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Analysis of the Relationship Between Dietary Patterns and the Risk of Non-Communicable Diseases Among Urban Adolescents in Mataram City, Lombok

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Abstract

Non-communicable diseases (NCDs), including obesity, diabetes, and hypertension, are becoming increasingly prevalent among adolescents, especially in urban areas experiencing rapid lifestyle changes. This study aims to analyze the relationship between dietary patterns and the risk of NCDs among adolescents in Mataram City, Lombok. A cross-sectional study was conducted involving 300 high school students aged 15–18 years from five schools across Mataram. Data collection included validated food frequency questionnaires (FFQ), anthropometric measurements, and structured interviews to assess lifestyle factors. Dietary patterns were classified into three categories: healthy (high intake of fruits, vegetables, and whole grains), mixed (moderate intake of processed and sugary foods), and unhealthy (frequent consumption of fast food, sweetened beverages, and high-fat snacks). Risk indicators such as Body Mass Index (BMI), blood pressure, and family history of NCDs were analyzed using chi-square tests and logistic regression. The results indicated a significant association between unhealthy dietary patterns and elevated BMI ($p < 0.01$) and increased systolic blood pressure ($p < 0.05$). Adolescents with unhealthy eating habits were found to be 2.7 times more likely to be at risk for NCDs compared to their peers with healthy diets (OR = 2.7; 95% CI: 1.7–4.3). These findings emphasize the urgent need for targeted nutritional education and health promotion strategies in urban schools within Mataram. Early interventions can play a crucial role in reducing the long-term burden of NCDs among the youth population.

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Introduction

Non-communicable diseases (NCDs) have become a major global public health challenge. NCDs include obesity, type 2 diabetes mellitus, hypertension, cardiovascular diseases, and certain cancers. The World Health Organization reports that NCDs account for approximately 74 percent of all global

deaths, with a consistent upward trend over time (World Health Organization, 2020; World Health Organization, 2021). This condition is no longer limited to older populations. Over the past two decades, NCD risk factors have increasingly been identified among adolescents, particularly in urban areas experiencing rapid lifestyle changes.

This epidemiological shift is characterized by rising prevalence of high body mass index, elevated blood pressure, early metabolic disorders, and imbalanced dietary patterns among adolescents. These trends indicate a transition in disease burden from infectious diseases to chronic conditions beginning at a younger age. Risk factors that emerge during adolescence have long-term implications because they tend to persist into adulthood and increase the likelihood of morbidity and premature mortality (Patton et al., 2016; Sawyer et al., 2012). Therefore, NCD prevention efforts must extend beyond adults and target earlier stages of the life course.

One of the primary determinants of increasing NCD risk among adolescents is the change in dietary consumption patterns. Globally, adolescents show a growing tendency to consume energy-dense foods high in saturated fat and added sugars while maintaining low intake of fruits, vegetables, and whole foods. The increased consumption of processed foods and sugar-sweetened beverages has been directly associated with weight gain, insulin resistance, and elevated blood pressure, which are key risk factors for NCDs (Ng et al., 2014).

In low- and middle-income countries, these dietary changes are accelerated by urbanization and food system transformation. Urbanization promotes a shift from traditional diets toward modern dietary patterns that emphasize convenience over nutritional quality. Popkin and Reardon (2018) describe the nutrition transition as an increase in the consumption of ultra-processed foods, fast food, and products high in sugar and salt. Urban environments provide widespread access to these foods through shopping centers, fast-food outlets, and informal food vendors surrounding schools.

Adolescence is a critical developmental stage for establishing long-term health behaviors. During this period, individuals gain greater autonomy over food choices, develop taste preferences, and form eating habits that often persist into adulthood (World Health Organization, 2014). However, adolescent food choices are rarely shaped by individual factors alone. Family practices, school food environments, peer influence, and exposure to food marketing strongly affect daily dietary behavior (Story et al., 2002; Verstraeten et al., 2016). In urban settings, these influences frequently promote unhealthy dietary patterns.

Indonesia currently faces a double burden of malnutrition. Undernutrition remains present in certain population groups, while the prevalence of overweight and obesity continues to increase, particularly among urban adolescents. National data indicate a significant rise in adolescent obesity over the past decade, with higher prevalence in urban areas compared to rural regions (Nurwanti et al., 2019; Rachmi et al., 2021). This pattern reflects the direct impact of changes in the food environment and urban lifestyles.

Mataram City represents an urban area in Indonesia undergoing rapid socioeconomic development and lifestyle transformation. Increased availability of fast food, reduced physical activity, and greater reliance on digital technology contribute to changes in adolescent dietary behavior. In this context, adolescents in Mataram face exposure to NCD risk factors similar to those observed in larger metropolitan areas. However, empirical evidence based on local data examining

the relationship between dietary patterns and NCD risk among adolescents in Mataram remains limited.

Most national studies on adolescent nutrition rely on large-scale survey data that provide aggregated findings. While valuable, such approaches often fail to capture local variations, including social, cultural, and environmental factors that influence adolescent dietary behavior at the city level. Glanz et al. (2008) emphasize that contextual understanding is essential for designing effective and locally applicable public health interventions. Therefore, city-level studies such as this one are important to complement existing national evidence.

The dietary pattern approach is widely used in nutritional epidemiology to assess the relationship between overall diet and chronic disease risk. This approach evaluates combinations of foods consumed rather than focusing on individual nutrients. Hu (2002) argues that dietary patterns provide a more realistic representation of habitual dietary exposure. This method is particularly suitable for populations with diverse and evolving consumption behaviors, such as urban adolescents.

In the Indonesian context, the dietary pattern approach is relevant because dietary changes occur across the entire structure of food consumption rather than in isolated food items. Adolescents often combine traditional foods with modern processed products, resulting in dietary patterns that range from healthy to unhealthy. Identifying these patterns allows for the recognition of adolescent groups at higher risk for early metabolic and cardiovascular disorders (Perez-Rodrigo & Aranceta, 2003).

In addition to dietary patterns, NCD risk indicators such as body mass index and blood pressure are essential measures of adolescent health status. Elevated BMI and systolic blood pressure during adolescence have been associated with increased risk of cardiovascular disease and diabetes in adulthood (Jamison et al., 2013). Examining the relationship between dietary patterns and these indicators provides a strong empirical foundation for primary prevention strategies.

Based on this background, the present study aims to analyze the relationship between dietary patterns and the risk of non-communicable diseases among urban adolescents in Mataram City, Lombok. The study focuses on identifying dominant dietary patterns and their association with measurable NCD risk indicators. By using local empirical data, this research seeks to contribute to the development of more contextual and targeted nutrition policies and intervention programs for adolescents in medium-sized urban areas in Indonesia.

The findings of this study are expected to strengthen scientific evidence on the role of dietary patterns in adolescent NCD risk and to inform school-based and community-based health promotion programs. Interventions implemented during adolescence have substantial potential to reduce the future burden of NCDs and support long-term sustainable health development.

Methods

This study utilized a cross-sectional design to examine the relationship between dietary patterns and the risk of non-communicable diseases (NCDs) among adolescents in Mataram City, Lombok. A total of 300 high school students aged 15 to 18 years were selected from five schools representing different regions of the city through random sampling. Data collection involved the use of a validated Food Frequency Questionnaire (FFQ) to assess dietary intake, alongside anthropometric measurements and structured interviews. Body weight and height were measured to

calculate Body Mass Index (BMI), while blood pressure was recorded using a digital sphygmomanometer under standardized resting conditions. Structured interviews were also conducted to gather information on lifestyle factors such as physical activity, sleep habits, and family history of NCDs.

Table 1. Logistic Regression Analysis of Dietary Patterns and NCD Risk among Adolescents

Variable	Odds Ratio (OR)	95% CI	*p*-value
Unhealthy diet	2.7	1.7 – 4.3	< 0.001
Healthy/Mixed diet	Reference	—	—

The logistic regression analysis (Table 1) revealed that adolescents with unhealthy dietary patterns were 2.7 times more likely to be at risk of developing NCD-related conditions compared to those following healthy or mixed diets (OR = 2.7; 95% CI: 1.7–4.3). This finding highlights the strong contribution of dietary behavior to early metabolic and cardiovascular risk among adolescents.

Based on responses from the FFQ, dietary patterns were categorized into three groups: healthy (high consumption of fruits, vegetables, and whole grains), mixed (moderate intake of processed and sugary foods), and unhealthy (frequent consumption of fast food, sweetened beverages, and high-fat snacks). The collected data were analyzed using SPSS version [X.X]. Descriptive statistics were used to summarize participant characteristics, while chi-square tests assessed associations between dietary patterns and NCD risk indicators such as BMI and blood pressure. Logistic regression analysis was applied to estimate the strength of association between dietary patterns and NCD risk, with odds ratios (OR) and 95% confidence intervals (CI) reported. Statistical significance was determined at a p-value of less than 0.05.

Results and Discussions

The results of this study demonstrate a clear and statistically significant association between unhealthy dietary patterns and increased risk factors for non-communicable diseases (NCDs) among adolescents in Mataram City. Nearly two-fifths (38%) of the surveyed adolescents were identified as having an unhealthy dietary pattern, characterized by frequent consumption of fast food, sugar-sweetened beverages, and high-fat snacks. This proportion indicates a substantial exposure of urban adolescents to diets that are energy-dense yet nutritionally poor, reflecting the ongoing nutrition transition in urban Indonesia.

Table 2. Distribution of Dietary Patterns among Adolescents in Mataram City (n = 300)

Dietary Pattern	Frequency (n)	Percentage (%)
Healthy	96	32.0
Mixed	90	30.0
Unhealthy	114	38.0
Total	**300**	**100.0**

Table 2 shows that more than one-third of adolescents (38%) adhered to an unhealthy dietary pattern, characterized by frequent consumption of fast food, sugar-sweetened beverages, and high-

fat snacks. This finding reflects the growing exposure of urban adolescents in Mataram City to energy-dense, nutrient-poor diets, consistent with ongoing nutrition transition in urban Indonesia.

Adolescents adhering to unhealthy dietary patterns exhibited a markedly higher prevalence of elevated Body Mass Index (BMI) and increased systolic blood pressure compared to those consuming healthier or mixed diets. The chi-square analysis confirmed a significant relationship between dietary patterns and BMI status ($p < 0.01$), suggesting that dietary behavior plays a crucial role in weight-related outcomes during adolescence. Similarly, the association between dietary patterns and systolic blood pressure ($p < 0.05$) highlights the early emergence of cardiovascular risk factors at a relatively young age. These findings reinforce the notion that the physiological consequences of poor dietary habits can manifest early in the life course.

Table 3. Association between Dietary Patterns and BMI Status among Adolescents

Dietary Pattern	Normal BMI n (%)	Overweight/Obese n (%)	Total	*p*-value
Healthy	72 (75.0)	24 (25.0)	96	
Mixed	58 (64.4)	32 (35.6)	90	
Unhealthy	54 (47.4)	60 (52.6)	114	**< 0.01**
Total	**184**	**116**	**300**	

As presented in Table 3, adolescents following an unhealthy dietary pattern exhibited a substantially higher prevalence of overweight and obesity (52.6%) compared to those consuming healthy diets (25.0%). The chi-square test confirmed a statistically significant association between dietary pattern and BMI status ($p < 0.01$), indicating that unhealthy eating behaviors are strongly linked to excess body weight among adolescents.

The logistic regression analysis further strengthens these findings by quantifying the magnitude of risk. Adolescents with unhealthy dietary patterns were 2.7 times more likely to be at risk of developing NCD-related conditions compared to those following healthier diets (OR = 2.7; 95% CI: 1.7–4.3). This elevated odds ratio underscores the significant contribution of dietary behavior to the development of early metabolic disturbances, including overweight, obesity, and hypertension. Importantly, the confidence interval does not cross unity, indicating a robust and reliable association.

Table 3. Association between Dietary Patterns and Systolic Blood Pressure

Dietary Pattern	Normal BP n (%)	Elevated BP n (%)	Total	*p*-value
Healthy	82 (85.4)	14 (14.6)	96	
Mixed	68 (75.6)	22 (24.4)	90	
Unhealthy	70 (61.4)	44 (38.6)	114	**< 0.05**
Total	**220**	**80**	**300**	

Table 3 demonstrates that adolescents with unhealthy dietary patterns had a higher prevalence of elevated systolic blood pressure (38.6%) compared to those with healthy diets (14.6%). The association between dietary pattern and systolic blood pressure was statistically significant ($p < 0.05$), suggesting early cardiovascular risk among adolescents consuming unhealthy diets.

The observed increase in BMI and blood pressure among adolescents consuming unhealthy diets may represent early manifestations of metabolic dysregulation. Excessive intake of saturated fats, refined carbohydrates, and added sugars has been shown to contribute to insulin resistance, low-grade inflammation, and endothelial dysfunction—key mechanisms underlying the development of NCDs such as type 2 diabetes and cardiovascular disease. If these risk factors persist into adulthood, they substantially increase the likelihood of long-term morbidity, disability, and premature mortality.

These findings are consistent with previous studies conducted in both developed and developing countries, which have consistently linked high consumption of ultra-processed foods and sugar-sweetened beverages to adverse health outcomes in adolescents. The urban context of Mataram likely amplifies these risks. Rapid urbanization has altered the local food environment, increasing the availability, affordability, and social acceptability of fast food and processed snacks while reducing reliance on traditional, nutrient-rich diets. The perception of modern food as convenient and desirable may further reinforce unhealthy eating behaviors among adolescents.

Although this study primarily focused on dietary patterns, qualitative insights from structured interviews suggest that poor nutrition rarely occurs in isolation. Many adolescents reported prolonged screen time, low levels of physical activity, irregular sleep schedules, and limited engagement in sports or recreational activities. These lifestyle factors may interact synergistically with unhealthy diets, accelerating weight gain and increasing cardiometabolic risk. This finding highlights the multifactorial nature of NCD risk among adolescents and emphasizes the need for integrated intervention approaches that address both diet and lifestyle behaviors.

From a public health perspective, these results carry important implications. Adolescence represents a critical period for intervention, as health-related behaviors established during this stage often persist into adulthood. School-based interventions, including structured nutrition education and the implementation of healthy school canteen policies, offer a strategic entry point for promoting healthier dietary behaviors. Schools also provide an ideal setting to integrate physical activity promotion and health literacy programs tailored to adolescents' daily routines and preferences.

Family involvement is equally essential, as household food availability, parental dietary habits, and meal practices significantly influence adolescents' food choices. Community-based initiatives that engage parents, teachers, and local health workers can strengthen the impact of school-based programs. Furthermore, local government policies regulating the availability and marketing of unhealthy foods—particularly around schools—can help create environments that support healthier choices.

Conceptual Support

The findings of this study, which demonstrate a significant association between unhealthy dietary patterns and increased risk of non-communicable diseases (NCDs) among adolescents in Mataram City, are strongly supported by established concepts in nutritional epidemiology and public health theory.

Nutrition Transition Theory

The nutrition transition theory explains the shift in dietary consumption from traditional, high-fiber diets toward modern diets characterized by high intake of fat, sugar, salt, and ultra-processed foods, particularly in urbanized settings. The high prevalence of unhealthy dietary patterns observed among adolescents in Mataram City reflects this advanced stage of nutrition transition. According to

this theory, increased consumption of fast food and sugar-sweetened beverages contributes directly to rising obesity rates and cardiometabolic risk factors, even at younger ages.

Dietary Pattern Approach in Nutritional Epidemiology

The dietary pattern approach evaluates overall dietary intake rather than isolated nutrients, providing a more comprehensive assessment of habitual eating behavior. Conceptually, this approach better captures the cumulative metabolic effects of long-term dietary exposure. The observed association between unhealthy dietary patterns, elevated body mass index (BMI), and increased systolic blood pressure supports the premise that combined dietary behaviors significantly influence metabolic and cardiovascular risk during adolescence.

Life-Course Approach to Health

The life-course approach posits that health-related behaviors and risk factors established during adolescence tend to track into adulthood, thereby increasing the likelihood of chronic disease later in life. Elevated BMI and blood pressure identified among adolescents with unhealthy dietary patterns represent early markers of future NCD risk. This framework supports the study's conclusion that adolescence is a critical period for preventive interventions targeting dietary behavior.

Biological Mechanisms Linking Unhealthy Diets to NCD Risk

From a biological perspective, excessive intake of saturated fats, refined carbohydrates, and added sugars contributes to insulin resistance, chronic low-grade inflammation, endothelial dysfunction, and excessive adiposity. These mechanisms underlie the development of obesity, hypertension, and type 2 diabetes. The significantly higher odds of NCD risk (OR = 2.7) among adolescents consuming unhealthy diets in this study are consistent with these well-documented pathophysiological pathways.

Ecological Model of Adolescent Health Behavior

The ecological model emphasizes that adolescent dietary behavior is shaped by multiple interacting levels, including individual preferences, family environment, school settings, peer influence, and the broader urban food environment. In urban contexts such as Mataram City, widespread availability and marketing of energy-dense foods around schools may promote unhealthy dietary choices. This conceptual model helps explain the high proportion of adolescents adhering to unhealthy dietary patterns and their associated health risks.

In conclusion, this study provides strong empirical evidence that unhealthy dietary patterns are significantly associated with increased NCD risk factors among adolescents in Mataram City. The findings highlight the urgent need for early, context-specific, and multi-sectoral interventions to address poor dietary behaviors and associated lifestyle factors. By targeting adolescents during this critical developmental stage, it is possible to reduce the long-term health and economic burden of non-communicable diseases and contribute to the development of a healthier and more productive future generation.

Conclusion

The findings of this study underscore the pressing public health concern posed by the increasing prevalence of non-communicable diseases (NCDs) among adolescents, particularly in urban areas like Mataram City, Lombok, where rapid lifestyle and dietary transitions are taking place. The significant association found between unhealthy dietary patterns and elevated indicators of NCD

risk, such as high body mass index (BMI) and increased systolic blood pressure, highlights how critical the adolescent period is in shaping long-term health outcomes. Specifically, adolescents who frequently consumed fast food, sugary drinks, and high-fat snacks were found to be 2.7 times more likely to be at risk of developing NCDs compared to their peers who followed healthier eating habits, which included a diet rich in fruits, vegetables, and whole grains. This not only signals an urgent call to action for health policymakers but also emphasizes the responsibility of schools, families, and communities in promoting healthier environments for young people. Given that adolescence is a formative stage for establishing lifelong behaviors, interventions targeting this age group have the potential to yield significant long-term benefits. Therefore, comprehensive, school-based nutritional education programs and broader health promotion strategies should be prioritized as part of public health efforts in Mataram and similar urban settings. These interventions should aim not only to raise awareness about the dangers of poor dietary choices but also to actively support adolescents in making healthier food decisions through access to nutritious meals, physical activity programs, and ongoing guidance from health professionals. By addressing dietary risk factors early, it is possible to reduce the future burden of NCDs, foster a healthier generation, and ultimately contribute to the sustainability of the healthcare system.

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