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Prevalence of Polycystic Ovary Syndrome (PCOS) among Students of Kerman University of Medical Sciences and a Meta-Analysis of the Prevalence of PCOS among Iranian Adolescent

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Abstract

Background: The main objective of the present study was to investigate the prevalence of the polycystic ovary syndrome (PCOS) among girls' students of Kerman University of Medical Sciences and its relationship with anthropometric indices and the secondary purpose included a meta-analysis of the prevalence of PCOS in Iranian adolescent girls.

Materials and Methods: In the first part, the cross-sectional descriptive study was carried out on 636 students residing in dormitories of Kerman University of Medical Sciences. Cluster sampling was used and stepwise logistic regression was used to evaluate the factors affecting the prevalence of PCOS. In the second part of the study, online databases were searched in Scopus, PubMed, Web of Science, EMABSE and Persian Magiran, SID, and Iran Doc databases basis of inclusion-exclusion criteria until January 2020. STROBE checklist was used to measure for evaluating of study quality.

Results: At firs part, 636 girl's students participant in this study. A total of 73 patients (11.5%) had PCOS. There was a significant relationship only between waist circumference with the prevalence of PCOS. For every one centimeter increase in waist circumference, the odds ratio of developing PCOS increases by 7%. According to the findings of six studies in the present meta-analysis, the prevalence of PCOS is 5.2% (95% CI: 3-8%). Heterogeneity cross studies was highly significant ($P<0.01$; $I_2=94\%$).

Conclusion: The prevalence of PCOS in adolescents and childbearing age group is not high in Iran. The results of the present study showed a significant relationship between waist circumferences (WC) with the prevalence of PCOS, so that for one-centimeter increase in WC, the odds ratio of developing PCOS increases by 7%.

Key Words: Girls, Prevalence, Polycystic Ovary Syndrome, Meta-analysis, Students.

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1- INTRODUCTION

Polycystic ovary syndrome (PCOS) is a hormonal disorder whose symptoms can begin at the onset of puberty and within the menstrual cycle (1). PCOS affects about 4% of women of childbearing age and about 5 to 10% of the general population and is characterized by oligomenorrhea, amenorrhea, abnormal gonadotropins, abnormal obesity, acne, androgens, hirsutism, type 2 diabetes mellitus, hyperpigmentation, and hyperinsulinemia. Physicians use various criteria such as National Institutes of Health (NIH) (3), Rotterdam (4), and the Androgen Excess and PCOS Society (AEPCOS) (5) to diagnose PCOS (6). To make a diagnosis PCOS according to Rotterdam criteria, patients should be have two out of the following criteria:

1) Clinical and/or bio chemical evidence of hyperandrogenism, 2) Chronic anovulation, and 3) Polycystic-appearing ovaries on sonogram (4). The definition given by the European Society of Reproduction and Embryology and the American Society of Reproduction at the Rotterdam Conference in 2003 considered the existence of two of the following three criteria as the diagnostic criteria for PCOS 1. Olligoovulation or anovulation 2. Clinical symptoms of hyperandrogenism or the presence of hyperandrogenemia and 3. The presence of polycystic ovaries on sonography (6). The pathophysiology of PCOS is still not properly specified. This syndrome occurs with anovulation, hirsutism, and infertility (7). Polycystic ovaries are found in 32% of women with idiopathic hirsutism and 92% of women with oligomenorrhea (8, 9). PCOS is estimated to affect 2.2 to 22.5% of women worldwide (10). In a systematic review and meta-analysis of 19,226 Iranian women aged 10-54 years, Sayehmiri et al. stated that the prevalence of PCOS was 6.8, 19.5 and 41.4%, according to the NIH, Rotterdam criteria and sonographic methods, respectively (11). In addition to an increased risk of reproductive problems such as infertility, ovarian disorders, endometrial cancer, and early menopause, people with PCOS are at increased risk for depression, low self-confidence, anxiety, and a range of metabolic disorders including insulin resistance, hypertension, and cardiovascular disease (12-17). Hirsutism is the most common clinical symptoms of hyperandrogenism in PCOS (18). Hirsutism refers to excessive growth of dark or coarse terminal hair on the face, neck, lower abdomen, chest, and inner thighs. Hirsutism should be distinguished from hypertrichosis.

Hypertrichosis refers to an excessive growth of non-androgenic and androgen-dependent fluffy hair and may occur in both sexes, and genetic, pharmacological and malignant factors are involved (19). Considering that there have been many studies (20-25) on PCOS during adolescence in Iran, adolescent group of child bearing age was excluded from the present study. Therefore, the primary purpose of this study was to investigate the prevalence of PCOS among girls residing in dormitories affiliated to Kerman University of Medical Sciences and its relationship with anthropometric indices, and the secondary purpose of this study, according to many studies carried out during adolescence, was to investigate the prevalence of this syndrome in adolescence in the form of a meta-analysis study.

2- MATERIALS AND METHODS

A. First part

This cross-sectional descriptive study was performed on girls' students residing in dormitories of Kerman University of Medical Sciences, Kerman, Iran, during 2019-2020. The sample size was estimated using a ratio estimate based on a similar study by Jalilian et al. (26). Based on this formula, the sample size was estimated

600 people. Taking into account the possible drop-out, 636 people were estimated the final sample size.

$$n = \frac{(z^2_{1-\frac{\alpha}{2}} \times p \times (1-p))}{d^2}$$

$$\alpha = 0.05, z_{1-\frac{\alpha}{2}} = 1.96$$

Sampling was carried out in two stages; cluster sampling was performed in the first stage and a total of 636 students were randomly selected from the dormitory affiliated to Kerman University of Medical Sciences. In the second stage, simple sampling was carried out an all rooms were selected as a sample after entering the dormitory and those who wished to participate in the study, were enrolled.

1. Inclusion and exclusion criteria

A. Inclusion criteria for the first stage of screening included:

1. Accommodation in girls' dormitories of Kerman University of Medical Sciences in 2019-20,
2. Students aged between 15-45 years,
3. Willingness to participate in the study,
4. Completing the written consent form,
5. At least 2 years have passed since menarche,

B. Inclusion criteria for the intervention stage (11):

1. Non-use of contraceptives in the last 7 months,
2. Previous definitive diagnosis for any of the diseases of Cushing's syndrome, adrenal tumor, hyperprolactinemia, congenital adrenal hyperplasia, ovarian tumor, diabetes and thyroid,
3. Unwillingness to participate in the study.

2. Methods

After entering the dormitory and providing explanations about PCSO and its short-term and long-term symptoms and complications, the researcher obtained written informed consent from students to participate in the study. Then a questionnaire was completed for each person. This questionnaire consists of two parts. The first part contains demographic information and the second part includes the PCSO screening form. After obtaining personal information, and asking about menstrual disorders, to check for hirsutism, the most common clinical symptom of hyperandrogenism, the researcher examined each student for hair growth on the back of the lips, chin, chest, abdomen, and genital area, front of the arm, thigh, and back in a room of the dormitory in a naked state.

PCOS screening questionnaire designed by Pedersen et al. (27) in 2007. PCSO screening includes four items and to identify people with probable PCOS, items were asked about the following areas: 1. The average duration of the menstrual cycle between the ages of 16 to 40 years, 2. The growth of dark and coarse hair in the areas (above the lips, chin), breasts and between breasts, back, abdomen, upper arm, upper thigh,) in the reproductive years 3. Obesity or overweight between the ages of 16 and 40 years, and 4. Milky nipple discharge with or without stimulation and an increase in prolactin in hormonal tests. If the calculated total score is more than 2, the patient is considered to have PCOS (27). To evaluate the body composition, Secca (made in Germany) measured the subjects' height with a 5-mm precision hip and waist circumference was measured using a tape measure (Mabis / Japan) with a 5% error. Body math index (BMI) was calculated as the ratio of an individual's weight in kilograms divided by the height in meters squared. To determine the waist-hip circumference ratio of the subjects, waist circumference

(WC) was measured with a tape measure at the lowest point between the lower end of the chest and navel in centimeters. The hip circumference (HC) was also measured in the widest place on the buttocks in centimeters. Finally, WC was divided by HC. All measurements were taken while the subjects had abstained from eating and drinking since four hours before the test and even the bladder, stomach, and intestines were empty.

3. Statistical Analysis

Data analysis was carried out using descriptive and analytical statistical indices. Frequency, percentage, mean and standard deviation indices were used in the case of descriptive statistics. With regard to the analytical statistics, stepwise logistic regression was used to investigate the factors affecting the prevalence of PCOS in SPSS ver. 20.

B. Second part

Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) checklist was used as a template for this review (**Figure.1**).

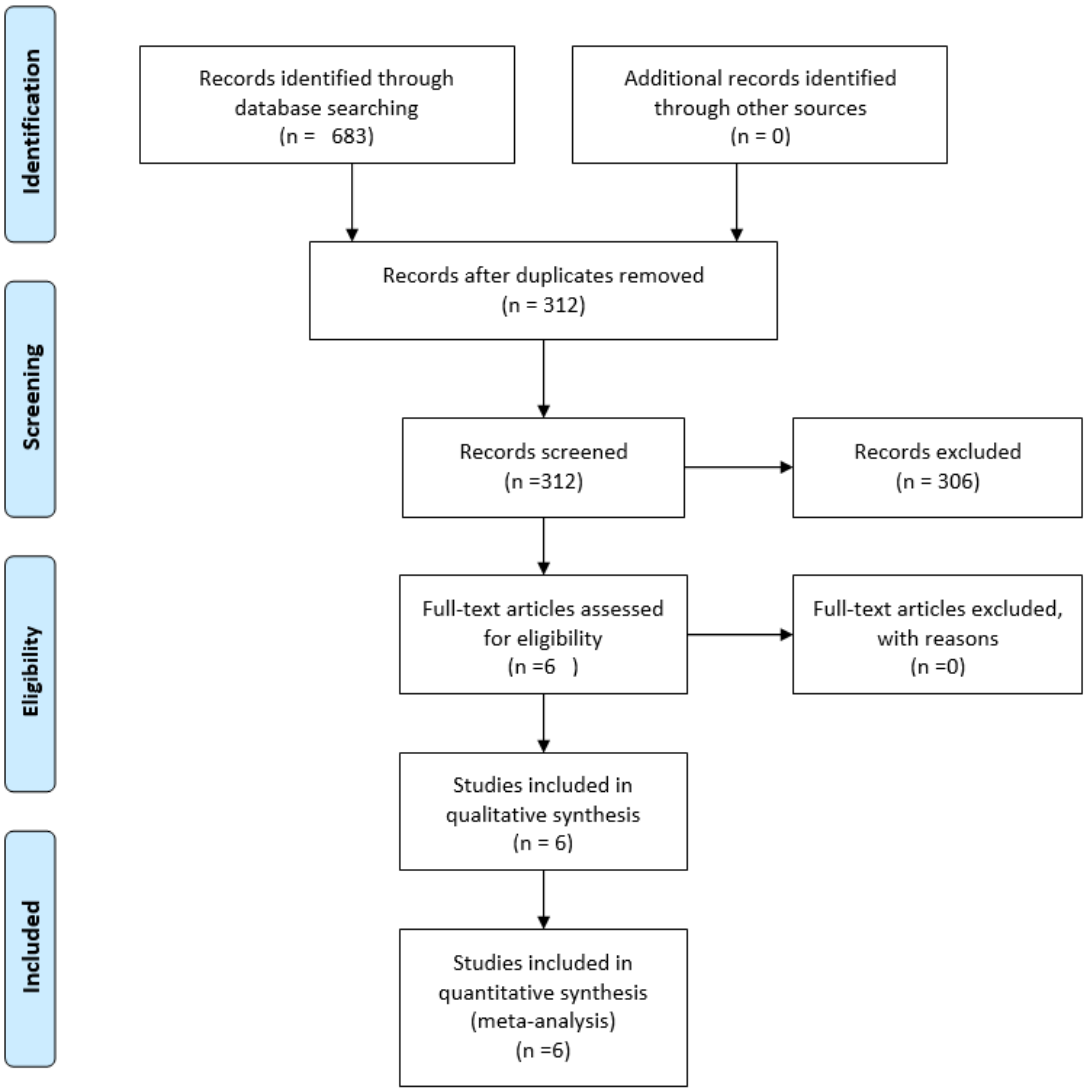

Fig.1: PRISMA flowchart.

1. Search Strategy

In this parts of study, online databases such as Scopus, PubMed, Web of Science, EMABSE, Magiran, SID, and Iran Doc were searched basis of inclusion-exclusion criteria in both Persian and English languages from inception to January, 2020. The search main keywords were as follows: (Prevalence) AND (Youth Adolescence OR Teens OR Female Adolescent OR Teenager) AND (Polycystic Ovary Syndrome OR PCOS OR Ovary Syndrome, OR Stein-Leventhal Syndrome Sclerocystic Ovary) AND (Iranian OR Iran). The search was performed by two independent researchers.

2. Eligibility criteria for inclusion of the study

1. The observational studies (cross-sectional, prospective cohort study and community-based cross-sectional studies),

2. Girls had between 10 and 18 year-old,

3. PCOS was diagnosed according to one of the standard criteria (NIH or Rotterdam),

4. Participants had no diseases such as Cushing's and thyroid disorder.

3. Exclusion criteria

Abstracts of conference papers, review papers, editor notes, letters, case reports, and animal studies as well as studies that used a combination of herbal medicines and ormeloxifene and topical treatment with raloxifene were excluded from the present study.

4. Study quality measurement

The methodological quality of each studies was graded by using the STROBE (strengthening the reporting of observational studies in epidemiology) checklist. It consists of 22 questions ranged 0–44, "low quality" considered when total scores below 23, total scores between 23 and 33 were considered as "moderate quality" and patients with total scores of 34> were considered "high quality" (28).

5. Extraction data

Team researcher designed a form for extraction of data. Following data was extracted by two authors including Authors' name, Years, and Type of design, Location, Sampling procedure, Sample size, Age, Diagnosis criteria, and total STROB score (**Table.1**).

6. Statistical Analysis

Data analysis was conducted by using Comprehensive Meta-Analysis. Finally, the between-study heterogeneity index was determined using I_2 and Q Cochran test. According to the results proposed by Higgins et al. (29), heterogeneity was divided into (I_2 < 25%), (I_2 25-25%), and (I_2>75%) indicate low, moderate, and high heterogeneity. Based on heterogeneity results, a random or fixed effect model was calculated to estimate the effect size of religious teachings with 95% confidence interval (CI) in the forest plots. Since there were less than 10 articles in the present study, the publication bias is not applicable and its diagram is not drawn (29). Finally, to show the results of meta-analysis, forest plot was used, in which the square size indicates the number of samples in each study and the lines drawn on both sides indicate a 95% confidence interval for the effect size of each study.

Table-1: General characteristics of the included studies and total STROBE scores (28).

Authors, years, reference	Type of design	Location	Sampling procedure	Sample size	Age, year	Diagnosis criteria	Total STROBE (ranged: 0-44)
Rahmanpour et al., 2012, (30)	Cross–sectional	Zanjan	Cluster	1882	14-18	Rotterdam's criteria	33a
Asgharnia et al., 2009, (21)	Cross–sectional	Rasht	Multi-stage cluster	1850	17-18	NIH	32
Azargoon et al., 2020, (22)	Cross-sectional	Semnan	Cluster	900	15-18	NIH	36
Esmaeilzadeh et al., 2013, (23)	Cross-sectional	Babol	Cluster	1549	16-20	Rotterdam's criteria	38
Hashemipour et al., 2004, (24)	Cross-sectional	Isfahan	Multi-stage random sampling	1000	14-18	NIH	29
Salehpour et al., 2006, (20)	Cross-sectional	Tehran	Cluster	1430	15-18	Rotterdam's criteria	37

NIH: National Institutes of Health, STROBE: The Strengthening the Reporting of Observational Studies in Epidemiology statement.

3- RESULTS

3-1. Results of first part

A total of 636 students participated in the present study. The mean ± SD of students' age was 21.99 ± 3.61 years. The most of participants were admitted in 2018 and 2019 with 31.5% and 22.5%, respectively. Also, a total of 10.5% of students were married and the rest were single. Finally, PCOS was identified in students scored 2 or higher with regard to the above four symptoms. According to this criterion, 73 subjects (11.5%) had PCOS. Logistic regression was used to simultaneously evaluate the effect of all variables on the prevalence of PCOS. **Table.2** shows the variables affecting the prevalence of PCOS. The results showed that a significant relationship between WC and drug with the prevalence of PCOS. The odds ratio of developing PCOS increases by 8% with one-centimeter increase in WC. In addition, the odds ratio of developing PCOS in people taking contraceptives and hormonal medication is 3.22 times higher than people taking no such medication. Other factors such as age, year of admission, marital status, height, weight and HC had no significant effect.

Table-2: Evaluate the effect of variables on the PCOS using multiple Logistic regression.

Variables		Beta	SD	OR	P-value
Intercept	-	-2.25	4.90	0.11	0.647
Age	Year	0.01	0.04	1.01	0.804
Marital status	Single	Ref.			
	Married	-0.15	0.44	0.86	0.733
Weight	Kg	-0.01	0.03	0.99	0.606
Height	Cm	-0.04	0.03	0.96	0.165
Waist circumference	Cm	0.08	0.02	1.08	0.001
Hip circumference	Cm	0.01	0.02	1.01	0.661
Drug use	No	Ref.			
	Yes	1.17	0.30	3.22	0.001

SD: Standard deviation, OR: Odds ratio.

3-2. Results of meta-analysis of the prevalence of PCOS among adolescents

Six studies examined the prevalence of PCOS among Iranian adolescent girls. The findings of these six studies were combined in a meta-analysis. The result ofQ test showed highly significant heterogeneity between studies (P <0.01, I_2= 94%). Also, the data were analyzed using meta-analysis and fixed effects model. According to the meta-analysis findings, the prevalence of PCOS among adolescents was 5.2% (95% CI: 3-8%) (**Figure.2**). We conducted the sensitivity analysis by deleting studies one by one, however, heterogeneity changed slightly.

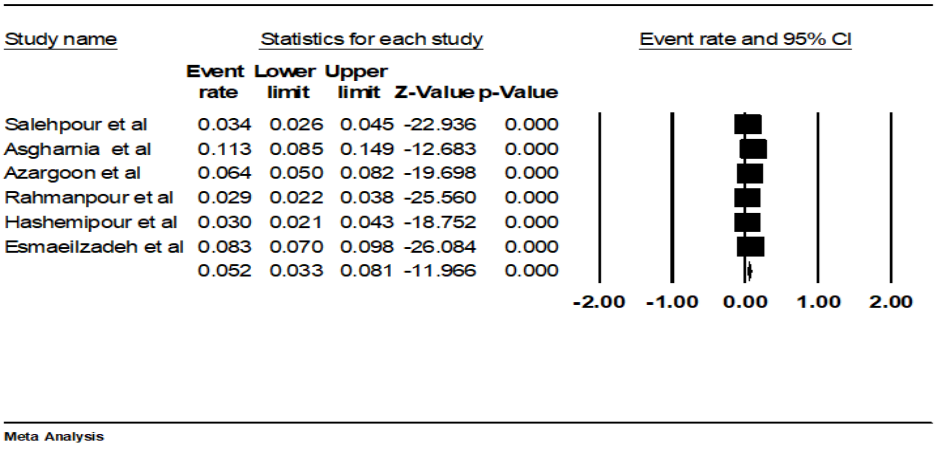

Fig 2: Overall Prevalence of polycystic ovarian syndrome according to the Rotterdam criteria (4).

The results of this subgroup analysis based on the diagnosis criteria showed that the prevalence of PCOS in Iranian girl adolescents according to Rotterdam criteria (4) was 5.4% (95% CI: 2.2-12%) (**Figure.3**), and based on the NIH criteria (3) was 5.1% (95% CI: 2.7-9.4%) (**Figure.4**).

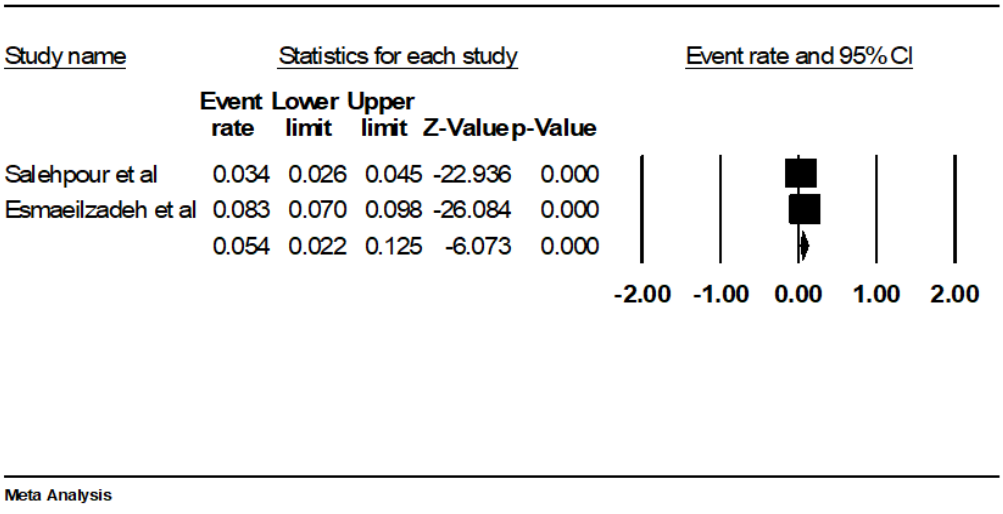

Fig.3: Prevalence of polycystic ovarian syndrome according to the Rotterdam criteria (4).

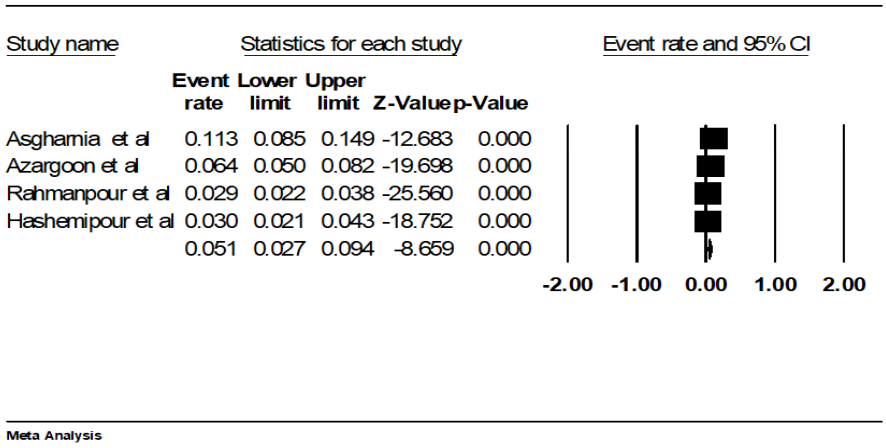

Fig. 4: Prevalence of polycystic ovarian syndrome based on the NIH criteria (3).

No evidence for bias publication was reported based on the results of the Begg's test (p = 0.57), and Egger's test (p = 0.33) (**Figure.5**).

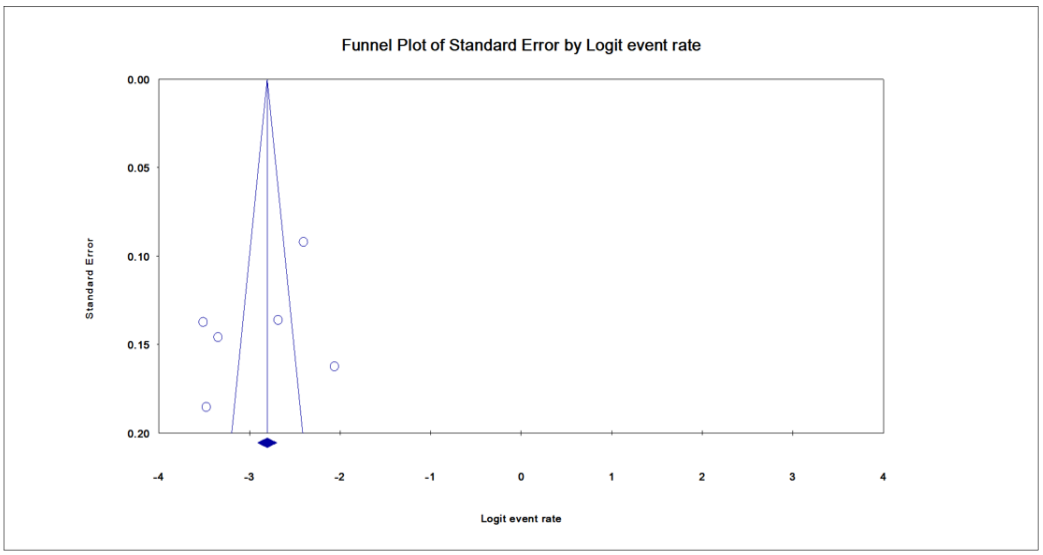

Fig.5: Bias publication evaluated by funnel plots.

4- DISCUSSION

The first aim of the study was to evaluate the prevalence of PCOS in girl medical students in Kerman, Iran. Finally, in our study, students with a score of ≥2 based on four symptoms were identified as patients with PCOS. Accordingly, 73 patients (11.5%) suffered from PCOS. PCOS prevalence in our study was almost same with previous studies (6, 21, 31-37). The prevalence of PCOS seems to be increasing due to lifestyle changes, nutrition, sedentary lifestyle, and obesity. However, Azargon et al. (2020) reported that the prevalence of PCOS was 6.44% (22). The difference in the prevalence of PCOS was due to the study population and the use of different diagnostic criteria. Ultrasound examination to diagnose this

syndrome may also provide false positive reports (38). The results of the present study showed a significant relationship between WC and the prevalence of PCOS so that the odds ratio of developing PCOS increases by 7% for one-centimeter increase in WC. In a study, Priyanka Maleedhu et al. found that PCOS increased with increasing WC. In this study, homocysteine levels increased with increasing WC. There is evidence suggesting that women with PCOS have impaired homocysteine metabolism (39). Obesity and increased abdominal fat affect the clinical and biochemical manifestations of PCOS in several ways. Obese women have much lower serum SHBG and higher levels of free testosterone (40). The second aim of the study was to conduct a meta-analysis to estimate the prevalence of PCOS in Iranian adolescent girls.

According to current meta-analysis, prevalence of PCOS (95% CI) based on diagnostic criteria of the NIH (3), and Rotterdam (4) were 5.1% and 5.4%, respectively. Saei Ghare Naz et al.'s meta–analysis involved 19,226 aged between 10 and 54 years old. According to theirs meta –analysis, prevalence of PCOS in adolescents was 19.5% based on the Rotterdam criteria, 6.8%, based on NIH criteria and 4.41% based on alone sonography (11). Bozdag et al. conducted a meta-analysis and exclude adolescent girl from their meta-analysis. The overall prevalence of PCOS (95% CI) was 6% (5–8%, n = 18 studies) according to diagnostic criteria of the NIH, 10% (8–13%, n = 15 trials) based on Rotterdam and the 10% (7–13%, n = 10) based on AEPCOS Society (41). It seems that there were some difference between the PCOS prevalence of adolescents and adults. According to PCOS Meta-analyzes among adolescents and other reproductive ages, the difference is that PCOS is more difficult to diagnose in adolescents. Menstrual disorders and anovulation are common in adolescents, especially in the first two years after the onset of PCOS. Acne, which is a symptom of hyperandrogenism, is common in adolescents. These physiological changes during adolescence can be attributed to PCOS. On the other hand, because the symptoms of PCOS appear gradually, some cases of PCOS may not be diagnosed until adulthood (30). According to a meta-analysis of the prevalence of PCOS worldwide, the prevalence of PCOS in adolescents the based on the NIH criteria was 3.39% (95% CI: 0.28–9.54%), and based on Androgen Excess and Polycystic Ovary Syndrome Society, it was 8.03% (95% CI: 6.24–10.01%) and based on Rotterdam criteria, it was 11.04% (95% CI: 6.84–16.09%) (42).

According to present meta-analysis and previous meta- analysis, it can be concluded that prevalence of PCOS in adolescent in Iran is lower than the global prevalence. Differences in the Saei Ghare Naz's meta-analysis (42), and the present study conducted on studies performed in Iran may be due to the greater accuracy of the ultrasound method in Western studies. Ultrasound is evaluated in the west through the vagina, which increases the odds ratio of diagnosing PCOS. Therefore, the detection of PCOS has increased today. This method is less possible in Iran (30). Saei Ghare Naz's meta-analysis involved 12,796 Iranian adolescent girls that the prevalence of PCOS according to the NIH criteria and Rotterdam criteria were 3% (95% CI: 2–4%), and 7% (95% CI: 6–8%), respectively (43). Difference between meta-analysis may be related to number of studies included into met analysis. A systematic review and meta-analysis assessed the prevalence of polycystic ovary syndrome in reproductive aged women of different ethnicity: lowest

prevalence was observed in Chinrese women (5.6% [95% CI:4.4–7.3%]), followed by Caucasians women (6.1% [95% (4.8–6.3%]), Middle Eastern women (6.1% [95% CI: 5.3–7.1%]), and Black women (CI 6.1% [95% CI:5.3–7.1%])(44). PCOS Prevalence in Iranian adolescent girls is almost same of Chinese women.

4-1. Limitations of the study

A. Limitations related to first part of study

The results of the present descriptive study in Kerman province may not be generalizable to all other provinces and countries.

B. Limitations related to second part (meta-analysis)

One of the main limitations of this study was the high heterogeneity among the studies. High heterogeneity in prevalence in current meta-analysis might be related to the age, race, and weigh, diet and lifestyle of individuals (42). High heterogeneity may be related to variability in the prevalence of PCOS. The reason for the observed difference in prevalence may be related to different criteria for defining PCOS. In many studies, the type of criterion was mentioned; in most studies, two definitions were used for PCOS. Using the Rotterdam PCOS criterion, it can increase its prevalence by 2 to 3 times. The use of screening methods to detect excess androgens or ovulation disorders can also affect the prevalence of PCOS. The observed differences can be due to different sampling. For example, the prevalence can be affected. Second limitation, search limited to the English and Persian languages were the other limitations of this review. Third Limitation our results for Iran may not generalize to other countries due to all articles included into meta-analysis were limited to Iran search. Fourth limitation, sample size of some studies included into systematic review were small. The fifth limitation of the study is the absence of a single definition in all articles included in this study. Some studies did not even mention the type of diagnostic criteria. The sixth limitation of meta-analysis is the lack of access to the abstract or full text (thesis).

5- CONCLUSION

The prevalence of polycystic ovary syndrome in adolescents of reproductive age is not high in Iran. The result of this study showed that there is a variation in the prevalence of PCOS among adolescents based on different criteria. The results of the present study showed a significant relationship between WC and the prevalence of PCOS so that the odds ratio of developing PCOS increases by 7% for one-centimeter increase in WC. Given the heavy burden and significant impact of this disorder on fertility and public health, the national healthcare providers should make plans to prevent the increase of this disease in society. In addition, due to the subsequent complications of PCOS, the therapeutic measure is best started in adolescence for this group of people.

6- ACKNOWLEDGMENTS

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7- CONFLICT OF INTEREST: None.

8- REFERENCES

1. Akbari Nasrekani Z, Fathi M. Efficacy of 12 weeks aerobic training on body composition, aerobic power and some women-hormones in polycystic ovary syndrome infertile women. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2016;19(5):1-10.

2. Naderi T, Akbarzadeh M, Dabbaghmaneh M, Tabatabaei H. Prevalence of various phenotypes of polycystic ovarian

syndrome among high school girls of Shiraz (2009). Journal of Inflammatory Diseases. 2012;15(4):60-7.

3. Zawadzski J. Diagnostic criteria for polycystic ovary syndrome: towards a rational approach. Polycystic ovary syndrome. 1992:39-50.

4. Chang J, Azziz R, Legro R. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group (2004). Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Fertil Steril. 2004;81(01):19-25.

5. Azziz R, Carmina E, Dewailly D, Diamanti-Kandarakis E, Escobar-Morreale HF, Futterweit W, et al. Criteria for defining polycystic ovary syndrome as a predominantly hyperandrogenic syndrome: an androgen excess society guideline. The Journal of Clinical Endocrinology & Metabolism. 2006;91(11):4237-45.

6. Rahmanpour H, Heidari R, Fekri S. The prevalence of polycystic ovarian syndrome in 14-18 year old girls of Zanjan High Schools, 2008. J Adv Med Biomed Res. 2009;17(67):79-88.

7. Diamanti-Kandarakis E. PCOS in adolescents. Best practice & research Clinical obstetrics & gynaecology. 2010;24(2):173-83.

8. Adams J, Polson D, Franks S. Prevalence of polycystic ovaries in women with anovulation and idiopathic hirsutism. Br Med J (Clin Res Ed). 1986;293(6543):355-9.

9. Akbarzadeh M, Naderi T, Dabaghmanesh MH, Tabatabaie H, Zare Z. The prevalence of hirsutism in girls 14 to 18 years old and its relationship with polycystic ovary syndrome in Shiraz, Iran. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2013;16(81):8-15.

10. Ganie MA, Rashid A, Sahu D, Nisar S, Wani IA, Khan J. Prevalence of polycystic ovary syndrome (PCOS) among reproductive age women from Kashmir valley: A cross-sectional study. International Journal of Gynecology & Obstetrics. 2020;149(2):231-6.

11. Sayehmiri F, Kiani F, Maleki F, Ahmadi M, Shohani M. Prevalence of polycystic ovary syndrome in Iranian women: a systematic review and meta-analysis. The Iranian Journal of Obstetrics, Gynecology and infertility. 2014;17(115):11-21.

12. Cena H, Chiovato L, Nappi RE. Obesity, polycystic ovary syndrome, and infertility: A new avenue for GLP-1 receptor agonists. The Journal of Clinical Endocrinology and Metabolism. 2020;105(8):e2695-e709.

13. Meczekalski B, Pérez-Roncero GR, López-Baena MT, Chedraui P, Pérez-López FR. The polycystic ovary syndrome and gynecological cancer risk. Gynecological Endocrinology. 2020;36(4):289-93.

14. Ramezani Tehrani F, Amiri M, Behboudi-Gandevani S, Bidhendi-Yarandi R, Carmina E. Cardiovascular events among reproductive and menopausal age women with polycystic ovary syndrome: a systematic review and meta-analysis. Gynecological Endocrinology. 2020;36(1):12-23.

15. Kirmizi DA, Baser E, Onat T, Caltekin MD, Yalvac ES, Kara M, et al. Sexual function and depression in polycystic ovary syndrome: Is it associated with inflammation and neuromodulators? Neuropeptides. 2020;84:102099.

16. Alkoudsi KT, Basheti IA. Prevalence of anxiety and depression among women with Polycystic Ovary Syndrome living in war versus non-war zone countries: A randomized controlled trial assessing a pharmacist intervention. Research in Social and Administrative Pharmacy. 2020;16(5):689-98.

17. Pani A, Gironi I ,Di Vieste G, Mion E, Bertuzzi F, Pintaudi B. From prediabetes to type 2 diabetes mellitus in women with polycystic ovary syndrome: lifestyle and pharmacological management. International Journal of Endocrinology. 2020;2020.

18. Warren-Ulanch J, Arslanian S. Treatment of PCOS in adolescence. Best practice & research Clinical endocrinology & metabolism. 2006;20(2):311-30.

19. Ghaderi R. Journal of Birjand University of Medical Sciences. 2004;11(1):9.

20. Salehpour S, Esmaeilnia Shirvani H, Entezari A .Evaluation of the prevalence of polycystic ovarian syndrome among

adolescent (15-18 Years Old) girls in Tehran during 2005-2006. International Journal of Fertility and Sterility. 2010;4(3):122-7.

21. Asgharnia M, Mirblook F, Soltani MA. The prevalence of polycystic ovary syndrome (PCOS) in high school students in Rasht in 2009 according to NIH criteria. International journal of fertility & sterility. 2011;4(4):156.

22. Azargoon A, Mirmohammadkhani M, Borjian S. The prevalence of polycystic ovarian syndrome, metabolic abnormalities and its association with obesity in adolescents: a cross sectional study in an urban population in Iran. Acta Medica Iranica. 2020:383-7.

23. Esmaeilzadeh S, Delavar MA, Amiri M, Khafri S, Pasha NG. Polycystic ovary syndrome in Iranian adolescents. International journal of adolescent medicine and health. 2014;26(4):559-65.

24. Hashemipour M, Faghihimani S, Zolfaghary B, Hovsepian S, Ahmadi F, Haghighi S. Prevalence of polycystic ovary syndrome in girls aged 14–18 years in Isfahan, Iran. Hormone Research in Paediatrics. 2004;62(6):278-82.

25. Naderi T, Akbarzadeh M, Dabbaghmaneh M, Tabatabaei H. Prevalence of various phenotypes of polycystic ovarian syndrome among high school girls of Shiraz (2009). J of Inflammatory Disease. 2012;15(4):60-7.

26. Jalilian A, Kiani F, Sayehmiri F, Sayehmiri K, Khodaee Z, Akbari M. Prevalence of polycystic ovary syndrome and its associated complications in Iranian women: A meta-analysis. Iranian J of reproductive medicine. 2015;13(10):5.

27. Pedersen SD, Faris SBP, Corenblum B. Syndrome des ovaires polykystiques. Can Fam Physician. 2007;53:1041-7.

28. Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. International J of surgery. 2014;12(12):1500.

29. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. Statistics in medicine. 2002;21(11):1539-58.

30. Rahmanpour H, Heidari R, Fekri SJJAMBR. The prevalence of polycystic ovarian syndrome in 14-18 year old girls of Zanjan High Schools, 2008. 2009;17(67):79.

31. Akhyany M, Daneshpajouh M, Barzegari M, Ghandi N, Ghiasi M, Chenari Z. The prevalence of hirsutism in female students of Tehran University School of Medicine. J Dermatol. 2006;9:242-9.

32. Tehrani FR, Rashidi H, Azizi F. The prevalence of idiopathic hirsutism and polycystic ovary syndrome in the Tehran Lipid and Glucose Study. Reprod Biol Endocrinol. 2011 Nov 1;9:144.

33. Kamkhah AF, Parvin N. Hormonal profile in hirsute patients referred to a laboratory in Shahrekord, 2005. J. Shahrekord Univ. Med. Sci. 2009; 10 (4): 112-16.

34. Ghaderi R, Sharifzadeh G, Javanbakht P. Factors associated with hirsutism. Journal of Birjand University of Medical Sciences. 2004;11:19-23.

35. Ghasemi N, Mortazavizadeh MR, Khorasani GA. Frequency of poly cystic ovary syndrome in patients with premenopausal breast cancer. Iranian Journal of Reproductive Medicine 2010; 8(2): 86-9.

36. Bani-Hashemi M. familial S, Nahidi E. Investigate the causes of hirsutism in patients admitted to hospital, Khatam-al 80-1382. Journal of Medicine Mashhad University of Medical Sciences. 2007;97(50):286-90.

37. Kashanian M, Fazy Z, Pirak A. Evaluation of the relationship between gestational diabetes and a history of polycystic ovarian syndrome. Diabetes research and clinical practice. 2008;80(2):289-92.

38. Azziz R, Carmina E, Dewailly D, Diamanti-Kandarakis E, Escobar-Morreale HF, Futterweit W, et al. The Androgen Excess and PCOS Society criteria for the polycystic ovary syndrome: the complete task force report. Fertility and sterility. 2009;91(2):456.

39. Maleedhu P, Vijayabhaskar M, Sharma S, Kodumuri PK. Status of homocysteine in polycystic ovary syndrome (PCOS). Journal of clinical and diagnostic research: JCDR. 2014;8(2):31.

40. Berek JS. Berek & Novak's Gynecology Essentials: Lippincott Williams & Wilkins; 2020.

41. Bozdag G, Mumusoglu S, Zengin D, Karabulut E, Yildiz BO. The prevalence and phenotypic features of polycystic ovary syndrome: a systematic review and meta-analysis. Human Reproduction. 2016;31(12):2841-55.

42. Naz MSG, Tehrani FR, Majd HA, Ahmadi F, Ozgoli G, Fakari FR, et al. The prevalence of polycystic ovary syndrome in adolescents: A systematic review and meta-analysis. International Journal of Reproductive BioMedicine. 2019;17(8):533.

43. Ghiasi A. Prevalence of Polycystic Ovarian Syndrome in Iranian Adolescents: A Systematic Review and Meta-analysis. Journal of South Asian Federation of Obstetrics and Gynaecology. 2019;11(3):195.

44. Ding T, Hardiman PJ, Petersen I, Wang F-F, Qu F, Baio G. The prevalence of polycystic ovary syndrome in reproductive-aged women of different ethnicity: a systematic review and meta-analysis. Oncotarget. 2017;8(56):96351.

45. Group REASPCW. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). Human reproduction. 2004;19(1):41-7.

46. McCartney CR, Marshall JC. Clinical Practice. Polycystic Ovary Syndrome. N Engl J Med. 2016 Jul 7;375(1):54-64.