

Original Research Article

Correlation estradiol levels and physical activities with lipid profile levels of premenopausal women, in Padang city, Indonesia

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ABSTRACT

Background: In premenopausal women, low estradiol levels and lack of physical activity can result in dyslipidemia. Dyslipidemia is a risk factor for coronary heart disease (CHD). The incidence of CHD occurs a lot in premenopausal age compared to productive age, the percentage of women who experience higher CHD than men. Objective was to determine the correlation of estradiol levels and physical activity with lipid profiles in premenopausal women in Padang City.

Methods: This research was carried out in Padang City. The study was observational, cross-sectional design. The study sample was 79 premenopausal women. Estradiol levels were assessed by the ELISA method, physical activity was assessed by an international physical activity (IPAQ) questionnaire, lipid profiles were assessed by colorimetric enzymatic methods. Correlation of estradiol levels with lipid profile levels were analyzed using the Pearson correlation test. Correlation of physical activity with lipid profile level using the ANOVA test.

Results: The mean estradiol level of respondents was 144.68pg/ml, the mean physical activity of respondents is heavy physical activity as much as 41.8%, the mean cholesterol level of respondents was 194.76mg/dl, the mean triglyceride level of respondents was 118.75mg/dl, the mean LDL cholesterol level of respondents was 120.64mg/dl, the mean HDL cholesterol level was 53.18mg/dl.

Conclusions: There were significant correlation between estradiol levels with triglyceride levels and LDL cholesterol. There was significant correlation physical activity with total cholesterol levels and triglyceride levels. There was no correlation between estradiol levels with total cholesterol and HDL cholesterol. There was no correlation physical activity with LDL cholesterol and HDL cholesterol.

Keywords: Estradiol level, Lipid profile level, Physical activity, Premenopause

INTRODUCTION

Cardiovascular disease is a disease that is still a health problem in the world, this is because cardiovascular disease is the leading cause of death in the world.¹ Data from Riskesdas in 2013 showed that the highest prevalence for cardiovascular disease in Indonesia was CHD, which was 1.5%. According to the age group, CHD was prevalent in the premenopausal age group

(2.1%) compared to the productive group (1.3%). Women have a higher percentage of having CHD that is (1.6%) when compared to men, which is 1.3%.² The cause of the disease is multifactorial where some of it can be modified. One risk factor that can be modified is dyslipidemia.³

In 2016 in Indonesia, there were 24,681 million premenopausal women, estimated in 2035 the number of

premenopausal women was 30,124.5 million.^{4,5} The number of premenopausal women in Padang City in 2016 was around 79,855 thousand.⁶

Various conditions occur in premenopause caused by hormonal changes, the hormone that changes in the premenopausal period is estrogen, reducing the loss of hormone estradiol due to loss of ovarian function can cause a decrease in the function of the body and impaired metabolism, such as lipid metabolism.^{7,8}

Research conducted by Hatma on ethnic groups in Indonesia showed that Minangkabau ethnic women over the age of 40 had a high average total cholesterol of 209.77mg/dl, an average of 146.02mg/dl LDL cholesterol and HDL cholesterol (46.87mg/dl).⁹

Physical activity is one of the modifiable risk factors that plays an important role in influencing lipid profiles.¹⁰ Data from Riskesdas in 2013 stated that 26.1% of the Indonesian population did less physical activity, in West Sumatra province there were 28.8% of the population who did less physical activity. This amount exceeds the average amount of physical activity that is lacking in the Indonesian population.

From the results of several studies, it was stated that regular physical activity had an influence on lipid profiles.^{11,12} Whereas another study stated that there were no significant differences in lipid profile levels after and before physical activity was given.¹³ During regular physical activity an increase in fatty acids in the blood is a raw material for the formation of energy in the muscles during physical activity, then these fatty acids will be transferred into the muscle as an energy source.¹⁴ Someone with less physical activity will increase triglyceride deposits in adipose tissue and in the liver, this is because the incoming energy is greater than the energy released or the fat source is accumulated in the body causing an imbalance in the blood lipid profile.¹⁴

Some studies state that there is a significant correlation between estrogen and lipid profile levels.^{15,16} Whereas another study stated that there was no significant relationship between estrogen levels and lipid profile levels in premenopausal women.¹⁷

Based on the background above the researchers wanted to conduct a study of the correlation of estradiol levels and physical activity with lipid profile levels in premenopausal women in the city of Padang in 2017.

METHODS

This study was an observational study with a cross sectional design. Examination of estradiol levels was carried out in the Biomedical Laboratory of the Medical Faculty of Andalas University and lipid profile examination was carried out at the Biochemistry

Laboratory of the Faculty of Medicine, Andalas University.

Physical activity interviews were carried out at the time the research was conducted. The population in this study were premenopausal women in the city of Padang. The sample in this study were premenopausal women who met the inclusion and exclusion criteria. The inclusion criteria in this study sample were: willing to take part in the study by signing informed consent, aged 40-55 years at the time of the study, experiencing menstrual disorders (changes in the cycle and volume of menstrual blood), using hormonal contraception (from history). While the exclusion criteria for the study sample were not coming and could not be found during research data collection, menopause (not menstruating for at least 12 months), suffering from chronic diseases such as cancer, and diabetes mellitus (from history), athletes and in radiotherapy or chemotherapy

Estradiol levels were measured by a spectrophotometer using the ELISA technique, physical activity was measured by a questionnaire from IPAQ (International Physical Activity Questionnaire), triglyceride levels were measured by colorimetric enzymatic methods (GPO-PAP), total cholesterol levels were measured by colorimetric enzymatic method (CHOD-PAP), LDL cholesterol levels were measured by colorimetric enzymatic method (CHOD-PAP), HDL cholesterol levels were measured by colorimetric enzymatic method (CHOD-PAP).

The results of the study were processed statistically, and the normality test of Kolmogorov Smirnov was carried out to see the normality of the data. Analysis to see the relationship between variable levels of estradiol with levels of lipid profile, namely Pearson correlation statistical test. To see the relationship between the variables of physical activity and the levels of the lipid profile the test used was the ANOVA statistical test. This research is part of the research of Prof. Dr. Delmi Sulastri, MS, SpGK. The study was approved by the Institutional Ethics Committee (279/KEP/FK/2017).

RESULTS

After conducting research and results examination of 79 premenopausal women. The results are shown in the following table.

Table 1: Age characteristics of respondents.

Characteristics	n	Mean±SD	Lowest	Highest
Umur (years)	79	46.68±3.98	40	54

Table 1 showed that the average age of respondents is 46.68±3.98 years, with the lowest age of respondents which is 40 years and the highest age of respondents is 54 years.

Table 2: Job characteristics of respondents.

Job characteristics	n	Percentage
Housewife	63	79.7
Government Employees	2	2.5
Entrepreneur	13	16.5
Farmer	1	1.3
Total	79	100

Table 2 shows that on average most of the respondents worked as housewives (79,7%), entrepreneur (16,5%), government employees (2,5%), farmer (1,3%).

Table 3: Average estradiol level of premenopausal women in the city of Padang.

Variables	N	Mean±SD	Lowest	Highest
Estradiol (pg/ml)	79	144.68±5.32	56.67	310.4

Table 3 shows that the average estradiol level of respondents is 144.68±47.31pg/ml, with the lowest estradiol level is 56.67pg/ml and the highest is 310.4pg/ml.

Table 4: Frequency distribution of physical activity of premenopausal women in the city of Padang.

Physical activity	N	Percentage
Light	16	20.3
Moderate	30	38.0
Heavy	33	41.8
Total	79	100

Table 4 shows that almost half of the respondents had heavy physical activity, namely 33 people (41.8%),

Table 7: Correlation of physical activity with lipid profile levels in premenopausal women.

Physical activity	Profile Lipid			
	Total cholesterol	Triglycerides	LDL cholesterol	HDL Cholesterol
	Mean±Standard Deviation			
Light	222.70±55.37	143.66±43.7	145.85±59.7	51.13±22.87
Moderate	193.89±38.56	112.55±32.4	116.83±44.2	55.23±17.82
Heavy	182.02±29.69	112.44±39.7	115.00±45.0	52.31±13.29
p value	0.005	0.017	0.090	0.695

Table 7 shows the analysis of the relationship between physical activity with lipid profiles (total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol), which is a significant correlation between physical activity and total cholesterol (p = 0.005), there is a significant correlation between physical activity and triglycerides (p = 0.017), there is no significant correlation between physical activity and LDL cholesterol (p = 0.090), and

moderate physical activity (38,0%) and light physical activity (20,3%).

Table 5: Average lipid profile (total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol) premenopausal women in Padang city.

Variables (mg/dl)	Mean±SD	Lowest	Highest
Total cholesterol	194.76±41.64	128.10	317.70
Triglycerides	118.75±39.50	61.00	263.60
LDL cholesterol	120.64±48.46	50.90	284.90
HDL cholesterol	53.18±17.15	17.70	116.20

Table 5 shows that the average cholesterol level of the total respondents is 194.76±41.63. The average triglyceride level of the respondents was 118.75±39.50. The average LDL cholesterol level of respondents was 120.64±48.46. The average HDL cholesterol level of respondents was 53.18±17.15.

Table 6 it is known that the results of the statistical tests have a significant correlation between triglyceride and LDL cholesterol levels with estradiol levels (p<0.05) and there is no significant correlation between total cholesterol and HDL cholesterol with estradiol levels.

Table 6: Correlation of estradiol levels with lipid profile levels of premenopausal women in the city of Padang.

Variables	p-value	r	R ²	
Estradiol levels	Total cholesterol	0.122	-0.175	0.031
	Triglycerides	0.020	-0.261	0.068
	LDL cholesterol	0.019	-0.263	0.069
	HDL cholesterol	0.113	0.179	0.032

there is no significant correlation between physical activity and HDL-cholesterol (0.695).

DISCUSSION

Age characteristics of respondents

The results of the analysis of the average age of premenopausal women were 46.68 years with the lowest

age of 40 years and the highest age was 54 years. The results also state that the average age of premenopausal women is 46 years and when women are 40 years old, anovulation becomes more frequent and the menstrual cycle becomes irregular, which is associated with decreased ovarian function.^{18,19} The results of other studies that also support this study are that endocrine changes and the onset of premenopausal symptoms begin at around the average age of 40-45 years, there are several factors that can influence them, namely geographic, genetic, socio-economic, environmental, ethnic differences, and lifestyle.^{20,21}

Job characteristics of respondents

The results of the respondent's job analysis were that most of the respondents worked as housewives (79.7%). Another study also stated that most premenopausal women work as housewives.²²⁻²⁴ Whereas in a study conducted by Hammam et al, it is known that in women who work, work stress comes from the work environment, so that it can increase work stress which will accelerate the woman in experiencing premenopausal symptoms.²⁵

Average estradiol level of premenopausal women in the city of Padang

The results of the average analysis of estradiol levels in premenopausal women in Padang City showed that the average estradiol level was 144.68pg/ml. When compared with the normal value of premenopausal estradiol levels of 100-350pg/ml, the estradiol level in premenopausal women in Padang City is still in the normal range.²⁶

Frequency distribution of physical activity of premenopausal women in the city of Padang

The results of the analysis of the frequency distribution of physical activity in premenopausal women in the city of Padang showed that almost half of the respondents had 41.8% heavy activity or as many as 33 respondents had severe levels of activity. Physical activity is also influenced by socio-economic, socio-economic people who are not yet able to provide modern home facilities and equipment, this condition will affect the physical activities carried out by the community.²⁷ Another study also showed that the majority of premenopausal women had severe physical activity (71.4%) and moderate physical activity as much as 28.6%, this was because respondents in this study as well as housewives also worked as entrepreneurs.²⁸

Average lipid profile (total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol) premenopausal women in Padang city

The levels of the lipid profile are in the normal range seen by the Laboratory of Clinical Chemistry, Biochemistry Section, Faculty of Medicine, Andalas

University. Lipid profiles are influenced by several factors such as low physical activity, high fat intake, obesity, changes in social conditions and stress, genetics, gender, age, geography, and ethnic.

Association between estradiol levels with total cholesterol levels in premenopausal women in Padang city

There was no significant correlation between estradiol levels and total cholesterol levels in premenopausal women in Padang City, this happens because many factors can affect total cholesterol levels other than estradiol. Other studies also state that there is no significant correlation between estradiol levels and total cholesterol levels in premenopausal women.²⁹

Association between estradiol levels with triglyceride levels in premenopausal women in Padang city

There is a significant correlation between estradiol levels and triglyceride levels in premenopausal women in the city of Padang. This study also supported the theory that in premenopausal women there was a decrease in ovarian estrogen synthesis, this would affect the activity of the lipoprotein lipase enzyme. This enzyme hydrolyzes triglycerides, so many free fatty acids are formed. The more fatty acids transferred from adipose tissue to the liver, the more fatty acids are esterified in hepatocytes to form triglycerides.³⁰

Association between estradiol levels with LDL cholesterol levels in premenopausal women in Padang city

There was a significant correlation between estradiol levels and LDL cholesterol in premenopausal women. This happens because estrogen is a regulator of lipoprotein lipase (LPL). LPL catalyzes the hydrolysis of VLDL into IDL and then to LDL. Estrogens also stimulate LDL receptor synthesis and ultimately reduce plasma LDL levels. In the premenopausal period there was a decrease in estrogen levels causing an increase in plasma LPL activity and also causing a decrease in the number of LDL receptors which caused an increase in plasma LDL levels.³¹ Another study also stated that there was a significant correlation between estradiol levels and LDL cholesterol levels in premenopausal women with a negative correlation direction.³²

Association between estradiol levels with HDL cholesterol levels in premenopausal women in Padang city

There was no significant correlation between estradiol levels and HDL cholesterol levels in premenopausal women in Padang City. This can occur because many factors can affect HDL cholesterol levels other than estradiol levels. Other research results also stated that

there was no association between estradiol levels and HDL cholesterol levels in premenopausal women.^{32,33}

Association between physical activity with total cholesterol levels in premenopausal women in Padang city

There is a significant correlation between physical activity with total cholesterol in premenopausal women in Padang City. The same results were also found in other studies, namely there was a significant correlation between physical activity and total cholesterol levels in premenopausal women.^{34,35} This happens because regular exercise will increase the activity of lipoprotein lipase (LPLa) and lecithin: cholesterol acyltransferase (LCATa) which will increase the degradation of triglycerides. LPLa also acts to transfer LDL from the blood to the liver to be converted into bile and secreted, so that LDL levels will decrease. Decreasing triglyceride and LDL levels will reduce total cholesterol levels.

Association between physical activity with triglyceride levels in premenopausal women in Padang city

There is a significant correlation between physical activity with triglyceride levels in premenopausal women in Padang City. This happens because physical activity increases lipoprotein lipase activity, so it will increase the hydrolysis of triglycerides and will affect triglyceride levels. This study is also supported by other studies, namely there is a significant correlation between physical activity and triglyceride levels in premenopause women.³⁶

Association between physical activity with LDL cholesterol levels in premenopausal women in Padang city

There is a significant correlation between physical activity with LDL cholesterol levels in premenopausal women in the city of Padang. This is in line with the research conducted by Kelley that physical activity balanced with a diet program will have a better influence on lipid profiles.³⁷

Association between physical activity with HDL cholesterol levels in premenopausal women in Padang city

There was a significant correlation between physical activity and HDL cholesterol levels in premenopausal women in Padang City. The results of other studies also state that HDL levels increase if someone does aerobic exercise performed at least 12 weeks in a row even though it is not always successful. Likewise, with HDL levels, exercising hard can increase HDL cholesterol in the blood to 20-30mg/dl. However, this does not last long because if we stop exercising, normal levels of HDL cholesterol and cholesterol return to their original levels before exercise begins. Therefore, if you want to improve

and control cholesterol levels in the blood it is necessary to exercise regularly.³⁸

CONCLUSION

There was a correlation between estradiol levels and triglyceride levels, LDL cholesterol, HDL cholesterol in premenopausal women in Padang City and there was no correlation between estradiol levels and total cholesterol levels in premenopausal women in Padang City. There is a correlation between physical activity and total cholesterol levels, triglyceride levels in premenopausal women in Padang City and there is no correlation between physical activity and LDL cholesterol and HDL cholesterol.

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