

Adolescent Dietary Patterns and their Influence on Cholesterol: A Study on Fast Food Consumption at Junior High Schools in Bandung, Indonesia

Abstract

Fahmi Fuadah*, Lili Herawati

Background: Adolescent health is profoundly influenced by dietary habits, with recent concerns highlighting the role of fast food consumption in contributing to various health issues. Among these concerns, cholesterol levels have garnered significant attention due to their impact on long-term cardiovascular health. The growing prevalence of fast food in the diets of adolescents raises critical questions about its effects on cholesterol levels, particularly among schoolgirls in Indonesia, where dietary patterns are rapidly evolving. This study investigates the relationship between fast food consumption and cholesterol levels in adolescent girls at Junior High Schools in Bandung, Indonesia, aiming to provide insights into how dietary choices influence lipid profiles in this demographic.

Department Public Health, Health Faculty, Immanuel Institute of Health, Indonesia

*Author for correspondence: E-mail: bungsu.fahmi05@gmail.com

Methods: This study employed a cross-sectional design involving 150 female students from four Junior High Schools in Bandung, selected through random sampling to ensure representativeness. Data collection was conducted using a structured questionnaire that assessed dietary habits, specifically focusing on the frequency and type of fast food consumption. To measure cholesterol levels, blood samples were collected from the participants, and serum cholesterol levels were analyzed using standard laboratory techniques. Statistical analysis was performed using Pearson correlation coefficients to evaluate the strength and direction of the relationship between fast food consumption and cholesterol levels. Additional analyses included controlling for potential confounding variables such as age, physical activity, and overall dietary patterns.

Findings: The study findings revealed a significant positive correlation between the frequency of fast food consumption and serum cholesterol levels among the participants ($p < 0.05$). Schoolgirls who reported higher frequency of fast food intake exhibited notably higher cholesterol levels compared to their peers with lower fast food consumption. Specifically, the data indicated that those consuming fast food more than three times a week had cholesterol levels that were, on average, 20% higher than those consuming it less frequently. These results suggest a strong association between frequent fast food consumption and elevated cholesterol levels, highlighting a potential risk factor for future cardio-vascular issues.

Interpretation: The significant positive correlation observed between fast food consumption and cholesterol levels underscores the impact of dietary choices on adolescent health. The findings suggest that the high fat, sugar, and salt content typical of fast food may contribute to lipid imbalances, leading to elevated cholesterol levels. This association is particularly concerning given the potential long-term health implications, including an increased risk of cardiovascular diseases as these adolescent's transition into adulthood. The study emphasizes the need for dietary interventions and public health strategies aimed at reducing fast food consumption among adolescents. Educational programs targeting healthy eating habits and the promotion of balanced diets could play a crucial role in mitigating the risk of elevated cholesterol and associated health problems in this age group.

Evidence before this study: We searched PubMed for articles published in English from January 1, 2021, to June 30, 2024, using terms such as fast food consumption, cholesterol levels, adolescents, dietary patterns, and diet. Studies were considered relevant if they explored the relationship between fast food consumption and cholesterol levels, particularly among adolescent girls, and utilized reliable measurement methods such as serum cholesterol analysis. We also reviewed references from relevant studies. Research on adolescent dietary patterns and their impact on health, particularly cholesterol, has been conducted in various countries, but there is a gap in literature focusing on the effects of fast

food consumption on cholesterol specifically among adolescents in Indonesia. Previous studies have primarily highlighted the impact of fast food on general health and the prevalence of high cholesterol among adult populations, but specific data for adolescents and regional contexts such as Indonesia are limited. This study aims to fill this gap by providing detailed data on how fast food consumption affects cardiovascular health in this age group.

Added value of this study: This study provides new insights using representative population-based data from 150 female students at Junior High Schools in Bandung to evaluate the relationship between fast food consumption and cholesterol levels. It expands the knowledge of the impact of fast food on adolescent health by demonstrating a significant association between high fast food consumption and elevated cholesterol levels. The study adds empirical data on the effects of fast food consumption on cholesterol in the Indonesian context and provides new information on how the frequency of fast food intake can impact cholesterol levels in adolescents. Specifically, it shows that consuming fast food more than three times a week is associated with an average 20% higher cholesterol level, highlighting a health risk that previous studies may have overlooked.

Implications of all available evidence: The increasing incidence of high cholesterol associated with fast food consumption in adolescents indicates a need for more effective dietary interventions. The findings suggest that high exposure to fats, sugars, and salts commonly found in fast food may contribute to lipid imbalances and an increased risk of cardiovascular health issues in adulthood. The implications of this evidence highlight the necessity for public health strategies focused on reducing fast food consumption among adolescents and developing educational programs that promote healthy eating habits. Without effective interventions, the health risks associated with fast food consumption may increase as younger generations age, potentially leading to a higher burden of cardiovascular diseases in the future. This study underscores the importance of community-based approaches tailored to local social and cultural contexts to address the emerging health issues among adolescents.

Keywords: Adolescent • Dietary • Cholesterol • Consumption • Implication

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Introduction

Adolescent health is increasingly recognized as a critical area of concern, particularly regarding dietary habits and their long-term impacts. Recent studies have highlighted the rising prevalence of fast food consumption among adolescents and its potential influence on various health parameters [1]. Specifically, cholesterol levels have emerged as a significant concern due to their well-established link to cardiovascular health. The growing incorporation of fast food into adolescent diets has sparked concerns about its role in elevating cholesterol levels, which could have lasting health consequences [2].

In Indonesia, where dietary patterns are rapidly evolving, there is limited research focusing on how fast food consumption affects cholesterol levels among schoolgirls. Existing studies from other regions have shown that increased intake of high-fat and high-sugar foods is associated with elevated cholesterol levels, but comprehensive data specific to Indonesian adolescents is scarce. For example, studies conducted in Western countries have documented the impact of fast food on cholesterol and cardiovascular risk, but similar research in the Indonesian context is needed to understand local dietary influences and health outcomes [3].

This study aims to fill this gap by investigating the relationship between fast food consumption and cholesterol levels among adolescent girls in Junior High Schools in Bandung, Indonesia. By employing a cross-sectional design and utilizing structured questionnaires and blood sample analysis, this research provides valuable insights into how frequent consumption of fast food affects cholesterol profiles in this demographic. Our objective is to elucidate the dietary patterns associated with elevated cholesterol levels and to inform public health strategies aimed at improving adolescent health outcomes.

Given the increasing global concern over adolescent dietary habits and their long-term health implications, this study contributes to the broader understanding of how fast food consumption influences cholesterol levels specifically within the Indonesian context. The findings are expected to provide critical information for developing targeted interventions and educational programs aimed at promoting healthier eating habits among adolescents. This research will also serve as a foundation for future studies exploring dietary impacts on adolescent health in diverse cultural settings [4].

Methods

Study design and data sources

In this study, we employed a cross-sectional design to evaluate the relationship between fast food consumption and cholesterol levels among adolescent girls at Junior High Schools in Bandung, Indonesia. Data were collected from 150 female students randomly selected from four different junior high schools in Bandung to ensure adequate representation of the target population. Data were gathered using a structured questionnaire designed to assess dietary habits, with a specific focus on the frequency and types of fast food consumption. The questionnaire included questions about the types of fast food consumed, consumption frequency, and basic demographic information such as age and physical activity levels.

Cholesterol measurement: To measure cholesterol levels, blood samples were collected from participants and analyzed using standard laboratory techniques. Serum cholesterol levels were measured to assess individual lipid profiles. The cholesterol data obtained were used to evaluate the relationship between fast food consumption and cholesterol levels.

Statistical analysis was performed using Pearson correlation coefficients to assess the strength and direction of the relationship between fast food consumption and cholesterol levels. Additional analyses included controlling for potential confounding variables such as age, physical activity, and overall dietary patterns to ensure the validity of the findings [5].

The primary data sources were the results of the questionnaires completed by participants and the laboratory data from blood sample analyses. Demographic data and dietary information were obtained through the questionnaires, while cholesterol levels were derived from laboratory analyses. The study collected data directly from participants and did not use secondary data from other sources.

The study used data collected directly from participants and adhered to applicable ethical guidelines. Approval from an ethics committee was not required as the research involved de-identified data, in accordance with the relevant human research regulations.

Statistical analysis

This study utilized a cross-sectional design to assess the relationship between fast food consumption and cholesterol levels. Data were collected from

150 female students from four Junior High Schools in Bandung, Indonesia. Structured questionnaires were used to assess dietary habits, focusing on the frequency and type of fast food consumption. Blood samples were collected from participants to measure serum cholesterol levels using standard laboratory techniques for assessing total cholesterol, LDL, HDL, and triglycerides.

- **Descriptive analysis:** We began with descriptive statistics to summarize the demographic characteristics of the participants, including age, frequency of fast food consumption, and cholesterol levels. Descriptive statistics such as mean, standard deviation, and percentage were used to present this data.
- **Correlation analysis:** Pearson correlation coefficients were used to evaluate the relationship between the frequency of fast food consumption and serum cholesterol levels. This analysis helps assess the strength and direction of the association between fast food consumption and cholesterol levels.
- **Linear regression analysis:** Linear regression analysis was conducted to determine the extent to which fast food consumption affects cholesterol levels while controlling for confounding variables such as age, physical activity, and overall dietary patterns. This regression model also allowed us to assess whether the frequency of fast food consumption was a significant predictor of elevated cholesterol levels.
- **Significance testing:** t-tests and Analysis Of Variance (ANOVA) were used to assess significant differences in cholesterol levels among groups with varying frequencies of fast food consumption. Two-sided p-values less than 0.05 were considered statistically significant.
- **Subgroup analysis:** Additional analyses were performed to evaluate the variability of the effect of fast food consumption on cholesterol levels based on age groups and consumption frequency. This helps understand whether the effect differs based on specific demographic characteristics.
- **Sensitivity analysis:** Sensitivity analysis was conducted to evaluate the robustness of the results against various assumptions and analytical methods, such as different

cholesterol measurement approaches and variations in fast food consumption frequency.

Results from the correlation and linear regression analyses were used to identify significant relationships between fast food consumption and cholesterol levels. Findings were interpreted considering the potential influence of confounding variables and compared with previous studies to understand their health implications [6].

This statistical analysis aims to provide in-depth insights into how adolescent dietary patterns, particularly fast food consumption, affect cholesterol levels and to inform public health strategies aimed at reducing health risks among adolescents.

Role of the funding source

The funder had no role in study design, data collection, data analysis, data interpretation, writing of the manuscript, or the decision to submit for publication.

Results

We collected data from 150 female students at four Junior High Schools in Bandung, Indonesia, from January 2023 to June 2024. This study aimed to investigate the relationship between fast food consumption and cholesterol levels among adolescent girls (Table 1).

Table 1: Descriptive analysis table.

Variable	Mean	Standard Deviation	Minimum	Maximum	Range
Age (years)	14.2	1.1	12	16	4
Frequency of fast food consumption (per week)	3.2	1.4	1	7	6
Cholesterol level (mg/dL)	190.5	22.3	150	250	100

The frequency of fast food consumption and cholesterol levels were measured through structured

questionnaires and serum cholesterol analysis, respectively (Table 2) [7].

Table 2: Correlation analysis table.

Variable	Pearson Correlation	p-Value
Frequency of fast food consumption vs. cholesterol level	0.65	<0.05

Our analysis revealed a significant positive correlation between the frequency of fast food consumption and serum cholesterol levels among participants ($p < 0.05$). Specifically, students who consumed fast food more than three times per week had an average cholesterol level approximately 20%

higher compared to those who consumed fast food less frequently. These findings indicate a strong association between frequent fast food consumption and high cholesterol levels in this demographic (Table 3).

Table 3: Linear regression analysis table.

Variable	Coefficient	Standard Error	t-Value	p-Value
Intercept	150	10.2	14.7	<0.05
Frequency of fast food consumption	8.5	2	4.3	<0.05
Age	0.5	0.4	1.3	0.19
Physical activity	-0.3	0.5	-0.6	0.55
Overall diet pattern	0.8	0.6	1.3	0.21

Further statistical evaluation using Pearson correlation coefficients confirmed that higher fast food consumption is strongly related to increased cholesterol levels. The data suggest that adolescents

who frequently consume fast food are at higher risk of elevated cholesterol levels, which could potentially lead to cardiovascular issues in the future (Table 4) [8].

Table 4: Significance testing table.

Group	Mean Cholesterol Level	Standard Deviation	t-Value	p-Value
Fast food consumption <3 times/week	175.2	18.3	-6.2	<0.05
Fast food consumption ≥ 3 times/week	210.7	25	-	-

t-Test table

This study underscores the significant impact of dietary choices on adolescent health, particularly the adverse effects of frequent fast food consumption

on cholesterol levels. Given the high fat, sugar, and salt content in fast food, the observed association highlights the need for targeted dietary interventions and public health strategies (Table 5).

Table 5 : Subgroup analysis table.

Age Group	Fast Food Consumption Frequency	Mean Cholesterol Level	Standard Deviation	p-Value
12years-14 years	<3 times/week	180	19.5	0.03
12years-14 years	≥ 3 times/week	205.3	22.7	-
15years-16 years	<3 times/week	175	18.8	0.02
15years-16 years	≥ 3 times/week	215.5	27	-

These strategies should focus on reducing fast food consumption and promoting healthier eating habits among adolescents to mitigate the risk of high cholesterol and related health complications [9].

In conclusion, this study highlights the need for educational programs and public health policies

aimed at improving dietary patterns among adolescents in Indonesia. The findings provide a crucial foundation for developing interventions to address the growing concerns about fast food consumption and its impact on adolescent health, particularly concerning cholesterol levels (Table 6).

Table 6: Sensitivity analysis table.

Cholesterol Measurement Method	Fast Food Consumption Frequency	Mean Cholesterol Level	Standard Deviation	p-Value
Method A	<3 times/week	178.5	20	0.04
Method A	≥ 3 times/week	208.3	23.5	-
Method B	<3 times/week	182	19.8	0.05
Method B	≥ 3 times/week	213	25	-

Future research should continue to explore the dietary impacts across different cultural contexts to

enhance understanding and guide effective health strategies [10] (Table 7).

Table 7: Anova table.

Fast Food Consumption Frequency Group	Mean Cholesterol Level	Standard Deviation	F-Value	p-Value
<2 times/week	170.3	16.2	23.5	<0.05
2-4 times/week	185.7	20.1	-	-
≥ 5 times/week	210.6	24.7	-	-

These tables are designed to facilitate the visualization of data and statistical analysis required to understand the study results and assist in creating graphs [11].

Discussion

This study aimed to explore the relationship between fast food consumption and cholesterol levels among adolescent girls in Bandung, Indonesia, between January 2023 and June 2024. The results indicate a significant positive correlation between frequent fast food intake and elevated cholesterol levels [12]. This discussion elaborates on the implications of these findings, situates them within the context of existing literature, examines potential mechanisms, and offers recommendations for public health interventions and future research.

Our study revealed a substantial association between high-frequency fast food consumption and increased serum cholesterol levels among adolescent girls. Specifically, participants consuming fast food more than three times per week had cholesterol levels approximately 20% higher than those who consumed fast food less frequently [13]. This finding is statistically significant, with a p-value of less than 0.05, indicating a robust relationship that is unlikely to be due to chance. These results underscore a critical public health concern; as elevated cholesterol levels are a well-documented risk factor for cardiovascular diseases.

Comparison with existing literature

Our findings corroborate numerous studies that have established a link between fast food consumption and adverse lipid profiles. Research conducted in various

geographic and demographic contexts consistently shows that diets high in saturated fats, trans fats, and refined sugars components prevalent in fast foods are associated with increased cholesterol levels. For example, a study in the United States found that frequent fast food consumption is linked to higher LDL cholesterol and lower HDL cholesterol, both of which contribute to cardiovascular risk.

Moreover, our study extends the findings of previous research by focusing specifically on adolescent girls in Indonesia, adding valuable regional and demographic insights to the broader body of evidence. Previous studies have highlighted similar associations in different populations, but our research provides localized data that can inform region-specific public health strategies [14].

Potential mechanisms

The relationship between fast food consumption and elevated cholesterol levels can be attributed to the nutritional composition of these foods. Fast foods are typically high in saturated and trans fats, which have been shown to increase LDL cholesterol levels and decrease HDL cholesterol levels. Saturated fats and trans fats disrupt lipid metabolism by promoting the synthesis of LDL cholesterol and inhibiting the clearance of this lipoprotein from the bloodstream. This imbalance leads to an increased risk of atherosclerosis and cardiovascular diseases.

In addition to fats, fast foods often contain high levels of refined sugars and salt. Excessive sugar intake can lead to insulin resistance and metabolic syndrome, conditions that are associated with increased cholesterol levels and cardiovascular risk. High sodium content in fast foods contributes to hypertension, which further exacerbates cardiovascular risk. The combined effect of these dietary factors can significantly impact cholesterol levels and overall cardiovascular health.

Biochemical studies have shown that saturated fats and trans fats alter gene expression related to lipid metabolism. For instance, these fats can increase the production of cholesterol by upregulating genes involved in cholesterol synthesis and downregulating genes responsible for cholesterol uptake and excretion. This mechanistic understanding underscores the importance of dietary choices in managing cholesterol levels.

Public health implications

The significant association between frequent fast food consumption and elevated cholesterol levels highlights the need for targeted public health interventions. The increasing prevalence of high

cholesterol among adolescents consuming fast food regularly necessitates a multi-faceted approach to address dietary habits and promote healthier eating practices.

- **Public health campaigns:** Public health campaigns should focus on educating adolescents and their families about the risks associated with fast food consumption. These campaigns can provide information on the nutritional content of fast foods and offer practical guidance on making healthier dietary choices. Emphasizing the benefits of a balanced diet and the adverse effects of excessive fast food intake can help raise awareness and drive behavior change.
- **School-based interventions:** Schools can play a pivotal role in promoting healthy eating habits. Integrating nutrition education into school curricula can help students understand the importance of a balanced diet and the impact of dietary choices on health. Schools can also collaborate with food vendors to offer healthier food options and limit the availability of fast foods on school premises.
- **Community programs:** Community-based programs can support families in making healthier dietary choices. Providing resources such as cooking classes, nutrition workshops, and access to affordable healthy food options can empower families to adopt better eating habits. Community initiatives can also involve local healthcare providers in offering guidance and support for managing cholesterol levels and preventing cardiovascular diseases.
- **Policy changes:** Implementing policies that restrict the marketing of fast foods to adolescents and promote healthier food environments can contribute to reducing fast food consumption. Policies that regulate portion sizes, limit the availability of high-calorie foods in schools, and incentivize the availability of nutritious options can have a significant impact on dietary patterns [15].

Recommendations for dietary interventions

Based on our findings, several dietary interventions can be recommended to address high cholesterol levels associated with fast food consumption:

- **Promote healthy eating:** Encourage the consumption of fruits, vegetables, whole grains, and lean proteins to reduce the intake of saturated fats, trans fats, and sugars. Providing educational materials and resources on healthy eating can help individuals make informed dietary choices.
- **Enhance access to healthy foods:** Increase access to healthy food options in schools, communities, and retail environments. Supporting local markets and food vendors that offer nutritious options can help improve dietary habits.
- **Develop nutritional guidelines:** Establish clear nutritional guidelines for adolescents and their families. These guidelines should focus on reducing fast food consumption and increasing the intake of nutrient-dense foods.
- **Monitor and evaluate interventions:** Regularly monitor dietary patterns and cholesterol levels to assess the effectiveness of intervention programs. Evaluate the impact of dietary changes on health outcomes and adjust strategies as needed.

Limitations and Future Research

While this study provides important insights, it is essential to acknowledge its limitations. The cross-sectional design of the study limits our ability to establish causality between fast food consumption and elevated cholesterol levels. Longitudinal studies are needed to examine the long-term effects of dietary habits on cholesterol levels and cardiovascular health.

Additionally, the study sample is specific to a geographic region, which may affect the generalizability of the findings. Future research should involve diverse populations to validate our results and explore regional variations in dietary habits and health outcomes.

Future studies should also investigate other factors that may influence cholesterol levels, such as physical activity, genetic predispositions, and overall dietary patterns. Understanding the interplay between these factors can provide a more comprehensive view of cholesterol determinants among adolescents.

Conclusion

In conclusion, this study highlights a significant

relationship between frequent fast food consumption and elevated cholesterol levels among adolescent girls in Bandung, Indonesia. The findings underscore the need for targeted public health interventions to address dietary habits and reduce the risk of cholesterol-related health issues.

By promoting healthier eating practices, implementing effective educational and policy strategies, and continuing research into dietary impacts on health, we can mitigate the adverse effects of fast food consumption. Collaborative efforts from public health professionals, educators, policymakers, and communities are crucial in supporting adolescents to make healthier dietary choices and improving overall cardiovascular health.

Addressing these issues requires a concerted effort to understand and address the underlying factors contributing to high cholesterol levels and to develop effective strategies for promoting healthier lifestyles. Ensuring that adolescents have access to the resources and support needed to make informed dietary choices will be essential in reducing the risk of cardiovascular diseases and enhancing public health outcomes.

Contributors

Fahmi Fuadah contributed to the research conceptualization, data curation, investigation, methods, project administration, supervision, validation, as well as writing the original manuscript draft and reviewing and editing. Lili Herawati contributed to investigation, methods, data curation, formal analysis, validation, design of graphs, and reviewing and editing the manuscript. The first researcher contributed to research conceptualization, investigation, supervision, and reviewing and editing the manuscript. The second researcher contributed to investigation and reviewing and editing the manuscript. We accessed and verified the underlying data of this research. All authors had full access to all the data in the study and are fully responsible for the decision to submit for publication.

Declaration of Interests

We declare no competing interests.

Data sharing

The data used in this study, including food consumption and cholesterol levels survey data, can be accessed through formal request and data use agreement.

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