Association Between Age and Cholesterol, Blood Sugar, and Uric Acid Levels in Office Workers

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Abstract

Degenerative conditions related to cholesterol, blood sugar, and uric acid tend to increase with age and lifestyle changes, particularly among office workers in the productive age group. This study investigates the association between age and levels of cholesterol, blood sugar, and uric acid among employees of the Bengkulu Ministry of Health Polytechnic. A descriptive analytical design was employed using medical check-up data from 203 respondents. Data normality was assessed using the Kolmogorov-Smirnov test, and correlations were analyzed using Pearson's method. The findings revealed significant correlations between age and total cholesterol, HDL, LDL, triglycerides, blood sugar, and uric acid levels, although most correlations were weak in strength. These results suggest that age contributes to elevated biochemical markers associated with degenerative diseases, highlighting the importance of routine health monitoring among office workers as a strategy for early prevention.

Keywords: Cholesterol, blood sugar, uric acid, degenerative diseases, office workers

INTRODUCTION

The mortality rate from degenerative diseases is projected to surpass that of infectious diseases by 2030. For example, ischemic heart disease is expected to account for approximately 7.2 million deaths (Abally et. al, 2013) , while stroke may cause around 5.5 million deaths. Currently, degenerative diseases, such as cardiovascular conditions and cancer, are the leading causes of death among non-communicable diseases. According to World Health Organization (WHO) data from 2020, mortality linked to degenerative diseases poses a major global health concern. The primary causes of death include heart disease (20.1%), type 2 diabetes (15.2%), malignant tumors (10.8%), and liver cancer (7.6%) .

Developing countries are currently facing a double burden of disease: while infectious diseases remain unresolved, degenerative diseases are increasingly affecting the population. This dual burden is also evident in Indonesia, which continues to be classified as a developing country (Bowry et. al, 2015).

The prevalence of degenerative diseases is rising, often in parallel with increased life expectancy and lifestyle changes. These conditions typically result from a progressive decline in organ function associated with aging and cellular degeneration, which are natural aspects of human biology. Common degenerative or age-related non-communicable diseases include cancer, hypertension, diabetes mellitus, stroke, coronary heart disease, and other cardiovascular disorders. Risk factors such as obesity, dyslipidemia, and elevated uric acid levels further contribute to the onset and progression of these conditions. Numerous studies have demonstrated a strong association between the aging process and the emergence of degenerative diseases (Chehab et. al, 2023)

Cardiovascular disease is a major category of degenerative illness and remains the leading cause of morbidity and mortality worldwide. According to the World Health Organization (WHO), cardiovascular conditions accounted for 32% of the 17.9 million deaths caused by various diseases in 2019. In addition to its high mortality rate, cardiovascular disease contributes significantly to disability and a reduced quality of life among affected individuals[5]. As the fourth most populous country in the world, Indonesia is particularly vulnerable to the rising prevalence of cardiovascular disease due to an aging population, increasing urbanization, and lifestyle changes. Stroke and ischemic heart disease are among the primary contributors to this burden (Diantari et al., 2013).

Elevated levels of cholesterol, glucose, and uric acid are commonly linked to risk factors and underlying causes of serious degenerative diseases, including heart disease, stroke, kidney disorders, diabetes mellitus, and other metabolic conditions. Numerous studies have explored the relationship between age and the development of these diseases. Research by Robrusan identified age as a significant risk factor for diabetes mellitus (DM), a condition characterized by elevated blood glucose levels. Individuals aged ≥45 years are 1.7 times more likely to develop DM compared to those under 45 years. Similar findings have been reported in other studies, reinforcing the association between age and the onset of diabetes mellitus (Dungga, 2022).

Age is also linked to changes in cholesterol levels, particularly elevated total cholesterol and LDL cholesterol, both of which are well-established risk factors for degenerative diseases such as cardiovascular disease. Cholesterol is a waxy, yellowish fat produced by the liver. Research by Siregar found that age is significantly associated with cholesterol levels; multivariate analysis identified age as one of the dominant factors contributing to elevated cholesterol (Fitriadin et. al, 2024). Similarly, gout is a common degenerative condition that tends to affect individuals who are overweight or lead unhealthy lifestyles (Heart et. al, 2014). This study aims to investigate the correlation between age and key biochemical parameters, including HDL, LDL, triglycerides, fasting blood glucose, and uric acid, among office workers, as these indicators are critical risk factors for degenerative diseases.

METHODS

This study employed a descriptive analytical design. Data were obtained from medical check-up (MCU) records and analyzed descriptively to provide a comprehensive profile. Analytical processing was conducted using SPSS version 26.1, applying bivariate and Pearson correlation tests to examine relationships between variables. The research utilized a cross-sectional approach.

The study population consisted of 203 civil servants at the Bengkulu Ministry of Health Polytechnic, including the Director, Vice Director, sub-section heads (academic and general administration), lecturers, administrative staff, laboratory technicians, finance officers, public relations personnel, and other supporting staffUric acid and cholesterol levels were measured using the Fuji Film Dry Chemistry Analyzer (Instrument Calibrated Type Nx.700, Serial Number 370-40087), provided by PT Nusantara Bina Diagnostika. Examinations were conducted in the morning between 08:00 and 12:00, prior to respondents consuming any food or beverages, following an 8–10 hour fasting period. Venous blood samples were collected using sterile syringes, with a volume of up to 2 mL per respondent.

RESULTS

Age Classification Distribution Table

Figure 1. Age Distribution of Respondents

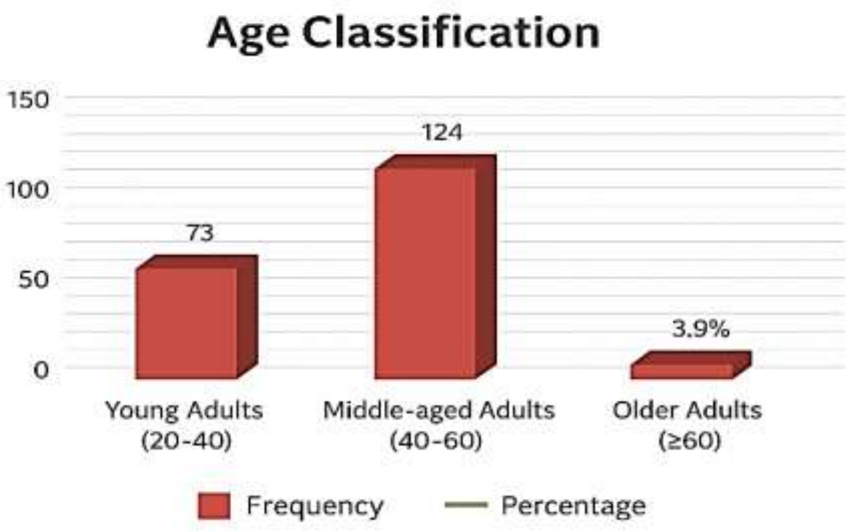

Figure 1 indicates that more than half of the respondents were aged between 40 and 60 years old, reflecting both their length of service and the limited number of new recruits hired annually.

Table 1. Prevalence of Total Cholesterol Categories in Office Workers

Total Cholesterol Level	Frequency	Percentage	Category
Total Cholesterol Less Than 200 mg/dl	89	43,4%	Good
Total Cholesterol 200-239 mg/dl	84	41,0%	Upper Threshold
Total Cholesterol 240 mg/dl and more	32	15,6%	High
Total	**205**	**100%**	

Based on Table 1, among the 205 respondents, 43.4% (89 individuals) had borderline cholesterol levels, 41.0% (84 individuals) had high cholesterol levels, and 15.6% (32 individuals) had normal cholesterol levels. These figures are notably higher than those reported in a previous study conducted in Bandar Lampung, where among 119 respondents, the proportions of normal, borderline high, and high cholesterol levels were 74.8%, 21.0%, and 4.2%, respectively (Priskila, 2015). In the current study, the most prevalent cholesterol category was borderline high, observed in 27 respondents (65.85%), while the least common was high cholesterol, found in 6 respondent.

Table 2. Prevalence of LDL Cholesterol Categories in Office Workers

Cholesterol Levels LDL	Frequency	Percentage	Category
Cholesterol LDL less than 100 mg/dl	112	55,40%	Optimal
Cholesterol LDL 100-129 mg/dl	55	27,20%	Almost Optimal
Cholesterol LDL 130-159 mg/dl	29	14,40%	Upper Threshold
Cholesterol LDL 160-189 mg/dl	5	2,50%	High
Cholesterol LDL 190 mg/dl dan lebih	1	0,50%	Very High
Total	**202**	**100%**	

Table 2 shows that nearly half of the workers (44.6%) had suboptimal LDL levels. This finding differs from previous research comparing LDL levels between workers and smokers. In that study, among 40 samples, the most common classification was LDL at the upper threshold, observed in 24 samples (60%). The least common classification was optimal LDL levels, found in only 3 individuals (7.5%). The remaining 13 samples (32.5%) fell into the category of near-optimal LDL levels (Lu'lu et. al, 2022).

Table 3. Prevalence of HDL Cholesterol Categories in Office Workers

HDL Levels	Frequency	Percentage	Category
HDL Cholesterol levels less than 40 mg/dl	0	0%	
Cholesterol Levels HDL 60 mg/dl	191	100%	High
Total	**191**	**100%**	

In accordance with international guidelines, HDL cholesterol was categorized as <40 mg/dL (low), 40–59 mg/dL (normal), and ≥60 mg/dL (high), which corresponds to the classification applied in this study (Chehab et. al, 2023).

Table 4 Classification of Triglyceride Levels in Blood

Triglyceride Levels in Blood	Frequency	Percentage	Category
Triglyceride levels less than 150mg/dL	147	71,70%	Normal
Triglyceride levels 150–199 mg/dL	27	13,20%	High Limit
Triglyceride levels 200–499 mg/dL	31	15,10%	High
Triglyceride levels are more than 500 mg/dL	0	0%	Very High
Total	**205**	**100%**	

**Kemenkes (2018)*

Patients with normal triglyceride levels, namely 23 respondents (40.4%) had normal triglyceride levels, 8 respondents (14.0) had normal triglyceride levels and 26 respondents (45.6) had high triglyceride levels. Triglyceride levels with normal values <150 mg/dl were 9 respondents (52.9%) and abnormal values (>150 mg/dl) were 8 people (47.1%).

Table 5. Prevalence of Uric Acid Categories in Male and Female Workers

Category	Level	Total	Percentage	Category	Level	Total	Percentage
High Male	>7	33	37 %	High Female	>6	33	14%
Normal Male	Normal	28	31%	Normal Female	Normal	112	49%
Less	<7	29	32%				
Total	**90**		**100%**	**Total**		**230**	**100**

This study has almost the same results as previous studies that uric acid levels above normal with a total of 36 respondents (60%) and those who have normal uric acid levels are 24 respondents (40%)16, also the Darmawan et al., 2016 research panel The results of the study obtained 52 office workers as respondents. There were 38 people (79.1%) who had uric acid levels within normal limits and 14 people (26.9%) who had high uric acid levels. The average value of blood uric acid levels was 6.09 mg/dL, the median value was 6.15 mg/dL, the minimum and maximum values were 3 mg/dL and 9 mg/dL and the standard deviation was 1.615 mg/dL. Of the 14 respondents, there was one female (7.1%) while the rest were male (92.9%) (National Cholesterol Education Program, 2022).

Table 6. Results of Data Normality Testing

Variable	Value p (Sig)	Notes
Age	0,052	Normal
Total Cholesterol	0,200	Normal
HDL	0,000	Not Normal
LDL	0,000	Not Normal
Triglycerides	0,000	Not Normal
Blood sugar	0,000	Not Normal
Uric Acid	0,009	Not Normal

Normality test was conducted using Kolmogorov Smirnov Test because data (n) > 50. Of the seven variable items that were tested for normality, only 2 types of data were normally distributed, namely age and total cholesterol or 28.57%, while HDL, LDL triglycerides and uric acid data were not normally distributed. Furthermore, the data was tested for sperm rank correlation.

Table 7. Results of Spearman's Rank Correlation Analysis

Relationship		Value r	Value p	Notes
Age	Total Cholesterol	0,169	0,016*	Significant
	HDL	0,151	0,030*	Significant
	LDL	0,304	0,000*	Significant
	Triglycerides	0,172	0,014*	Significant
	Blood sugar	0,233	0,001*	Significant
	Uric Acid	0,202	0,004*	Significant
Cholesterol Total	HDL	0,375	0,000*	Significant
	LDL	0,223	0,001*	Significant
	Triglycerides	0,121	0,083	Not Significant
	Blood sugar	0,164	0,019*	Significant
	Uric Acid	0,044	0,527	Not Significant
HDL	LDL	0,428	0,000*	Significant
	Triglycerides	0,220	0,002*	Significant
	Blood sugar	0,244	0,000*	Significant
	Uric Acid	0,179	0,010*	Significant
LDL	Triglycerides	0,499	0,000*	Significant
	Blood sugar	0,163	0,020*	Significant
	Relationship	**Value r**	**Value p**	**Notes**
Triglycerides	Uric Acid	0,294	0,000*	Significant
	Blood sugar	0,223	0,001*	Significant
	Uric Acid	0,346	0,000*	Significant
Blood Sugar	Uric Acid	0,191	0,006*	Significant

Table 7 presents the results of the rank correlation test, showing that most variables are correlated with one another, except for cholesterol levels with triglycerides and cholesterol with uric acid. The correlations observed were generally weak but statistically significant. The following relationships were identified: Age with LDL, blood sugar, and uric acid, Total cholesterol with HDL and LDL, HDL with LDL, triglycerides, and blood sugar, LDL with triglycerides, and Triglycerides with blood sugar and uric acid.

DISCUSSION

This study highlights the association between age and cholesterol, blood sugar, and uric acid levels among office workers. Data from the International Labour Organization (ILO), which highlights the Asia-Pacific region as one of the fastest-aging populations globally. The ratio of individuals aged ≥65 to the working-age population (15–64 years) is projected to increase significantly by 2050 compared to current levels.

The subjects' uric acid levels ranged between 2.48-6.45 mg/dl with a mean of 4.36 ± 0.99 SD indicating that of the 40 subjects, 92.5% (n=37) of subjects had normal uric acid levels with uric acid levels between 2.6-6 mg/dl and 5% (n=2) had high uric acid levels above 6 mg/dl. The remaining 2.5% (n=1) had uric acid levels below normal (Siregar dan Sartika, 2020).

Cholesterol levels in the body are closely linked to the high prevalence of obesity in the community and are influenced by lifestyle factors, which can contribute to cardiovascular disease. Physical activity plays a significant role in regulating body fat levels. The intensity of an individual's workload is largely determined by the nature of their daily activities. Office workers with heavier workloads tend to have lower cholesterol levels compared to those with lighter workloads. Individuals with less physically demanding tasks are at greater risk of elevated cholesterol levels (Puspitorini, 2017). Triglyceride levels were mostly normal, aligning with prior studies, though some respondents still showed elevated values. This highlights the importance of lifestyle factors, including dietary intake and physical activity.

Uric acid levels varied by sex, consistent with prior findings where men generally had higher levels than women. This is likely related to hormonal influences and dietary differences. The correlation analysis revealed weak but significant associations between age and several parameters (LDL, blood sugar, uric acid). This aligns with previous research showing age-related metabolic changes, particularly among pre- and post-menopausal women due to hormonal shifts. Interestingly, no significant correlation was found between total cholesterol and triglycerides or between triglycerides and uric acid. However, fasting blood glucose correlated positively with triglycerides, which is consistent with metabolic syndrome pathophysiology. These findings underscore the importance of routine screening for office workers, as many parameters may appear only mildly abnormal but collectively increase the risk of cardiovascular disease. Preventive strategies should emphasize lifestyle modifications, particularly diet and physical activity.

The association between age and LDL, blood sugar, and uric acid levels is consistent with previous research. Age-related increases in LDL are particularly notable among pre- to menopausal females, as declining estrogen levels contribute to hormonal imbalances (Rahayu et. al, 2012). The relationship between total cholesterol, HDL, and LDL is influenced by degenerative processes and increased exposure to harmful agents such as cholesterol, with atherosclerosis playing a key role as age advances (Shah et. al, 2008). The correlations between HDL, LDL, triglycerides, and blood sugar were weak, similar to findings in earlier studies. For instance, one study found that total cholesterol, LDL, and HDL levels were associated with vascular disease (VD), whereas fasting blood glucose (GDP) and triglyceride (TG) levels were not related to the extent of VD in patients with coronary heart disease (CHD) (Siregar dan Sartika, 2020).

The correlation between triglycerides, blood sugar, and uric acid was also weak, with mixed findings across studies. Some research reported no relationship between GDP and total cholesterol or uric acid levels, while others found a significant association between fasting blood sugar and triglyceride levels A very weak correlation was observed in seven variables (33.0%), including: (1) age with total cholesterol, (2) age with HDL, (3) age with triglycerides, (4) total cholesterol with blood sugar, (5) HDL with uric acid, (6) LDL with blood sugar, and (7) blood sugar with uric acid. Although the correlation between age and cholesterol was weak, it remains biologically significant. Cholesterol has been shown to inhibit the activity of the protective protein TGF-beta (transforming growth factor beta), which becomes upregulated in human atherosclerotic plaques. This study also aimed to explore the relationship between age and the consumption of fatty foods in relation to total cholesterol levels. Components of dyslipidemia, including elevated total cholesterol, triglycerides, and LDL, along with reduced HDL, play a critical role in the development of atherosclerosis and cardiovascular disease. Total cholesterol is a key indicator for assessing cardiovascular risk. Hypercholesterolemia often presents without symptoms, underscoring the importance of routine screening and preventive measures for individuals at high risk (Torry et. al, 2012) .

Our findings revealed no statistically significant association between total cholesterol and triglycerides, nor between triglycerides and uric acid. However, fasting blood glucose and triglycerides were positively correlated. These patterns suggest that certain metabolic markers, such as glucose and triglycerides, tend to fluctuate together in this sample, while others do not, indicating potential heterogeneity in underlying biological pathways or variability in measurement and sample characteristics.

CONCLUSIONS

This study found a significant association between age and several blood biochemical indicators, including total cholesterol, HDL, LDL, triglycerides, blood sugar, and uric acid, among office workers. Although the strength of most correlations was weak, the findings reinforce that advancing age contributes to elevated biomarker levels associated with degenerative diseases. These results highlight the importance of routine health monitoring, particularly for individuals in the productive age group and older, to support early detection and prevention of metabolic and degenerative conditions

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