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# CORRELATION OF CHOLESTEROL LEVELS, BLOOD GLUCOSE, URIC ACID AND AGES

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***ABSTRACT***

*Metabolic syndrome and cardiovascular disease are often associated with elevated serum lipid, glucose, and uric acid levels. When these conditions occur together, they significantly increase the risk of heart disease, stroke, and type 2 diabetes, especially in individuals in the productive age range. This study was conducted to evaluate the association between cholesterol, blood sugar levels, uric acid concentrations, and age variables. The methodology in this study was descriptive correlational using a purposive sampling technique. This study selected Wiyono Village and Taman Sari Village, Gedung Tataan District, Pesawaran Regency, Lampung, as the research area. A total of 110 adult residents were involved in this study. Univariate and bivariate analyses were performed. Data collection included blood sampling to obtain cholesterol, uric acid, and blood glucose levels. After the results were obtained, each respondent received counseling on a healthy lifestyle (NEWSTART) according to the results of each respondent's examination by health workers. Revealing a statistically significant (sig value 0.023 <0.05) between cholesterol and uric acid. A sig value of 0.019 < 0.05 indicates a significant correlation between cholesterol and blood sugar. A sig value of 0.015 < 0.05 indicates a significant correlation between age and uric acid. Lifestyle management is essential as a preventative measure for increased lipid, glucose, and hyperuricemia levels.*

*KEYWORDS: Ages, Blood Glucose, Cholesterol, Uric Acid*

**ABSTRAK**

Sindrom metabolik dan penyakit kardiovaskular sering dikaitkan dengan peningkatan kadar lipid, glukosa, dan asam urat serum. Bila kondisi ini terjadi bersamaan, secara signifikan meningkatkan risiko penyakit jantung, stroke, dan diabetes tipe 2 terutama pada individu dalam rentang usia produktif. Studi ini dilakukan untuk mengevaluasi keterkaitan antara kolesterol, kadar gula darah, konsentrasi asam urat, serta variabel usia. Metodologi dalam penelitian ini adalah deskriptif korelasional dengan menggunakan teknik *purposive sampling*. Penelitian ini memilih Desa Wiyono dan Desa Taman Sari, Kecamatan Gedung Tataan, Kabupaten Pesawaran, Lampung, sebagai daerah penelitian. Sebanyak 110 penduduk dewasa terlibat dalam penelitian ini. Analisis univariat dan analisis bivariat dilakukan. Pengumpulan data meliputi pengambilan sampel darah untuk mendapatkan kadar kolesterol, asam urat, dan glukosa darah. Setelah hasilnya diperoleh, setiap responden menerima konseling tentang gaya hidup sehat (NEWSTART) sesuai dengan hasil pemeriksaan setiap responden oleh tenaga kesehatan. Mengungkapkan signifikan secara statistik (nilai sig 0,023 < 0,05) antara kolesterol dan asam urat. Nilai sig 0,019 < 0,05 antara kolesterol dan gula darah. Nilai sig 0,015 < 0,05 signifikan antara usia dan asam urat. Manajemen gaya hidup perlu diperhatikan sebagai langkah pencegahan peningkatan kadar lipid, glukosa dan hiperurisemia

KATA KUNCI: Glukosa Darah, Kolesterol, Asam Urat, Usia

## INTRODUCTION

Non-communicable diseases (NCDs) were the cause of 74% of deaths in 2019. The percentage of degenerative diseases such as diabetes mellitus, hypercholesterolemia, and gout continues to increase

causing death and decreasing quality of life (Lusiana et al., 2019). Insufficiencies characterized by consistently elevated blood sugar levels, results from either a decrease in insulin production or an impairment in the action of insulin, or both. A determination of diabetes mellitus is made by analyzing blood glucose levels (Baharuddin et al., 2018). Cholesterol is a fat that is useful for the body (Yully, 2022). However, if the levels are too high in the body, cholesterol will build up in the blood vessels and disrupt blood flow. High cholesterol does not cause symptoms. As a result, many people are unaware of high cholesterol levels until serious complications such as heart disease or stroke arise (Hongsha Wang et al., 2018). Gout is a degenerative disease caused by high uric acid as a result of the body's metabolic processes in the final stages of purines (Lusiana et al., 2019). The accumulation of uric acid crystals causes gout, an inflammatory form of arthritis. Any joint, including the big toe, ankle, knee, and most often the toes, might experience this ailment. The usual process for excreting uric acid from the body involves dissolving it in blood (Yully, 2022). An elevated level of uric acid (≥ 6 mg/dL in women and ≥ 7 mg/dL in males) is known as hyperuricemia (Valsaraj et al., 2020). Hypercholesterolemia is characterized by increased cholesterol levels in the blood, ≥ 200 mg / dL (Yani, 2015), when fasting blood glucose levels are over 125 mg/dL and 2 hours postprandial levels are above 180 mg/dL, the condition is known as hyperglycemia. When the fasting plasma glucose level is between 100 and 125 mg/dL, the patient is considered to have impaired glucose tolerance and is at risk for developing diabetes. A patient is categorized as diabetic if their fasting blood glucose level exceeds 125 mg/dL (Villegas-Valverde et al., 2018). Individuals afflicted with metabolic syndrome—a conglomeration of ailments characterized by hypertension, diabetes, excessive abdominal fat, and aberrant lipid profiles—often have elevated serum uric acid levels (Borghi et al., 2020; Cameron et al., 2004). When combined, these factors heighten the danger of cardiovascular disease, diabetes, stroke, renal disease, and many other catastrophic health issues (Hajhosseiny et al., 2015). An increased TG/HDL ratio was associated with elevated serum uric acid levels, regardless of metabolic syndrome or obesity, and there was an association between elevated uric acid levels and an increased prevalence of hyperglycemia, hypertriglyceridemia, and abdominal obesity, according to epidemiological data (Borghi et al., 2020). The 2018 Basic Health Research (Riskesdas) data shows that the prevalence of gout in Lampung Province is 7.6%, while the prevalence of diabetes mellitus in Bandar Lampung is 2.25%, with Metro City having the highest prevalence at 3.03% and Pesisir Barat having the lowest at 0.83% (Kementerian Kesehatan Republik Indonesia, 2018).

The reduction and management of risk factors is one strategy for the control of non-communicable illnesses factors so that they can be identified as early as possible and can be followed up (Direktorat Jenderal Pencegahan dan Pengendalian Penyakit, 2019). Examination of blood sugar, cholesterol and uric acid levels is one of the efforts to detect non-communicable diseases such as diabetes mellitus, cardiovascular and other non-communicable diseases (Lima et al., 2020). The study objective is to identify correlation of cholesterol total levels with blood glucose and uric acid in Pesawaran.

## MATERIALS AND METHODS

The methodology in this study is descriptive correlational using purposive sampling technique. This study selected Wiyono Village and Taman Sari Village, Gedung Tataan District, Pesawaran Regency, Lampung, Indonesia, as the research area. A total of 110 adult participants were selected by purposive sampling, with the following inclusion criteria: aged over 19 years, willing to participate, and not currently undergoing treatment for chronic diseases that can affect cholesterol, blood sugar, and uric acid levels. This study obtained ethical approval No. 428 / KEPK-FIK. UNAI / EC / I / 25. This study involved a total of 110 adult residents. Total cholesterol, uric acid, and blood sugar levels were measured using a digital Accu Check meter with capillary blood samples. Where respondents were previously informed to fast for 10 hours the night before the next morning's blood sample was taken. The age of participants was collected through demographic data in the questionnaire. Data analysis was performed using the Pearson correlation test to examine the relationship between cholesterol, uric acid levels, blood sugar, and age. Statistical analysis was performed using SPSS version 25. After the results were obtained, each respondent received counseling on a healthy lifestyle consisting of nutrition,

exercise, water, sunlight, air, rest, and faith in God (NEWSTART) based on the results of each respondent's examination by a health worker.

## RESULT

Table 1. Distribution of Characteristics (n=110)

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| Gender | Man | 32 | 29.1 |
| | Woman | 78 | 70.9 |
| Age | Young Adult | 1 | 9 |
| | Adult | 17 | 15.5 |
| | Middle Age | 26 | 23.6 |
| | Elderly | 66 | 60.0 |
| Cholesterol | Normal | 40 | 36.4 |
| | Upper Limit | 35 | 31.8 |
| | High | 35 | 31.8 |
| Uric Acid | Normal | 28 | 25.5 |
| | High | 82 | 74.5 |
| Blood Glucose | Normal | 42 | 38.2 |
| | Pre-Diabetes | 36 | 32.7 |
| | Diabetes | 32 | 29.1 |

The results showed that most of the respondents were female (70.9%), and most of the respondents were elderly age (60.0%). The table showed that cholesterol in upper limit category (31.8%) and cholesterol is in the high category (31.8%). Meanwhile, uric acid in the high category (74.5%). The table showed that blood glucose in pre diabetes category (32.7%) and blood glucose is in diabetes category (29.1%).

Table 2. Correlation Between Cholesterol and Age Group, Uric Acid, Blood Glucose

| | | **Cholesterol** | **Uric Acid** | **Blood Glucose** | **Age** |
|---|---|---|---|---|---|
| Cholesterol | Correlation Coefficient | 1.000 | .217* | .224* | .108 |
| | Sig. (2-tailed) | | .023 | 0.19 | .260 |
| | N | 110 | 110 | 110 | 110 |
| Uric Acid | Correlation Coefficient | .217 | 1.000 | 0.94 | .231* |
| | Sig. (2-tailed) | .023 | | .327 | .015 |
| | N | 110 | 110 | 110 | 110 |
| Blood Glucose | Correlation Coefficient | .224* | .0.94 | 1.000 | .217* |
| | Sig. (2-tailed) | .019 | .327 | | .023 |
| | N | 110 | 110 | 110 | 110 |
| Age | Correlation Coefficient | .108 | .231* | .217* | 1.000 |
| | Sig. (2-tailed) | .260 | .015 | 0.23 | |
| | N | 110 | 110 | 110 | 110 |

Table 2 shows that uric acid and cholesterol have a significant relationship, indicated by a sig value of $0.023 < 0.05$. Cholesterol and blood glucose are statistically significant ($p < 0.05$), indicated by a sig value of 0.019. Age and uric acid are statistically significant ($p < 0.05$). Age group and cholesterol are not statistically significant (sig value $0.260 > 0.05$). Blood glucose and age are not significant (sig value $0.23 > 0.05$).

## DISCUSSION

The results indicated a notable correlation between cholesterol and uric acid, with a significance value of 0.023 < 0.05. There is significant relationship between uric acid and age with a sig value of 0.015 < 0.05. Previous research conducted a study stating that uric acid levels are related to cholesterol (Y. Li et al., 2019). Studies showed a positive correlation between serum cholesterol and uric acid (Ali et al., 2019). Additional research findings indicate that uric acid levels affect the elevation of total cholesterol levels (Hidayah & Ciptono, 2025). The research indicated that dyslipidemia and its components were strongly associated to serum urid acid levels, and that this association may be influenced by gender and age (Chen et al., 2020). Dyslipidemia is more likely to occur when serum uric acid levels are high (Zheng et al., 2017). The association between elevated uric acid and the onset of hypertension and other cardiovascular diseases (CVDs) is well-established (Kuwabara et al., 2018). A novel biomarker called UHR might represent the body's inflammatory load and oxidative stress level, according to recent study (Kolahi Ahari et al., 2023). UHR refers to uric acid relative to high-density lipoprotein cholesterol. The risk of stroke was considerably greater in persons with low UA levels (<3.5 mg/dL), whereas the risk of cardiovascular mortality was significantly higher in those with high UA levels (>7.5 mg/dL), according to another research (You et al., 2020). Blood uric acid exhibited a U-shaped relationship with all-cause mortality in both genders when assessing the optimal blood uric acid level in patients with hyperlipidemia. Regarding patient survival, threshold effect analysis indicated that an average SUA level of 6.3 mg/dL (6.5 mg/dL for men and 6.0 mg/dL for women) could be deemed safe (Huang et al., 2023). Men were more likely to die from cardiovascular causes if their SUA level was high (>6.7 mg/dL), while men with low SUA levels were more likely to die from cancer. There was an increased risk of cancer-related and cardiovascular death in females with an SUA level >5.5 mg/dL (Liu et al., 2023). A meta-analysis of earlier cohort studies indicated that the likelihood of death from any cause increased by 8% and mortality from cardiovascular disease by 5% for each 1 mg/dL increase in blood uric acid levels among individuals with diabetes (B. Li et al., 2023). By elevating levels of oxidative stress and proinflammatory factors, elevated uric acid may lead to endothelial dysfunction. Vasodilation is obstructed and nitric oxide synthesis in arterial endothelial cells is diminished when uric acid quickly crystallizes in the walls of blood vessels (Papežíková et al., 2013). Boosts the production of oxygen free radicals, which may lead to the peroxidation of low-density lipoprotein (LDL) cholesterol (杨, 2023).

A notable correlation exists between uric acid levels and age, with a significance value of 0.015 < 0.05. Patients with high uric acid levels typically fall within the age range of 50-55. The findings of this research indicate that uric acid levels rise as one gets older. A different study involving samples from middle-aged individuals and older revealed that the occurrence of hyperuricemia was 30.9% and was more prevalent in men (Suwanchatchai et al., 2023). A 2022 cohort study indicated that lower total testosterone levels (<400 ng/dL) in older men could elevate the risk of hyperuricemia (Tsai et al., 2022). The prevalence of hyperuricemia increases beginning in the 60s and reaches a critical level by the 70s (Kuo et al., 2015; Zhu et al., 2011). The impact of advanced age on hyperuricemia showed slight variation between genders; older women were more prone to develop hyperuricemia than older men. The uricosuric effect of estrogen diminishes after menopause, potentially clarifying this discrepancy (Kuo et al., 2015).

The correlation between cholesterol and blood glucose is statistically significant ($p < 0.05$), as shown by a sig value of 0.019. People who have type 2 diabetes are more likely to develop cardiovascular disease if they have hypercholesterolemia. One of the main causes of diabetes mellitus and its consequences is abnormal lipid metabolism. Serum triglyceride levels that are too high and serum HDL cholesterol levels that are too low are symptoms of diseases related to lipid metabolism. An integral part of the development of diabetes is abnormalities in lipid metabolism (Huijuan Wang et al., 2023). A major risk factor for cardiovascular disease, compared to DM alone, is cumulative exposure to chronic hyperglycemia. An elevated risk of cardiovascular events was found in a large cohort of over 2 million persons with type 2 DM in Korea if their LDL-C levels were 130 mg/dL or higher with a duration of less than 5 years of diabetes, 100 mg/dL or higher with a duration of 5 to 9 years of diabetes,

or 70 mg/dL or higher with a duration of 10 years or more of diabetes (Kim et al., 2024). Patients with type 2 DM who had it later in life were less likely to have a high cardiac 10-year predicted risk and a greater probability of acquiring CVD (Magliano et al., 2020). The prevalence of cardiovascular disease is expected to rise as the average duration of diabetes among those with type 2 DM continues to rise (Yao et al., 2023).

## CONCLUSIONS

A significant link between cholesterol and Uric Acid, with a sig value of 0.023 <0.05, can be inferred from the findings of this research. A sig value 0.019 <0.05 indicates a substantial association between cholesterol and blood glucose. With a sig value of 0.015 <0.05, a significant association is shown between uric acid and age. If risk factors are actively and effectively prevented, non-communicable illnesses may be detected earlier, treated more effectively, complications can be reduced or delayed, patients' quality of life can be improved, disability rates can be reduced, and life expectancy can be prolonged. Subsequent research should incorporate variables associated with metabolic syndrome criteria to obtain a more thorough insight into metabolic disorders.

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