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# Hypercholesterolemia risk in nutrition students: junk food consumption and physical activity

Yuliatul Fitria, Noor Rohmah Mayasari*, Lini Anisfatus Sholihah, Salma Shafrina Aulia

Department of Nutrition, Faculty of Sport and Health Sciences, Surabaya State University, Surabaya, Jawa Timur, 60213, Indonesia

*Correspondence: noormayasari@unesa.ac.id

## ABSTRAK

***Latar Belakang:*** *Hiperkolesterolemia merupakan faktor penyebab utama penyakit jantung iskemik, sekitar sepertiga kasus global. Penelitian terdahulu pada mahasiswa kesehatan menunjukkan bahwa sebagian besar mahasiswa memiliki kebiasaan makan yang buruk dan tingkat aktivitas fisik yang rendah.*
***Tujuan:*** *Penelitian ini bertujuan untuk menganalisis hubungan antara frekuensi konsumsi junk food dan aktivitas fisik dengan risiko hiperkolesterolemia pada mahasiswa gizi Universitas Negeri Surabaya.*
***Metode:*** *Penelitian ini menggunakan desain cross-sectional dan dilakukan pada 26-29 September 2024 di Fakultas Ilmu Keolahragaan dan Kesehatan, Universitas Negeri Surabaya. Rumus slovin digunakan dalam penentuan jumlah sampel dan diperoleh sampel sebanyak 92 responden. Metode proporsional random sampling digunakan untuk menentukan jumlah sampel per angkatan mahasiswa. Pengukuran variabel frekuensi konsumsi junk food menggunakan kuesioner SQ-FFQ, sedangkan aktivitas fisik diukur menggunakan IPAQ-SF. Pengukuran kolesterol menggunakan alat EasyTouch GCU (Glucose, Cholesterol, Uric Acid) meter dengan strip kolesterol. Chi-square digunakan untuk menguji hubungan antara konsumsi junk food dan aktivitas fisik dengan hiperkolesterolemia.*
***Hasil:*** *Sebagian besar mahasiswa mengalami hiperkolesterolemia dengan prevalensi sebesar 59,8%. Prevalensi konsumsi junk food pada mahasiswa sebesar 51% dan prevalensi mahasiswa yang melakukan aktivitas fisik ringan sebesar 53%. Data statistik menunjukkan bahwa terdapat hubungan yang signifikan antara frekuensi konsumsi junk food (p=0.004) dan aktivitas fisik (p=0.000) dengan risiko hiperkolesterolemia.*
***Kesimpulan:*** *Dengan demikian, dapat disimpulkan bahwa pola konsumsi junk food yang tinggi dan kurangnya aktivitas fisik merupakan faktor risiko yang signifikan terhadap kejadian hiperkolesterolemia pada mahasiswa gizi. Perlu dilakukan tindakan pencegahan melalui skrining pada usia muda.*

**KATA KUNCI***: aktivitas fisik; hiperkolesterolemia; junk food*

## ABSTRACT

***Background:*** *Hypercholesterolemia is a primary cause of ischemic heart disease, accounting for around one-third of global cases. Previous studies among health students have shown that most students had unhealthy eating habits and low physical activity.*

***Objectives****: This study aims to examine the correlation between junk food consumption frequency, physical activity levels, and the risk of hypercholesterolemia among nutrition students at Surabaya State University.*

***Methods:*** *This study employed a cross-sectional design conducted from September 26 to 29, 2024, at the Faculty of Sport and Health Sciences, Surabaya State University. Slovin's formula was employed to estimate the sample size, resulting in 92 respondents. Proportional random sampling was used to determine the sample size per student class. The SQ-FFQ questionnaire was used to assess junk food consumption frequency, while the IPAQ-SF questionnaire was used to assess physical activity levels. The EasyTouch GCU meter with cholesterol strips was used to measure cholesterol levels. Chi-Square test was used to examine the relationship between junk food consumption frequency, physical activity, and the risk of hypercholesterolemia.*

***Results:*** *Most students had hypercholesterolemia (59.8%). The prevalence of junk food consumption frequency among students was 51%, and the prevalence of students engaging in low physical activity was 53%. Statistical data showed a significant relationship between junk food consumption frequency (p=0.004) and physical activity (p=0.000) with the risk of hypercholesterolemia.*

***Conclusions:*** *High junk food consumption and low physical activity are identified as significant risk factors for hypercholesterolemia among nutrition students. Preventive measures should be taken, including screening at an adolescent age.*


**KEYWORDS*:*** *hypercholesterolemia; junk food; physical activity*

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## INTRODUCTION

Globally, one-third of ischemic heart disease cases are attributed to hypercholesterolemia. Hypercholesterolemia is defined as a blood cholesterol level exceeding 200 mg/dl, which is above the normal level required by the body (≥200 mg/dl) (1). High junk food consumption and low physical activity can elevate the risk of hypercholesterolemia, a major contributor to coronary heart disease and death among young people, with a mortality rate of 7.90% that is expected to continue rising annually (2,3,4). Hypercholesterolemia is a cause of coronary heart disease, which causes young people to die at a rate of 7.90% and is expected to see sustained annual growth (4).

According to the 2013 Riskesdas data, most of the Indonesian population had abnormal cholesterol levels, with a higher percentage of women at 39.60% compared to men at 30.0%. Furthermore, the Indonesian Ministry of Health reported that in 2016, the incidence of hypercholesterolemia in Indonesia was 54.30% among females and 48% among males. Riskesdas data in 2018 shows that 21.20% of the Indonesian population over the age of 15 years have abnormal cholesterol levels with a higher percentage of females (24%) than males (18.30%). While the 2018 Riskesdas data shows a decrease in percentage, the numbers are still considerable, and females are still at higher risk compared to males.

Cholesterol levels are strongly associated with diet and physical activity (5). Junk food is characterized by high-calorie content from sugar and fat, but low fiber and vitamin content (6). In line with the emergence of modern eating patterns and lifestyles, junk food has become a popular food trend across all age groups, with a global prevalence of approximately 70% (7). According to the Health Education Authority (2012), fast food is commonly consumed by individuals aged 15-34 years. Specifically, a previous study found that around 83.9% of students were classified as frequently consuming junk food (8).

A significant portion of children and adolescents in Indonesia (57%) fail to meet the World Health Organization's (WHO) physical activity recommendations of at least 150 minutes of moderate physical activity per week. In 2013, 26.10% of individuals aged over 10 years in Indonesia reported insufficient physical activity, increasing to 33.50% by 2018 (9). Adolescent eating habits significantly influence long-term health outcomes (10), and the prevalence of poor dietary habits and low physical activity among students (11) underscores the need for early intervention. Therefore, screening for cholesterol levels in late adolescents (17-21 years) may contribute to disease prevention (12). This study investigates the relationship between junk food consumption, physical activity, and hypercholesterolemia risk among nutrition students at Surabaya State University.

Eating habits during adolescence can have a lasting impact on health in later life (10). A study found that public health students exhibited poor eating habits and low levels of physical activity (11). Therefore, screening for cholesterol levels in late adolescents (17-21 years) may contribute to disease prevention (12). These phenomena require special attention to prevent and manage hypercholesterolemia and its risk factors, thereby reducing the burden of diseases associated with hypercholesterolemia. Therefore, this study aimed to investigate the relationship between junk food consumption, physical activity, and the risk of hypercholesterolemia among nutrition students at Surabaya State University.

## MATERIALS AND METHODS

A cross-sectional design was employed in this study. This study was conducted from September 26 to 29, 2024. A total of 519 nutrition students from Surabaya State University, spanning three academic years (2021-2023), made up the study sample. The sample size was calculated using Slovin's formula with an error margin (e) of 0.1 and a 10% consideration, resulting in a sample size of 92 respondents. Proportional random sampling was used to select participants based on their class, yielding 13 respondents from the class of 2021, 33 from the class of 2022, and 46 from the class of 2023. The inclusion criteria for this study were: being a nutrition student at Surabaya State University, aged 17-21, and willing to provide informed consent. This study had two independent variables: the frequency of junk food consumption and the level of physical activity. The dependent variable in this study was the incidence of hypercholesterolemia. The Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) was adapted from Irawan's study (2022) and used to measure the frequency of junk food consumption. The measurement classification consisted of two categories: 1) frequent consumption (<3 times/week) and 2) infrequent consumption (≥3 times/week).

Respondent characteristics, including BMI, were categorized according to the Indonesian Ministry of Health guidelines. Respondents aged 17 and 18 use BMI-for-age Z scores (BFA), and over 18 years use BMI. Normal weight was defined as a BMI of 18.5-25 or a BMI-for-age z-score (BFA) between -2SD and +1SD. Underweight was defined as BMI <18.5 or BFA <-2SD. Overweight was defined as BMI >25 to ≥ 27 or BFA > +1SD. Obesity is defined as BMI >27 or BFA > +3SD (14). Physical activity levels were measured using the International Physical Activity Questionnaire Short Form (IPAQ-SF). The IPAQ-SF has been validated in 14 centers across 12 countries, demonstrating considerable validity and reliability (15).

There are seven questions in the questionnaire. These questions inquire about physical activities performed by respondents over the past seven days. Cholesterol levels were measured using the EasyTouch GCU (Glucose, Cholesterol, Uric Acid) meter with cholesterol test strips. GCU device usage involves calibration, function checks, and verification of cholesterol strip expiration dates according to manufacturer guidelines.

The data analysis employed univariate and bivariate analysis. Bivariate analysis utilized the Chi-Square test to examine the relationship between junk food consumption, physical activity, and the risk of hypercholesterolemia among nutrition students at Surabaya State University. Regression analysis was employed to calculate the odds ratio (OR), which measures the likelihood of an event occurring. This study received ethical approval from the Ethics Committee

(No.0624/HRECC.FODM/VII/2024) of the Faculty of Dentistry, Airlangga University, Surabaya.

## RESULTS AND DISCUSSIONS

This study involved 92 students from the Nutrition Study Program at Surabaya State University, spanning three academic years (2021-2023) and aged 17-21. **Table 1** presents the characteristics of the respondents. The respondents' characteristics were stratified by their hypercholesterolemia levels. **Table 1** shows that the majority of respondents were female (n=90, 97.80%), with only 2 male respondents (2.20%) participating in the study. This reflects the predominantly female enrollment in the Nutrition Study Program at Surabaya State University. Respondents were distributed across three classes: 2021 classes (13 respondents, 14.10%), 2022 classes (33 respondents, 35.90%), and 2023 classes (46 respondents, 50%). The chosen classes included students within the specified age range of 17 to 21 years, aligning with the study's inclusion criteria.

**Table 1. Respondent Characteristics**

| Respondent Characteristics | Normal (n=37) n (%) | Hypercholesterolemia (n=55) n (%) |
|---|---|---|
| Gender | | |
| Male | 1 (2.70) | 1 (1.80) |
| Female | 36 (97.30) | 54 (98.20) |
| Age (years) | | |
| 17 | 0 (0.00) | 2 (3.60) |
| 18 | 2 (5.40) | 2 (3.60) |
| 19 | 13 (35.10) | 17 (30.90) |
| 20 | 13 (35.10) | 26 (47.30) |
| 21 | 9 (24.30) | 8 (14.50) |
| BMI | | |
| Overweight/Obese | 7 (18.90) | 9 (16.40) |
| Normal | 29 (78.40) | 38 (69.10) |
| Underweight | 1 (2.70) | 8 (14.50) |
| Junk Food Consumption | | |
| Infrequently | 25 (67.60) | 20 (36.40) |
| Frequently | 12 (32.40) | 35 (63.60) |
| Physical Activity | | |
| Low | 5 (13.50) | 44 (80.00) |
| Moderate | 32 (86.50) | 11 (20.00) |

The results of the data analysis by age showed that 2 respondents (2.20%) were 17 years old, 4 (4.30%) were 18 years old, 30 (32.60%) were 19 years old, 39 (42.40%) were 20 years old, and 17 (18.50%) were 21 years old. The age range of 17-21 years falls within the late adolescent phase (16). During this phase, individuals often prioritize food trends over health considerations when making dietary choices (17). According to the 2018 Riskesdas data, 21.20% of the Indonesian population aged 15 years and above had abnormal cholesterol levels, with a higher prevalence among women (24%) than men (18.30%). Therefore, screening for hypercholesterolemia is recommended among late adolescents aged 17-21 years as a preventive measure (12). Furthermore, the prevalence of obesity and overweight was 16.30%, while 72.80% had a normal weight, and 9.80% were underweight. In contrast to the findings of this study, Putri (2024) reported that 58.70% of respondents were underweight. Putri's study (2024) identified an imbalance in nutritional intake as a contributing factor to malnutrition problems (18).

This study revealed that 63.6% of nutrition students with hypercholesterolemia consumed junk food ≥3 times a week, whereas 36.40% consumed it less frequently (<3 times a week). In contrast, Annisa's study (2022) on nutrition students at Siliwangi University found that the majority of nutrition students (58%) rarely

consumed junk food. Fried food was the most commonly consumed type of junk food among nutrition students. This finding is consistent with previous research by Budianto & Akbar (2022), which reported that 75.80% of respondents consumed fried food. The consumption of high-fat foods, including fried foods, a type of junk food, can elevate total blood cholesterol levels (11). This study revealed that Nutrition students with hypercholesterolemia were more likely to engage in low physical activity (80%) than moderate physical activity (20%). A similar research conducted among health students reported comparable findings, with 70.7% of respondents exhibiting low physical activity levels (2). The demanding lecture schedules of students often leave them with limited time for physical activity, as they are frequently fatigued from their academic commitments on campus (20). Furthermore, Alkaririn (2022) identified technological advancements and globalization as contributing factors to changes in physical activity levels among students.

Junk food consumption frequency was assessed using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), a self-administered tool. Table 2 presents the relationship between junk food consumption frequency and the incidence of hypercholesterolemia.

**Table 2. The relationship between the frequency of junk food consumption and physical activity with the incidence of hypercholesterolemia**

| Variable | Normal | | Hypercholesterolemia | | *p*-value |
|---|---|---|---|---|---|
| | N=37 | % | N=55 | % | |
| Frequency of junk food consumption | | | | | |
| Frequently (≥3 times/week) | 12 | 32.40 | 35 | 63.60 | 0.004* |
| Infrequently (<3 times/week) | 25 | 67.60 | 20 | 36.40 | |
| Physical Activity | | | | | |
| Low (<150 minutes/week) | 5 | 13.50 | 44 | 80.00 | <0.000* |
| Moderate (≥150 minutes/week) | 32 | 86.50 | 11 | 20.00 | |

**p-value was analyzed using Chi-Square. Statistical significance was set at p<0.05.*

The results of the Chi-Square test and odds ratio are summarized in **Table 2**, which includes a cross-tabulation of the data with p-values and respondent counts. A majority of students with hypercholesterolemia (63.60%) reported frequent junk food consumption. The data revealed a significant association between junk food consumption (p=0.004) and the risk of hypercholesterolemia among nutrition students at Surabaya State University. This can be explained by several factors related to student behavior, such as eating habits and physical activity levels. Students who frequently consume junk food tend to have an unbalanced diet, high in fat and sugar, but low in fiber and other essential nutrients (6). These factors can increase the risk of hypercholesterolemia.

This study indicated that nutrition students who frequently consumed junk food had increased hypercholesterolemia levels. The mechanism may be associated with high saturated fat and cholesterol content in junk food, which can contribute to elevating blood cholesterol levels (24). Time constraints and demanding academic commitments lead nutrition students to rely on convenient junk food options, which are abundant around campus and easily accessible through online delivery orders. As noted in a previous study, 45.70% of Indonesians regularly consume fried snacks as a junk food option (22), highlighting the need for nutrition education and awareness. Moreover, we found that nutrition students had low physical activity. Nutrition students may experience low physical activity due to a combination of factors, such as insufficient time, low motivation, and influences from their social and environmental surroundings (26). Low physical activity reduces the body's capacity to use lipid as a source of fuel during exercise, which can lead to an increased cholesterol level in the body (27).

In contrast to Yuningrum's study (2020), which reported that 68.70% of respondents had normal cholesterol levels, this study found differing

results. Research by Lainsamputty & Gerungan (2022) emphasizes the substantial impact of diet and physical activity on cholesterol levels. This finding is supported by the high prevalence of frequent junk food consumption (63.60%) and low physical activity levels (80%) among students, which can elevate the risk of hypercholesterolemia.

Fried food was the most commonly consumed junk food among nutrition students at Surabaya State University. This finding is consistent with previous research by Budianto & Akbar (2022), which reported that 75.80% of respondents consumed fried food. Similarly, a study conducted among health students reported comparable findings, with 70.70% of respondents exhibiting low physical activity levels (2).

This study focused on nutrition students, who, as future health professionals, should understand and practice a healthy lifestyle to prevent non-communicable diseases like hypercholesterolemia. However, the results revealed that fried food was a frequently consumed junk food among them. A survey by Kompas Research and Development (2022) supports this finding, revealing that 45.70% of Indonesians regularly eat fried food as a junk food option. These findings align with previous research by Budianto & Akbar (2022), which demonstrated a significant association between fried food consumption and elevated cholesterol levels (p=0.001).

Junk food refers to foods that are typically high in calories from sugar and fat, but low in essential nutrients like fiber and vitamins (6,23). The high-fat content in junk food can lead to elevated blood lipid levels, potentially increasing the risk of blood vessel disorders (24). Frequent junk food consumption, combined with inadequate physical activity and insufficient high-fiber food intake, can lead to fat accumulation (19). Adequate fiber intake can facilitate the elimination of excess cholesterol from the body through fecal excretion (25).

This study indicated that nutrition students who frequently consumed junk food had increased hypercholesterolemia levels. The mechanism may be associated with high saturated fat and cholesterol content in junk food, which can contribute to elevating blood cholesterol levels (24). Time constraints and demanding academic commitments lead nutrition students to rely on convenient junk food options, which are abundant around campus and easily accessible through online delivery orders. As noted in a previous study, 45.70% of Indonesians regularly consume fried snacks as a junk food option (22), highlighting the need for nutrition education and awareness. Moreover, we found that nutrition students had low physical activity. Nutrition students may experience low physical activity due to a combination of factors, such as insufficient time, low motivation, and influences from their social and environmental surroundings (26). Low physical activity reduces the body's capacity to use lipid as a source of fuel during exercise, which can lead to an increased cholesterol level in the body (27).

Fried foods are foods that go through a frying process with hot cooking oil (21). Oil contains PUFA (Polyunsaturated Fatty Acid) fatty acids, which can help lower cholesterol levels. However, when heated and reused repeatedly, these fatty acids can transform into trans fatty acids (1). Fried foods sold on the market often use cooking oil that has been heated and reused repeatedly, which increases the risk of elevated cholesterol levels in the blood. Consuming high amounts of saturated and animal fats in junk food can lead to increased total cholesterol levels in the blood, mainly Low-Density Lipoprotein (LDL) levels (4,25). Excessive LDL levels can undergo oxidation, resulting in the formation of clots or plaques that can block blood vessel flow and lead to atherosclerosis (1).

Physical activity was assessed using the self-administered IPAQ-SF. Table 2 illustrates the relationship between physical activity and the incidence of hypercholesterolemia. The results of the bivariate analysis revealed that most students of the Nutrition study program at Surabaya State University had low levels of physical activity (53%). This study detected a significant relationship between the level of physical activity and the incidence of hypercholesterolemia (p=0.000). The findings of this study are supported by Rosita's study (2024), which obtained a value of p =0.002 (p<0.05), showing a significant relationship between the level of physical activity and the incidence of hypercholesterolemia. Conversely, the results of this study differ from

Lestari's study (2023), which stated that there was no relationship between the level of physical activity and the incidence of hypercholesterolemia (p=0.167).

Low physical activity is an unhealthy lifestyle and can cause increased cholesterol levels in the blood (Lainsamputty & Gerungan, 2022). Low physical activity can also cause decreased elasticity of blood vessels and the heart, leading to increased blood pressure (20). Engaging in regular and sufficient physical activity can help reduce LDL cholesterol and triglyceride levels due to decreased fat catabolism in the liver, while a lack of physical activity can increase LDL levels and reduce HDL levels (11, 29). If the body does enough physical activity, it will lead to an increase in lipoprotein lipase activity and a decrease in hepatic lipase activity (11). Lipoprotein lipase will catalyze the hydrolysis of triglycerides and Very Low-Density Lipoprotein (VLDL). As a result, VLDL conversion and Intermediate-Density Lipoprotein (IDL). Hepatic lipase converts some IDL into low-density lipoprotein (LDL), while the liver and peripheral tissues utilize the remaining IDL through the LDL receptor. The lipoprotein lipase enzyme in this mechanism plays a role in helping to move excess LDL in the blood to the liver, which is then converted into bile or secreted, ultimately LDL levels in the blood decrease (25).

In the context of nutrition students, who are expected to have knowledge and awareness about healthy lifestyles, these findings highlight a gap between knowledge and behavior. Therefore, education and health promotion efforts are necessary to increase awareness and healthy behaviors among students, as well as reduce the risk of hypercholesterolemia and other diseases. Limitations of this study include the relatively small sample size, which may limit the generalizability of the findings. Furthermore, the study's short duration may have restricted the collection of more accurate and comprehensive data.

## CONCLUSION AND RECOMMENDATION

There is a significant correlation between junk food consumption (p=0.004), physical activity levels (p<0.001), and the incidence of hypercholesterolemia among undergraduate students of the Nutrition Study Program at Surabaya State University. It is hoped that students will be able to adopt a healthy diet and lifestyle by reducing the frequency of consuming junk food and increasing their level of physical activity.

Future research is expected to investigate other variables, such as knowledge, gender, and history of hypertension, as well as other factors that can influence the incidence of hypercholesterolemia, to expand the scope of the study. Furthermore, similar research can be conducted with different targets, such as non-health students.

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