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LITERATURE REVIEW

DIFFERENCES IN HDL AND TRIGLYCERIDE LEVELS IN OBESE AND NORMAL WEIGHT PATIENTS WITH METABOLIC SYNDROME: A LITERATURE REVIEW

(PERBEDAAN KADAR HDL DAN TRIGLISERIDA PADA PASIEN OBESITAS DAN BERAT BADAN NORMAL DENGAN SINDROM METABOLIK)

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ABSTRACT

Metabolic Syndrome (MS) is a cluster of complex metabolic disorders characterized by central obesity, insulin resistance, dyslipidemia, and hypertension, which collectively increase the risk of cardiovascular disease. One important indicator of dyslipidemia is the *triglyceride-to-high-density lipoprotein* (HDL) ratio, where elevated triglycerides and reduced HDL levels reflect an imbalance in lipid metabolism. The risk of MS is not only found in obese individuals but also in those with normal body weight (metabolically obese normal-weight individuals), indicating that visceral fat distribution, genetic factors, and lifestyle also play a role. This literature review aims to examine differences in HDL and triglyceride levels in MS patients with obesity and normal body weight. Articles were searched through PubMed, DOAJ, Google Scholar, and GARUDA databases within the last 10 years using relevant keywords. Of the 18 articles that met the inclusion criteria, the review showed a consistent pattern indicating that individuals with MS, whether in the obese or normal-weight groups, exhibited elevated triglyceride levels accompanied by significantly reduced HDL levels. These findings highlight that lipid abnormalities represent a central mechanism in MS that contributes to the risk of atherosclerosis and cardiovascular disease, regardless of body weight status. In conclusion, this review demonstrates that there are differences in triglyceride and HDL levels among MS patients with obesity and those with normal body weight, suggesting that lipid profile evaluation should be a primary focus in cardiometabolic disease prevention strategies.

Keywords: dyslipidemia, *high-density lipoprotein* (HDL), obesity, metabolic syndrome, triglycerides

ABSTRAK
Sindrom Metabolik (SM) merupakan kumpulan gangguan metabolik yang kompleks, ditandai dengan obesitas sentral, resistensi insulin, dislipidemia, dan hipertensi yang secara bersama meningkatkan risiko penyakit kardiovaskular. Salah satu indikator penting dislipidemia adalah rasio trigliserida terhadap High Density Lipoprotein (HDL) yaitu peningkatan trigliserida dan penurunan HDL mencerminkan ketidakseimbangan metabolisme lipid. Risiko SM tidak hanya ditemukan pada individu obesitas, tetapi juga pada individu dengan berat badan normal (metabolically obese normal weight), yang menunjukkan bahwa distribusi lemak viseral dan faktor genetik serta gaya hidup turut berperan. Telaah literatur ini bertujuan menelaah perbedaan kadar HDL dan trigliserida pada pasien SM dengan obesitas maupun berat badan normal. Pencarian artikel dilakukan melalui basis data PubMed, DOAJ, Google Scholar, dan GARUDA pada publikasi 10 tahun terakhir menggunakan kata kunci yang relevan. Dari 18 artikel yang memenuhi kriteria, hasil telaah menunjukkan pola konsisten bahwa individu dengan SM, baik pada kelompok obesitas maupun berat badan normal, mengalami peningkatan kadar trigliserida disertai penurunan kadar HDL yang signifikan. Temuan ini menegaskan bahwa abnormalitas lipid merupakan mekanisme sentral dalam SM yang berkontribusi terhadap risiko aterosklerosis dan penyakit kardiovaskular, terlepas dari status berat badan. Simpulan dari telaah ini adalah terdapat perbedaan kadar trigliserida dan HDL pada pasien SM obesitas maupun berat badan normal, sehingga evaluasi profil lipid perlu menjadi fokus utama dalam strategi pencegahan penyakit kardiometabolik.

Kata Kunci: dislipidemia, high-density lipoprotein (HDL), obesitas, sindrom metabolik, trigliserida

INTRODUCTION

Metabolic Syndrome (MS) is a complex metabolic disorder associated with obesity, insulin resistance, dyslipidemia, and hypertension, and is recognized as a major risk factor for cardiovascular disease.[123] Epidemiological data indicate that the global prevalence of MS is approximately 20–25%.[4] The current diagnostic criteria for metabolic syndrome refer to those established by the World Health Organization (WHO), the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III, and the International Diabetes Federation (IDF), which include central obesity, hypertriglyceridemia, hypertension, hyperglycemia, and microalbuminuria.[5] The diagnostic parameters for metabolic syndrome consist of elevated triglycerides (>150 mg/dL), low HDL cholesterol levels (men <40 mg/dL, women <50 mg/dL), central obesity (waist circumference >102 cm in men, >88 cm in women), fasting blood glucose >110 mg/dL, and blood pressure >130/85 mmHg. One of the primary causes of metabolic syndrome is an unhealthy modern lifestyle. Obesity, defined as an excessive accumulation of body fat, is classified by the WHO for Asian populations as a body mass index (BMI) ≥30. [6,7]

Waist circumference is an indicator of the risk of insulin resistance and metabolic syndrome.[8,9] Blood lipid profiles consist of High-Density Lipoprotein (HDL), cholesterol, Low-Density Lipoprotein (LDL), and triglycerides. Low levels of HDL cholesterol are a strong risk factor for cardiovascular disease and metabolic syndrome. The triglyceride/HDL ratio is used as an indicator of metabolic syndrome and insulin resistance. [10,11] Individuals with metabolic syndrome have a higher risk of developing cardiovascular disease. At present, the risk of metabolic syndrome is observed not only in individuals with obesity but also in those with normal body weight, making it an emerging public health concern. [12] This article aims to determine the relationship between HDL cholesterol and triglyceride levels in metabolic syndrome patients who are obese compared with those who have normal body weight.

MATERIAL AND METHODS

The research method used was a narrative review, with literature searches conducted through Google Scholar, PubMed, DOAJ, and GARUDA databases. From a total of 59 articles published within the last 10 years, 18 relevant articles were selected and summarized for analysis.

DISCUSSION

The analysis results indicate that 18 publications were identified as relevant to the study topic. All retrieved sources reported findings by combining, analyzing, and reviewing research data from multiple previous studies. A summary of the analysis results is provided in Table 1.

Table 1 Summary of literature on HDL and triglyceride levels in metabolic syndrome among individuals with obesity and normal body weight

References	Years	Title	Methods	Results
Narasimha GV.et.al.	2017	Metabolic syndrome: a rising epidemic: comprehensive review	Comparative Analysis	Metabolic syndrome (MS) is characterized by obesity, insulin resistance, dyslipidemia, hyperglycemia, and hypertension, all of which increase cardiovascular risk.
Siwalima et.al.	2021	Education and Early Detection of Metabolic Syndrome	Literature Review	A total of 29 out of 50 participants (58%) were diagnosed with MS, with an average blood pressure of 148/94 mmHg, a fasting glucose level of 158 mg/dL, and a triglyceride level of 198 mg/dL.
Kawalec A	2019	Analysis of the body composition of young adults and the frequency of occurrence of so-	Comparative Study	Obesity is caused by an unhealthy modern lifestyle, including lack of

References	Years	Title	Methods	Results
		called normal weight obesity		physical activity, poor dietary patterns, and irregular or excessive eating.
Sutanto K .et.al.	2019	The Relationship Between Central Obesity and the Incidence of Dyslipidemia Among Employees Visiting the Polyclinic of the Faculty of Medicine, Tarumanagara University	Online Survey	There is a significant association between central obesity and dyslipidemia.
Suliga E et.al.	2016	Prevalence of metabolic syndrome in normal weight individuals	Observational and Interventional Study	Individuals with central obesity show increased levels of total cholesterol, LDL, and triglyceride, as well as decreased HDL levels.
Kusumaningnastiti B et.al.	2019	Body Type (Somatotype) and Metabolic Syndrome in Non-Obese Adult Women Aged 25–40 Years	Observational Study	Individuals with normal-weight remain at risk of developing MS; therefore, monitoring blood pressure, blood glucose, lipid profiles, and waist circumference is essential.
Indrayanti et.al.	2019	Obesity Is Associated with Lipid Status in Patients with Coronary Heart Disease at the Cardiology Clinic of Bahteramas General Hospital, Southeast Sulawesi ProvincE	Descriptive-Analytical Study	A correlation exists between endomorphic body type and metabolic syndrome score, in which higher endomorphy corresponds to a higher metabolic syndrome score.
Yuliadewi et.al.	2020	Lipid Profile and Dyslipidemia in Obese Adolescents in Denpasar City, Bali, Indonesia	Descriptive-Analytical and Observational Study	Most patients with coronary heart disease are obese, showing an association between obesity and lipid abnormalities in this population.
Aswania et.al.	2020	Dyslipidemia as a Predictor of Major Cardiovascular Events in Patients with Acute Myocardial InfarctioN	Analytical Observational Study	The majority of individuals with dyslipidemia presents with elevated total cholesterol, low HDL levels, and high LDL levels.
Shi TH et.al.	2020	The influence of metabolic syndrome in predicting mortality risk among US adults: Importance of metabolic syndrome even in adults with normal weight	Online Survey	Dyslipidemia acts as a major predictor of cardiovascular events in patients with acute myocardial infarction.
Luscher et.al.	2018	Epidemiology of Cardiovascular Disease: The New ESC Atlas and Beyond	Epidemiological Study	MS is a risk factor for mortality in both normal-weight and obese adults.

References	Years	Title	Methods	Results
Rojas et.al.	2020	Diagnostic criteria and management of metabolic syndrome: Evolution over time	Literature Study	MS increases cardiovascular risk through obesity, dyslipidemia, hypertension, insulin resistance, and changes in HDL and triglyceride levels.
Xu H et.al.	2019	Etiology of metabolic syndrome and dietary intervention	Descriptive-Analytical Study	Approximately 30% of the global population has MS, with 2–3 times higher morbidity and mortality risk than healthy individuals.
Pluta et.al.	2022	Metabolic Obesity in People with Normal Body Weight (MONW)	Literature Review	MS has a major impact on the development of diabetes and cardiovascular disease (CVD).
Annabel et.al.	2017	Prevalence of Metabolic Syndrome and its Individual Features Across Different (Normal, Overweight, Pre-Obese and Obese) Body Mass Index (BMI) Categories in a Tertiary Hospital in Philippines	Retrospective Study	The diagnosis of metabolically obese normal-weight (MONW) individuals begins with anthropometric assessment, particularly measurements of waist circumference and evaluations of body fat distribution.
Jennifer et.al.	2019	Metabolic syndrome identifies normal weight insulin-resistant stroke patients at risk for recurrent vascular disease	Cohort Study	Among individuals with normal BMI, hypertension and high fasting glucose are the most common findings, while central obesity is present in approximately 7.3% of cases.
Puspaseruni et.al.	2021	Management of Dyslipidemia Related to Atherosclerotic Cardiovascular Disease (ASCVD): Focus on LDL-c Reduction	Observational Study	Metabolic syndrome in normal-weight individuals indicates insulin resistance without diabetes, yet still contributes to an increased risk of cardiovascular disease.

Metabolic syndrome may increase the risk of cardiovascular disease and type 2 diabetes mellitus, both of which contribute to a higher risk of mortality.[13,14,15] Several factors play a role in the development of metabolic syndrome, including overweight, obesity, physical inactivity, genetic predisposition, and insulin resistance.[16]

In dyslipidemia, the primary lipid abnormalities include elevated levels of low-density lipoprotein (LDL) and triglycerides, along with decreased levels of high-density lipoprotein (HDL).[17] High-Density Lipoprotein plays an important role in removing lipid deposits from blood vessels by transporting cholesterol from cells to the liver for excretion.[18,19]

Metabolic syndrome is triggered by insulin resistance resulting from obesity, physical inactivity, and visceral fat accumulation, all of which lead to inflammation,

hypertension, and an increased risk of cardiovascular disease.[20]

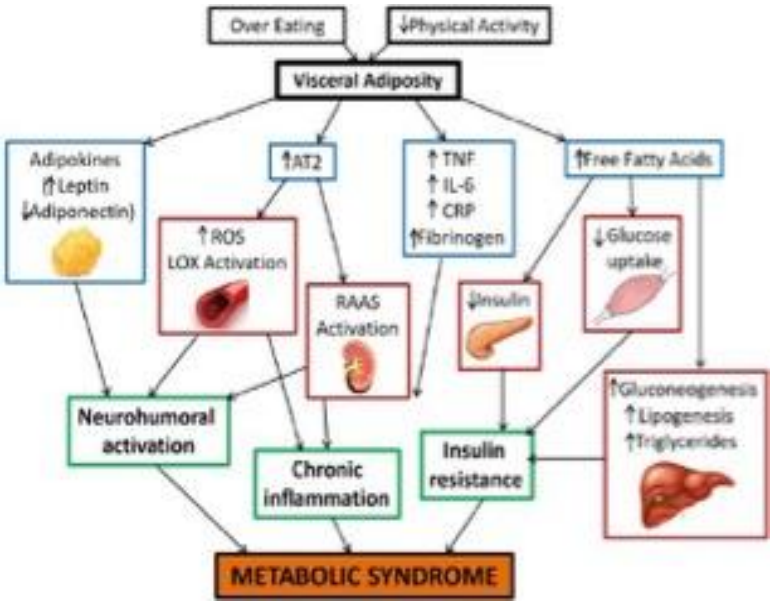

Figure 1 Pathophysiology of Metabolic Syndrome.[21]

The risk factors for metabolic syndrome are divided into modifiable factors, such as smoking, alcohol consumption, poor dietary habits, and physical inactivity and non-modifiable factors, including age, sex, and genetic predisposition.[22,23] Lifestyle modification combined with pharmacological interventions is recommended to reduce the risk of cardiovascular diseases.[16,22,24]

The JNC 7 recommends the DASH (Dietary Approaches to Stop Hypertension) diet, which is rich in vegetables, fruits, low-fat dairy products, whole grains, fish, poultry, and legumes, while limiting the intake of sugars, fats, and red meat.[25] This dietary pattern encouraged increased physical activity and supports better regulation of nutritional intake.[26,27,28,29]

***Normal Weight Metabolically Unhealthy* (NWMU)**

Normal Weight Metabolically Unhealthy (NWMU) refers to individuals with a normal Body Mass Index (BMI) who exhibit metabolic characteristics that increase the risk of metabolic syndrome. These individuals have a BMI of <25 kg/m² but present with hyperinsulinemia, insulin resistance, hypertriglyceridemia, or hypertension. [30,31,32,33,34]

Research findings on Normal Weight Metabolically Unhealthy (NWMU)

individuals indicate that excessive fat accumulation, particularly in the abdominal area, adversely affects lipid profiles and blood pressure, and also increases inflammation, blood coagulation, and oxidative stress.[31,35,36]

The Relationship Between Obesity and Triglyceride and HDL Levels

Obesity affects lipid metabolism through insulin resistance, which disrupts fat storage, increases lipolysis, and promotes the release of triglycerides into the circulation. Insulin deficiency decreases HDL levels by influencing cholesteryl ester transfer protein (CETP), which transfers cholesterol esters from HDL to VLDL, and by impairing apoA synthesis, thereby worsening the lipid profile.[37,38]

The relationship between Normal Weight Metabolically Unhealthy (NWMU) individuals and triglyceride and HDL levels

The association between NWMU and triglyceride and HDL levels is characterized by increased visceral adiposity, elevated fasting insulin levels, higher BMI, waist circumference, and body fat mass, which indicate the accumulation of fat around internal abdominal organs.[31,35,36,39]

An increase in visceral adipose tissue mass leads to enhanced lipolyticactivity and excessive release of free fatty acids. In the liver, this results in elevated biosynthesis and reduced degradation of very low-density lipoproteins (VLDL), thereby increasing plasma triglyceride concentrations. Increased lipolytic activity and cholesterol transfer through cholesteryl ester transfer protein (CETP) activity also affect HDL levels. This exchange process produces larger HDL particles; however, excessive CETP activity can lead to a reduction in plasma HDL concentrations. Hepatic insulin resistance is characterized by increased glycogenolysis and gluconeogenesis, while in skeletal muscle, lipid accumulation disrupts the insulin signaling pathway, inhibits GLUT4 translocation, reduces glucose transport, and limits glucose uptake into myocytes.[35]

CONCLUSION

Based on the above literature review, it can be concluded that differences in triglyceride and HDL levels are observed in patients with metabolic syndrome who are either obese or of normal weight. Therefore, comprehensive lipid profile evaluation should be a primary focus in cardiometabolic disease- prevention strategies.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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