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Risk factors for polycystic ovary syndrome among women of reproductive age in Egypt: A case control study

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Abstract

Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorder among women of reproductive age, associated with an increased risk of multiple diseases, and its pathogenesis is not fully understood. Purpose: identify risk factors for Polycystic Ovary Syndrome in reproductive-aged Egyptian women attending an outpatient gynecological clinic at a specialized hospital of Obstetrics and Gynecology in Port Said City, Egypt. The study population included 248 women; 124 women suffered from PCOS and 124 Non-PCOS. Methods: - Case-control study was conducted among women. PCOS women were diagnosed clinically by transvaginal ultrasound and laboratory investigations. Data were collected using; I) a structured interview questionnaire, including socio-demographic status, medical and family history, menstrual and obstetrical history and lifestyle habits, and clinical examination; II) anthropometric parameters; III) perceived stress scale. The mean age of cases was 26.18±0.45 years. The most common risk factors for PCOS were urban residence, high education, working, insufficient income, history of anemia, hypertension, cancer, and family history of PCOS and infertility, increasing body mass index, fast food, and drinking of coffee. The study concluded that the significant risk factors for polycystic ovarian disease in Egypt women included socio-demographic characteristics, medical and family history, increasing body mass index, and lifestyle habits. This study recommended that Polycystic Ovary Syndrome women follow a healthy diet and exercise regularly. *(Afr J Reprod Health 2023; 27 [6]: 41-50).*

Keywords: Clinical manifestations, Complication, Polycystic Ovary Syndrome (PCOS), Risk factors

Résumé

Le syndrome des ovaires polykystiques (SOPK) est le trouble endocrinien le plus courant chez les femmes en âge de procréer, associé à un risque accru de maladies multiples, et sa pathogenèse n'est pas entièrement comprise. Objectif : identifier les facteurs de risque du syndrome des ovaires polykystiques chez les femmes égyptiennes en âge de procréer qui fréquentent une clinique gynécologique externe dans un hôpital spécialisé en obstétrique et gynécologie de la ville de Port Saïd, en Égypte. La population étudiée comprenait 248 femmes; 124 femmes souffraient de SOPK et 124 non-SOPK. Méthodes : - Une étude cas-témoins a été menée auprès de femmes. Les femmes atteintes du SOPK ont été diagnostiquées cliniquement par échographie transvaginale et examens de laboratoire. Les données ont été recueillies à l'aide de ; I) un questionnaire d'entretien structuré, comprenant le statut socio-démographique, les antécédents médicaux et familiaux, les antécédents menstruels et obstétriques et les habitudes de vie, et l'examen clinique II) les paramètres anthropométriques III) l'échelle de stress perçu. L'âge moyen des cas était de 26,18 ± 0,45 ans. Les facteurs de risque les plus courants du SOPK étaient la résidence urbaine, un niveau d'instruction élevé, le travail, un revenu insuffisant, des antécédents d'anémie, d'hypertension, de cancer et d'antécédents familiaux de SOPK et d'infertilité, l'augmentation de l'indice de masse corporelle, la restauration rapide et la consommation de café. L'étude a conclu que les facteurs de risque significatifs de la maladie des ovaires polykystiques chez les femmes égyptiennes comprenaient les caractéristiques sociodémographiques, les antécédents médicaux et familiaux, l'augmentation de l'indice de masse corporelle et les habitudes de vie. Cette étude a recommandé aux femmes atteintes du syndrome des ovaires polykystiques de suivre un régime alimentaire sain et de faire de l'exercice régulièrement. *(Afr J Reprod Health 2023; 27 [6]: 41-50).*

Mots-clés: Manifestations cliniques, Complication, Syndrome des ovaires polykystiques (SOPK), Facteurs de risque

Introduction

The most prevalent endocrine condition affecting women of reproductive age is polycystic ovarian syndrome (PCOS). It reflects a diverse illness that raises the possibility of becoming type 2 diabetes[1] dyslipidemia, heart diseases, and endometrial carcinoma, besides those psychological complications that represent a significant socioeconomic burden to health care[1,2]. Despite evidence of the intricate interplay between genetic, behavioral, and environmental elements that influence the onset of PCOS, the disease's pathophysiology remains unknown[3]. The use of the criterion for diagnosis influences the prevalence of PCOS. 4–20% of Indian women are impacted. According to estimates, PCOS affects 13.5% of fertile people in Egypt and 37.5% of secondarily infertile[4,5].

The Rotterdam criterion had been defined PCOS as following; two of the following criteria must be fulfilled:-1-irregular/no ovulations, 2-clinical/biochemical hyperandrogenemia, 3-polycystic ovaries, other causes of hyperandrogenism should be ruled out[6]. In contrast, the National Institute of Health (NIH) included only the following two criteria: Ovulatory failure combined with biochemical and clinical hyperandrogenism when other associated illnesses have been ruled out. For those not using oral contraceptives, hirsutism (self-reported undesirable hair growth at ages 20 to 30) or high testosterone levels, either total or free, tested at year 2 were used to diagnose hyperandrogenism. Using oral contraceptives to control periods or waiting 34 days between menstrual cycles are examples of ovulatory dysfunction[7].

PCOS has various clinical manifestations, 85%–90% of women have oligomenorrhea, 30%–40% have amenorrhea, 80% have symptoms of androgen excess as hirsutism which constitutes up to 70% and acne, 15-30% of women with PCOS, PCOS affects 90 to 95 percent of ovulatory women who consult infertility clinics, and this condition affects 40 percent of women with PCOS., and spontaneous abortion occurs in 42%–73% of Women with PCOS[8]. PCOS has many changeable and unmodifiable risk factors, such as an unfavorable attitude, lack of exercise, and a family history of diabetes and infertility. An irregular menstrual cycle, a BMI of 25 or higher, a waist-hip ratio of 0.86 or higher, dyslipidemia, impaired blood glucose control, abdominal obesity, elevated blood pressure, and Insulin resistance[9]. Despite the high prevalence of PCOS and its various system-related complications, there is still no cure. The mainstays of treatment are regular exercise, weight control, and oral contraceptives. There has not yet been a nationally representative study to evaluate the PCOS risk factors among affected women in Egypt. Planning effective preventive health strategies and close long-term follow-up monitoring of their menstrual function depend on assessing the presence of associated risk factors. To reduce problems, prevalence, and improve the quality of life for women of reproductive age, this study aims to identify risk factors for Polycystic Ovary Syndrome in reproductive-aged Egyptian women.

Methods

Study design

A case-control study was performed to identif**y** the risk factors of PCOS among women in reproductive age.

Setting

The study was conducted in an outpatient gynecological clinic at a specialized hospital of Obstetrics and Gynecology in Port Said City, Egypt.

Study sample

Target population

PCOS group: The women who were previously diagnosed as having PCOS based on the following: A- Rotterdam criteria According to the updated criteria, a diagnosis of PCOS now requires two of the three characteristics:

- Irregular menstrual cycles, also known as oligomenorrhea or amenorrhea.
- Hyperandrogenism (based on chemical (hormone levels in the blood) and/or clinical indications).
- Polycystic Ovary Syndrome (on the ultrasound)

B- transvaginal ultrasound: To measure the bilateral ovarian volume and antral follicle count (AFC), vaginal ultrasonography was performed on each woman. The existence of 12 or more follicles, each measuring 2 to 9 mm in diameter, and/or an elevated

ovarian volume (>10 ml) were used to diagnose PCOS.

C-Laboratory investigations which contained Samples taken from all women on the third through fifth days of their period. Antecubital venous blood was taken in the morning from the patients who had been fasting and silent for 8 hours. The immune chemiluminescence method was used to measure the levels of follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin (PRL), estradiol (E2), and testosterone (T). A double antibody sandwich enzyme-linked immunosorbent test was used to detect serum dehydroepiandrosterone sulphate (DHEAs) and sex hormone binding globulin (SHBG) (ELISA). The enzymatic approach was used to identify serum triglycerides (TG), total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and fasting blood glucose (FBG). Higher blood androgens, elevated serum levels of FSH and LH, and a reversed ratio were the laboratory findings that suggested PCOS[10].

The Non-PCOS group: were women who had no evidence of PCOS and had the same age group to ensure matching. They attended the hospital of Obstetrics and Gynecology in Port Said City, Egypt for seeking medical advice for another health problem.

Sampling technique

In this study, a convenient sample was gathered in accordance with the eligibility requirements.
Inclusion criteria included women between the ages of 18 and 45 who were married, diagnosed with PCOS, and who consented to participate in the study. Exclusion criteria included women with psychiatric disorders, malignancies such as virilizing neoplasms, women diagnosed with endocrine disorders such as Cushing's disease, thyroid disease, adrenal disease, and women taking drugs that induce PCOS.

Sample size

The sample size was determined at 90% power with an alpha error of 5% to be 101 for each group, according to the combined frequency of PCOS in research that followed the NIH guidelines (7% [95% CI: 6–7%]) [9].

Tools of data collection

The following tools were used to collect the data: I) a structured interview questionnaire and II) a clinical examination to collect the data. Based on an analysis of local and international literature, the questionnaire was created.; the questionnaire was assessed for validity by jury expertise in the obstetric and gynecological field. A pilot study was carried out to evaluate the questionnaire's clarity, and no modification was needed. The questionnaire consisted of the following parts:

I) A structured interview questionnaire

First part: -included risk factors related to socio-demographic details of the studied groups as age, marital status, residence, degree of education, occupation, and income.2-Second part: -included risk factors regarding menstrual history as the age of menarche, regularity of menstrual cycle, dysmenorrhea, obstetrical History, History of infertility, medical or surgical treatment of infertility, gravidity, parity, and any complication in the previous pregnancy.3-Third part: risk factors of medical and family history (evidence of anemia, hypertension, Diabetes mellitus, family history of PCOS, infertility, cancer, HTN, and DM.4-fourth part: risk factors as diet, exercise, tea and coffee drinking, and stress are examples of lifestyle choices

II) Anthropometric parameters

The weight of the participants in fasting state and single-layer garment was measured, the waist circumference and hip circumference were measured under stable breathing, and the height was measured. Each index was measured twice and the average was taken. Body mass index (BMI) = height (kg)/ weight (m^2), and BMI ≥25 indicated obesity; while a healthy range is 18.5-24.9; waist-hip ratio (WHR) = waist circumference/hip circumference.

III) Perceived stress scale

The 10-item Perceived Stress Scale (PSS-10) was created by Cohen et al. in 1983 and is frequently used to measure stress levels in adolescents and adults over the age of 12. rate how unpredictable, uncontrollable, and cluttered your life has felt over

the past month. Perceived stress scale (PSS) asks about how you've been feeling and thinking throughout the past month. about how you've been feeling and thinking throughout the past month. It has 10 questions, can be administered individually or in groups, and takes between 5 and 10 minutes. On her 5-point scale, ranging from "not at all" to "very often," women are asked how often they feel in a particular mood. Responses are scored as follows:
Never = 0, rarely = 1, sometimes = 2, quite often = 3, very often = 4 To calculate the overall PSS score, the four positive items (items 4, 5, 7 and 8) is the opposite (i.e. 0 => 4; 1 => 3; 2 => 2; 3 => 1; 4 => 0). The total of each item yields the PSS score. Low stress is indicated by a score of 0 to 13, moderate stress by a score of 14 to 26, and high stress is indicated by a score of 27 to 40.[11]

Tools validity and reliability

Six medical and nursing professionals who served on the jury made the determination.

Pilot study

Before data collecting started, a pilot study was conducted after the tool was created. Ten percent of the sample size (25 women) were used to test the feasibility, clarity, and usefulness of the tool. The length of time needed for data gathering was also estimated using a pilot study. The sample size did not include a pilot sample.

Procedure

Preparatory phase

Researchers used books, articles, the Internet, journals and journals to review relevant local, national, and worldwide studies on the research question. Next, researchers prepared the necessary data collection tools. Obstetrics and gynecology specialists reviewed the data collection tools and confirmed their effectiveness.

Field of work

Data was collected within 3 months from October to December 2022. Data was collected 5 days/week from 9am to 1 pm from women visiting the specialist hospital's gynecological outpatient clinic in Port Said, Egypt. Women were chosen based on inclusion and exclusion standards. Researchers introduced themselves and gave each woman a description of the study's objectives and methodology. All women provided written consent to take part in the study. Data were collected individually using tool developed in plain Arabic through face-to-face interviews in private rooms to minimize distractions and ensure privacy. The interview lasted 15-20 minutes for each woman.

Ethical consideration

On October 2, 2022, the Nursing Faculty Ethics Committee in Port Said University, Egypt approved the study with reference code No. 18. All of the women who were interviewed provided informed consent before starting of the study. The researchers also explained to every woman who participated in the interview the goals, procedures, and anticipated findings of the study, as well as the fact that their privacy would be protected, there would be no risk to them, and they could withdraw at any time.

Statistical analysis

The Statistical Package for Social Science (SPSS) program was used to enter, and analyze data on a computer. (Version 25)[12] . Depending on the situation, data were input as numerical or categorical. Minimum, maximum, mean, and standard deviation were used to describe the data. An independent sample t-test was used to compare two independently examined, normally distributed variables[13,14]. When appropriate, Yates' adjustment for continuity (or Yates' chi-squared test) was applied[15]. The odds ratio (OR) was used to the odds of developing the disease given risk exposure. Logistic regression analysis was used to identify predictors of PCOs. With a significance level of 95%, an alpha level of 5 percent was chosen. At a p-value of <.05, statistical significance was evaluated [16].

Results

The mean age of the enrolled women was 26.18±0.45 and 26.02±6.58 in cases and control groups respectively. Regarding residence, most of participants lived in urban areas in both cases (94.35%) and control group (52.42%). In regard to occupation, many of participants weren't working in both cases (51.61%) and control (77.42%) group. Concerning the income level, most of the

Table 1: Risk factors related to socio-demographic characteristics of the studied groups

	PCOS group (n=124)	Non PCOS group (n=124)	Test of significance	
Age (years)				
Min-Max	18.00-42.00	19.00-42.00	t=0.206	
Mean ± SD	26.18±0.45	26.02±6.58	*p*=.837 NS	
Residence				OR=15.1
Rural	7 (5.65%)	59 (47.58%)	χ^2= 55.827	95% CI: 6.5 to 35.1
Urban	117 (94.35%)	65 (52.42%)	*p*<.001*	*p*<0.000*
Education level				OR=1.9
Other than high	48 (38.71%)	68 (54.84%)	χ^2= 6.479	95% CI: 1.1 to 3.1
High education	76 (61.29%)	56 (45.16%)	*p*=.011*	*P*<.001*
Marital Status				OR=32.6
Not married	14 (11.29%)	0 (0.00%)	χ^2= 14.838	95% CI: 1.9 to 554.1
Married	110 (88.71%)	124 (100.00%)	*p*<.001*	*p*=.0158*
Occupation				OR=3.2
Not working	64 (51.61%)	96 (77.42%)	χ^2= 18.036	95% CI: 1.8 to 5.5
Working	60 (48.39%)	28 (22.58%)	*p*<.001*	*p*=.00113*
Family monthly income				
Not Sufficient	15 (12.10%)	2 (1.61%)	χ^2= 11.608	
Sufficient	105 (84.68%)	120 (96.77%)	$p_{(MC)}$=.002*	
Sufficient and save	4 (3.23%)	2 (1.61%)		

Min-Max: Minimum to Maximum
SD: Standard deviation
t: Independent Samples "Student's" t-test
χ^2: Pearson's chi-squared test
OR: Odds ratio
CI: Confidence interval
*: Statistically significant (p<.05)
NS: Statistically not significant (p≥.05)

Table 2: Risk factors regarding menstrual and obstetrical history

	PCOS group (n=124)	Non PCOS group (n=124)	Test of significance	
Age of menarche (years)				
Min-Max	11.00-16.00	10.00-16.00	t=1.633	
Mean ± SD	13.52±1.06	13.27±1.33	*p*=.104 NS	
Regularity of the cycle				
Regular	29 (23.39%)	124 (100.00%)	χ^2= 153.987	
Irregular	95 (76.61%)	0 (0.00%)	*p*<.001*	
Gravidity				
Nulligravida	54 (43.55%)	43 (34.68%)	χ^2= 2.049	
Any number of gravidae	70 (56.45%)	81 (65.32%)	*p*=.152 NS	
Parity				
Nullipara	58 (46.77%)	43 (34.68%)	χ^2= 3.758	
Any parity	66 (53.23%)	81 (65.32%)	*p*=.053 NS	
Any complication in the previous pregnancy				
No	113 (91.13%)	124 (100.00%)	χ^2= 11.511	OR=25.2
Yes	11 (8.87%)	0 (0.00%)	*p*=.003*	95% CI: 1.4 to 433.0
				p=.0260*
History of infertility				OR=581.0
No	37 (29.84%)	124 (100.00%)	χ^2= 134.012	95% CI: 35.2 to 9589.1
Yes	87 (70.16%)	0 (0.00%)	*p*<.001*	*p*<.000*
History of medical treatment to manage infertility				
No	103 (83.06%)	124 (100.00%)	χ^2= 22.943	OR=450.4
Yes	21 (16.94%)	0 (0.00%)	*p*<.001*	95% CI: 27.3 to 7418.02
				P<.001*
History of surgical treatment to manage infertility				
No	44 (35.48%)	124 (100.00%)	χ^2= 118.095	
Yes	80 (64.94%)	0 (0.00%)	*p*<.001*	

Min-Max: Minimum to Maximum
SD: Standard deviation
t: Independent Samples "Student's" t-test
χ^2: Pearson's chi-squared test
OR: Odds ratio
CI: Confidence interval
*: Statistically significant (p<.05). NS: Statistically not significant (p≥.05)

Table 3: Risk factors regarding medical and family history

	PCOS group (n=124)	Non PCOS group(n=124)	Test of significance	
Anemia				OR=23.1
No	70 (56.45%)	120 (96.77%)	χ^2= 56.261	95%CI:8.0 to 66.6
Yes	54 (43.55%)	4 (3.23%)	*p*<.001*	*p*<.000*
Hypertension				OR=4.3
No	112 (90.32%)	121 (97.58%)	χ^2= 5.748	95%CI:1.1 to 15.7
Yes	12 (9.68%)	3 (2.42%)	*p*=.017*	*p*=.026*
Diabetes mellitus				OR=3.5
No	114 (91.94%)	121(97.58%)	χ^2= 3.978	95%CI: 0.9 to 13.1
Yes	10 (8.06%)	3 (2.42%)	*p*=.046*	*p*=.059 NS
Family history of PCO				OR=20.3
No	93 (75.00%)	122 (98.39%)	χ^2= 29.396	95%CI: 4.7 to 87.1
Yes	31 (25.00%)	2 (1.61%)	*p*<.001*	*p*<.000*
Family history of Hypertension				
No	120 (96.77%)	122 (98.39%)	χ^2= 0.683	
Yes	4 (3.23%)	2 (1.61%)	*p*=.408 NS	
Family history of Cancer				OR= 13.1
No	112 (90.32%)	123 (99.19%)	χ^2= 9.823	95%CI: 1.6 to 102.9
Yes	12 (9.68%)	1 (0.81%)	*p*=.002*	*p*=.0140*
Family history of Diabetes mellitus				
No	121 (97.58%)	122 (98.39%)	χ^2= 0.204	
Yes	3 (2.42%)	2 (1.61%)	*p*=.651 NS	
Family history of Infertility				OR= 11.9
No	113 (91.13%)	123 (99.19%)	χ^2= 8.757	95%CI: 1.5 to 94.2
Yes	11 (8.87%)	1 (0.81%)	*p*=.003*	*p*=.0183*

Min-Max: Minimum to Maximum
SD: Standard deviation
t: Independent Samples "Student's" t-test
χ^2: Pearson's chi-squared test
p: Probability of error (chance)
*: Statistically significant (p<.05)
NS: Statistically not significant (p≥.05)
W: Welch's t-test

Table 4: Risk factors regarding (body mass index, stress, and lifestyle habits)

	PCOS group (n=124)	Non PCOS group (n=124)	Test of significance	
BMI				
Min-Max	19.38-41.02	18.59-43.82	t=5.839	
Mean ± SD	30.86±4.53	27.54±4.40	*p*<.001*	
BMI				
Normal weight: 18.5-24.9:	10 (8.06%)	39 (31.45%)	χ^2= 34.296	OR=3.4, 95%CI: 11.5-7.6,
Pre-obesity: 25.0-29.9	45 (36.29%)	51 (41.13%)	*p*<.001*	*p*=.003*
Obesity class I : 30.0-34.9:	40 (32.26%)	27 (21.77%)		OR=5.7, 95%CI: 2.4-13.5,
Obesity class II : 35.0-39.9:	28 (22.58%)	6 (4.84%)		*p*<.001*
Obesity class III : 40 or Above:	1 (0.81%)	1 (0.81%)		OR=18.2, 95%CI: 5.9-55.9, *p*<.001*
				OR=3.900, 95%CI: .2-67.9, *p*=.351 NS
Stress (Perceived Stress Score)	27 (21.77%)[a]	61 (49.19%)[b]	χ^2= 20.774	
Low (0-13)	81 (65.32%)[a]	55 (44.35%)[b]	*p*<.001*	OR= 188.295%CI: 25.4 to 1391.9 (*p*<.001)
Moderate (14-26)	16 (12.90%)[a]	8 (6.45%)[a]		
High (27-40)				
Physical exercise duration (minutes/week)	117 (47.18%)	108 (43.55%)		

NO (only women who practice physical exercises)			$t_{(W)(df=196.977)}$=1.447	
Min-Max	10.00-90.00	10.00-90.00	$p_{(W)}$=.154 NS	
Mean ± SD	48.24±18.53	44.03±24.88		
Type of diet				
Non vegetarian (n=243)	124 (100.00%)	119 (95.97%)	χ^2= 3.266	OR=0.4
Vegetarian (n=5)	0 (0.00%)	5 (4.03%)	$p_{(Y)}$=.071 NS	95%CI: 0.4 to 0.5
Coffee drinking				
No (n=111)	24 (19.35%)	87 (70.16%)	χ^2= 64.728	OR=9.7
Yes (n=137)	100 (80.65%)	37 (29.84%)	p<.001*	95%CI: 5.4 to 17.6
Fast food				
No (n=91)	16 (12.90%)	75 (60.48%)	χ^2= 60.425	OR=10.3
Yes (n=157)	108 (87.10%)	49 (39.52%)	p<.001*	95%CI: 5.4 to 19.5

Min-Max: Minimum to Maximum
SD: Standard deviation
t: Independent Samples "Student's" t-test
χ^2: Pearson's chi-squared test
*: Statistically significant (p<.05)
NS: Statistically not significant ($p\geq$.05)
W: Welch's t-test

Table 5: Univariate and multivariate logistic regression analysis for the parameters affecting PCOS (n = 124 vs. 124)

	Univariate		**#Multivariate**	
	P	**OR (LL – UL 95%C.I)**	***p***	**OR (LL – UL 95%C.I)**
Age (years)	0.836	1.0 (0.9 –1.0)		
Urban Residence	<0.001*	15.1(6.5 – 35.1)	0.002*	7.6 (2.0 – 28.3)
High Education level	0.011*	1.9 (1.1– 3.1)	0.043*	3.4 (1.0 – 11.1)
Married	0.998	–		
Working	<0.001*	3.2 (1.8 – 5.5)	0.061	3.0 (0.9 – 9.5)
Not sufficient income	0.005*	8.3(1.8 – 37.5)	0.011*	0.0 (0.0 – 0.5)
Age of menarche (years)	0.105	1.1 (0.9 – 1.469)		
Regular of the cycle	0.996	–		
Nulligravida	0.153	1.4 (0.8 – 2.4)		
Nullipara	0.053	1.6(0.9 – 2.7)		
Any complication in the previous pregnancy	0.999	–		
History of infertility	0.996	–		
History of medical treatment to manage infertility	0.996	–		
History of surgical treatment to manage infertility	0.996	–		
Anemia	<0.001*	23.1 (8.0 – 66.6)	<0.001*	50.7 (9.4 – 272.4)
Hypertension	0.026*	4.3 (1.1 – 15.7)	0.711	0.6 (0.0 – 7.5)
Diabetes mellitus	0.060	3.5 (0.9 – 13.1)		
Family history of PCO	<0.001*	20.3 (4.7 – 87.1)	0.061	17.8 (0.8 – 365.3)
Family history of Hypertension	0.418	2.0(0.3 – 11.3)		
Family history of Cancer	0.014*	13.1 (1.6 – 102.9)	0.860	0.7 (0.0 – 36.0)
Family history of Diabetes mellitus	0.654	1.5 (0.2 – 9.2)		
Family history of Infertility	0.018*	11.9 (1.5 – 94.2)	0.635	4.1 (0.0 – 1437.3)
BMI	<0.001*	1.1 (1.1 – 1.2)	<0.001*	1.3 (1.2 – 1.5)
Vegetarian (Type of diet)	0.999	–		
Coffee drinking	<0.001*	9.7 (5.4 – 17.6)	0.029*	3.6 (1.1 – 11.5)
Fast food	<0.001*	10.3 (5.4 – 19.5)	0.002*	7.6 (2.1 – 26.8)

OR: Odd`s Type of dietratio
C.I: Confidence interval LL: Lower limit UL: Upper Limit
#: All variables with p<0.05 was included in the multivariate
*: Statistically significant at p ≤ 0.05

participants had sufficient income in both cases (84.86%) and control group (96.77%) (Table 1). Regarding the menstrual and obstetric risk factors of PCOs, our study found that irregularity of the cycle (p<.001), history of any complications in the previous pregnancy(p=.003), history of infertility

(p<.001), history of medical and surgical management of fertility(p<.001) were significant risk factors for PCOS. The results showed that 76% and 70% of women in the PCOS group had irregularity of menstruation and history of infertility respectively (Table 2).

Regarding risk factors related to medical and family history, anemia was present in 43% of women with PCOS-with odds ratio 23 (OR=23, and 95%CI:8 and p<.0001), the probability of hypertension in women with PCOS group was 4.32 times more than the Non PCO group (OR=4.3, 95% CI:1.1884 to 15.7147, p=.0263), the probability of diabetes in women having PPCO was 3.5 times (OR=3.5, 95% CI: 0.9495 to 13.1828, p=.059), the probability of family history of PCO among PCO women was 20.33 times (OR=20.3, 95% CI: 4.7450 to 87.1326, p<.0001) higher than Non PCOgroup, the probability of family history of cancer in women with PCOs was more than 13.17 times than Non PCO (OR= 13.1, 95%CI: 1.6863 to 102.9892, p=.0140), the probability of infertility increased in women with PCO 11.97 times than control (OR= 11.9735, 95%CI: 1.5215 to 94.2278, p=.0183) (Table 3).

Regarding to lifestyle habits linked to PCOS, high BMI (p<.001), stress(p<.001), coffee drinking (p<.001) and fast food (p<.001) were significant risk factors of PCOs. BMI was statistically significant higher in the PCOS group compared with control (p<.001). Most of cases suffered from moderate level of stress (65.32%) compared with control (44.35%) (Table 4).

The present study found that urban residence (p=0.002), high educational level (p=0.043), anemia (p<0.001), high BMI(p=<0.001), coffee drinking (p=0.029) and fast food (p= 0.002) were significant predictors of PCOS on multivariate logistic regression analysis (Table 5).

Discussion

A frequent endocrine illness in women of reproductive age is polycystic ovarian syndrome (PCOS), which is distinguished by increased androgen production and ovulatory failure with a variety of repercussions on the reproductive, metabolic, and cardiovascular systems and consequently on the patient's entire life span. The complexity of PCOS's etiology makes it difficult to determine. According to literature, the interaction of genetic and environmental factors causes PCOS. So, the aim of this study was to identify risk factors of PCOS.

Concerning the menstrual history of the PCOS women in the current study, it was found that the age of menarche was 13 years, and the majority had had irregular menstruation since menarche. This outcome was in line with **S**han et al, who claimed that the age of menarche in women with PCOS was 13 years, menstrual cycle disorders and irregular menstruation since menarche were present and considered risk factors for PCOS[17], also Shinde *et al*., conducted a study that revealed that risk factor for PCOS includes menstrual irregularity since menarche[2].

According to this study, the risk factors regarding medical and family history for PCOS, hypertension, family history of PCOS, family history of cancer, and family history of infertility are all conditions that run in families. The results of this study were similar to a study conducted by Shan *et al*., that evaluated the significant risk factors of polycystic ovarian syndrome, and their findings indicated that the risk factors for PCOS were depression, a mother's irregular periods, , and infertility[17]. Tian *et al*., reported that the mother's infertility is a risk factor, for the PCOS disease's heritability[18], Bates *et al*. found that increased risk for the daughter is also caused by the association between the mother's irregular menstruation and the daughter's PCOS[19].

Our study showed the risk factors related to PCOS were an elevated body mass index and unhealthy lifestyle habits such as drinking coffee and eating fast food. These findings agreed with Shan et al. who found that tea drinking and insufficient exercise are considered risk factors for PCOS[17]. This result matched with Shinde et al. who conducted the study, revealing that risk factor for PCO includes lack of physical activity and being overweight[2]. Patten et al. showed the same results[20]. Along the same line, Barrea et al. found that individual eating fast food diets and obesity are at higher risk of PCOS than participants without these predisposing factors[21]. Another study found that eating fast food was associated with increased odds of PCOS which match this study[22].

This study found that PCOS was common among women with low income compared to women with high socioeconomic status, which may predispose to consumption of unhealthy food rich in

carbohydrates and obesity. This matched a study done by Rubin et al. who found that Danish women with PCOS more often had low personal income, were more often unemployed or on welfare, and had more often retired early compared with age-matched controls[23].

The current study found that most of the women had psychological and mood changes. This finding agreed with a study conducted in Mumbai, which indicates that psychological pain in women with PCOS due to physical pain [2]. Also Shan et al. mentioned that severe stress increases the risk for PCOS[19].

Additionally, the findings of present study were in line with a previous study conducted in Iraq reported that PCOS cases had a higher BMI, higher infertility proportions, obesity, and an unpleasant mood compared with controls[24]. The current study showed that anemia was a significant risk factor associated with PCOS in line with a prior study, which revealed that (58.3%) of women with PCOS had a high prevalence level of anemia. This might be a result of PCOS related menstrual irregularites[25].

The current study showed that living in urban areas is a risk factor for PCOS as they may be exposed to more stress and anxiety. Involvement in vigorous work activity was significantly higher among rural participants compared to urban areas. Several studies matched the results of this population as they mentioned that the proportion of PCOS was higher in urban populations in comparison to rural areas[26,27].

In this study, high educational level was considered a risk factor for PCOS women, this matched Merkin et al who found increase incidence of PCOS among highly educated women but it require further research by several studies as data is limited[28-30].

Strengths and limitations

This study investigated important risk factors for the development of PCOS, so early detection may help in the prevention of PCOS and decreasing PCOS symptoms and complications. But we had some limitations for this study as case control study design cannot identify the causal relationship. We used a convenient sample which is not representative so, there is a need to investigate a larger number of women through several hospitals and private clinics all over the country. Although we investigate the most risk factors for PCO, we didn't do some important laboratory investigations for women such as insulin resistance test and lipid profile.

Conclusions

The sociodemographic status, medical and family history, and lifestyle habits were significant risk factors for developing PCOS at reproductive age. The current study suggests that PCOS is significantly associated with urban residence, a high educational level, insufficient income, a high BMI, anemia, eating fast food and drinking coffee.

Recommendation

PCOS women should follow a healthy diet and engage in regular exercise for a workable preventive strategy that can increase insulin sensitivity and ameliorate PCOS symptoms. In order to increase women's awareness and motivation to take preventative action and early diagnosis of PCOS symptoms, proactive health education should be recommended and implemented among women and their families.

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