obesitas pada Remaja Usia 13-15 Tahun di DKI. 2023;7(2):124–31.
6. Suha GR, Rosyada A. Faktor-faktor yang berhubungan dengan kejadian obesitas pada remaja umur 13 – 15 tahun di Indonesia (analisis lanjut data Riskesdas 2018) Program Studi Ilmu Kesehatan Masyarakat , Fakultas Kesehatan Masyarakat , Universitas Sriwijaya. 2022;06(01):43–56.
7. Fatmawati TY, Efni N. Hubungan Aktifitas Fisik , Kebiasaan Konsumsi Fast Food , Konsumsi Buah dan Sayur terhadap Obesitas pada Remaja. 2024;13(September):270–6.
8. Vera. Pengaruh Konsumsi Fast Food terhadap Obesitas pada Remaja. 2025;(2020):202–9.
9. Obesity I, Force T. Global Prevalence of Overweight and Obesity in Children and Adolescents A Systematic Review and Meta-Analysis. 2024;178(8):800–13.
10. Hidayah RN, Nuradhiani A, Bohari B. The Relationship Between Dietary Patterns and the Incidence of Overweight among Adolescents. 2024;3(2):111–20.
11. Puspitasari I, Listyorini MW, Prima A, Minarningtyas A, Islam MSAD, Poddar S. Relationship Between COVID-19 Preventive Measures and Adolescent Anxiety Levels During the Transition Period. Malaysian J Med Heal Sci. 2023;19(Supplement 9):162–5.
12. Lalu Hendra Saputra. Analysis of the Relationship Between Dietary Patterns and the Risk of Non-Communicable Diseases Among Urban Adolescents in Mataram City, Lombok. 2025;3(2):66–74.
13. Cahyaningsih I, Rokhman MR, Maziyyah N, Niamuzisilawati E, Taxis K, Denig P. Translation and Validation of the Diabetes Knowledge Questionnaire in Indonesian Patients With Type 2 Diabetes. 2024;
14. Filippi AR, Amodio E, Napoli G, Breda J, Bianco A, Jemni M, et al. The web-based ASSO-food frequency questionnaire for adolescents : relative and absolute reproducibility assessment. 2014;1–11.
15. Dharmansyah D, Budiana D. Indonesian Adaptation of The International Physical Activity Questionnaire (IPAQ): Psychometric Properties.
16. Elias C, Abraham A. Prevalence of overweight / obesity and its association with fast food consumption among adolescents in Southern Ethiopia , 2022 : a cross-sectional study. 2025;(January).
17. Woo S, Yang H, Kim Y, Song HJ, Park KH, Woo S. Sedentary Time and Fast-Food Consumption Associated With Weight Gain During COVID-19 Lockdown in Children and Adolescents With Overweight or Obesity. 2022;37(12):1–11.
18. Slaght JL, Wicklow BA, Dart AB, Sellers EAC, Gabbs M, Carino M, et al. Physical activity and cardiometabolic health in adolescents with type 2 diabetes : a cross- - sectional study. 2021;1–7.
19. Oh S, Lee SY, Kim D yeon, Woo S, Kim Y, Lee H ja, et al. Association of Dietary Patterns with Weight Status and Metabolic Risk Factors among Children and Adolescents. 2021;1–13.
20. Li L, Sun N, Zhang L, Xu G, Liu J, Hu J, et al. Fast food consumption among young adolescents aged 12 – 15 years in 54 low- and middle-income countries. Glob Health Action [Internet]. 2020;13(1). Available from: https://doi.org/10.1080/16549716.2020.1795438
21. Fontes S, Id D, Diniz C, Faria FR, Roberto P. activity in Brazilian adolescents : Achievement recommendations and BMI associations through compositional data analysis. 2022;1–16. Available from: http://dx.doi.org/10.1371/journal.pone.0266926
22. Roberts-lewis SF, White CM, Ashworth M, Rose MR, White CM, Ashworth M, et al. The validity of the International Physical Activity Questionnaire (IPAQ) for adults with progressive muscle diseases The validity of the International Physical Activity Questionnaire (IPAQ) for adults with progressive muscle

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diseases ABSTRACT. Disabil Rehabil [Internet]. 2022;44(23):7312–20. Available from: https://doi.org/10.1080/09638288.2021.1983042
23. Rocha P, Meh K, Sember V, Va H, Jurak G. The dilemma of physical activity questionnaires : Fitter people are less prone to over reporting. 2023;1–16.
24. Moitra P, Madan J. Independent and combined influences of physical activity , screen time , and sleep quality on adiposity indicators in Indian adolescents. 2021;1–12.
25. Nagata JM, Smith N, Alsamman S, Lee CM, Dooley EE, Kiss O, et al. Association of Physical Activity and Screen Time With Body Mass Index Among US Adolescents. 2023;1–12.
26. Nigg C, Amrein M, Rackow P, Scholz U, Inauen J. Compensation and transfer effects of eating behavior change in daily life : Evidence from a randomized controlled trial. Appetite [Internet]. 2021;162(February):105170. Available from: https://doi.org/10.1016/j.appet.2021.105170
27. Sögüt SC. Determining the differences in nutrition knowledge , dietary behaviors , physical activity and self-efficacy behaviors based on obesity status among adolescents. 2018;15(2).
28. Alghanim L. Factors Associated With Self-efficacy Toward Healthy Eating and Physical Activity Among Kuwaiti Adolescent Girls. 2020;1–21.
29. Chu P, Patel A, Helgeson V, Goldschmidt AB, Ray MK, Vajravelu ME. Perception and Awareness of Diabetes Risk and Reported Risk-Reducing Behaviors in Adolescents. 2023;6(5):1–11.