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Atherogenic Index Profiles as Predictor of Cardiovascular Risk in Premenopausal and Menopausal Women

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A B S T R A C T

Cardiovascular disease was a disease with impaired function of the heart and blood vessels. Cardiovascular disease was more common in women. Postmenopausal women have a higher risk of cardiovascular disease than premenopausal women. This is because postmenopausal women lack the hormone estrogenin regulating lipid metabolism factors. Decreased production of the hormone estrogen will cause changes in the lipid profile in the blood. Several studies have shown that assessment with the Atherogenic Index (IA) is a good predictor of cardiovascular disease. The atherogenic index was obtained by calculating the TG/HDL-C log. This assessment proved to be more sensitive in assessing the risk of cardiovascular disease compared to the respective lipid profile calculations. This study aimed to compare the profile of the Atherogenic Index in premenopausal women with menopause. This research used the Cross-Sectional Study research method which was presented in the form of data, tables, and narratives. The study results on each 40 menopausal and premenopausal women respectively showed that the comparison value of the atherogenic index in the two categories of subjects was <0.05 (0.00). This showed that there is a significant difference in the mean atherogenic index between postmenopausal and premenopausal women.

INTRODUCTION

Cardiovascular diseases are a group of impaired functions of the heart and blood vessels. It is most prevalent in the Indo-Pacific with 4,735,000 people. According to the World Heart Federation, CVD is estimated 1.8 million to cause deaths in Southeast Asia. In Indonesia, the number of morbidities and multi-morbidity due to CHD increases along with the increasing number of elderly people and South Sulawesi is the province with the 7th highest prevalence of heart disease, which is around 1.7% and stroke at 10.6% (Anorital, 2016; Ghani et al., 2016).

Cardiovascular disease affects more women with a higher risk of cardiovascular disease among postmenopausal women compared to premenopausal women because menopausal women experience a lack of the hormone estrogen which plays a role in regulating lipid metabolism factors (Swapnali et al., 2011). The decrease in the hormone estrogen causes physiological changes in the vascular system, body fat distribution, blood pressure and lipid profile, thus leading to the emergence of advanced risk factors such as dyslipidemia, overweight and hypertension which can indirectly lead to a high risk of cardiovascular disease during the postmenopausal period (Khakurel et al., 2018).

Decreased production of the hormone estrogen tends to increase the risk of changes in the lipid profile in the blood (Sherwood, 2014). Several studies have shown that assessment using the Atherogenic Index

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(IA) is a good predictor of cardiovascular disease. The atherogenic index by calculating the TG/HDL-C log proved to be more sensitive in assessing the risk of cardiovascular disease than the lipid profile calculated individually. Few reports of traditional lipid profile women premenopausal and menopausal are available in South Sulawesi. Hence, the present study aims to assess the lipidemic status of premenopausal and menopausal women by calculating the atherogenic index of plasm.

METHOD

The research type used was an analytic correlation with a cross-sectional study design involving 80 outpatient departments of the Parahita Clinic in Makassar from August to October 2021. The study population was premenopausal women aged 35-45 years old and menopause aged 46-60 years old at Antang Public Health Center. The samples of each study were 40 premenopausal and menopausal women based on the purposive sampling technique. Women with a history of irregular menses, pregnant women, cardiovascular disease, hypertension diabetes mellitus and were excluded from this study.

Respondents who met the requirements will fill out the informed consent and research questionnaire before taking and checking the levels of the Atherogenic Index (AI) and traditional lipid profile. Fasting blood sample was taken by venipuncture and was collected in a vacutainer no-additive tube. The Serum was analyzed for TG, HDL, and LDL. The AI was calculated by using the equation: log (TG/ HDL-C). Data processing was done by grouping respondents based on the characteristics of the research subject. The research data were then analyzed using statistical test software which was made in the form of a frequency distribution tabulation and independent t-test.

RESULT

Based on the research results that have been carried out, the following results are obtained:

Table 1 Characteristics of Research Respondents (n=80)

Variable	n	%
Menopausal age (y.o)		
51-54	16	40
55-60	24	60
Premenopause (y.o)		
40-45	6	15
46-50	34	85
BMI Menopause (kg/m^2)		
18-20	9	22,5
21-24	31	77,5
BMI Premenopause (kg/m^2)		
18-20	8	20
21-24	32	80
Menopausal TG (mg/dL)		
< 150	23	57,5
≥ 150	17	42,5

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Premenopausal TG (mg/dL)		
< 150	11	27,5
≥ 150	29	72,5
Menopausal HDL (mg/dL)		
< 45	17	42,5
≥ 45	23	57,5
Premenopausal HDL (mg/dL)		
< 45	1	2,5
≥ 45	39	97,5
Menopausal AI		
< 0,11	3	7,5
0,11 – 0,21	6	15
> 0,21	31	77,5
Premenopausal AI		
< 0,11	3	7,5
0,11 – 0,21	23	57,5
> 0,21	14	35

The examination results of Atherogenic Index (AI) levels (table 1) were then analyzed for frequency distribution based on the level of risk factors of the respondent group for cardiovascular events.

Table 2. Overview of Atherogenic Index Levels in Menopausal Women by Risk Category

Menopausal Women	f (%)	Atherogenic Index		Mean
		Min	Max	
Low risk	3 (7,5)	0,04	0,06	0,05
Moderate risk	6 (17,5)	0,14	0,24	0,19
High risk	31 (75)	0,28	1,02	0,78

Based on table 2 shows that the atherogenic index value in the postmenopausal women group as many as 6 people (75%) have a high risk of CHD disease and as many as 23 people (57.5%) women in the premenopausal group have a moderate risk of CHD (table 3).

Table 3. Overview of Atherogenic Index Levels in Premenopausal Women by Risk Category

Premenopausal women	f (%)	Atherogenic Index		Mean
		Min	Max	
Low risk	3 (7,5)	0,09	0,10	0,09
Moderate risk	23 (57,5)	0,11	0,21	0,17
High risk	14 (35)	0,25	0,7	0,48

The mean value of the atherogenic index in premenopausal and postmenopausal women was analyzed using an independent t-test. Based on the different tests, the p-value is obtained as shown in the table below:

Table 4. Comparison of the Atherogenic Index Profile of Menopausal and Premenopausal Women

Category	n	Atherogenic Index		Mean	*p-value*
		Min	Max		
Menopause	40	0,04	1,02	0,3	0,00
Premenopausal	40	0,09	0,7	0,27	

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DISCUSSION

Cardiovascular disease (CVD) is the leading cause of death in women, who have had increase risk factors for this disease after menopause and typically develop coronary heart disease several years later than any disease. In this study, there was a statistically significant increase in triglyceride in menopausal women compared to premenopausal women. Decreased estrogen hormone is closely related to the emergence of cardiovascular disease because an increase in cholesterol occurs simultaneously with an increase in renin-angiotensin activity which causes vasoconstriction and endothelial dysfunction. The menopause incidence in women is one of the determinants of the risk of experiencing coronary heart disease (CHD) (Ghani et al., 2016; Oemiyati & Rustika, 2015). Coronary heart disease can be detected early through the calculation of the atherogenic index (Ghani et al., 2016; Oemiyati & Rustika, 2015). The research subjects are women who have a normal BMI. BMI is an anthropometric tool that can be used to detect metabolic syndrome in addition to measuring waist circumference (Sumarni & Sari, 2018). Niroumand et al. (2015) in their research showed that plasma atherogenic index values had a significant correlation with abdominal circumference, BMI, and physical activity (p-value <0.05) on the incidence of CHD. The research by Kaniawati (2020) shows that there is a significant relationship between abdominal cirumference and LDL levels, triglycerides, and plasma atherogenic index (AIP).

The results showed that as many as 29 premenopausal women and 17 menopausal women experienced an increase in triglyceride levels. Triglycerides from food will be absorbed in the intestine and will be synthesized in the liver, then secreted into the circulation in the form of Very Low-Density Lipoprotein (VLDL). VLDL will be converted into Intermediate Density Lipoprotein (IDL) and will be brought back to the liver to be metabolized into LDL which will carry cholesterol to peripheral tissues and the liver (Erizon & Karani, 2020; Sumarni & Sari, 2018). Menopause causes changes in lipid profile by increasing LDL (atherogenic) levels (Jim, 2013; Ma'rufi & Rosita, 2014). Women with triglyceride levels between 200-399 mg/dl have a 65% increased risk of death from cardiovascular events (Perhimpunan Dokter Spesialis Kardiovaskular Indonesia, 2015).

Premenopausal women (40-50 years old) are mostly at moderate risk, with as many as 23 people (57.5%) for CHD and postmenopausal women (51-60 years old) show about 31 people (75%) at high risk for CHD. A study by Bass et al in the Guidelines for Management of Cardiovascular Disease Prevention in Women found that triglyceride and HDL levels were strong predictors of death from cardiovascular disease. Women with HDL cholesterol levels <50 mg/dl had a 30% higher risk of death from cardiovascular events (Perhimpunan Dokter Spesialis Kardiovaskular Indonesia, 2015). Menopause causes HDL levels to decrease as cardioprotective or anti-atherogenic (Jim, 2013; Ma'rufi & Rosita, 2014). Atherosclerosis is a condition in the walls of the arteries which is characterized by the occurrence of fatty deposits. These deposits consist of cholesterol, fatty substances, cellular waste products, calcium,

and fibrin. Fat deposits in arteries cause thickening, stiffness, and narrowing of blood vessels. This situation causes reduced blood flow, the amount of oxygen and other nutrients reaching all parts of the body. Low levels of HDL in the blood are closely related to the oxidation process and endothelial dysfunction. HDL can stimulate the production of nitric oxide (NO) which functions in maintaining blood vessel tone (Erizon & Karani, 2020; Gunawan & Nada, 2017). HDL is a lipoprotein compound that helps carry cholesterol from tissues through the blood plasma to the liver and the constituent of HDL protein is apolipoprotein A1 (Apo A1) (Jim, 2013; Ma'rufi & Rosita, 2014).

The results showed that there was a significant difference (p-value = 0.00) in the atherogenic index value in premenopausal and postmenopausal women. The mean atherogenic index value in the postmenopausal women group was higher than the premenopausal women. The atherogenic Index of Plasma (AIP) obtained by Khanduker et al. (2018) was significantly higher (0,63) in postmenopausal women compared to premenopausal women (0,50). The increase in the atherogenic index in postmenopausal and premenopausal women is because that some of them have unhealthy lifestyles, such as eating high calories food, high in fat, and carbohydrates without being accompanied by physical activity that is carried out on an ongoing basis so that it becomes one of the causes increased triglyceride levels and decreased HDL in the body. The atherogenic index value is one of the strongest markers of the risk of atherosclerosis and CHD compared to the results of the parameters of each lipid profile. Research by Niroumand et al. (2015) and Kaniawati (2020) showed that the atherogenic Index of Plasma (AIP) was strongly associated with obesity (hip circumference and BMI) and physical activity ($p<0,005$). The atherogenic index value is not influenced by smoking habits, history of diabetes mellitus (DM), and hypertension (Edwards et al., 2017; K. A. Sari et al., 2020).

CONCLUSION

According to research results that has been carried out, shows that there is a significant difference in the average atherogenic index value in postmenopausal and premenopausal women. Women entering menopause (premenopausal) age need to adjust their lifestyle to prevent the occurrence of CHD.

REFERENCES

Anorital, A. (2016). Morbiditas dan Multi Morbiditas Pada Kelompok Lanjut Usia di Indonesia. *Jurnal Biotek Medisiana Indonesia*, *4*(2), 77–88. https://doi.org/10.22435/jbmi.v4i2.5124.77-88

Edwards, M. K., Blaha, M. J., & Loprinzi, P. D. (2017). Atherogenic Index of Plasma and Triglyceride/High-Density Lipoprotein Cholesterol Ratio Predict Mortality Risk Better Than Individual Cholesterol Risk Factors, Among an Older Adult Population. *Mayo Clinic Proceedings*, *92*(4), 680–681. https://doi.org/10.1016/j.mayocp.2016.12.018

Erizon, & Karani, Y. (2020). *HDL DAN ATEROSKLEROSIS*. *5*, 9.

Ghani, L., Susilawati, M. D., & Novriani, H. (2016). Faktor Risiko Dominan Penyakit Jantung Koroner di Indonesia. *Buletin Penelitian Kesehatan*, *44*(3), 153–164. https://doi.org/10.22435/bpk.v44i3.5436.153-164

Gunawan, D., & Nada, I. K. W. (2017). *Fisiologi Sirkulasi*. 70.

Jim, E. L. (2013). *METABOLISME LIPOPROTEIN*. 8.

Kaniawati, M.-. (2020). Perbandingan Indeks Aterogenik Plasma Log (TG/HDL) pada Wanita Obes dan Non Obes. *Jurnal Ilmiah Farmasi Farmasyifa*, *3*(1), 35–43. https://doi.org/10.29313/jiff.v3i1.5118

Khanduker, S., Ahmed, R., Nazneen, M., Alam, A., & Khondokar, F. (2018). A Comparative Study of Lipid Profile and Atherogenic Index of Plasma Among the Pre- and Post-Menopausal Women. *Anwer Khan Modern Medical College Journal*, *9*(1), 44–49. https://doi.org/10.3329/akmmcj.v9i1.35824

Ma'rufi, R., & Rosita, L. (2014). HUBUNGAN DISLIPIDEMIA DAN KEJADIAN PENYAKIT JANTUNG KORONER. *Jurnal kedokteran dan kesehatan Indonesia*, *6*(1), 47–53. https://doi.org/10.20885/JKKI.Vol6.Iss1.Art7

Niroumand, S., Khajedaluee, M., Khadem-Rezaiyan, M., Abrishami, M., Juya, M., Khodaee, G., & Dadgarmoghaddam, M. (2015). Atherogenic Index of Plasma (AIP): A marker of cardiovascular disease. *Med J Islam Repub Iran*, *29*, 9.

Oemiyati, R., & Rustika, R. (2015). FAKTOR RISIKO PENYAKIT JANTUNG KORONER (PJK) PADA PEREMPUAN (Baseline Studi Kohor Faktor Risiko PTM) (Risk Factors for Coronary Heart Disease (CHD) in Women [Baseline Cohort Study of Risk Factors for Non-Communicable Disease]). *Buletin Penelitian Sistem Kesehatan*, *18*(1), 47–55. https://doi.org/10.22435/hsr.v18i1.4277.47-55

Perhimpunan Dokter Spesialis Kardiovaskular Indonesia. (2015). *PEDOMAN TATALAKSANA PENCEGAHAN PENYAKIT KARDIOVASKULAR PADA PEREMPUAN*. 100.

Sari, K. A., Yaswir, R., Prihandani, T., & Efrida, E. (2020). Korelasi Kadar Adiponektin dengan Indeks Aterogenik Plasma pada Penyandang Obes. *Jurnal Kesehatan Andalas*, *9*(3), 343. https://doi.org/10.25077/jka.v9i3.1335

Sherwood L. (2014). Fisiologi manusia: dari sel ke sistem (8th ed). Jakarta: EGC; p. 781-841

Sumarni, & Sari, P. (2018). SURVEILANS PETANDA KARDIOMETABOLIK PADA SIVITAS AKADEMIKA UNIVERSITAS TADULAKO. *Jurnal Kesehatan Tadulako*, *4*(1), 6.

Swapnali, R. K., Kisan, R., & Murthy, D. S. J. (2011). *Effect of Menopause on Lipid Profile and Apolipoproteins*. *4*, 8.