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ORIGINAL PAPER

THE IMPACT OF OBESITY IN POLYCYSTIC OVARIAN SYNDROME: A CROSS-SECTIONAL STUDY

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Abstract

Introduction. Obesity has been shown to influence the ovulatory functions of females with polycystic ovarian syndrome (PCOS).
The objective of the study was to investigate how obesity may change the clinical features of Algerian females with PCOS.
Materials and methods. The cross-sectional study with retrospective data collection was conducted in the Specialized Hospital of Gynecology and Obstetrics of Sidi Bel Abbes (Algeria), between January 2022 to December 2024. The female patients were divided into the two groups: non-obese group vs. obese group.
Results. 123 PCOS patients were admitted during the study period. The prevalence of obesity was 37.4%. The mean age of the patients was 39.47±15.78 years, and the PCOS duration 13.92±12.72 years. Most women were multipara (45.5%), and 10.6% primipara. An irregular menstrual cycle was found in 58.5% of the cases. Clinically, hypertension (11.4%), diabetes (11.4%), hirsutism (58.5%), and acne (52.0%) were noted. Most females (56.1%) had macropolycystic ovaries on ultrasound. In the obese group, the number of follicles per

Résumé

L'impact de l'obésité dans le syndrome des ovaires polykystiques: une étude transversale

Introduction. Il a été démontré que l'obésité influence les fonctions ovulatoires des femmes atteintes du syndrome des ovaires polykystiques (SOPK).
L'objectif de l'étude était d'étudier l'impact de l'obésité sur les caractéristiques cliniques des femmes algériennes atteintes du SOPK.
Matériel et méthodes. L'étude transversale avec recueil rétrospectif de données a été menée à l'hôpital spécialisé de gynécologie et d'obstétrique de Sidi Bel Abbès (Algérie), de janvier 2022 à décembre 2024. Les patientes ont été réparties en deux groupes: un groupe non obèse et un groupe obèse.
Résultats. 123 patientes atteintes du SOPK ont été admises pendant la période d'étude. La prévalence de l'obésité était de 37,4%. L'âge moyen des patientes était de 39,47±15,78 ans et la durée du SOPK de 13,92±12,72 ans. La plupart des femmes étaient multipares (45,5%) et 10,6% primipares. Un cycle menstruel irrégulier a été constaté dans 58,5% des cas.

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ovary and cysts' diameter were markedly higher compared to non-obese patients (number of follicles per ovary 16.80±3.97 vs. 13.62±2.30, p< 0.001; cysts' diameter 9.39±2.21 mm vs. 5.91±1.47 mm, p< 0.001, respectively).
Conclusions. Obesity is an independent risk factor for PCOS and aggravates many of its clinical features. Thus, continuous monitoring and intervention are required to prevent the gynecological complications.

Keywords: obesity, ovulatory functions, polycystic ovarian syndrome, gynecological complications.

List of abbreviations:
PCOS - polycystic ovarian syndrome
LH – luteinizing hormone
BMI – body mass index
SBP – systolic blood pressure
DBP – diastolic blood pressure
FBG – fasting blood glucose
HbA1c – glycated hemoglobin
TC – total cholesterol
TG – triglycerides
ALT – alanine aminotransferase
AST – aspartate aminotransferase
hs-CRP – high-sensitivity C-reactive protein
SD – standard deviation
SPSS – Statistical Package for the Social Sciences

Cliniquement, une hypertension (11,4%), un diabète (11,4%), un hirsutisme (58,5%) et de l'acné (52,0%) ont été notés. La plupart des femmes (56,1%) présentaient des ovaires macropolykystiques à l'échographie. Dans le groupe obèse, le nombre de follicules par ovaire et le diamètre des kystes étaient nettement plus élevés que chez les patientes non obèses (nombre de follicules par ovaire 16,80±3,97 contre 13,62±2,30, p < 0,001; diamètre des kystes 9,39±2,21 mm contre 5,91±1,47 mm, p < 0,001, respectivement).
Conclusions. L'obésité est un facteur de risque indépendant du SOPK et aggrave bon nombre de ses caractéristiques cliniques. Une surveillance et une intervention continues sont donc nécessaires pour prévenir les complications gynécologiques.

Mots-clés: obésité, fonctions ovulatoires, syndrome des ovaires polykystiques, complications gynécologiques.

Introduction

Polycystic ovarian syndrome (PCOS) is an endocrine disease that affects women of childbearing age[1]. Its prevalence varies among different races and ethnic groups. According to a recent meta-analysis, PCOS affects approximately 9.2% of reproductive age women, globally[2]. In European countries and the USA, the prevalence of PCOS varies from 6 to 15%[3], while in the Asian region it has been estimated at 3.3% in South Asia, 1% in China, and 1.5% in the Philippines[4]. In addition, it was found that PCOS was ubiquitous among African females, with a reported prevalence of 16.7%[5]. A recent Middle East and North Africa region-based study demonstrates a 37.9% increase in prevalence since 1990[6]. This syndrome associates spaniomenorrhea or amenorrhea, sterility, hirsutism, and obesity, with abnormally high serum levels of androgens and luteinizing hormone (LH), which trigger the development of multiple ovarian microcysts, confirming the diagnosis[1]. Obesity has been associated with symptoms that overlap with metabolic syndromes like hypertension, peripheral insulin resistance, PCOS, and dyslipidemia[7]. It has been shown that obesity can be considered an independent risk factor for PCOS, which substantially exacerbates its clinical features[8]. It is estimated that 30 to 40% of patients with PCOS have a normal weight and 35 to 50% are obese (body mass index (BMI) > 30 Kg/m^2)[9].

Obese women are not only more likely to have PCOS than non-obese females but are also much more likely to have menstrual irregularity associated closely with anovulatory infertility[8]. In reproductive age women, the relative risk of anovulatory infertility increases at a BMI of 25 kg/m^2 and continues to rise with increasing BMI[10]. Conversely, consistent with the pathophysiological implications of obesity, weight reduction can normalize the menstrual cycles in these women.

Evidence that obesity affects ovulatory dysfunction has been highlighted in experimental studies. Interestingly, the histopathological examination of the ovaries in women with PCOS showed a greater number of large-sized follicles among obese women, indicating that the increased numbers of medium and cystic follicles were induced by obesogenic diets[11]. Nonetheless, the clinical features of PCOS among obese reproductive age women have not been well studied in Algeria.

The objective of the study was to investigate how obesity may change PCOS clinical features in Algerian females.

Material and methods

Study design

This study employed a cross-sectional design with both descriptive and analytical aims. Retrospective data were collected over three years, from January 1, 2022, to December 31, 2024. The ethical approval was obtained from the local ethics committee of the specialized hospital (15th February 2025, No 2025/27).

Participants

The study population consisted of 123 patients diagnosed with PCOS, who consulted the Specialized Hospital of Gynecology and Obstetrics of Sidi Bel Abbes (Algeria). The diagnosis of PCOS was retained based on the existence of at least two of the Rotterdam criteria[12]: abnormality of the menstrual cycle, the existence of clinical and/or biological hyperandrogenism, and polycystic ovaries (by ultrasonography). All patients meeting the aforementioned criteria were included in this study. Patients were excluded if they had ovarian congenital abnormalities, congenital adrenal hyperplasia, Cushing syndrome, or androgen-secreting tumours.

Data collection and measurements

All patients had a complete anthropometric evaluation of weight, height, and BMI. A sphygmomanometer was used to measure blood pressure in the supine position, followed by a second measurement (after a few minutes) in a standing position. Hypertension was defined as systolic blood pressure (SBP) of 140 mmHg or higher and diastolic blood pressure (DBP) of 90 mmHg or higher. Fasting blood glucose (FBG), glycated hemoglobin (HbA1c), urea, serum creatinine, and serum lipids (total cholesterol (TC), and triglycerides (TG)), as well as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and high-sensitivity C-reactive protein (hs-CRP) were all collected from patients' medical records.

Arbitrarily, patients were divided into two groups according to their BMI values (a BMI ³ 30 Kg/m² indicates obesity, whereas a BMI lower than this threshold is classified as non-obese). Hirsutism was assessed using the modified Ferriman-Gallway scoring system. It involves scoring the amount of terminal hair growth on nine or eleven body areas, using a scale of 0 to 4, where 0 indicates no hair and 4 indicates extensive hair growth. A score of 8 or more indicates hirsutism[13]. At ultrasonography, PCOS was evaluated with the presence of 10 or more follicles in each ovary measuring 2–9 mm in diameter, and/or increased ovarian volume (≥10 mL)[14]. The characteristic appearance of the cysts on ultrasound scan was defined as microcystic (2 to 7 mm in diameter) and macrocystic (³ 8 mm in diameter). The cysts that appear bright on ultrasound due to the presence of echoes within the fluid were referred to as echogenic cystic lesions. However, the cysts that appear completely black (fluid-filled structures) without echoes were referred to as anechogenic cystic lesions. The ultrasound examination was performed using the ACUSON S1000™ ultrasound machine.

Statistical analysis

Qualitative data were expressed as percentages (%) and relative frequencies, and continuous normally distributed variables were presented as mean±standard deviation (SD) with their 95% confidence interval. The association between the variables was determined by comparing them using the Chi-square test or the Student *t*-test, as applicable, at a 5% significance level. A partial correlation test was applied to evaluate the correlation between PCOS features and BMI values. Statistical significance was established at $p < 0.05$. All computations were performed using SPSS 30 software (SPSS 30, IBM Corporation; Chicago, IL. September 2024).

Results

Sociodemographic and clinical profile

The sociodemographic and clinical characteristics of the patients are presented in Table 1. A total of 123 patients with PCOS were admitted to the Specialized Hospital of Gynecology and Obstetrics during the study period. Of the 123 PCOS patients, 46 (37.4%) were obese.

For all patients, the mean age was 39.47±10.78 years (range 20-49 years), and the mean duration of PCOS was 13.92±12.72 years. Meanwhile, the mean age of obese patients was significantly higher than that of the non-obese group (39.20±10.99 years *vs.* 31.05±10.33 years, p< 0.001). Similarly, the mean PCOS duration was considerably higher among the obese group compared to non-obese patients (16.35±14.48 years *vs.* 10.55±13.20 years, p= 0.025) (Table 3). The most affected age group was the one younger than 40 years, with a rate of 60.20%. The prevalent comorbidities were hypertension and diabetes (11.4%) (Table 1). Among the obese group, 26 patients (56.5%) had cesarean childbirth, while 22 (47.8%) had an abortion history (Table 2).

Table 3 presents the clinical and biochemical profiles of the two groups. Regarding orthostatic measurements, there was a statistical difference in DBP (p= 0.045) between the two groups. In addition, statistically higher hs-CRP concentrations (p= 0.034), urea (p= 0.009), and ALT (p= 0.011) were found in the obese group compared to the non-obese group (Table 3).

Table 1. Sociodemographic and clinical characteristics of the study sample.

Variables	All patients, n=123 Number (%)	Non-obese group, n=77 Number (%)	Obese group, n=46 Number (%)	p-value
Age groups, years				
< 40 years	74 (60.2%)	54 (70.1%)	20 (43.5%)	0.003*
≥ 40 years	49 (39.8%)	23 (29.9%)	26 (56.5%)	
Place of residence, n (%)				
Urban	106 (86.2%)	69 (89.6%)	37 (80.4%)	0.156
Rural	17 (13.8%)	8 (10.4%)	9 (19.6%)	
Marital status, n (%)				
Single	26 (21.1%)	20 (26.0%)	6 (13.0%)	0.527
Divorced	89 (72.4%)	50 (64.9%)	39 (84.8%)	
Married	8 (6.5%)	7 (9.1%)	1 (2.2%)	
Employment status, n (%)				
Employed	39 (31.7%)	23 (29.9%)	16 (34.8%)	0.575
Unemployed	84 (68.3%)	54 (70.1%)	30 (65.2%)	
Signs of hyperandrogenism, n (%)				
Acne	64 (52.0%)	43 (55.8%)	21 (45.7%)	0.277
Hirsutism	72 (58.5%)	43 (55.8%)	29 (63.0%)	0.437
Other associated complications, n (%)				
Hyperthyroidism	5 (4.1%)	3 (3.9%)	2 (4.3%)	0.023*
Hypothyroidism	3 (2.4%)	2 (2.6%)	1 (2.2%)	
Hypertension	14 (11.4%)	5 (6.5%)	9 (19.6%)	
Diabetes	14 (11.4%)	8 (10.4%)	6 (13.0%)	
Asthma	4 (3.3%)	3 (3.9%)	1 (2.2%)	
Family history of PCOS, n (%)				
No	58 (47.20%)	38 (49.40%)	20 (43.50%)	0.151
Yes	65 (52.80%)	39 (50.60%)	26 (56.50%)	

(*) percentages were compared with the Chi-square test, and p< 0.05 was considered significant. PCOS: polycystic ovary syndrome.

Table 2. Gynecologic characteristics of the study sample.

Variables	*All patients, n=123 Number (%)*	*Non-obese group, n=77 Number (%)*	*Obese group, n=46 Number (%)*	*p-value*
Menstrual cycle, n (%)				
Regular	31 (25.2%)	21 (27.3%)	10 (21.7%)	0.233
Irregular	72 (58.5%)	46 (59.7%)	26 (56.5%)	
Menopause	20 (16.3%)	10 (13.0%)	10 (21.7%)	
Mode of childbirth, n (%)				
Normal vaginal birth	17 (13.8%)	8 (10.4%)	9 (19.6%)	0.041*
Cesarean childbirth	52 (42.3%)	25 (32.5%)	27 (58.7%)	
Parity, n (%)				
Nullipara	54 (43.9%)	44 (57.1%)	10 (21.7%)	0.062
Primipara	13 (10.6%)	9 (11.7%)	4 (8.7%)	
Multipara	56 (45.5%)	24 (31.2%)	32 (69.6%)	
Menorrhagia, n (%)				
No	74 (60.2%)	47 (61.0%)	27 (58.7%)	0.799
Yes	49 (39.8%)	30 (39.0%)	19 (41.3%)	
Infertility, n (%)				
No	68 (55.3%)	36 (46.8%)	32 (69.6%)	0.014*
Yes	55 (44.7%)	41 (53.2%)	14 (30.4%)	
Type of infertility, n (%)				
Primary	32 (26.0%)	25 (32.5%)	7 (15.2%)	0.030*
Secondary	23 (18.7%)	16 (20.8%)	7 (15.2%)	
Abortion history, n (%)				
No	78 (63.4%)	54 (70.1%)	24 (52.2%)	0.046*
Yes	45 (36.6%)	23 (29.9%)	22 (47.8%)	

(*) percentages were compared with the Chi-square test, and p< 0.05 was considered significant.

Table 3. Comparison of clinical and biochemical profiles between obese and non-obese patients.

Variables	*All patients, n=123*		*Non-obese group, n=77*		*Obese group, n=46*		*p-value*
	Mean ±SD	*95% CI*	*Mean ±SD*	*95% CI*	*Mean ±SD*	*95% CI*	
Mean age (years)	39.47 ± 10.78	36.65-42.29	31.05 ± 10.33	27.23-35.33	39.20 ± 10.99	36.70-46.65	<0.001*
Menarche age (years)	12.57 ± 0.57	12.47-12.67	12.56 ± 0.57	12.43-12.69	12.59 ± 0.58	12.41-12.76	0.791
Menstrual cycle length (years)	29.80 ± 3.77	29.12-30.47	29.86 ± 3.42	29.08-30.63	29.70 ± 4.34	28.41-30.99	0.820
Age of onset of PCOS (years)	27.02 ± 6.94	25.78-28.26	25.91 ± 6.77	24.37-27.45	28.87 ± 6.89	26.82-30.92	0.023*
PCOS duration (years)	13.92 ± 12.72	10.23-15.20	10.55 ± 13.20	7.55-13.54	16.35 ± 14.48	12.05-20.65	0.025*
Body height (m)	1.63 ± 0.06	1.61-1.64	1.64 ± 0.05	1.63-1.65	1.60 ± 0.06	1.58-1.62	<0.001*
Body weight (Kg)	77.71 ± 10.89	75.77-79.66	72.06 ± 8.99	70.02-74.10	87.17 ± 6.26	85.31-89.03	<0.001*
BMI (Kg/m^2)	29.30 ± 4.50	28.50-30.11	26.55 ± 2.36	26.01-27.09	33.91 ± 3.29	32.94-34.89	<0.001*
SBP (mmHg)	121.4 ± 13.40	119.00-123.80	120.40 ± 13.10	116.50-124.30	121.90 ± 13.60	118.80-125.10	0.274
DBP (mmHg)	77.0 ± 11.10	75.0-79.0	74.8 ± 10.70	71.6-78.0	78.3 ± 11.2	75.8-80.9	0.045*
Fasting blood glucose (g/L)	1.00 ± 0.22	0.95-1.04	0.97 ± 0.23	0.91-1.03	1.04 ± 0.20	0.98-1.10	0.112
HbA1c (%)	5.12 ± 1.17	4.87-5.38	4.95 ± 0.80	4.73-5.17	5.39 ± 1.58	4.83-5.95	0.092
hs-CRP (mg/L)	18.51 ± 16.55	12.29-20.72	13.79 ± 8.93	11.17-16.41	27.76 ± 20.29	10.57-30.95	0.034*
Total cholesterol (g/L)	2.19 ± 0.49	2.10-2.28	2.15 ± 0.48	2.04-2.26	2.25 ± 0.51	2.10-2.40	0.147
Triglycerides (g/L)	1.59 ± 1.02	1.41-1.77	1.61 ± 1.07	1.37-1.86	1.55 ± 0.95	1.27-1.84	0.372
Creatinine (mg/L)	8.03 ± 2.76	7.48-8.57	7.92 ± 2.72	7.22-8.62	8.18 ± 2.84	7.28-9.08	0.322
Urea (g/L)	0.23 ± 0.10	0.21-0.25	0.21 ± 0.07	0.19-0.23	0.26 ± 0.12	0.22-0.30	0.009*
AST (U/L)	23.44 ± 11.22	21.12-25.77	22.19 ± 8.95	19.76-24.61	25.31 ± 13.86	20.69-29.94	0.096
ALT (U/L)	21.21 ± 19.79	17.08-25.33	17.29 ± 9.86	14.59-19.98	26.93 ± 27.92	17.62-36.24	0.011*

(*) means were compared with the independent sample Student's *t*-test, and a p< 0.05 was considered significant. ALT: alanine aminotransferase, AST: aspartate aminotransferase, BMI: body mass index, CI: confidence interval, DBP: diastolic blood pressure, HbA1c: glycosylated hemoglobin, hs-CRP: high-sensitivity C-reactive protein, PCOS: polycystic ovary syndrome, SBP: systolic blood pressure, SD: standard deviation, TC: total cholesterol, TG: triglycerides.

Table 4. Clinical presentation of PCOS features between obese and non-obese patients.

Variables	*All patients, n=123 Number (%)*	*Non-obese group, n=77 Number (%)*	*Obese group, n=46 Number (%)*	*p-value*
Localization of follicles per ovary, n (%)				
Left ovary	39 (31.7%)	26 (33.8%)	13 (28.3%)	
Right ovary	48 (39.0%)	27 (35.1%)	21 (45.7%)	0.957
Both ovaries	36 (29.3%)	24 (31.2%)	12 (26.1%)	
Number of cysts per ovary, Mean ±SD	14.93 ± 3.35	13.62 ± 2.30	16.80 ± 3.97	<0.001**
Cyst's form, n (%)				
Microcysts	54 (43.9%)	45 (58.4%)	9 (19.6%)	<0.001*
Macrocysts	69 (56.1%)	32 (41.6%)	37 (80.4%)	
Cyst's diameter (mm), Mean ± SD	7.52 ± 4.13	5.91 ± 1.47	9.39 ± 2.21	<0.001**
Cyst's ultrasonographic diagnosis, n (%)				
Echogenic cystic lesions	38 (30.9%)	26 (33.8%)	12 (26.1%)	0.377
Anechogenic cystic lesions	85 (69.1%)	51 (66.2%)	34 (73.9%)	
Ovarian volume (mL), Mean ± SD	10.66 ± 1.36	10.51 ± 1.10	10.91 ± 1.46	0.367

(*) percentages were compared with the Chi-square test, and p< 0.05 was considered significant.
(**) means were compared with the independent sample Student's *t*-test, a p< 0.05 was considered significant.

PCOS ultrasound examination

Our results extensively looked at the clinical presentation of PCOS features among the study patients. When the clinical features were compared according to categories, the number of cysts per ovary (p< 0.001), cyst's form (p< 0.001), and cyst's diameter (p< 0.001) had a significant association with the BMI cutoffs (Table 4).

Correlations

Partial correlation was applied to establish the correlation between the PCOS features and BMI values by controlling for age and disease duration. There was a significant positive correlation between the number of follicles per ovary (r=0.275; p< 0.002), and cyst's diameter (r=0.244; p< 0.007) with the BMI values. These results elucidate that an increase in

Table 5. Partial correlation between PCOS features with BMI after adjustment for age and disease duration.

Variables	BMI (Kg/m^2)	
	r (correlation coefficient)	p-value
PCOS features		
Number of follicles per ovary	0.275	0.002*
Cyst's diameter	0.244	0.007*
Ovarian volume	0.002	0.980

(*) Partial correlation significant at p< 0.05, BMI: body mass index, PCOS: polycystic ovary syndrome.

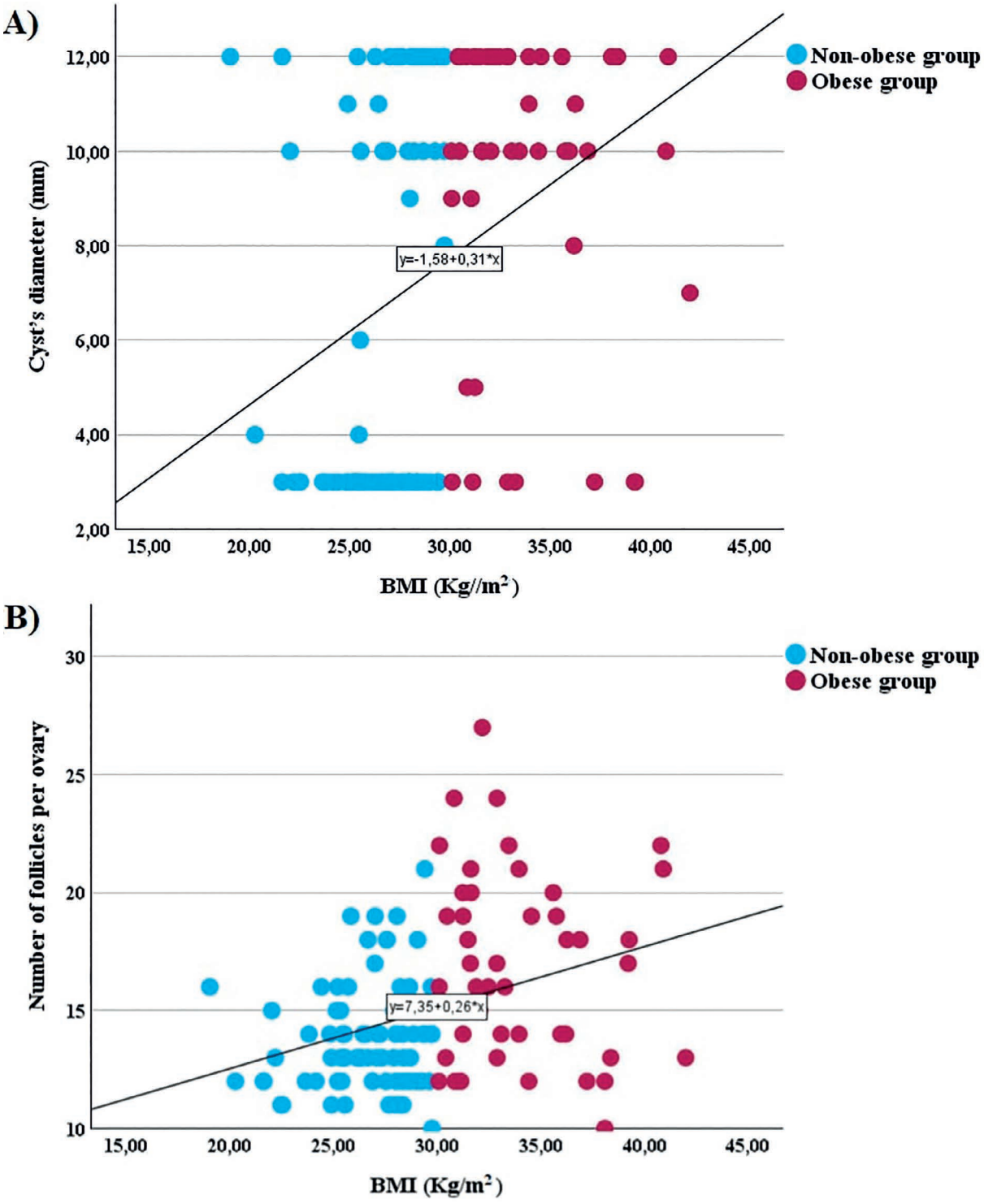


Figure 1. Linear correlation of PCOS features and BMI among obese and non-obese patients.

BMI values is correlated with aggravated PCOS features (Table 5).

As displayed in Figure 1, there was a linear correlation between PCOS features (number of follicles per ovary and cyst's diameter) and BMI values.

Discussion

PCOS remains a prevalent health burden due to its related metabolic, psychological, and reproductive complications. The present study has demonstrated that 60.20% of patients with PCOS are under 40 years old. Longitudinal research of a referred PCOS group, diagnosed in their early 20s and followed for 20 years, confirmed these findings by demonstrating a decrease in the prevalence of more severe phenotypes by the fourth decade of life[15]. The phenotype was less severe in several cases, and a minority no longer fulfilled the diagnostic criteria for PCOS[15]. Our research showed a significant effect of PCOS duration on the differences in BMI. The results are consistent with the literature, where patients with PCOS have excessive insulin production or impaired insulin efficacy. The dysfunction of insulin is a contributing factor to the weight increase or difficulty in weight loss experienced by women with PCOS[16]. Obstetrically, among patients with PCOS, obesity was significantly associated with cesarean childbirth. In a recent meta-analysis, Khomami et al. concluded that obesity is a major risk factor for delivery-related difficulties in females with PCOS, suggesting that hormone disorders contribute to birth outcomes through endometrial abnormalities such as thickening of the endometrium[17]. In this study, the history of abortion in obese females was found to be significantly related to the presence of PCOS. These results follow reports from the literature showing that PCOS and obese patients have a higher risk of spontaneous abortion[18]. Interestingly, hypertension was diagnosed in 14 cases, and it was present in 9 (19.60 %) obese patients. Our findings are consistent with previous research by Pinola et al., which indicated that overweight and obese patients with PCOS had 5 mmHg increased SBP and 4 mmHg higher DBP compared to controls[19]. This increased blood pressure is a component of the metabolic syndrome often associated with PCOS, particularly in obese individuals. Considerably, the hs-CRP concentrations were different between the obese and non-obese groups. In their study, Gowri et al. reported that hs-CRP values are markedly elevated in obese females, especially those over 30 years of age, with a strong correlation observed in females with PCOS compared to controls[20].

In our study, the number of cysts per ovary increased with BMI. Thus, overweight and obese PCOS patients require careful weight monitoring. Multiple studies employing animal models or humans illustrate that obesity significantly impairs ovarian function, emphasizing that obesity increases the number of primordial, antral, and atretic follicles, which may lead to depletion of the ovarian reserve and consequently contribute to subfertility[21]. Furthermore, it was highlighted that obesity contributes to the ovulatory dysfunction of PCOS by altering the hypothalamic-pituitary-ovarian axis[10].

Additionally, Patel et al. found that obesity was highly associated with macrocystic forms of PCOS and affects the metabolism of androgens. Moreover, androgen disturbances alter its delivery to target tissues and influence the enhancement of ovarian cyst size in patients with PCOS[22].

One of the strengths of this research was the inclusion of a well-characterized and homogenous ethnic cohort of patients with PCOS. Most medical data were accessible, allowing us to utilize reliable information to address the study questions. Consequently, this clinical data permitted us to examine the association between more aggravated clinical features of PCOS and obesity. A potential limitation of our study is that, since our clinical data primarily originated from a cross-sectional protocol, the prevalence of patients with PCOS who could be included was restricted, resulting in a small sample size. Nonetheless, the data from medical records were notably reliable due to consistent ultrasonography screening and the exclusion of ovarian tumours. To our knowledge, this is the first study among Algerian females to evaluate the association between the number of follicles per ovary and obesity. The insight acquired from this study can form the basis for future studies, which may facilitate the development of a treatment and reduce the risk of PCOS.

Conclusions

In conclusion, obesity is an independent risk factor for PCOS and aggravates many of its clinical and metabolic features. Remarkably, obese patients with PCOS had an increased number of cysts per ovary and higher cysts diameter. Timely screening and accurate diagnosis are imperative to mitigate the progression of associated gynecological complications and improve long-term female reproductive health outcomes.

Authors' Contributions:

W.H.H. selected the study subjects, performed clinical assessment, data analysis, and drafted the initial manuscript. E.Z. conceived the study idea, revised the manuscript

critically. All the authors have read and agreed with the final version of the article.

Compliance with ethics requirements:

"The authors declare no conflicts of interest regarding this article."

"The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law.

Informed consent was obtained from all the patients included in the study."

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