The Effect Between The Examination Results Blood Glucose Levels With Lipid Profile In Polycystic Ovary Syndrome (PCOS) Patients

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DOI: https://doi.org/10.56293/IJASR.2022.5460

IJASR 2022
VOLUME 5
ISSUE 6 NOVEMBER - DECEMBER **ISSN: 2581-7876**

Abstract: Polycystic Ovary Syndrome (PCOS) is one of the most common gynecological problems in women of reproductive age. PCOS is usually a collection of symptoms including amenorrhea, oligomenorrhea, infertility, obesity, hirsutism, acne, alopecia, and acanthosis nigrican. The number of women of reproductive age scattered in the world, as many as 4-18% have PCOS. This study aims to assess the relationship between blood glucose levels and lipid profile in patients with polycystic ovary syndrome (PCOS). The type of research used is an analytic observational study with a cross-sectional design. The population in this study was PCOS patient data that met the inclusion and exclusion criteria for the period January 2019 - December 2021 at RSUD Budhi Asih. The results of the study of 27 PCOS patient data were tested by Pearson correlation analysis, on the level of GDP and total cholesterol, the Sig (p) value was 0.000 ($p < 0.05$) with a strong closeness (r) and a positive direction of correlation (0.812). GDP levels with LDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness (r) and a positive direction of correlation (0.578). GDP levels with HDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness level (r) and a positive direction of correlation (0.574). GDP levels with triglyceride levels, obtained a sig (p) value of 0.020 ($p < 0.05$) with a moderate level of closeness (r) and a positive direction of correlation (0.444). The conclusion in this study is that there is a relationship between fasting blood glucose (GDP) levels and lipid profiles (total cholesterol, LDL, HDL, and triglycerides).

Keywords: PCOS, Blood Glucose, Lipid Profile

1. Introduction

Polycystic Ovarian Syndrome (PCOS) is a heterogeneous and metabolic endocrine disorder characterized by irregular menstruation (oligomenorrhea/anovulation) in adolescents and early adulthood, hyperandrogenism (increased androgen levels in women of reproductive age), and polycystic ovaries that can be seen on ultrasound images. (Sirmans & Pate, 2014).

PCOS is the most common cause of anovulation and anovulatory infertility. The number of women of reproductive age worldwide who experience PCOS is 4-18% (Lizneva et al., 2016), in America there are about 5-10% incidence of PCOS and 44.9% found in Beijing (Wang et al., 2016). The exact number of PCOS incidence in Indonesia does not yet exist; however, some experts state that its prevalence reaches 5% – 10% in women of reproductive age. As an illustration, the Dharmais Hospital Jakarta recorded 30 patients each year, then by Pangastuti et al (2011) at the Dr. CiptoMangunkusumo Hospital Jakarta found 105 cases within one year (Ginting, 2013). Research in Palembang, the incidence of PCOS was 78.8% in the Private Practice of Obstetrics and Gynecology Palembang in 2014-2017 (Mareta, 2018). The cause of this polycystic ovary syndrome is not known with certainty, but it is suspected that there is a connection with the process of regulating ovulation and the inability of enzymes that play a role in the synthesis of estrogen in the ovaries (Saftarina&Putri, 2016). Insuline resistance and hiperandrogenisme is the most common hormonal disorder found in PCOS patients and contributes to reproductive disorders (irregular menstruation, oligo or anovulation infertility), metabolic disorders (dyslipidemia, type 2 diabetes mellitus, and obesity), as well as psychological appearance (depression, anxiety, low quality of life) (Hardita, 2015).

PCOS sufferers who experience chronic anovulation and hyperandrogenism will increased the risk for diabetes, dyslipidemia, hypertension and coronary heart disease. Chronic anovulation will cause an unopposed estrogen condition so that it will increase the risk of endometrial cancer (Wiweko&Ritonga, 2016).

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Research by Pani A, et al in 2020, almost 30% of PCOS women experienced dysglycemia, namely impaired glucose tolerance, then according to the Jeyakuma study in 2019 it was stated that 7.5% -10% of women with PCOS had type 2 diabetes. Diabetes mellitus is a chronic condition characterized by with relative or absolute insulin deficiency or resistance, and characterized by impaired carbohydrate, protein, and fat metabolism (Masriadi, 2017). Blood glucose is a sugar in the blood formed from carbohydrates in food and stored as glycogen in the liver and skeletal muscles. Glucose is then absorbed by the body with the help of the hormone insulin produced by the pancreas gland, and then the absorbed glucose will be converted into energy in the cells (Simatupang, 2020).

In PCOS sufferers, who experience insulin resistance, there is a disruption in the glycolysis process where the pancreas continues to produce insulin but the body's cells do not absorb glucose in the blood, so it cannot be processed into energy as a result, blood glucose levels will increase. Glucose that increases excessively will damage blood vessels, because glucose cannot be processed into energy so energy will be made from other sources such as protein and fat (Fadila, 2017).

In addition to insulin resistance, lipid metabolism in women with PCOS may also be affected by ovarian and/or adrenal secretion of sex steroids. The effects of sex steroids on lipid metabolism are complex and involve the actions of both androgen and estrogen hormones.

An elevated lipid profile may occur in dyslipidemia and obesity, both of which are common metabolic disorders in women with the polycystic ovary syndrome. This situation can cause insulin resistance through increased production of free fatty acids (Wahyuni, 2015). As a result, there is a decrease in insulin sensitivity, namely hyperinsulinemia; this will increase the function of androgen hormones due to suppression of sex hormones and globulin synthesis increasing androgen hormone production in the ovaries. The resulting condition is hyperandrogen and menstrual cycle abnormalities clinically manifest in anovulatory cycles and subfertility. Usually, factors inhibiting ovarian follicular development and steroidogenesis have an effect on reproductive disorders in obese women (Islami, 2016).

2. Method

The research method used is an analytic observational study with a cross-sectional design. The population in this study was PCOS patient data that met the inclusion and exclusion criteria for the period January 2019 - December 2021 at Budhi Asih Hospital with a total sample of 27 people. This study presents data in tabular form and then describes it with narration.

3. Results

The results of the study on PCOS patients who examined fasting blood glucose levels with lipid profiles in the period January 2019 to December 2021 at Budhi Asih Hospital obtained 27 data.

Table 1 Frequency Distribution of PCOS Patients by Age

Age Group (years)	Frequency (n)	Percentage (%)
< 20 years	2	7,4
20 - 25 years	3	11,1
26 - 30 years	15	55,6
31 - 35 years	4	14,8
36 - 40 years	3	11,1

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Total	27	100

Based on table 1 describing the results of the study of PCOS sufferers, it shows that most of the research subjects came from the 26-30 year age group, namely 15 people or 55.6%. PCOS patients with the smallest age proportion were in the age group < 20 years as many as 2 people or 7.4%.

Table 2 Descriptive Analysis of Average Fasting Blood Glucose Levels and Lipid Profiles in PCOS Patients

Variable	Minimum	Maximum	Average
Fasting blood glucose level	75	255	118,30
Total cholesterol level	78	274	168,93
LDL Levels	55	156	105,85
HDL Levels	30	94	49,22
Triglyceride Levels	58	307	154,85

Based on table 2, the results showed that the average blood glucose level of PCOS patients was 118.30mg/dL. The lowest blood glucose level of PCOS patients was 75 mg/dL with the highest level of 225 mg/dL. Average cholesterol levels total PCOS sufferers is 168.93mg/dL. The lowest total cholesterol level in PCOS patients was 78 mg/dL with the highest level of 274 mg/dL. The average LDL level of PCOS patients is 105.85mg/dL. The lowest LDL level in PCOS patients was 55 mg/dL with the highest level of 156 mg/dL. The average HDL level of PCOS patients is 49.22 mg/dL. The lowest HDL level in PCOS patients was 30 mg/dL with the highest level of 94 mg/dL. The average triglyceride level in PCOS patients is 154.85 mg/dL. The lowest triglyceride level in PCOS patients was 58 mg/dL with the highest level of 307 mg/dL.

Tabel 3 Frequency Distribution of Fasting Blood Glucose Levels and Lipid Profile

	Fasting Blood Glucose Level (mg/dL)	Total Cholesterol Levels (mg/dL)	LDL level (mg/dL)	HDL levels (mg/dL)	Triglyceride Level (mg/dL)
Normal	16 59,3%	20 74,1%	20 74,1%	2 7,4%	12 44,4%
Medium	6 22,2%	3 11,1%	7 25,9%	21 77,8%	9 33,3%
High	5 18,5%	4 14,8%	0 0%	4 14,8%	6 22,3%

Based on table 3, PCOS sufferers, who have high fasting blood glucose (GDP) levels are 5 people (18.5%). There are 4 patients with PCOS who have high total cholesterol levels (14.8%). The number of PCOS sufferers who have

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high HDL levels is 4 people (14.8%). Number of PCOS sufferers who have high triglyceride levels as many as 6 people (22.3%).

Tabe 5 Pearson Correlation Test Results Between Fasting Blood Glucose Levels and Lipid Profile

Variable	Fasting blood glucose level	
	Sig (p)	Correlation coefficient (r)
Total cholesterol level	0,000	0,812
LDL level	0,002	0,578
HDL level	0,002	0,574
Triglyceride levels	0,020	0,444

Table 4.5 is the result of the Pearson correlation test on the variable fasting blood glucose levels with total cholesterol, obtained a Sig (p) value of 0.000 ($p < 0.05$) with a strong closeness level (r) and a positive direction of correlation (0.812). In the variable fasting blood glucose levels with LDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness level (r) and a positive correlation direction (0.578). In the variable fasting blood glucose levels with HDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness level (r) and a positive correlation direction (0.574). Pada variabel kadar glukosa darah puasa dengan kadar trigliserida, didapatkan nilai sig (p) sebesar 0,020 ($p< 0,05$) dengan tingkat keeratan (r) sedang dan arah korelasi bersifat positif (0,444).

4. Discussion

Polycystic Ovarian Syndrome (PCOS) is a heterogeneous and metabolic endocrine disorder characterized by irregular menstruation (oligomenorrhea/anovulation) in adolescents and early adulthood, hyperandrogenism (increased androgen levels in women of reproductive age), and polycystic ovaries that can be seen on ultrasound (Sirmans & Pate, 2014). PCOS sufferers who experience chronic anovulation and hyperandrogenism are at increased risk for diabetes, dyslipidemia, hypertension, coronary heart disease and diabetes mellitus. (Wiweko & Ritonga, 2016). Diabetes mellitus is a chronic condition characterized by relative or absolute insulin deficiency or resistance, and is characterized by disturbances of carbohydrate, protein, and fat metabolism (Masriadi, 2018).

Based on 27 data on PCOS patients seen from table 4.1 the results showed the majority of PCOS patients, namely the 26-30 year age group as many as 15 people or 55.6%, followed by the 31-35 year age group with 4 patients or 14.8%. PCOS is a polygenic disorder with multiple phenotypes that is common in women of reproductive age which is the most common cause of infertility due to anovulation. (Ningrum, 2021). The results of this study are in line with Ginting H's (2013) research on PCOS, that most PCOS occurs in the 26-30 year age group with a percentage of 56.1%, while the 36-40 age group has a smaller percentage of 5.3%. (Ginting, 2013).

Table 4.2 shows that the average blood glucose level of PCOS sufferers is 118.30mg /dL, the average result is above the normal value of fasting blood glucose or categorized as a moderate value. The lowest blood glucose level of PCOS patients was 75 mg/dL with the highest level of 225 mg/dL. In PCOS patients, who experience insulin resistance, there is a disruption in the glycolysis process where the pancreas continues to produce insulin but the body's cells do not absorb glucose in the blood, so it cannot be processed into energy, resulting in blood glucose levels will increase (Fadila, 2017). Women with PCOS have been considered insulin resistant, and are at high risk of developing diabetes (Bu Z, 2019). The Jeyakuma study in 2019 stated that 31-35% of PCOS women experienced an increase in fasting blood glucose.

The average total cholesterol level of PCOS patients is 168.93mg/dL, the average LDL level of PCOS patients is 105.85 mg/dL, the average HDL level of PCOS patients is 49.22 mg/dL, the average triglyceride level is PCOS

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patients is 154.85 mg/dL, the average result of these levels is included in the normal value. An increased lipid profile can occur in dyslipidemia and obesity, both of which are common metabolic disorders in PCOS. This situation can cause insulin resistance through increased production of free fatty acids (Wahyuni, 2015). Increased secretion of VLDL particles by the liver results in an increase in plasma concentrations of triglycerides, then triglycerides are exchanged for cholesteryl esters (CE) by the action of CE transfer protein. This process produces TG-enriched LDL particles that are catabolized more rapidly, and CE-enriched VLDL particles that are converted, into small LDL particles. As a consequence, insulin resistance contributes to decreased plasma levels of HDL-C and apolipoprotein (apo) A-I, as well as higher levels of apo-B. (Fauser, 2011). Lipid metabolism in women with PCOS may also be affected by the secretion of sex steroids by the ovaries and/or the adrenals. The effects of sex steroids on lipid metabolism are complex and involve the actions of both androgen and estrogen hormones. Hyperandrogenism has been associated with increased liver lipase activity. This enzyme, which has a role in HDL particle catabolism, shows strong sexual dimorphism, with exogenous androgens increasing and estrogens decreasing the activity of liver lipase enzymes. A study of 17 male-to-male transsexuals who were exposed to exogenous testosterone treatment showed a significant increase in liver lipase enzymes with a decrease in plasma HDL-C levels. Endogenous estrogens can influence LDL metabolism through up-regulation of LDL receptors, which results in hepatic clearance of LDL particles from plasma. Significant increase in cholesterol levels indicates a primary change in lipid metabolism in patients with PCOS (Ginting, 2013). Similar results were also found in Ginting Hendri's study in 2013 with an average total cholesterol level of 186.07 mg/dL, an average LDL level of 115.30 mg/dL, an average HDL level of 51.31 mg /dL, and the average triglyceride level was 95.80 mg/dL. Elevated LDL, and triglyceride (TG) levels with decreased HDL levels occur in dyslipidemic PCOS patients, although many women with PCOS have normal lipid profiles Referring to the National Cholesterol Education Program guidelines, nearly 70% of women with PCOS have at least one elevated or borderline lipid levels (Ginting, 2013).

Based on table 4.3, PCOS sufferers who have high fasting blood glucose (GDP) levels are 5 people (18.5%). There are 4 patients with PCOS who have high total cholesterol levels (14.8%). The number of PCOS sufferers who have high HDL levels is 4 people (14.8%). The number of PCOS patients who had high triglyceride levels was 6 people (22.3%). The results are in line with Rasidi's 2018 study, namely the levels of GDP (fasting blood glucose), triglycerides and cholesterol in PCOS cases were higher in non-PCOS patients. High blood glucose levels can stimulate the synthesis of cholesterol and the formation of glycogen from glucose, resulting in an increase in tissue lipolysis and a decrease in the effectiveness of lipoprotein lipase and ultimately causes the level of fat in the blood to increase (Ekawati, 2012).

The results of the Pearson correlation analysis test, in table 4.5 levels of GDP with total cholesterol levels obtained a closeness level (r) of 0.812 which means a strong relationship and the direction of the correlation is positive. At the level of GDP with LDL levels obtained a level of closeness (r) is 0.578 which means a strong relationship and the direction of the correlation is positive. At the level of GDP with HDL levels, the closeness level (r) is 0.574, which means that the relationship is strong and the direction of the correlation is positive. At the level of GDP with LDL levels obtained a level of closeness (r) that is 0.444 which means the relationship is moderate and the direction of the correlation is positive. The results of this study are in line with the research results of Roa et al. in 2009 in Venezuela, said that GDP levels with lipid profiles in PCOS patients had a consistent relationship, namely an increase in total cholesterol, LDL, and triglyceride levels while low HDL levels. This study has a slight difference in LDL and HDL levels which do not show significant changes, but have similarities with the research of Javadian et al. in 2011 who said women with PCOS had higher levels of triglycerides, cholesterol, and fasting blood glucose than normal women.

Glucose that increases excessively will damage blood vessels, because glucose cannot be processed into energy, so energy will be made from other sources such as protein and fat. As a result, cholesterol formed in fat metabolism in adipose tissue will accumulate in blood vessels so that cholesterol levels in the blood become high, high cholesterol levels will trigger the development of atherosclerosis in blood vessel walls. An increase in blood glucose levels is directly proportional to an increase in total cholesterol, LDL, and triglyceride levels. High levels of cholesterol in the blood is a serious problem because it is a risk factor for various non-communicable diseases such as heart disease, stroke and diabetes mellitus (Anies,2015). Risk factors for high cholesterol levels in PCOS patients are insulin resistance, hyperinsulinemia, impaired fatty acid metabolism and hyperglycemia (Fadila, 2017).

5. Conclusion

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Based on the research that has been done, it can be concluded as follows :

1. There is a relationship between fasting blood glucose (GDP) levels and lipid profiles (total cholesterol, LDL, HDL, and triglycerides). The level of GDP with total cholesterol obtained a Sig (p) value of 0.000 ($p < 0.05$) with a strong closeness (r) and a positive direction of correlation (0.812). GDP levels with LDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness (r) and a positive direction of correlation (0.578). GDP levels with HDL levels, obtained a sig (p) value of 0.002 ($p<0.05$) with a strong closeness (r) and a positive direction of correlation (0.574). GDP levels with triglyceride levels, obtained a sig (p) value of 0.020 ($p < 0.05$) with a moderate level of closeness (r) and a positive direction of correlation (0.444).
2. The majority of PCOS sufferers in Budhi Asih Hospital are in the age group of 26-30 years as many as 15 people or 55.6% and the second most is the age group 31-35 years with 4 patients or 14.8%.
3. The average blood glucose level of PCOS patients in Budhi Asih Hospital is 118.30mg/dL with a minimum blood glucose level of 75 mg/dL and a maximum level of 225 mg/dL. The average total cholesterol level is 168.93mg/dL with a minimum total cholesterol level of 78 mg/dL and a maximum level of 274 mg/dL. The average LDL level is 105.85mg/dL with a minimum LDL level of 55 mg/dL and a maximum level of 156 mg/dL. The average HDL level is 49.22 mg/dL with HDL minimum 30 mg/dL and maximum level 94 mg/dL. The average triglyceride level is 154.85 mg/dL with a minimum triglyceride level of 58 mg/dL and a maximum level of 307 mg/dL.

The suggestions that can be submitted are as follows:

1. For PCOS sufferers, it is recommended to maintain a healthy lifestyle and diet regardless of age or any clinical condition so as not to be exposed to the risk of metabolic disorders.
2. For further researchers, it is necessary to do research by adding screening examination variables such as Body Mass Index (BMI), Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH).
3. For educational institutions, it is hoped that the results of this study can be used as reading material or additional literature for readers about PCOS.

6. Acknowledgement

Thank you to as well as Mr., Ms. Lecturers and staff of the Department of Medical Laboratory Technology who have provided guidance, direction, and support in preparing this research. Thank you to the Education and Training staff, Clinical Laboratory staff and Medical Record staff at Budhi Asih Hospital who helped the author in the data collection process.

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