

The Relationship Between Obesity and Level of Polycystic Ovary Syndrome (PCOS) : Literature Review

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ABSTRACT

Polycystic ovary syndrome (PCOS) is a condition related with genetics, obesity, insulin resistance, and hyperandrogen causes menstrual irregularities, oligo-ovulation or anovulation, infertility, metabolic disorders and others. Obesity has a negative impact on reproductive organs make functional changes from the HPO axis, obese women also have high insulin levels and increase in androgen production. This study to determine the relation between obesity and the incidence of PCOS. The research design is literature review conducted based on the results of searching scientific articles on the Google Scholar, Science Direct and PubMed databases, using the keywords "obesity" OR "overweight" AND "prevalence of PCOS". Obtained 15 scientific articles according to the inclusion criteria, can be analyzed. The conclusion there is a relationship between PCOS and obesity, this correlates with increase in IR and hyperandrogens. Prevalence of BMI and weight gain increased in women with PCOS. Obese women with hyperandrogen increase the risk of PCOS.

Keywords: *obesity, overweight, PCOS prevalency*

1. INTRODUCTION

Obesity is a global health disorder that can cause insulin resistance, hyperinsulin, impaired glucose tolerance, and obstructive sleep apnea. In Indonesia, the prevalence of obesity increases from year to year, in 2007 it was around 10.5% in 2013 14.8% and increased in 2018 21.8%. (Kemenkes, 2018).

Obesity decreased quality of life, lower productivity, increased progression of chronic diseases and a risk factor for other diseases. Obesity increases the risk of metabolic, cardiovascular, musculoskeletal, Alzheimer's disease and depression (Heslehurst Id *et al.*, 2019).

Obesity has a severe impact on the reproductive organs because it alters the function of the HPO axis. Obese women have high insulin levels, which leads to an increase in androgen production, resulting in menstrual cycle abnormalities such oligomenorrhea and hyperandrogens (Broughton & Moley, 2017).

Polycystic ovary syndrome (PCOS) is a condition associated with genetics, obesity, insulin resistance, hormone stimulation and hyperandrogenism. Women with PCOS have disorders of the reproductive organs,

excessive androgen hormones, menstrual irregularities, oligo-ovulation or anovulation, infertility, metabolic disorders, dyslipidemia and many others (Joham *et al.*, 2016).

The prevalence of PCOS in women of reproductive age worldwide is around 12-18%, while PCOS in women of childbearing age is around 6-21% of the world's population (Johamet *al.*, 2016). PCOS affects 26 percent of women in Europe, 5-10 percent of women in the United States, and 44.9 percent of women in Beijing (Imantika *et al.*, 2014). In Palembang, PCOS was found in 78.8% of women who visited obstetrics and gynecology practice between 2014 and 2017. (Mareta *et al.*, 2018). Another study in the city of Lampung, there were 70% of PCOS sufferers from 316 subjects studied, and most were found at the age of 24-27 years (Mareta *et al.*, 2018). Research at the regional general hospital (RSUD) dr. Soetomo Surabaya, there are around 79 PCOS people with the most ages between 25-44 years (Putra, 2019). 74.3% infertility was found in PCOS women. Research shows that approximately 30-40% of women with PCOS have prediabetes, 12.6% with type 2 diabetes, insulin resistance disorders, inflammation, adipose dysfunction,

impaired fasting glucose and impaired glucose tolerance (Liao *et al.*, 2021).

PCOS is a reproductive health problem that is detected as an adult, due to a lack of awareness of reproductive health in adolescents. This can increase other complications if not detected immediately. Women who are obese are at a higher risk of developing metabolic syndrome, which can cause hyperinsulin and increase the occurrence of PCOS (Kataoka *et al.*, 2019)

Women with PCOS have a tendency to be obese with a BMI 25, and have lipid (metabolic) profile abnormalities, which raise the risk of type 2 diabetes, cardiovascular disease, infertility, and other chronic disorders (Alves *et al.*, 2017). Obesity and PCOS are linked through the hypothalamic-pituitary-ovarian (HPO) system which leads to the development of PCOS (Barber *et al.*, 2019). Between 32.7% and 67.3% of obese women were diagnosed with PCOS (Goodman *et al.*, 2015). Obesity causes severe clinical manifestations of PCOS metabolism, insulin resistance, hyperinsulin, increased androgen or adrenal production and suppresses sex hormone binding globulin (SHBG) (Anderson *et al.*, 2014).

2. METHOD

The type of research used is a literature review. Data collection by taking literature related to the problem, the data will be collected to answer the problem.

Data collection in this study was sourced from online databases including: pubmed, science direct and google scholar using the following keywords: (“obesity” OR “overweight” AND “prevalence PCOS”). This study collected data in the form of research publications from a variety of nations during a short period of time, focusing on articles published between 2011 and 2021. The literature review has been approved by the Ethics Commission with No. 3879/C.1/KEPK-FKUMS/XI/2021.

3. RESULT

There 15 literatures that matched inclusion criteria for further analysis in a narrative review.

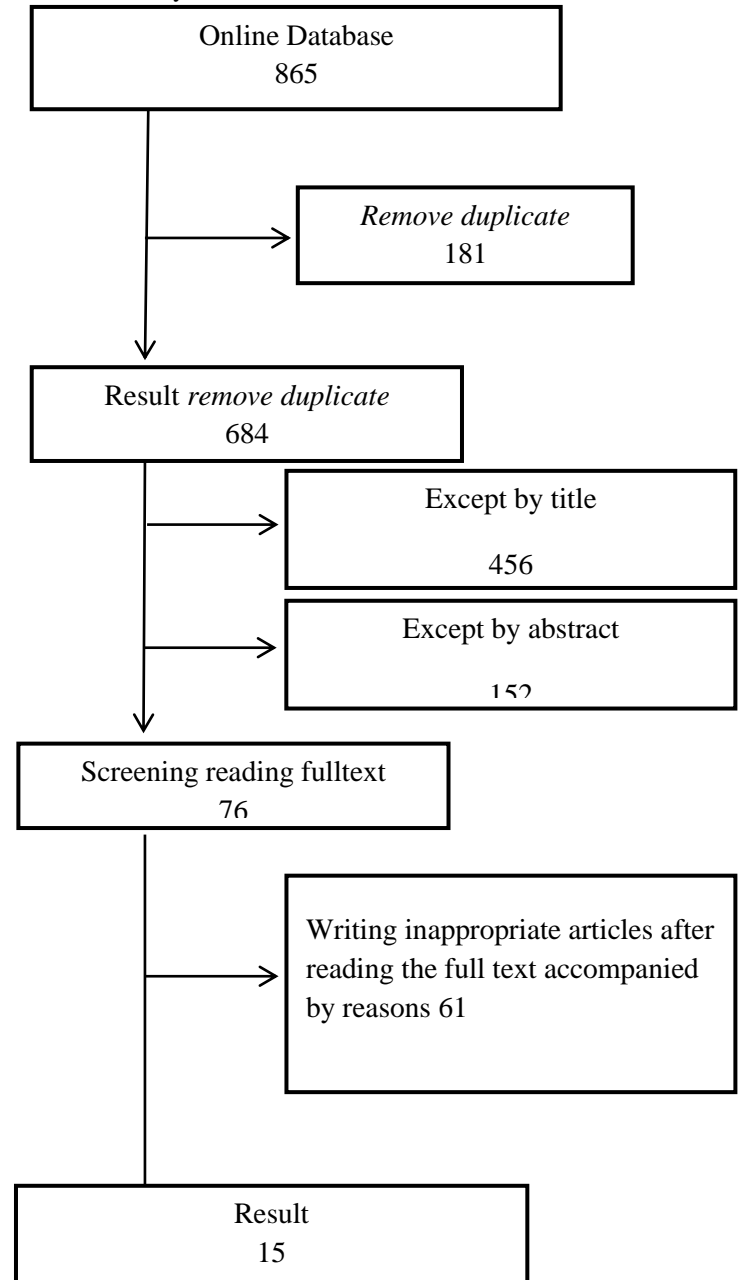


Figure 1. PRISMA flow diagram

Table 1. Article characteristics

No	Nama tahun	Title	Desain study	Patient population and criteria	Result	Conclusion
	(Medeiros <i>et al.</i> , 2021)	<i>Comparison of metabolic and obesity biomarkers between adolescent and adult women with polycystic ovary syndrome</i>	<i>Cross-sectional study</i>	Participants was 310, 62 were adolescents with PCOS and 248 adults with PCOS.	In women, PCOS adults obesity is 94 (37.9%) adolescents 12 (21%). IR 35.7% adolescents and 48.4% adults. FAI increased 41.1% in adolescents and 47.2% adults	Significant P=0.016 OR=1.12
	(Kim <i>et al.</i> , 2019)	<i>Prevalence of insulin resistance in homeostasis model assessing for syndrome according to various Korean women with polycystic ovary insulin resistance cutoff values</i>	<i>Case control study</i>	1271 participants age 15-44 years in PCOS and 18-42 in control.	<ul style="list-style-type: none"> control <ul style="list-style-type: none"> 27 (4,7%) <i>overweight</i> 21 (3,7%) obesity PCOS <ul style="list-style-type: none"> 63 (9,4%) <i>overweight</i> 142 (21,1%) obesity HOMA IR increased 48,4% of lean women with PCOS and 33,3% in controls with obesity. FAI in PCOS women was 5.53.	Significant P=0,001 R=0,504 in PCOS R=0,009 in control
	(Ybarra <i>et al.</i> , 2018)	<i>Polycystic Ovary Syndrome among Obese Adolescents</i>	<i>Cross-sectional study</i>	49 participants age 10-18, with methformin and contraception oral use.	<ul style="list-style-type: none"> 5 (10,2%) <i>overweight</i> 26 (53,1%) obesity 18 (36,7%) svere obesity. FAI in participants 6,3.	Not significant P=0.453
	(Chowdhury & Chakraborty, 2017)	<i>Relationship of subclinical hypothyroidism and obesity in polycystic ovarian syndrome patients</i>	<i>Cross-sectional study</i>	287 participants normal BMI 21 with hypotiroid, 91 eutiroid and 37 women <i>overweight</i> hypotiroid and 138 eutiroid	<ul style="list-style-type: none"> PCOS <ul style="list-style-type: none"> 112 (39%) IMT normal TSH : 2,27 175 (61%) IMT <i>overweight</i> TSH : 3,10 Testosteron increased significantly 0,005	Obesity and PCOS Significant P=<0.001 Obesity with in hipotyroid PCOS Not significant P=0,622

(Ollila et al., 2016)	<i>Weight Gain and Dyslipidemia in Early Adulthood Associate with Polycystic Ovary Syndrome: Prospective Cohort Study</i>	<i>Cohort study</i>	A total of 3127 participants were observed from time to time and collected at the age of 14, 31 and 46 years by administering a questionnaire, physical examination and laboratory examination at the age of 31 years.	<ul style="list-style-type: none"> • IMT in 14 Control : 19 normal PCOS : 20 normal • IMT in 31 Control : 24 normal PCOS : 26 <i>overweight</i> • IMT in 46 Control : 26 <i>overweight</i> PCOS : 28 obesity HOMAIR: 1,89 FAI: 1,12	IMT and PCOS Significant P=<0.001 BMI and insulin OR 1,07 BMI and FAI OR 1,06
(Muñoz et al., 2016)	<i>Association of obesity and overweight with the prevalence of insulin resistance, pre-diabetes and clinical-biochemical characteristics among infertile Mexican women with polycystic ovary syndrome: a cross-sectional study</i>	<i>Cross-sectional study</i>	613 participants diagnosed with PCOS and infertility.	<ul style="list-style-type: none"> • 83 (15,4%) IMT normal • 217 (40,3%) <i>overweight</i> • 238 (44,3%) obesity HOMA-IR ≥2,5 16 (19,3%) IMT normal 122 (56,2%) <i>overweight</i> 186 (78,2%) obesity	Obesity and PCOS Significant P=<0.0001 BMI and IR R=0,38
(Yuan et al., 2016)	<i>Polycystic ovary syndrome patients with high BMI tend to have functional disorders of androgen excess: a prospective study</i>	<i>Case control study</i>	Participants were 255, with 125 Chinese adult women diagnosed with PCOS and 130 women with regular menstruation as controls.	<ul style="list-style-type: none"> • 5,6% obesity • 9,6% <i>overweight</i> • 66,4% <i>underweight</i> FAI is higher in PCOS and SHBG is lower in PCOS.	Significant P=<0.0001 Hyperandrogen, and decreased SHBG in PCOS OR: 4,41
(Zhang et al., 2015)	<i>High Intake of Energy and Fat in Southwest Chinese Women with PCOS: A Population- Based Case-Control Study</i>	<i>Case control study</i>	Of the 507 participants aged 12-44 years who are ethnic Chinese. 169 participants diagnosed with PCOS and 338 controls not PCOS	Prevalence of obesity in PCOS 16(16.6%) in control 7(2.1%) Hyperinsulin PCOS 11.8% in control 7.4%. IR PCOS 35,5% in control 34,3%.	Significant P=<0.001
(Chen et al., 2015)	<i>Adiponectin and leptin in overweight/obese and lean women with polycystic ovary syndrome</i>	<i>Retrospective study</i>	Of the 422 women of Taiwanese race 224 with PCOS 198 without PCOS. The average age for obesity PCOS is 27 years and non PCOS is 30 years, the average age for thin women with PCOS is 25 years and non-PCOS is	<ul style="list-style-type: none"> • Control 61 women IMT ≥25 (<i>overweight-obesity</i>) 137 women IMT ≤25 (<i>normal-underweight</i>) PCOS	Significant P=0.301

			38 years..	121 women IMT ≥ 25 (obesity- overweight) 103 women IMT ≤ 25 (normal-underweight) HOMA IR 76% on obesity with PCOS, 37% PCOS underweight, 74% obesity not PCOS and 27% underweight not PCOS	
(Boyle et al., 2015)	<i>Polycystic ovary syndrome and metabolic syndrome in Indigenous Australian women</i>	<i>Cross-sectional study</i>	There were 109 Australian women who could participate in the study with 38 PCOS women, 5 of whom had diabetes, and 79 controls did not have PCOS	<ul style="list-style-type: none"> In PCOS, BMI was 33.4, HOMA-IR 3.6 and SHBG 19.8. In control, BMI was 23.8, HOMA-IR was 1.7 and SHBG was 41.4. 	Significant P=0.0001 OR=0,83
(Hosseinpanah et al., 2014)	<i>Metabolic aspects of different phenotypes of polycystic ovary syndrome: Iranian PCOS Prevalence Study</i>	<i>Cross-sectional study.</i>	There are 136 Iranian women aged 18-45. The mean age for PCOS women is 33.6 years.	<ul style="list-style-type: none"> 49 (36,5%) IMT normal 51 (37,1%) overweight 36 (26,4%) obesity HOMA-IR: 1,7	Significant P=0.02 OR=2.49
(Esmailzadeh et al., 2014)	<i>Polycystic ovary syndrome in Iranian adolescents</i>	<i>Cross-sectional study</i>	A total of 1549 Iranian women aged 16-20 years. There were 129 PCOS women with an average age of 18 years and controls without PCOS 1420 with an average age of 17.2 years.	<ul style="list-style-type: none"> control 120 (8,5%) <i>underweight</i> 1044 (73,5%) normal 182 (13,2%) <i>resiko overweight</i> 74 (5,4%) <i>overweight</i> HOMA-IR 68% <ul style="list-style-type: none"> PCOS 14 (10,9%) <i>underweight</i> 84 (65,1%) normal 22 (17,1%) <i>resiko overweight</i> 9 (7%) <i>overweight</i> HOMA-IR 80,6%	Tidak significant P=0.237 OR=0.70

(Kim et al., 2014)	<i>Complete phenotypic and Korean women with polycystic consecutive cohort of untreated metabolic profiles of a large ovary syndrome</i>	<i>Cross-sectional study</i>	About 865 Korean women with PCOS were classified based on complaints of irregular menstruation, hyperandrogen or polycystic ovaries, 500 participants and the group with complaints of irregular menstruation or polycystic ovaries. With a mean age of 24 years in PCOS women	<ul style="list-style-type: none"> • 122 (14.1%) overweight • 174 (20.1%) obesity FAI: 3,79 HOMA-IR: 1,95 	Significant P=<0.001
(Li et al., 2014)	<i>Prevalence and predictors of metabolic abnormalities in Chinese women with PCOS: a cross-sectional study</i>	<i>Cross-sectional study</i>	Chinese women as many as 3565 who took part in the study with the age of 19-45 years. The average age of PCOS women is 29.1 years.	<ul style="list-style-type: none"> • IMT <23 <i>underweight</i> Non-PCOS 4,9% PCOS 4,8% • IMT 23,1-24,9 normal Non-PCOS 21,3% PCOS 25,0% • IMT 25-30 <i>overweight</i> Non-PCOS 24,4% PCOS 47,6 • IMT <30 obesity Non-PCOS 21,3% PCOS 25,0% HOMA-IR: 0,9 FAI: 3,7 	Significant P=<0.001 OR=1,420
(Rashidi et al., 2014)	<i>To what extent does the use of the Rotterdam criteria affect the prevalence of polycystic ovary syndrome? A community-based study from the Southwest of Iran</i>	<i>Community-based study</i>	A total of 602 women of reproductive age 18-45 years in Iran. Women without PCOS were 279 and 421 women with PCOS. The median age in PCOS women 29 years.	<ul style="list-style-type: none"> • 36,9% <i>overweight</i> • 22,1% obesity FAI: 3,0 	Significant

Based on the analysis, fifteen literatures were analyzed and according to the inclusion criteria. Ybarra et al (2018) found insignificant relationship between obesity and the risk level for PCOS cause the women, both control and PCOS women, had a BMI that was classified as overweight to severe obesity. Metformin in this study was used as therapy in PCOS can increase IR, oral contraceptives as a therapy complaints in the PCOS group stabilizing hormones in PCOS.

Esmaeilzadeh et al (2014) adolescents with a family history of obesity increase the risk of obesity, which is associated with genetic factors, lifestyle and unhealthy food intake. Chowdhury & Chakraborty (2017) there is no relationship between hypothyroidism and obesity and PCOS, but higher TSH levels in obese women can increase the production of fat cells by inflammatory mediators through the hormone leptin. This disease is also associated with systemic inflammation, with an increase in inflammatory mediators such as C reactive protein, TNf, cytokines such as interleukin 6 (IL-6) and IL-18, and leukocytes (Muñoz et al., 2016).

Hyperinsulin at 31 will increase diagnosis of PCOS at age 46 years. obesity and weight gain at the age of 20 and 30 years diagnosed PCOS at the age of 27-30 (Ollila et al., 2016).

Overweight and obese PCOS women increased IR and hyperandrogen characterized by increased testosterone (Hosseinpanah et al., 2014).

Hyperandrogen increases the risk hyperinsulin causes androgen secretion ovaries and inhibits SHBG production (Yuan et al., 2016). PCOS increase in LH and a decrease in FSH (Zhang et al., 2015). Study of Esmaeilzadeh et al (2014) there were not significant differences levels of FSH, LH, and free testosterone between overweight women and women with normal BMI (Esmaeilzadeh et al., 2014). In this study, relationship between the LH and FSH indices has not been explained with the incidence of obesity and PCOS.

PCOS women with obesity stimulate an increase in androgen hormones, adipose mass, and dyslipidemia (Yuan et al., 2016). High leptin levels due to fat mass can increase IR, testosterone and BMI, and decrease adiponectin levels, which causes a higher BMI. overweight and obese PCOS women had lower adiponectin levels and higher leptin levels than control women (Chen et al., 2015).

Kim et al (2019) PCOS women with normal BMI also increased IR the same as overweight and obese control women but in PCOS women with obesity the increase in IR was higher, increasing body weight can also reduce insulin sensitivity (Kim et al., 2019).

Obesity during adolescence can increase the occurrence of IR followed increase androgen hormones (Medeiros et al., 2021). In adolescents who experience puberty earlier can increase the risk of PCOS (Li et al., 2014). The presence of hyperandrogens during puberty increase body weight, triglyceride levels in adulthood and risk factor that increases the incidence of PCOS (Ollila et al., 2016). Significant obesity in adolescents may be a risk factor for PCOS (Ybarra et al., 2018)

Metabolic syndrome is more common in women with PCOS because of an increase in BMI and IR (Boyle et al., 2015). BMI differences can also occur due to genetic factors, lifestyle and dietary habits (Rashidi et al., 2014). Kim et al (2014) food intake and exercise, which form the basis for PCOS management, most women with this disease do not exercise regularly. Women with complaints of hyperandrogenism, polycystic ovaries and IR have a higher prevalence of obesity and metabolic disorders than women with PCOS without an increase in androgens. Increased awareness of education and counseling for PCOS women regarding lifestyle changes is very much needed in the management of PCOS (Kim et al., 2014).

Limitation in this study, is a literature review looking for literature in the database used so that more cross-sectional studies are obtained that cannot be observed whether patients come with complaints of obesity or PCOS. The exclusion criteria in this study were only pregnant subjects, so that the incidence of PCOS could be caused by etiologies such as family history, androgen-secreting tumors and others.

4. CONCLUSION

For further researchers can identify other factors that can cause an increased risk of PCOS. Excluding the etiology of increased androgen hormone, IR and decreased SHBG other than PCOS and a family history of PCOS. Searching the cohort literature so that it can be observed from time to time regarding the effect of obesity and PCOS.

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