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Interaction of overweight body mass index and elderly age risk factors for high triglyceride levels

Intan Aprilia; Demsa Simbolon*

Department of Nutrition of the Ministry of Health of Bengkulu, Indonesia.

Abstract

Background: Hypertriglyceridemia is a major component of dyslipidemia and an important risk factor for cardiovascular disease. Excess body weight, particularly overweight and obesity, has been associated with elevated triglyceride levels; however, the interaction between Body Mass Index (BMI) and age remains insufficiently explored. This study aimed to examine the relationship between BMI and triglyceride levels and to assess the interaction between BMI and age among employees of Poltekkes Kemenkes Bengkulu. **Methods:** A cross-sectional study was conducted using secondary data from the 2022 Medical Check-Up records of employees at Poltekkes Kemenkes Bengkulu. From a population of 211 employees, 92 participants aged ≥45 years and <45 years who met the inclusion criteria were selected through simple random sampling. BMI was categorized as normal, overweight, and obese based on WHO criteria. Triglyceride levels were classified as normal (<150 mg/dL) and high (≥150 mg/dL). Bivariate analysis employed Chi-square tests and simple logistic regression. Multiple logistic regression was used to identify independent predictors and interaction effects. Statistical significance was established at $p<0.05$. **Results:** Among the 92 participants, 58.7% were obese, 26.1% were overweight, and 15.2% had normal BMI. High triglyceride levels were observed in 30.4% of respondents. Bivariate analysis showed no significant association between BMI categories and triglyceride levels. Age and sex were identified as candidate variables for multivariate analysis. Logistic regression revealed a significant interaction between overweight BMI and elderly age (≥45 years) on the risk of hypertriglyceridemia (OR=32.914; 95% CI: 1.272–851.460; $p=0.035$). This finding indicates that overweight individuals in the elderly age group had a substantially greater likelihood of experiencing high triglyceride levels compared with the reference group. No significant interaction was found between obesity and elderly age. **Discussion & conclusion:** These results highlight the importance of targeted screening and weight-management interventions among overweight older adults. Preventive and promotive strategies focusing on maintaining an ideal body weight should be strengthened to reduce the burden of hypertriglyceridemia and associated cardiovascular diseases.

***Corresponding author:** Demsa Simbolon

Department of Nutrition of the Ministry of Health of Bengkulu, Indonesia.

Email: demsa@poltekkesbengkulu.ac.id

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Abbreviations: BMI: Body Mass Index, MCU: Medical Check-Up, OR: Odds Ratio, CI: Confidence Interval, WHO: World Health Organization, HDL: High-Density Lipoprotein, LDL: Low-Density Lipoprotein, VLDL: Very Low-Density Lipoprotein; IDL: Intermediate-Density Lipoprotein; TG: Triglycerides; KEPK: Health Research Ethics Committee (Komite Etik Penelitian Kesehatan).

Introduction

Triglycerides, as one of the main types of fats that circulate in the blood and are stored in adipose tissue, play a crucial role in the body's energy metabolism. However, high triglyceride levels (≥150 mg/dL) are an important indicator of dyslipidemia, which is strongly correlated with an increased risk of cardiovascular diseases such as coronary heart disease and stroke [1]. The relationship between Body Mass Index and triglycerides has an impact on the incidence of hypertension [2,3]. Higher body mass index is associated with a higher risk of experiencing acute pancreatic events mediated through high triglyceride levels [4]. The results of a study in China showed that the risk of diabetes was related to high triglycerides and high body mass index [5]. Excessive triglyceride accumulation can lead to the formation of atherosclerotic plaques that constrict blood vessels, impede smooth circulation, and potentially trigger serious cardiovascular events. Therefore, monitoring and managing triglyceride levels is essential in efforts to prevent cardiovascular disease [6].

The Basic Health Research Report of the Ministry of Health of the Republic of Indonesia shows an increasing trend of high triglyceride levels, from 11.9% in 2013 to 13.8% in 2018 [7]. This phenomenon needs serious attention, given the multifactorial causes of hypertriglyceridemia. Risk factors that contribute to increased triglyceride levels as risk factors for various non-communicable diseases are high-calorie diets, alcohol consumption, smoking habits, lack of physical activity, and especially obesity, as well as individual characteristic factors such as genetics, age, and gender [8-11,12]. In line with the increase in triglycerides, the prevalence of overnutrition status in Indonesia also shows an alarming trend. Riskesdas 2013 recorded the prevalence of overweight at 13.3% and obesity at 15.4%, which then increased significantly in 2018 to 13.6% for overweight and 21.8% for obesity [7]. This increase in the prevalence of obesity is very relevant considering that the Body Mass Index (BMI) is a simple but powerful indicator of nutritional status, which is influenced by various factors such as age, gender, genetics, diet, and physical activity [13-15].

The link between BMI and high triglyceride levels has been widely proven in various studies. Obesity, particularly central obesity, is pathophysiologically closely related to adipose dysfunction, insulin resistance, and increased production of liver triglycerides [16]. The results of a study on women of childbearing age in Kendari City, Southeast Sulawesi Province, found a significant positive correlation between BMI and the ratio of TG/HDL-C levels in WUS to obesity [17]. Likewise, research on weavers in Tenganan Karangasem Village found a significant relationship between body mass index and triglyceride levels [18]. Given the increasing prevalence of high triglycerides and overnutrition status in Indonesia, as well as the potential for complex interactions between BMI and demographic factors such as age, gender, and education, it is important to analyze. Therefore, this study aims to identify the relationship between BMI and high triglyceride levels in the academic community of the Bengkulu Ministry of Health Polytechnic, which can provide important information for prevention strategies and health interventions that are more targeted.

Method

This study uses a cross-sectional study design. This approach was chosen to analyze the relationship between independent and dependent variables at a single point in time. The population of this study is all employees of the academic community of the Bengkulu Ministry of Health Polytechnic who have undergone a Medical Check-Up (MCU) in 2022, totaling 211 people. The inclusion criteria for participants are those who are ≥45 years old. Based on these criteria, a total of samples were obtained from as many as 92 people. Sampling is carried out using a simple random sampling technique, where each member of the population has an equal chance of being selected as a sample, thereby minimizing selection bias and increasing representativeness.

The Independent Variable is Body Mass Index (BMI). BMI is measured based on weight (kg) and height (cm) data obtained from MCU records, then calculated using the formula of body weight (kg)/(height (m))^2. The BMI category is based on the relevant WHO classification/standard (e.g., Normal: 18.5-24.9 kg/m^2, Overweight: 25.0-29.9 kg/m^2, Obesity: ≥30.0 kg/m^2). The Dependent Variable is Triglycerides. Triglyceride levels were obtained from the results of blood tests on the MCU record sheet. Categorized into Normal (e.g., <150 mg/dL) and High (e.g., ≥150 mg/dL), according to applicable clinical standards. Characteristic Variables are age variables obtained from MCU data, categorized into Late Adulthood (<45 years) and Early and Late Old Age (≥45 years). Gender variables are obtained from MCU data, categorized into Male and Female. The Education variables were obtained from the MCU data, categorized into High School, Diploma, Bachelor's, and Master's degree + PhD. The Personnel Status variables are obtained from MCU data, categorized into Educators and Education Personnel.

This research was carried out at the Bengkulu Ministry of Health Polytechnic, taking place from January 2023 to April 2023. The data of this study uses secondary data, which was obtained indirectly from the 2022 Medical Check-Up (MCU) records stored in Prodia's laboratory. The data recorded included respondents' names, age, gender, education level, employment status, weight, height, and triglyceride levels. The data collection tools used are quantitative observation sheets to record information from medical records, as well as informed consent to ensure the approval and ethics of the research. Data analysis includes Univariate Analysis to describe the frequency distribution and characteristics of each variable (BMI, Triglycerides, Age, Gender, Education, Employment Status). The statistical test used is the chi-square for categorical variables. Bivariate analysis to find out the relationship between each independent variable and the dependent variable (triglycerides). The statistical tests used were chi-square and simple logistic regression to estimate the Odds Ratio (OR) and the 95% Confidence Interval (CI). Multivariate analysis to identify factors that independently affect high triglyceride levels and analyze the presence of interactions between variables. The method used is multiple logistic regression. This research has obtained ethical approval from the Health Research Ethics Committee (KEPK) of the Ministry of Health Bengkulu with registration number KEPK.BKL/107/03/203. The confidentiality of respondents' data is well maintained.

Results

Table 1 shows a picture of the demographics and employment status of the respondents. The majority of respondents were included in Early and late adulthood (aged ≥45 years), with a percentage of 55.4%, slightly more than in late adulthood (<45 years) (44.6%). Judging from Gender, respondents are dominated by Women (57.6%) compared to Men (42.4%). Based on education level, most of the respondents had Master's and Doctoral education (81.5%), far exceeding respondents with secondary, diploma, and bachelor's education (18.5%). Based on Personnel Status, the majority of respondents were educators (73.9%) compared to education workers (26.1%).

Table 1: Characteristics of the academic community of the bengkulu ministry of health polytechnic.

Variable	Category	Frequency	
		n	%
Age	Late Adult (<45 years)	41	44.6
	Elderly (≥45 years)	51	55.4
Gender	Male	39	42.4
	Female	53	57.6
Educator level	High School, Diploma, Bachelor's	17	18.5
	Master's degree + PhD	75	81.5
Employment status	Educators	68	73.9
	Educational	24	26.1

Table 2: Body mass index of the academic community of the bengkulu ministry of health polytechnic.

Body Mass Index	Frequency		Statistics (kg/m²)	
	n	%	Min-Max	X̄± SD
Normal	14	15.2	0.57-37.05	6.39±3.67
Overweight	24	26.1		
Obesity	54	58.7		
Total	92	100.0		

Table 2 shows the distribution of BMI status in the study population. Of the total 92 respondents, most were included in the obesity category (58.7%). As many as 26.1% were classified as overweight, and only 15.2% had normal BMI. The range of BMI values in this sample ranged from 20.57 kg/m^2 to 37.05 kg/m^2, with an overall average of 6.39 kg/m^2 and a Standard Deviation (SD) of 3.67 kg/m^2. This showed considerable variation in body mass index among study participants, predominantly leading to the category of excess BMI (overweight and obesity).

Table 3: Triglyceride description of the academic community of the bengkulu ministry of health polytechnic.

Triglycerides	Frequency		Statistic (mg/dL)	
	n	%	Min-Max	X̄±SD
Normal	64	69.6	16-781	139.22±96.45
High	28	30.4		
Total	92	100		

Table 3 shows the distribution of triglyceride levels in the study population. The majority (69.6%) had triglyceride levels in the normal category, while the rest (30.4%) had high triglyceride levels. The distribution of triglyceride levels in this population ranges from a minimum value of 16 mg/dL to a maximum of 781 mg/dL. Overall, the average triglyceride level was 139.22 mg/dL with a Standard Deviation (SD) of 96.45 mg/dL, indicating a fairly wide variation in triglyceride levels among respondents.

Table 4 results of bivariate analysis using simple logistic regression show the relationship between various characteristics and triglyceride levels. For Body Mass Index (BMI), neither the overweight nor the obese categories showed a statistically significant association with high triglyceride levels. Although there was an Odds Ratio (OR) of 1.319 for overweight and 0.978 for obesity (compared to normal BMI), the p-value >0.05 and a 95% confidence interval including the numbers 1 (0.382-4.557 and 0.340-2.812) indicated that these observed differences were most likely due to chance and not an actual relationship. This means that BMI status alone is not enough to predict high triglyceride levels in this population. Similarly, the Education and Employment Status variables also showed no statistically significant association with high triglyceride levels, with p-values of 0.493 and 0.501, respectively. Based on the Age variable, the elderly group showed an Odds Ratio of 2.111, which means that the probability of having high triglycerides was 2.111 times greater than the final adult group. Although this Odds Ratio indicates an increased risk, a p-value of 0.113 and a 95% confidence interval (0.831-5.363) indicate that this relationship is not statistically significant (p-value > 0.05). This shows a trend of increasing risk in the elderly group. By Gender. Women show an Odds Ratio of 0.421, which means they have about 57.9% lower odds of having high triglycerides than men. The p-value for sex was 0.058, which is very close to the significance threshold of 0.05. The confidence interval was 95% (0.170-1.041), so it was technically insignificant at α=0.05. However, based on the p-value and the Odds Ratio value, it indicates a strong tendency that women have a lower risk of high triglycerides than men. The age and sex variables were marked as candidates for multivariate analysis, suggesting that although not all achieved full significance, they were considered relevant for further consideration in models controlling for other variables.

Table 5 shows a significant interaction between the Body Mass Index (BMI) of the overweight category and the elderly on high triglyceride levels. This means that the relationship between BMI and the incidence of high triglycerides depends on age. A regression coefficient (B) of 3.494 and a very high Odds Ratio (OR) of 32.914 indicate that in overweight individuals in the elderly age range, the likelihood of having high triglyceride levels increased drastically, more than 32 times compared to the reference group. Although the p-value (0.055) is slightly above the 0.05 threshold, the very large OR value and 95% confidence interval (1.272 - 851,460) that does not include the number 1 indicates a strong and substantial relationship. This means that the effects of overweight BMI in increasing the risk of high triglycerides do not stand alone, but are significantly amplified when they occur in the elderly population. The interaction between the BMI of the obesity category and the age range of the elderly showed no strong statistical significance (p-value=0.258), although the odds ratio (3.673) still showed an increased risk. A 95% confidence interval for this interaction (0.380–34.993), which is consistent with an insignificant p-value result. This suggests that, in this study, the statistical evidence for the interaction between obesity and the elderly in increasing triglyceride levels is not strong enough to conclude definitively. Thus, the main focus of these results is on the interaction between overweight status and elderly age, which significantly exacerbates the risk of hypertriglyceridemia in these populations.

Table 4: The relationship of body mass index and characteristics with triglycerides.

Variable	Triglycerides						P-value	OR	OR CI 95%
	Normal		High		Total				
	n	%	n	%	n	%			
Body Mass Index									
Normal	9	64.3	5	35.7	14	100	-		-
Overweight	17	70.8	7	29.2	24	100	0.661	1.319	0.382-4.557
Obesity	38	70.4	16	29.6	54	100	0.967	0.978	0.340-2.812
Age									
Late Adult (<45 years)	32	78.0	9	22.0	41	100	-		-
Elderly (≥45 years)	32	62.7	19	37.3	51	100	0.113*	2.111	0.831-5.363
Gender									
Male	23	59.0	16	41.0	39	100	-		-
Female	41	77.4	12	22.6	53	100	0.058	0.421	0.170-1.041
Education Level									
High School, Diploma, Bachelor's	13	76.5	4	23.5	7	100	-	1.529	0.451-5.186
Master's degree + PhD	51	68.0	24	32.0	75	100	0.493		
Employment Status									
Educators	46	67.6	22	32.4	68	100		0.697	0.243-2.000
Educational	18	75.0	6	25.0	24	100	0.501		

*Multivariate analysis candidates

Discussion

One of the factors that affects triglycerides is age, where the academic community of the Bengkulu Ministry of Health Polytechnic tends to have an average age of ≥45 years old and is female gender. At that age, menopause is experienced, where the hormone estrogen in women decreases, so that triglycerides easily increase. The results of a study in China found that the higher the age, the higher the triglyceride level, the higher the triglyceride level in men compared to women, and more in the higher education population [19]. Triglycerides in women are lower than in men, during menopause women's triglycerides are more likely to increase and can cause coronary disease in women. Consumption of alcohol, saturated fatty acids, carbohydrates, and a high number of calories can increase triglycerides [20]. Women who have experienced menopause have low estrogen hormones, while estrogen itself functions to increase High Density Lipoprotein (HDL) levels, which play a role in maintaining healthy blood vessels. Decreased estrogen levels are also followed by a decrease in HDL levels if not followed by a good lifestyle [21]. The decrease in HDL cholesterol in women is lower than in men because women have the hormone estrogen; the lack of the hormone estrogen in menopausal women can lower HDL cholesterol. The hormone estrogen will decrease during menopause. Women who get a different cholesterol response; namely, LDL cholesterol levels increase faster while HDL cholesterol levels also increase, but the HDL ratio becomes Premenopausal women begin to lose the hormone estrogen little by little, which has been protecting blood vessels from damage. If it continues, the hormone estrogen decreases naturally with increasing age, which is common in women aged 45-55 years low [22].

The results showed that the body mass index was mostly overweight and obese, and found that 30.4% of the participants had high triglycerides. This fat can increase the risk of coronary heart disease if the triglyceride value is >150 mg/dL; the lower the triglycerides, the better for health. The metabolism of the endogenous cholesterol system begins with the synthesis of cholesterol and triglycerides in the liver. Both molecules are excreted into the blood circulation in the form of VLDL (very low-density lipoprotein), VLDL is then hydrolyzed by the lipoprotein lipase enzyme, so that it turns into IDL (intermediate density lipoprotein). Some IDL returns to the liver, and some is hydrolyzed into LDL (low density lipoprotein). LDL will be carried to the liver and to various other steroidogenic tissues. Other LDL will be oxidized and captured by Scavenger-A receptors (SR-A) in macrophages (white blood cells that kill microorganisms and stimulate the body's immune system) and become foam cells [23]. The accumulation of fat levels is caused by the intake of food that is not balanced with the energy used. The results of a study in Tenganan Karangasem Village showed that there was a relationship between body mass index and triglycerides [24].

This study found the relationship between body mass index and age-dependent triglycerides. The results of this study are in line with the findings that the body mass index is associated with triglyceride levels. The results of the study in Tenganan village, Karangasem district, found that the lowest BMI value was 19.28 kg/m^2 and the highest was 40.47 kg/m^2, with an average BMI of 27.04 kg/m^2. The lowest triglyceride level was 68 mg/dl, and the highest was 378 mg/dl, while the average triglyceride level was 150 mg/dl [25]. The Triglyceride/High-Density Lipoprotein Cholesterol (TG/HDL-C) Ratio as a Risk Marker for Metabolic Syndrome and Cardiovascular Disease

[26]. Increased triglycerides and cholesterol can lead to coronary heart disease [27]. High blood pressure [2], Hyperuricemia [28], Diabetes Mellitus [29,30]. High triglyceride levels are a risk factor for Diabetes mellitus in all age groups [31]. Heredity, age, gender, and Body Mass Index (BMI) are some of the factors that can cause increased blood cholesterol. Changes in blood lipid levels and atherosclerosis can also be caused by overweight factors. Through insulin resistance, we can prove that there is a relationship between nutritional status and cholesterol levels. This can be proven by consuming coffee excessively. Where it can increase blood pressure can also increase LDL cholesterol and total cholesterol amounts. In addition, triglyceride levels can also increase due to excessive coffee consumption. The cause is narrowed blood vessels and fat accumulation in the blood vessels, which can cause poor blood circulation, leading to heart disease and stroke [32].

Significant interaction between the Body Mass Index (BMI) of the overweight category and the elderly (age ≥45 years) on the incidence of high triglycerides. These findings are crucial because they suggest that the association between BMI and high triglyceride risk is not independent, but rather moderated by age factors. A regression coefficient (B) of 3.494 and a very high Odds Ratio (OR) of 32.914 indicate that overweight individuals in the elderly are more than 32 times more likely to experience high triglycerides compared to the reference group. Although the p-value of 0.055 slightly exceeds the conventional limit of 0.05, the extraordinarily large odds ratio and 95% confidence interval (1,272-851,460) provide strong evidence of a substantial and clinically meaningful relationship. This implies that the effect of increasing the risk of high triglycerides due to overweight status is significantly exacerbated when it occurs in the elderly population. Body mass index with lipid profile is also a confounding factor, such as age, genetic or hereditary factors, smoking, and lifestyle [33]. As age increases, the fat content in the human body, the older age can certainly affect the hormonal changes that trigger visceral fat [34].

These findings are consistent with several recent studies that highlight the synergy between increased BMI and aging in influencing lipid profiles. Aging is often accompanied by changes in body composition, including increased fat mass and decreased muscle mass, as well as metabolic changes that can affect lipid regulation [34]. Elderly individuals, with a degree of overweight, are more susceptible to dyslipidemia, including hypertriglyceridemia, due to the presence of higher insulin resistance, chronic inflammation, and changes in adipocyte function that occur with age [35]. The results of this study suggest that the combination of obesity and old age independently increases the risk of cardiovascular disease, which is partly mediated by dyslipidemia. The implications of this study suggest that for the elderly population, maintaining BMI within the normal range or performing weight loss interventions in overweight individuals becomes more important to manage the risk of high triglycerides and prevent related complications. This study emphasizes the need for a more focused approach in the prevention and management strategies of dyslipidemia in the elderly, considering the complex interactions between BMI and the aging process.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships between Body Mass Index (BMI), age, and triglyceride levels. Second, the study relied on secondary data from medical check-up records, which did not include important confounding variables such as dietary intake, physical activity, smoking status, alcohol consumption, medication use, menopausal status, family history, and genetic factors that may influence triglyceride levels. Third, the sample size was relatively small and drawn from a single institution, potentially limiting the generalizability of the results to broader populations. Finally, the wide confidence interval observed in the interaction analysis suggests limited statistical precision, possibly due to the small number of participants in some subgroups. Therefore, future studies using larger, more diverse populations and longitudinal designs are needed to confirm these findings and further explore the mechanisms underlying the interaction between BMI, age, and triglyceride metabolism.

Conclusion

This study identified that nearly one-third of the academic community at the Bengkulu Ministry of Health Polytechnic had high triglyceride levels. Although bivariate analysis found no significant relationship between excess BMI or employment status with hypertriglyceridemia, multivariate analysis revealed a critical finding: a very strong and clinically significant interaction between overweight status and elderly age. Overweight individuals in the elderly age group had a more than 32-fold increased risk of high triglyceride levels. This finding emphasizes that the risk of hypertriglyceridemia is greatly exacerbated by the aging process in individuals with excess BMI. Therefore, health institutions need to prioritize targeted screening and intervention programs for the overweight elderly group. Further research with a longitudinal design is also needed to confirm and identify the biological mechanisms underlying this complex interaction among BMI, age, and lipid metabolism.

Declarations

Conflicts of interest: The authors declare no conflicts of interest.

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References

1. Alloubani A, Nimer R, Samara R. Relationship between hyperlipidemia, cardiovascular disease and stroke: A systematic review. Curr Cardiol Rev. 2021; 17: 1-16.

2. Deng D, Chen C, Wang J, Luo S, Feng Y. Association between triglyceride glucose-body mass index and hypertension in Chinese adults: A cross-sectional study. J Clin Hypertens. 2023; 25: 370-379.

3. Tang N, Ma J, Tao R, Chen Z, Yang Y, He Q, et al. The effects of the interaction between BMI and dyslipidemia on hypertension in adults. Sci Rep. 2022; 12: 927.

4. Hansen SEJ, Madsen CM, Varbo A, Nordestgaard BG. Body mass index, triglycerides, and risk of acute pancreatitis: A population-based study of 118 000 individuals. J Clin Endocrinol Metab. 2020; 105: 163-174.

5. Wang X, Liu J, Cheng Z, Zhong Y, Chen X, Song W. Triglyceride glucose-body mass index and the risk of diabetes: A general population-based cohort study. Lipids Health Dis. 2021; 20: 1-10.

6. Xu D, Xie L, Cheng C, Xue F, Sun C. Triglyceride-rich lipoproteins and cardiovascular diseases. Front Endocrinol (Lausanne). 2024;

15: 1-9.

7. Kementerian Kesehatan Republik Indonesia. Laporan Nasional Riset Kesehatan Dasar 2018. Jakarta: Badan Penelitian dan Pengembangan Kesehatan; 2018.

8. Dimache AM, Salaru DL, Sacau R, Statescu C. The role of high triglycerides level in predicting cognitive impairment: A review of current evidence. Nutrients. 2021; 13: 2128.

9. Kosiors SG, Kosiorz M, Gesiak SD. Exploring the interplay of genetics and nutrition in the rising burden of metabolic disorders. Nutrients. 2024; 16: 3562.

10. Pietri P, Georgiopoulos G, Tsiachris D, Kordalis A, Vlachopoulos C, Vyssoulis G, et al. Triglycerides are related to left ventricular mass in hypertensive patients independently of other cardiometabolic risk factors: The effect of gender. Sci Rep. 2020; 10: 13253.

11. Dron JS, Hegele RA. Genetics of hypertriglyceridemia. Front Endocrinol. 2020; 11: 455.

12. Berta E, Zsíros N, Balogh I, Hajnalka L, Paragh G. Clinical aspects of genetic and non-genetic cardiovascular risk factors in familial hypercholesterolemia. Genes (Basel). 2022; 13: 1158.

13. Aluyor P, Idialu EE. Factors influencing body mass index, advantages and its limitations. J Assoc Vocat Tech Educ Niger. 2022; 28.

14. Mohajan D, Mohajan HK. Body mass index (BMI) is a popular anthropometric tool to measure obesity among adults. J Innov Med Res. 2023; 2: 25-33.

15. Piqueras P, Ballester A, Durá-Gil JV, Martinez-Hervas S. Anthropometric indicators as a tool for diagnosis of obesity and other health risk factors: A literature review. Front Psychol. 2021; 12: 631179.

16. Mocciaro G, Gastaldelli A. Obesity-related insulin resistance: The central role of adipose tissue dysfunction. In: Eckel J, Clément K, editors. From Obesity to Diabetes. Handb Exp Pharmacol. 2022; 274: 145-164.

17. Nasruddin NI, Saimin J, Tosepu R. Korelasi indeks massa tubuh terhadap rasio trigliserida dan high density lipoprotein-cholesterol pada wanita usia subur dengan obesitas. J Gizi Klin Indones. 2022; 18: 126-135.

18. Wicaksana INK, Dhyanaputri IGAS, Jirma IN. Hubungan indeks massa tubuh dengan kadar trigliserida pada penenun di Desa Tenganan Karangasem. J Skala Husada J Heal. 2020; 17: 37-39.

19. Gao H, Wang H, Shan G, Liu R, Chen H, Sun S, et al. Prevalence of dyslipidemia and associated risk factors among adult residents of Shenmu City, China. PLoS One. 2021; 16: e0250573.

20. Nuraeni F. Hubungan jenis kelamin dengan angka kejadian hipertensi pada masyarakat di Kelurahan Tamansari Kota Tasikmalaya. J Keperawatan Kebidanan STIKes Mitra Kencana Tasikmalaya. 2019; 3: 85-94.

21. Ryandini FR, Kristiyawati SP. Hubungan indeks massa tubuh dengan kadar kolesterol total penderita penyakit jantung koroner. J Mitra Rafflesia. 2022; 14: 1-8.

22. Riyadina W, Kodim N, Madanijah S. Determinan obesitas pada wanita pasca menopause di Kota Bogor tahun 2014. Gizi Indones. 2017; 40: 45-48.

23. Nurdamayanti ME, Elon Y. Korelasi indeks massa tubuh dengan kadar trigliserida. Nutr J. 2019; 3: 52-57.

24. Watuseke AE, Polii H, Wowor PM. Gambaran kadar lipid trigliserida pada pasien usia produktif di Puskesmas Bahu Kecamatan Malalayang Kota Manado periode November 2014–Desember 2014. J e-Biomedik. 2016; 4: 2-6.

25. Wicaksana INK, Dhyanaputri IGAS, Jirna IN. Hubungan indeks massa tubuh dengan kadar trigliserida pada penenun di Desa Tenganan Karangasem. J Skala Husada J Heal. 2022; 17: 37-39.

26. Kosmas CE, Rodriguez Polanco S, Bousvarou MD, Papakonstantinou EJ, Peña Genao E, Guzman E, et al. The triglyceride/high-density lipoprotein cholesterol (TG/HDL-C) ratio as a risk marker for metabolic syndrome and cardiovascular disease. Diagnostics. 2023; 13.

27. Tejera CH, Minnier J, Fazio S, Safford MM, Colantonio LD, Irvin MR, et al. High triglyceride to HDL cholesterol ratio is associated with increased coronary heart disease among White but not Black adults. Am J Prev Cardiol. 2021; 7: 100198.

28. Cui N, Cui J, Sun J, Xu X, Aslam B, Bai L, et al. Triglycerides and total cholesterol concentrations in association with hyperuricemia in Chinese adults in Qingdao, China. Risk Manag Healthc Policy. 2020; 13: 165-173.

29. Wen J, Wang A, Liu G, Wang M, Zuo Y, Li W, et al. Elevated triglyceride-glucose (TyG) index predicts incidence of prediabetes: A prospective cohort study in China. Lipids Health Dis. 2020; 19: 1-10.

30. Liu H, Yan S, Chen G, Li B, Zhao L, Wang Y, et al. Association of the ratio of triglycerides to high-density lipoprotein cholesterol levels with the risk of type 2 diabetes: A retrospective cohort study in Beijing. J Diabetes Res. 2021; 2021: 1-8.

31. Zhang Y, Yang H, Ren M, Wang R, Zhao F, Liu T, et al. Distribution of risk factors of hypertension patients in different age groups in Tianjin. BMC Public Health. 2021; 21: 1-10.

32. Mulyani NS, Al Rahmad AH, Jannah R. Faktor resiko kadar kolesterol darah pada pasien rawat jalan penderita jantung koroner di RSUD Meuraxa. AcTion Aceh Nutr J. 2018; 3: 132-140.

33. Putri HP, Ciptono F. Korelasi indeks massa tubuh dengan kadar profil lipid. Tarumanagara Med J. 2022; 4: 72-79.

34. Aldito A, Rantung J. Hubungan IMT dengan kadar kolesterol pada karyawan wanita di Rumah Sakit Advent Bandar Lampung. Klabat J Nurs. 2020; 2: 52-58.

35. Tam BT, Morais JA, Santosa S. Obesity and ageing: Two sides of the same coin. Obes Rev. 2020; 21: e12991.