Jurnal Keperawatan Global
Vol. 8, No. 2, December 2023
https://doi.org/10.37341/jkg.v8i2.859

Original Research

Cholesterol, Blood Glucose and Hemoglobin Profiles of Urban Adolescents

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ABSTRACT

Background: *Prevention of heart and cardiovascular disease must be carried out as early as possible with routine biochemical examinations. Aim of this study is to describe the profile of Cholesterol, Blood Glucose and Hemogobin in urban adolescents.*

Methods: *This research method uses a descriptive design with a cross sectional approach. The sample population in this study was 63 nursing students at the Surakarta Health Polytechnic. The study was conducted in August 2023 and the sample was selected randomly. Data were analyzed descriptively.*

Results: *The average cholesterol level was 197mg/dl, the average blood sugar level was 91.1 mg/dl and the average hemoglobin was 13.2 g/dl.*

Conclusion: *The incidence of hypercholesterolemia was high in respondents. This condition is possible due to insufficient consumption of vegetables and lack of physical activity resulting in high cholesterol levels. These specific findings can help create policies to develop more strategic evidence-based interventions, through grouping risk factors in controlling the risk of non-communicable diseases in adolescents.*

ARTICLE HISTORY
Received: June 15th, 2023
Accepted: December 23th, 2023

KEYWORDS
adolescents, blood glucose, cholesterol, hemoglobin, non communicable diseases;

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Cite this as: Setyorini, Y., Darmawan, R. E., Ardesa, Y. H., Rinawati, R. S. A. W., & Astuti, R. W. (2023). Cholesterol, Blood Glucose and Hemoglobin Profiles of Urban Adolescents. *(JKG) Jurnal Keperawatan Global*, *8*(2), 117–125. https://doi.org/10.37341/jkg.v8i2.859

INTRODUCTION

Non-communicable diseases (NCDs) are the most common causes of long-term illness, disability and premature death worldwide (Majić et al., 2023). PTM is considered a disease that does not involve microbial influence and is only influenced by lifestyle factors (Budreviciute et al., 2020). Non-communicable diseases (NCDs), also known as chronic diseases, last a long time and are the result of a combination of genetic, physiological, environmental and behavioral factors in diabetes (WHO, 2021). The factors identified as the main determinants of NCD prevalence are hypertension,

increased total cholesterol, tobacco use, alcohol consumption, lack of physical activity, unhealthy eating patterns, obesity, and increased blood sugar. This shows that the majority of NCDs are caused by risk factors. which can be prevented (Majić et al., 2023). Non-communicable diseases target all groups, men, women, children, and people in all groups with the condition that someone may look healthy, but they may suffer from these diseases. One of the most serious concerns regarding non-communicable diseases is that these diseases attack people at the productive age of their lives, making them the main cause of premature death (Balsarkar, 2022).

Despite the fact that non-communicable diseases are usually associated with the elderly population, basically non-communicable diseases are very risky at all age levels. Evidence shows that every year, 17 million people die from NCDs before the age of 70 years 86% (WHO, 2021). In America, non-communicable diseases occur in 15 million people - 2.2 million in America between the ages of 30 and 69 years, this condition causes premature death, reaching more than 85% of deaths (PAHO, 2021). Of all deaths due to NCDs, there are four large groups that account for more than 80% of all premature deaths. Cardiovascular disease is the leading cause of NCD deaths, or 17.9 million people each year, followed by cancer (9.3 million), chronic respiratory disease (4.1 million), and diabetes (2.0 million including deaths due to kidney disease which caused by diabetes) (WHO, 2021). In Indonesia, PTM was the main cause of death in 2016. PTM was responsible for 73% of death incidents with the proportions being cardiovascular disease (35%), cancer (12%), chronic respiratory disease (6%), diabetes (6%), and risk of premature death is more than 20% (Arifin et al., 2022).

We are now living in the midst of a global syndemic—which is a synergy of three parallel epidemics occurring simultaneously—namely NCDs, social inequality, and the corona virus disease (COVID-19). As a result, traditional societies are limited in dealing with risk factors and diseases that continue to develop. (Canfell et al., 2022). Poor lifestyle or behavioral patterns, lack of physical activity, unhealthy eating patterns, tobacco use (smoking, passive smoking), and dangerous alcohol use increase the risk of non-communicable diseases (Canfell et al., 2022). In Sub-Saharan Africa (SSA), the problem of NCDs and their risk factors is increasing with some experiencing symptoms of anemia, increased blood lipids and obesity, increased blood glucose, increased blood pressure, etc. (Yaya et al., 2018). Therefore, in this case, initial screening for NCD treatment, as well as palliative care, is a key component in the response to NCDs, including checking cholesterol, blood glucose and hemoglobin levels, especially among adolescents to control risk factors for death at an early age (Ministry of Health of the Republic of Indonesia, 2018; PAHO, 2021).

Lifestyle modification and appropriate interventions are a top priority in disease prevention and to reduce the risk of NCDs (Budreviciute et al., 2020). Most non-communicable disease conditions can be reduced by addressing behavioral risk factors such as tobacco use, alcohol abuse, inappropriate eating habits, obesity, and lack of adequate physical activity. Non-communicable diseases and their consequences are generally preventable, but lack of patient knowledge, attitudes, and practices can be important factors influencing the selection and implementation of health promotion behaviors to achieve a healthy lifestyle (Ramesh & Kosalram, 2023). In overcoming the epidemic situation of Non-Communicable Diseases, great determination is needed to continue providing education to the entire community to adopt a healthy lifestyle (Balsarkar, 2022). In order to achieve large-scale progress, collaboration between the government and various non-governmental organizations, schools and universities, to

provide advice on lifestyle changes and warn the public about the risks of NCDs, is urgently needed. However, to achieve the highest attainable health standards, it is important to encourage individuals and families to live a healthy lifestyle in order to achieve an effective response in the prevention and control of NCDs and improve health outcomes (Budreviciute et al., 2020). So further studies are needed on integrated development of risk factors for non-communicable diseases in higher education health institutions.

MATERIALS AND METHOD

This research method uses a descriptive design with a cross sectional approach. The population in this study were Surakarta Health Polytechnic students with a total of 63 respondents. The sampling technique is total sampling. In this research, data collection for each variable uses a questionnaire. Biomedical examination of respondents was carried out after signing the informed consent which included taking blood samples and then these samples were analyzed for examination, cholesterol, blood glucose and hemoglobin.

RESULTS

Survey results of 63 respondents consisting of The average age is 21 years (69.8%) and the majority of respondents are female (95.2%). The results showed that the average cholesterol was 197, the average blood sugar level was 91.1 and the average hemoglobin was 13.2.

Table 1. Survey results

Variables	Frequency	Percentage
Age		
20	14	22.2
21	44	69.8
22	5	7.9
Gender		
Man	3	4.8
Woman	60	95.2
Cholesterol		
Mean	197	
Median	196	
Mode	189	
Blood sugar		
Mean	91.1	
Median	86	
Mode	85	
Hemoglobin		
Mean	13.2	
Median	12	
Mode	11.8	

DISCUSSION

It is known that there are four main types of non-communicable diseases,

including cardiovascular disease, cancer, chronic respiratory disease and diabetes (WHO, 2021). Among all respondents in this study, indicators of non-communicable diseases include high cholesterol levels, high blood sugar levels, and high and low hemoglobin

concentrations detected at age (20-22 years) with an average cholesterol reaching 197, blood sugar 91.1 hemoglobin. 13.2 where these figures must be taken into account (ADA, 2018; Billett, 1990; Grundy et al., 2019). When compared with the United States during 2015–2018, the prevalence of high total cholesterol in adults aged ≥20 years was 11.4%, and there was no significant difference between men (10.5%) and women (12 .1%) (Margaret, 2020). In the United States 1.6 million adults aged 20 years or older—or 5.7% of all US adults diagnosed with diabetes—report having type 1 diabetes and using insulin (CDC, 2022). In the United States Regionally in 2019, the prevalence of anemia in women of childbearing age (women aged 15–49 years) was 15.4% (95% uncertainty interval (UI) 12.1–19.5), equivalent to 39 million women suffering from anemia (Finucane et al., 2015).

Meanwhile in Indonesia, the prevalence of hypercholesterolemia in Indonesia in the 15-34 year age group is 39.4% and increases with age (Nasrul, 2022). It is estimated that the adult diabetes population aged between 20-79 years is 19,465,100 people or the prevalence of diabetes among those aged 20-79 years is 10.6% (Sutadarma, 2022). According to 2013 Riskesdas data, anemia in women (23.9%) is relatively higher in men (18.4%). There are 18.4% aged 15-24 years experiencing anemia. This means that in Indonesia around 1 in 5 teenagers suffer from anemia (Ministry of Health of the Republic of Indonesia, 2021). The prevalence obtained in this study is sufficient to conclude that Indonesian teenagers already suffer from risk factors for non-communicable diseases at their productive age.

Of the four types of main components, the relationship between high cholesterol levels and low or high hemoglobin concentrations, the relationship between cholesterol levels and blood glucose levels, the relationship between cholesterol levels and the incidence of cancer are interrelated with an increase in cardiovascular disease and all causes of death (Lee et al., 2018). High cholesterol is a condition in which the body has too many lipids in the blood. The body needs the right amount of lipids to function. However, if the body has too much lipid, the extra lipid will build up in the arteries, combining with other substances in the blood and causing the appearance of atherosclerotic plaque. High cholesterol increases the risk of conditions such as peripheral artery disease, high blood pressure, and stroke (Cleveland Clinic, 2022).

In addition, high cholesterol levels are closely related to hemoglobin levels which are related to the size of lipoprotein particles. Where high hemoglobin levels are associated with larger VLDL particle sizes, smaller LDL particle sizes and, smaller HDL particle sizes increase the number of VLDL and LDL particles. So several studies have concluded that high hemoglobin concentrations are related to bad lipoprotein particles, these bad protein particles can also increase the risk of heart disease, diabetes and metabolic syndrome (Hämäläinen et al., 2018). Several potential mechanisms may explain how low hemoglobin concentrations increase the risk of CVD-related and all-cause mortality. One of them is that anemia status can cause ventricular remodeling and cardiac dysfunction. Chronic anemia with hemoglobin <10 g/dL is known to cause increased cardiac output which can cause left ventricular hypertrophy (Lee et al., 2018). So maintaining hemoglobin concentrations in the normal range correlates with a reduction in all-cause mortality (Lee et al., 2018).

In addition, increased serum glucose and cholesterol levels have been shown to be associated with increased mortality from cardiovascular disease and all-cause mortality. Hypercholesterolemia is a risk factor for cardiovascular disease in type 2 diabetes patients. In addition, the relationship between high cholesterol levels and an increased risk of cancer has long been of interest and investigation because the cholesterol synthesis pathway can produce various tumorigenic compounds and because cholesterol functions as a precursor for the synthesis of many related sex hormones with an increased risk of various types of cancer (Ding & Hu, 2008). The pathogenesis of diabetes mellitus is very complex, diabetes mellitus is caused by various factors and mechanisms that work together. Abnormal lipid metabolism is an important factor in the development of diabetes mellitus and an important cause of its complications. Lipid metabolism disorders include, among other things, increased serum triglyceride levels and decreased serum high-density lipoprotein cholesterol. Lipid metabolism disorders play an important role in the pathogenesis of diabetes (Wang et al., 2023).

Diabetes mellitus (type 1 diabetes and type 2 diabetes) doubles the risk of coronary artery disease and peripheral artery disease. Diabetes is associated with lower HDL levels and higher levels of triglycerides and LDL. About 7 in 10 people with type 2 diabetes are diagnosed with diabetes-related dyslipidemia. This means they have high levels of triglycerides, high levels of "small density" LDL, and low levels of HDL. "Low dense" LDL is a specific type of cholesterol protein that can easily enter artery walls and cause damage. Having too much small dense LDL in your blood can cause plaque growth (Cleveland Clinic, 2022). Given the global economic and social burden of non-communicable diseases, understanding risk factors for non-communicable diseases that can be intervened in can help reduce the economic burden on countries and individuals. Active and effective prevention of risk factors can lead to early detection of non-communicable diseases, facilitate timely and effective treatment, reduce and delay the occurrence and development of complications, improve patient quality of life, reduce disability rates and extend life expectancy (Wang et al., 2023).

In this case, the causes of the emergence of risk factors for non-communicable diseases among the productive age group are closely related to changes in the environment, lifestyle and technology in Indonesia. Risk factors such as poor diet, smoking, sedentary behavior, and being overweight/obesity increase the risk of NCDs. Investigations show that behavioral risk factors are often acquired in adolescence and then implemented in adulthood (Pengpid & Peltzer, 2019). Among adolescents aged 10-20 years, lack of physical activity and sedentary behavior (e.g. watching television, playing games, and use of computers and smartphones) have been associated with increased obesity and fat, poor diet (insufficient fruit and vegetable consumption , salt, foods sweetened with sugar), drinks and consumption of saturated fats, low iron, etc.), depression, causing a decrease in the quality of life of the productive age (Nilsen et al., 2020; Tremblay et al., 2016).

Globally, unhealthy eating patterns, especially due to consumption of sugary drinks and saturated fats, increase the risk of CVD (Afshin et al., 2019). Prevention and control of NCDs has emerged as a global priority in the Sustainable Development Goals in encouraging early prevention and control of NCD risk factors., a number of countries, including Australia and Canada, have reformed their national strategies on preventing NCD risk factors by highlighting the importance of physical activity, sleep and proper nutrition during childhood and adolescence (Nilsen et al., 2020; Tremblay et al., 2016). Global health leaders also emphasize the importance of preventing and controlling NCDs

at key stages of life, particularly during adolescence. Due to greater plasticity, adolescence is considered an important time to intervene and disrupt pathways to poor health in adulthood (Biswas et al., 2022). We found that insufficient consumption of fruit and vegetables, and lack of physical activity were the most common risk factors across the region. In almost all countries, more than 40% of teenagers are not physically active, and consume less fruit and vegetables. Proper nutrition during adolescence is critical for current, future, and intergenerational health (Victora et al., 2008).

It is recommended that countries implement prevention approaches that target clusters of risk factors for preventing NCDs among adolescents. limited resources, in targeting the burden of NCD risk factors among adolescents. School health promotion is known as an effective approach to combat NCD risk factors among adolescents. However, although health-promoting school approaches are promoted, with guidance provided on their development and implementation, we found that less than half of LMIC countries have rigorously implemented their respective national health-promoting school guidelines. The lack of health-promoting schools may be due to a lack of open spaces for physical activity or sport, particularly in urban areas (Biswas et al., 2022). A study by Sharma et al. reported that school-based Health Promotion has a positive impact on behavior that can cause risk factors for non-communicable diseases (Sharma et al., 2018).

CONCLUSION

The prevalence of three or more NCD risk factors is very large and varies between countries. Insufficient vegetable consumption, insufficient fruit consumption, and lack of physical activity are the most common causal factors in all regions. These specific findings can help shape policies to develop more strategic evidence-based interventions. Health promotion in schools can prevent risk factors, however, education-based interventions in schools require deeper understanding and attention to complex patterns and strategic grouping based on risk factors can avoid the burden of NCDs in adolescents.

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