

# Polycystic ovary syndrome: risk factor for reproductive age women's: epidemiological study in Iraq

Síndrome de ovario poliquístico: factor de riesgo para las mujeres en edad reproductiva: estudio epidemiológico en Irak

437

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Received: 07/20/2024 Accepted: 08/19/2024 Published: 09/12/2024 DOI: <http://doi.org/10.5281/zenodo.14248940>

## Abstract

**Background:** One of the most widespread endocrine issues affecting women of reproductive age is PCOS, which is also one of the main reasons of infertility. Cysts are not harmful, but they do cause hormonal problems, that can cause period problems and make it difficult to conceive<sup>1</sup>.

**Study Material:** A quantitative study design (case-control study) was carried out in order to achieve the stated objective that include to identify of the polycystic ovary syndrome risk factors in women of reproductive age. The study is begun from July 7, 2021 to September 16, 2021 in Karbala Governmental. **Sample and sampling:** Study Sample non-probability Purposive sample of 61 control case and 50 study case woman's.

**Results:** The study results that the indicate different between control and study groups) for risk factors among (PCOS) for study sample. This table explain according to difference according to (Odd ratio) which there is that the no different between control and group study among

patient risk factors (variable (PCOS such as (bad mood, Family History of diabetes, Fast food, Physical activity, discharge, and body mass index (0.84, 0.80, 0.59, 0.79, 0.66, 0) respectively. While there is effect of risk factors among study groups for variables are (PCOS in the family, infertility in the family, regular menstruation in the mother, and dietary) (2.71, 2.97, 1.55, and 1.22) respectively.

**Conclusion:** The study conclude the most the study sample for control study is (26-31) years and (19) years for study groups within and within level of education have academic study for control and secondary school for study. The study conclude by determine risk factors for poly cyst syndrome through comparison between case and study groups are PCOS in the family, infertility in the family, regular menstruation in the mother, and dietary.

**Keywords:** PCOS (polycystic ovarian syndrome), its risk factors, and its etiology

## Resumen

**Antecedentes:** Uno de los problemas endocrinos más extendidos que afectan a las mujeres en edad reproductiva es el síndrome de ovario poliquístico, que también es una de las principales causas de infertilidad. Los quistes no son dañinos, pero sí provocan problemas hormonales, que pueden provocar problemas menstruales y dificultar la concepción<sup>1</sup>.

**Material de estudio:** Se realizó un diseño de estudio cuantitativo (estudio de casos y controles) para lograr el

objetivo planteado que incluye identificar los factores de riesgo del síndrome de ovario poliquístico en mujeres en edad reproductiva. El estudio se inició del 7 de julio de 2021 al 16 de septiembre de 2021 en Karbala Governmental. Muestra y muestreo: Muestra de estudio no probabilística Muestra intencional de 61 casos de control y 50 casos de estudio de mujeres.

**Resultados:** Los resultados del estudio indican diferencias entre los grupos de control y de estudio) para los

factores de riesgo entre (SOP) para la muestra del estudio. Esta tabla explica según la diferencia según (Odd ratio) que existe, que no hay diferencias entre el control y el estudio grupal entre los factores de riesgo del paciente (variables (SOP como (mal humor, antecedentes familiares de diabetes, comida rápida, actividad física, alta y el índice de masa corporal (0,84, 0,80, 0,59, 0,79, 0,66, 0) respectivamente, aunque existe un efecto de los factores de riesgo entre los grupos de estudio para las variables (SOP en la familia, infertilidad en la familia, menstruación regular en la familia). madre y dieta) (2,71, 2,97, 1,55 y 1,22) respectivamente.

**Conclusión:** El estudio concluye que la muestra de estudio para el estudio de control es (26-31) años y (19) años para los grupos de estudio dentro y dentro del nivel de educación que tienen estudios académicos para el control y escuela secundaria para el estudio. El estudio concluye determinando los factores de riesgo para el síndrome de poliquistes mediante la comparación entre los grupos de casos y de estudio: SOP en la familia, infertilidad en la familia, menstruación regular en la madre y dieta.

**Palabras clave:** SOP (síndrome de ovario poliquístico), sus factores de riesgo y su etiología.

**P**olycystic ovarian syndrome (PCOS) is a multifactorial endocrine condition that affects approximately 5%–10% of reproductive-aged women. Women with PCOS are more likely to experience oligo- or anovulation, obesity, and hyperandrogenism<sup>2</sup>. Symptoms of PCOS include hyperinsulinemia, glucose intolerance, hyperlipidemia, type 2 diabetes, hypertension, coronary atherosclerosis, and endometrial cancer<sup>3,4</sup>.

It is believed that oxidative stress has a role in a number of diseases, including cancer, Alzheimer's disease, autism, atherosclerosis, diabetes, heart failure, and infection<sup>5,6</sup>. Oxidative stress is the term used to describe the imbalance between oxidants and antioxidants that causes an abnormal redox state in cells.

These antioxidants have been linked to the cause of female infertility as well as the female reproductive system<sup>7,8</sup>. PCOS and oxidative stress have been connected<sup>9,10</sup>. In a meta-analysis study, Murri et al. came to the conclusion that circulating markers of oxidative stress are abnormal in women with PCOS, suggesting that

oxidative stress may be involved in the pathogenesis of PCOS<sup>11</sup>.

The significance of oxidative stress in the development of PCOS, however, is still unknown.

Although the origin of polycystic ovary syndrome is unknown, family and twin investigations have revealed evidence of a hereditary component<sup>12</sup>. In women with polycystic ovarian syndrome, oligo-ovulation or anovulation is a typical reason for infertility, and in order to get pregnant, these women may need ovulation induction or assisted reproductive technologies<sup>13</sup>.

Lifestyle changes, on the other hand, can help to alleviate the endocrine and metabolic effects in cases of polycystic ovarian syndrome, perhaps relieving anovulation-based infertility<sup>14</sup>. There is confirmation of polycystic ovarian syndrome negatively affects the course of pregnancies, including an increased risk of gestational diabetes, hypertension during pregnancy, and preterm birth<sup>15</sup>.

The most prevalent endocrine condition affecting women is PCOS (polycystic ovarian syndrome), with prevalence rates in this group of women ranging from 4 to 18 percent<sup>16,17</sup>.

Obesity, poor Type 2 diabetes mellitus (DM), metabolic syndrome, dyslipidemia, and cardiovascular disease are all related with PCOS<sup>18</sup>. The severity and manifestation of these symptoms may change over time both within an individual and throughout the population. There is presently no treatment for PCOS, which has an unknown origin. The cornerstones of modern care are the treatment of symptoms and the management of risk factors for linked disorders. PCOS patients frequently worry about infertility or subfertility, with varying levels of reported prevalence.

Several meta-analyses have been conducted to look at the link link the likelihood of having a difficult pregnancy and PCOS. Birth weight changes, early pregnancy loss, gestational diabetes mellitus (GDM), and hypertensive problems have all been associated with PCOS<sup>19,20</sup>.

**Study Material:** A quantitative study design (case-control study) was carried out in order to achieve the stated objective that included to identify of the risk factors for polycystic ovary syndrome among reproductive age. The study is begun from July 7, 2021 to September 16, 2021 in Karbala Governmental. **Sample and sampling:** Study Sample non-probability Purposive sample of 61 control case and 50 study case woman's Furthermore, the target population are woman's who attending to gynecology consultant in Government hospital in Karbala health directorate. A study cases their majority suffer from menstrual disorder. In order to strengthen the validity of this instrument and make it better suited to attaining the goals of the current study, certain statements of this questionnaire were developed and modified.

**Instruments:** The research instrument was made up of three parts: Data on the demographics and the clinical Information for woman's and risk factors about poly cyst ovarian syndromes (10) items.

**Data collection:** The collected data was interview by researcher with women's among study or control cases to complete some information, each questionnaire need time (10-15) minutes.

**Statistically analyzed** by two methods:

- A statistical method that is descriptive (frequencies and percentages).
- Statistical inference method (Correlation Coefficient and P. Value). and odd Ratio.

Table 1. Statistics distribution of the study sample by their demographic data for control and study groups

Demographic data	Rating	Control (N=61)		Case (N=50)	
		Frequency	Percent	Frequency	Percent
Age/ years	<=19	2	3.3	17	34
	20-25	13	21.3	12	24
	26 - 31	21	34.4	8	16
	32 - 37	10	16.4	4	8
	38 - 43	10	16.4	6	12
	44 - 49	7	11.5	3	6
Education	Illiterate	3	4.9	2	4
	Primary	11	18	19	38
	Secondary	16	26.2	20	40
	Institute	10	16.4	2	4
	College	21	34.4	7	14
Marital state	Single	3	4.9	3	6
	Married	58	95.1	47	94
Occupation	House wife	33	54.1	39	78
	Employee	25	41	6	12
	Student	3	4.9	5	10
Residency	Urban	50	82	33	66
	Rural	11	18	17	34
Gravid	0	35	57.4	36	72
	1	2	3.3	1	2
	2	20	32.8	13	26
	3	4	6.6	36	72
Parity	0	13	21.3	33	66
	1	6	9.8	7	14
	2	15	24.6	9	18
	3	8	13.1	0	0
	4	9	14.8	0	0
	5	8	12.2	1	2
Socioeconomic class	Upper	14	23	5	10
	Lower	5	8.2	15	30
	media	42	68.9	30	60
	Total	61	100	50	100

This table show that the study result that indicate most the study sample for control study is (26-31) years and (19) years for study groups within and within level of education have academic study for control and secondary school for study. Regarding the residence the study sample was live in urban and haven't gravid, also in study group haven't parity but in control groups have two. However, the study results indicate related to socioeconomic class for control and study group is media class.

**Table 2 summary statistics for study sample response about risk factors among women complication with polycystic ovarian syndrome**

	Rating	Control (N=61)		Case (N=50)	
		Frequency	Percent	Frequency	Percent
<b>(Risk factor) Menstrual cycle Complication Menstruation related to PCOS</b>	DON'T	42	68.9	4	8
	Dysmenorrhea	3	4.9	19	38
	Amenorrhea:	8	13.1	7	14
	Menorrhagia:	5	8.2	11	22
	Metrorrhagia:	2	3.3	1	2
	Hypomenorrhea	1	1.6	6	12

This table depict that the study results for complication menstruation among patient women with polycystic ovarian syndrome in control is don't any complication but in study groups is dysmenorrhea.

**Table 3 summary statistics for study sample responses for risk factors for psychological symptoms among patient with (PCOS)**

	Rating	Control (N=61)		Case (N=50)	
		Frequency	Percent	Frequency	Percent
<b>(Risk factor)</b>	DON'T	19	31.1	8	16
	Anxiety	17	27.9	8	16
<b>Psychological</b>	Depression	3	4.9	1	2
	Psychosexual dysfunction:	6	9.8	1	2
<b>symptoms related to PCOS</b>	Eating disorder	12	19.7	2	4
	Anxiety,				
	depression And eating	4	6.6	26	52
	disorder				

This table depict that the study results for psychological symptoms among patient women with polycystic ovarian syndrome in control is don't psychological symptoms in study. While in study groups are suffer from anxiety, depression and eating disorder.

**Table 4 summary statistics for study sample for different between control and study groups) for risk factors among (PCOS) according to (Odd Ratio)**

Risk factors for PCOS	Rating	Control (N=61)		Case (N=50)		Oddratio
		Frequency	Percent	Frequency	Percent	
Bad. mood	Yes	43	70.5	34	68	0.84
	No	17	27.9	16	32	
Family History	Yes	7	11.5	13	26	2.71
	No	54	88.5	37	74	
Family History of diabetes	Yes	42	68.9	32	64	0.804
	No	19	31.1	18	36	
Family History of infertility	Yes	9	14.8	17	34	2.97
	No	52	85.2	33	66	
Mothers Regular menstruation	Yes	57	93.4	41	82	1.55
	No	4	6.6	9	18	
Fast food	Yes	34	55.7	20	40	0.59
	No	27	44.3	30	60	
Physical activity	Present	8	13.1	5	10	0.79
	Absent	53	86.9	45	90	
Dietary	Vegan	2	3.3	2	4	1.22
	Mix	59	96.7	48	96	
Discharge	Yes	46	75.4	33	66	0.66
	No	15	24.6	17	34	
BMI	Normal	25	41	14	28	0
	Overweight	21	34.4	14	28	
	Obesity	15	24.6	22	44	

This table show the study results that the indicate different between control and study groups) for risk factors among (PCOS) for study sample. This table explain according to difference according to (Odd ratio) which there is that the no different between control and group study among patient risk factors (variable (PCOS such as (bad mood, Family History of diabetes, Fast food, Physical activity, discharge, and body mass index (0.84, 0.80, 0.59, 0.79, 0.66, 0) respectively. While, there is effect of risk factors among study groups for variables are (PCOS in the family, infertility in the family, regular menstruation in the mother, and dietary) (2.71, 2.97, 1.55, and 1.22) respectively.

**T**he study results for demographic data among control groups are (26-31) years old and (20-25) with study group among age groups. In addition, the most of the study sample for control and case groups are (secondary school), married, and house wife. However, the study results indicate regarding with residence address are urban and the majority of the study sample are don't have children and (2) parity for control and don't parity for study groups, in addition and related to socioeconomic class is insufficient for case and control groups.

According to the study, the prevalence of hirsutism (84.3%), acne (29.4%), and irregular menses (82.4%) among PCOS women suggests that Omani women with PCOS have a similar phenotype to South Asian women with PCOS. South Asian PCOS women had more acne, hirsutism, and irregular menses than Caucasian PCOS women did<sup>(21,22)</sup>. This could be explained by the proximity of Oman to South Asia in terms of both geography and culture, which has led to the sharing of genetic and sociocultural traits that have produced phenotypic similarities between Omanis and South Asians. The study finding most of the study samples are don't have risk factors for Complication Menstrual cycle Menstruation related to Poly Cyst ovarian syndrome (PCOS) for case group while opposite in study groups are suffer from Dysmenorrhea.

While previous research has shown that contraceptive pills are effective in Oral contraceptive tablets were the first line of defense in addressing clinical symptoms of androgen excess, such as acne and hirsutism, in polycystic ovarian syndrome. They also assist in cycle regulation and guard against estrogen's one-way effects on the endometrium<sup>21,22,23</sup>.

It is anticipated that a woman who has both of her ovaries removed would lose around 11% of her bone density

in a year<sup>24</sup>, and nursing mothers would lose about 5% in 6 months<sup>25</sup>.

Spinal bone density falls by around 10.5 percent from three years before menopause to three years after menopause<sup>26</sup>.

The findings of the study include psychological symptoms among patient women with polycystic ovarian syndrome, while the control group had no psychological symptoms. Anxiety, sadness, and eating disorders are common in study groups.

The findings of the study back up previous research that linked increased Stress and worry can contribute to polycystic ovarian syndrome development<sup>72</sup>.

Previous research has found that the findings of this study in connection to body weight are substantially equal to the level of fatty acid and androgenic regulation, which results in lower free testosterone levels and biochemically morbid polycystic ovarian syndrome. This may be connected to the degree of androgenic control and fatty acid levels, which result in lower free testosterone levels and biochemically morbid polycystic ovarian syndrome<sup>28</sup>.

Research participants' fast food diet patterns, participation in physical activity, body mass index, and waist circumference were all noted as potential risk factors for the onset of PCOS<sup>29</sup>.

The study finding that the indicate different between control and study groups) for risk factors among (PCOS) for study sample. The study finding according to difference according to (Odd ratio) which there is that the no different between control and group study among patient risk factors (variable (PCOS such as (bad mood, Family History of diabetes, Fast food, Physical activity, discharge, and body mass index (0.84, 0.80, 0.59, 0.79, 0.66, 0) respectively. While there is effect of risk factors among study groups for variables are (PCOS in the family, infertility in the family, regular menstruation in the mother, and dietary) (2.71, 2.97, 1.55, and 1.22) respectively.

Exercise has been demonstrated to impact lipid metabolism and insulin sensitivity in skeletal muscle. Exercise also raises the concentration of intra-myocellular triacylglycerol, which improves insulin sensitivity<sup>(30)</sup>. The 104 female participants' average age was 24.62 years, which is nearly the same as the average age reported in other studies<sup>31</sup>. 18 (17.3%) of them had polycystic ovary, which is almost in agreement with the study's findings<sup>32</sup>. In our study, the majority of the polycystic ovarian syndrome patients were females under the age of 25, and the results were statistically significant, similar to the study by<sup>33</sup>. Another study found that one in 15 girls between the ages of 25 and 30 have polycystic ovarian syndrome<sup>34</sup>.

According to some research, the percentage of PCOS patients with infrared IR was as high as 50%–70%<sup>35</sup>.

PCOS is frequently associated with a family history of diabetes, particularly inherited metabolic abnormalities. This is in line with Roe et al's findings<sup>36</sup>. The odds ratio for a mother's infertility was previously believed to be 8.599, but our research found that it was actually 2.97, suggesting that PCOS is a hereditary disorder<sup>37</sup>. The increased risk of PCOS in the daughter is correlated with the mother's irregular menstrual cycle<sup>38</sup>.

PCOS patients have indeed been shown to have severe mental or psychological disorders in both national and international psychology evaluation research, and it is assumed that having a bad mood increases the risk of PCOS. In this regard, Xiao et al's research described comparable findings<sup>39</sup>. A major risk factor for centripetal obesity is a lack of physical activity, which leads to an uneven distribution of body fat. One study indicates that obese PCOS patients should follow a healthy diet and exercise routine to alleviate that combining medicine with kinesiotherapy and individualized nutrition therapy within three months might result in considerable improvements in metabolism and internal secretion, including symptoms like excessive hair and irregular menstruation<sup>40</sup>.

1. The study concludes that the most of the study sample for control study is (26- 31) years and (19) years for study groups within and within level of education have academic study for control and secondary school for study.
2. The majority of the study sample in control is don't any complication but in study groups is dysmenorrhea.
3. Psychological symptoms among patient women with polycystic ovarian syndrome in control is don't psychological symptoms in study. While in study groups are suffer from anxiety, depression and eating disorder.
4. The study concludes by determine risk factors for polycystic syndrome through comparison between case and study groups are PCOS in the family, infertility in the family, regular menstruation in the mother, and dietary.

#### Author Contributions

Ridha M lefta planned, put the frame of the study, and collecting references. AMJS critically revised the manuscript. MAL revised with editing. AFO write the draft and collecting references.

#### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

#### Funding

The author receipt of financial support for the research, authorship, and/or publication of this article from university of Alameed.

## References

1. Suhas D, Suresh D, Panchshila D. Review on Introduction to PCOS and their management. *J Sci* 2015;5:208-12.
2. Azziz R, Woods KS, Reyna R, Key TJ, Knochenhauer ES, Yildiz BO. The prevalence and features of the polycystic ovary syndrome in an unselected population. *J Clin Endocrinol Metab.* 2004;89(6):2745-2749.
3. Mahmood M, El-Basel M, Sheta M. Polycystic ovary syndrome in premenopausal women with type 2 diabetes mellitus: prevalence, characters and related morbidity. *Med J Cairo Univ.* 2009;77(4):327-335.
4. Ehrmann DA. Polycystic ovary syndrome. *N Engl J Med.* 2005;352(12): 1223-1236.
5. Fang YZ, Yang S, Wu G. Free radicals, antioxidants, and nutrition. *Nutrition.* 2002;18(10):872-879.
6. Tošić-Pajić J, Šeklić D, Radenković J, et al. Augmented oxidative stress in infertile women with persistent chlamydial infection. *Reprod Biol.* 2017;17(2):120-125.
7. Agarwal A, Gupta S, Sharma RK. Role of oxidative stress in female reproduction. *Reprod Biol Endocrinol.* 2005;3:28.
8. Poston L, Igosheva N, Mistry HD, et al. Role of oxidative stress and antioxidant supplementation in pregnancy disorders. *Am J Clin Nutr.* 2011;94(Suppl\_6):1980S- 1985S.
9. Hilali N, Vural M, Camuzcuoglu H, Camuzcuoglu A, Aksoy N. Increased prolidase activity and oxidative stress in PCOS. *Clin Endocrinol (Oxf).* 2013;79(1):105-110.
10. Zuo T, Zhu M, Xu W. Roles of oxidative stress in polycystic ovary syndrome and cancers. *Oxid Med Cell Longev.* 2016;2016:8589318.
11. Murri M, Luque-Ramírez M, Insenser M, Ojeda-Ojeda M, Escobar Morreal HF. Circulating markers of oxidative stress and polycystic ovary syndrome (PCOS): a systematic review and meta-analysis. *Hum Reprod Update.* 2013;19(3):268-288.
12. Legro RS, Driscoll D, Strauss JF 3rd, Fox J, Dunaif A. Evidence for a genetic basis for hyperandrogenemia in polycystic ovary syndrome. *Proc Natl Acad Sci USA* 1998;95:14956-60.
13. Rajashekar L, Krishna D, Patil M. Polycystic ovaries and infertility: our experience. *J Hum Reprod Sci* 2008;1:65-72.
14. Moran LJ, Hutchison SK, Norman RJ, Teede HJ. Lifestyle changes in women with polycystic ovary syndrome. *Cochrane Database Syst Rev* 2011;2:CD007506.
15. Boomsma CM, Eijkemans MJ, Hughes EG, Visser GH, Fauser BC, Macklon NS. A meta-analysis of pregnancy outcomes in women with polycystic ovary syndrome. *Hum Reprod Update* 2006;12:673-83.
16. Melo AS, Vieira CS, Barbieri MA, et al. High prevalence of polycystic ovary syndrome in women born small for gestational age. *Hum Re-*

- prod. 2010;25:2124–2131.
17. Muscogiuri G, Altieri B, de Angelis C, et al. Shedding new light on female fertility: the role of vitamin D. *Rev Endocr Metab Disord*. 2017;18: 273–283.
  18. Muscogiuri G, Altieri B, de Angelis C, et al. Shedding new light on female fertility: the role of vitamin D. *Rev Endocr Metab Disord*. 2017;18: 273–283.
  19. Kjerulff LE, Sanchez-Ramos L, Duffy D. Pregnancy outcomes in women with polycystic ovary syndrome: a meta-analysis. *Am J Obstet Gynecol*. 2011;204:558.e1– 558.e6.
  20. Boomsma CM, Eijkemans MJC, Hughes EG, et al. A meta-analysis of pregnancy outcomes in women with polycystic ovary syndrome. *Hum Reprod Update*. 2006;12:673–683.
  21. Mani H, Davies MJ, Bodicoat DH, et al. Clinical characteristics of polycystic ovary syndrome: investigating differences in White and South Asian women. *Clin Endocrinol (Oxf)*. 2015;83(4):542–549.
  22. Wijeyaratne CN, Balen AH, Barth JH, Belchetz PE. Clinical manifestations and insulin resistance (IR) in polycystic ovary syndrome (PCOS) among South Asians and Caucasians: is there a difference? *Clin Endocrinol (Oxf)*. 2002;57(3):343–350.
  23. SD. Reed, D. Scholes, AZ. LaCroix, LE. Ichikawa, WE. Barlow, SM. Ott, et al., “Longitudinal changes in bone density in relation to oral contraceptive use,” *Contraception*, 68, pp. 177-82, 2003.
  24. M. Gambacciani, B. Cappagli, M. Ciaponi, C. Benussi, AR. Genazzani, “Hormone replacement therapy in perimenopause: Effect of a low dose oral contraceptive preparation on bone quantitative ultrasound characteristics,” *Menopause*, 6, pp. 43-8, 1999.
  25. M. Gambacciani, B. Cappagli, V. Lazzarini, M. Ciaponi, F. Fruzzetti, AR. Genazzani, et al., “Longitudinal evaluation of perimenopausal bone loss: Effects of different low dose oral contraceptive preparations on bone mineral density,” *Maturitas* 54, pp. 176-80, 2006.
  26. Hashimoto K, Nozaki M, Inoue Y, Sano M, Nakano H. The chronological change of vertebral bone loss following oophorectomy using dual energy X-ray absorptiometry: the correlation with specific markers of bone metabolism. *Maturitas* 1995;22:185–91.
  27. Kalkwarf HJ, Specker BL. Bone mineral changes during pregnancy and lactation. *Endocrine* 2002;17:49–53.
  28. Recker R, Lappe J, Davies K, Heaney R. Characterization of perimenopausal bone loss: a prospective study. *J Bone Miner Res* 2000; 15:1965–73.
  29. S. Benson, P. Arck, S. Tanc, S. Hahn, K. Mann, N. Rifaie, et al., “Disturbed stress responses in women with polycystic ovary syndrome,” *Psychoneuroendocrinology*, 34, pp. 727–735, 2009.
  30. H. Escobar-Morreale, J. Botella-Carretero, F. Ivarez-Blasco, J. Sancho, J. San Milla’n, “The Polycystic Ovary Syndrome Associated with Morbid Obesity May Resolve after Weight Loss Induced by Bariatric Surgery,” *J Clin Endocrinol Metab*, 90 (12), pp. 6364– 6369, 2005. Begum S, Shariff A, Ayman G, Mohammad B, Housam R, Khaled N. Prevalence of polycystic ovarian syndrome among students of RAK Medical and Health Sciences University, United Arab Emirates. *International Journal of Medicine and Pharmaceutical Science*. 2016;6:109–118.
  31. B. Keevil, “Steroid Mass Spectrometry for the Diagnosis of PCOS,” *Med. Sci*. 7, pp. 78, 2019.
  32. J. Mellembakken, S. Berga, M. Kilén, T. Tanbo, T. Abyholm, P. Fedorcsak, “Sustained fertility from 22 to 41 years of age in women with polycystic ovarian syndrome,” *Human Reproduction*, 26(9), pp. 2499–2504, 2011.
  33. R. Azziz, K. Woods, R. Reyna, T. Key, E. Knochenhauer, B. Yildiz, “The Prevalence and Features of the Polycystic Ovary Syndrome in an Unselected Population,” *J Clin Endocrinol Metab*, 89(6), pp. 2745–2749, 2004.
  34. T. Du, Y. Duan, K. Li, X. Zhao, R. Ni, Y. Li, D. Yang, “Statistical Genomic Approach Identifies Association between FSHR Polymorphisms and Polycystic Ovary Morphology in Women with Polycystic Ovary Syndrome,” *BioMed Research International*, 10 (1), pp. 7, 2015.
  35. S. Qureshi, K. Shah, J. Gupta, N. Upmanyu, “Prevalence and risk factor of polycystic ovarian syndrome,” *Asian J Pharm Clin Res*, 9(2), pp. 23-25, 2016.
  36. Karakas SE, Kim K, Duleba AJ. Determinants of impaired fasting glucose versus glucose intolerance of polycystic ovary syndrome. *Diabetes Care* 2010; 33(4): 887-893.
  37. Roe AH, Prochaska E, Smith M, Sammel M, Dokras A. Using the androgen excess- PCOS society criteria to diagnose polycystic ovary syndrome and the risk of metabolic syndrome in adolescents. *J Pediatr* 2013; 162(5): 937-941.
  38. Tian XX, Ruan XY, Wang J, Liu SY, Yin DM, Lu YJ, et al. Analysis of risk factors for 437 cases of polycystic ovary syndrome. *J Cap Univ Med Sci* 2014; 35(4): 414-418.
  39. Bates GW, Legro RS. Longterm management of polycystic ovarian syndrome (PCOS). *Mol Cell Endocrinol* 2013; 373(1–2): 91-97.
  40. Xiao WH, Qiu XY, Zhang T, Zhuang AW. Study on the mood of polycystic ovarian syndrome patients. *Zhejiang J Trad Chin Med* 2011; 46(11): 795-796.
  41. Le Donne M, Alibrandi A, Giarrusso R, Lo Monaco I, Muraca U. Diet, metformin and inositol in overweight and obese women with polycystic ovary syndrome: effects on body composition. *Minerva Ginecol* 2012; 64(1): 23-29.