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Obesity in women of reproductive age and its relation to polycystic ovarian syndrome and sub-fertility

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Abstract

Background and objective: The Sub-fecundity and infertility are both enhanced by obesity. Regardless of the method of conception, obese women have less favourable reproductive results, and poorer fertility prognosis. One of the main reasons for infertility is polycystic ovarian syndrome (PCOS). The purpose of this study is to determine how obesity and polycystic ovarian syndrome affect fertility in women of reproductive age.

Methods: A cross-sectional study was performed at a maternity teaching hospital in Erbil, Kurdistan Region, Iraq. It comprises 400 women: 200 with a BMI of 30 or above and 200 with a BMI between 18 and 24. From January 1, 2021, until December 31, 2021.

Results: The average age of the enrolled women was 29.9 years. The majority (81.5%) were under 30 years of age, and (70.6%) were classified as overweight. In the obese group, 55% of women had never experienced pregnancy. A greater percentage of the obese group had no history of miscarriage in comparison to the non-obese group. The obese group exhibited a significantly higher prevalence of hirsutism (59%) compared to the non-obese group (39.5%). Infertility rates varied from 84% in the obese group to 38.5% in the non-obese group. In contrast to 44.5% of non obese women, the ultrasonographic findings indicated that 60% of obese women displayed PCOS morphology.

Conclusion: Obesity has effect on the occurrence of sub-fertility and polycystic ovary syndrome at all reproductive ages.

Keywords: Obesity; Sub-Fertility; Polycystic ovary syndrome; BMI; Reproductive age.

Introduction

Obesity is a global pandemic that has serious clinical, social, and economic repercussions in both industrialized and developing nations. Since 1975, the frequency of obesity has almost quadrupled globally. In 2016, there were more than 1.9 billion overweight individuals, of which over 650 million were obese.[1] Insulin resistance is intimately linked to the illness of obesity, which is characterized by an excess of body fat.[2] Over 340 million children and adolescents between the ages of 5 and 19 were overweight or obese in 2016, making obesity one of the leading causes of premature death. Obesity also affects children and adolescents, as there were 41 million under the age of 5 and over 340 million between the ages of 5 and 19.[2]

Regardless of the method of conception, obese women have inferior reproductive results, and a greater body mass index (BMI) is linked to a worse fertility prognosis.[3] Since PCOS is the most prevalent endocrine illness in women of reproductive age, it is one of the main causes of infertility. Hyperandrogenism, oligo-anovulation, and polycystic ovarian shape are among the diagnostic indicators,[4] but many women with PCOS are also overweight or obese.[5]

Through disruption of the hypothalamus-pituitary-gonadal (HPG) axis (hyperandrogenism) and the follicular environment, female obesity can affect

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fertility.[6,7,8] It is commonly known that obese women take longer to get pregnant than normal-weight women, and that they also have lower fertility rates, higher gonadotropin needs, and higher rates of miscarriage.[9]A diverse endocrine illness called polycystic ovarian syndrome (PCOS) affects a lot of women across the world who are of reproductive age.[10] This disease is frequently accompanied by oversized and dysfunctional ovaries, high levels of testosterone, and insulin resistance.[11]

Although the elevated frequency of gonadotropin-releasing hormone (GnRH) and the high ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) are recognized to be the fundamental causes of PCOS,[12] the precise etiology and pathophysiology are not well understood.[12, 13] It is also important to note that PCOS raises the risk of additional issues such cardiovascular illnesses and type 2 diabetes mellitus,[13,14] metabolic syndrome,[14] depression, and anxiety.[15]

According to ultrasounds, PCOS is characterized by ovulatory dysfunction, hyperandrogenism, and polycystic ovarian morphology (PCOM).[16] An inadequate cell response to insulin is referred to as insulin resistance.[17] Insulin directly causes the synthesis of androgens in ovarian theca cells,[18,19] and grows.[20] Insulin activates its receptors in the follicle membrane cells, which successfully promotes ovarian follicle development and hormone output.[21] It was shown that PCOS women have greater plasma testosterone concentrations, which are capable of being converted to estrone in adipose tissue. Increased estrone to estradiol conversion impacts follicle development and raises the LH to FSH ratio, which results in ovulatory failure.[22]

Although it is yet unknown exactly what factors contribute to the higher prevalence of pregnancy problems in PCOS-positive women. Compared to healthy controls, pregnant women with PCOS gain more weight during pregnancy.[23]When a couple has never given birth, they have primary sub-fertility.[24] A kid might present difficulties for one or both couples for one or many reasons. Female subfertility is discovered to be caused by ovarian, tubal, uterine, and hormone-related factors as well as inadequate fertility awareness worldwide.[25,26]

This study aims to investigate the relationship between obesity and polycystic ovarian syndrome in reproductive-age women and their impact on fertility. To ascertain if obesity elevates the risk of PCOS and to evaluate the impact of various PCOS phenotypes on weight.

Methods

Study design

The study employed a cross-sectional design with a comparative group, comprising a sample of 400 participants: 200 obese women (BMI ≥ 30 kg/m²) and 200 non-obese women (BMI 18-24). The data was gathered via direct interviews with women and the completion of a prearranged questionnaire by the participants. The researcher assessed the women, measuring their weight and height to compute the body mass index for comparison between two distinct groups.

Study setting

The study was conducted at the Outpatient Clinic of the Maternity Teaching Hospital in Erbil, Kurdistan Region, Iraq. A duration of 12 months from January 1, 2021, to December 31, 2021.

Inclusion criteria

Women of reproductive age (18–40) with a high body mass index (BMI) of 30 or above, women with a BMI between 18 and 24, and infertile or fertile married women were among the participants'.

Exclusion criteria

Women with systemic disorders who declined to take part in the trial were excluded.

Ethical consideration

The study proposal was officially authorized by the Hawler College of Medicine's Scientific Committee (approval number 5,23 of May 2021) and the Hawler Directorate of Health's Ethical Committee.

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Statistical Analysis:
The Statistical Package for Social Sciences (SPSS, version 25) was used to analyse the data. When the expected frequency (value) of more than 20% of the table's cells was less than 5, Fisher's exact test was applied (instead of the Chi-square test). The means of the two samples were compared using a student's t-test of two independent samples (unpaired t-test). Statistical significance was defined as *P*-value 0.05

Results

The women who were recorded ranged in age from 18 to 40, with a mean age of 24.3 ± 5.54. In Table 1, around one third (29.3%) of the whole sample were aged ≥ 35 years, and 25.5% were aged less than 25 years, but there was no significant difference in the age distribution for the two groups (*P* = 0.190). More than half (55%) of the obese group had never been pregnant before, compared with (16.5%) of the non-obese group (*P* <0.001). The same can be applied for the parity, where it is evident that 57% of the obese group were nulliparous women, compared with 20.5% of the non-obese group (*P* <0.001). A significantly higher percentage of the obese group had no history of miscarriage (70.5%) compared with 52% of the non-obese group (*P* <0.001).

Table 1 The Basic Characteristics of the Study Sample

	Obese	Non-obese	Total	
	No. (%)	No. (%)	No. (%)	*P*-value
Age (years)				
< 25	44 (22.0)	58 (29.0)	102 (25.5)	
25-29	44 (22.0)	41 (20.5)	85 (21.3)	
30-34	54 (27.0)	42 (21.0)	96 (24.0)	
≥ 35	58 (29.0)	59 (29.5)	117 (29.3)	0.316**
Mean ± SD	30.30 (6.07)	29.46 (6.8)	29.9 (6.4)	0.190†
Gravidity				
No history of pregnancy	110 (55.0)	33 (16.5)	143 (35.8)	
Primi-gravida	14 (7.0)	36 (18.0)	50 (12.5)	
Multi-gravida	69 (34.5)	106 (53.0)	175 (43.8)	
Grand multi-gravida	7 (3.5)	25 (12.5)	32 (8.0)	< 0.001**
Parity				
Nulli-parous	114 (57.0)	41 (20.5)	155 (38.8)	
Primi-parous	29 (14.5)	59 (29.5)	88 (22.0)	
Multi-parous	57 (28.5)	97 (48.5)	154 (38.5)	
Grand multi-parous	0 (0.0)	3 (1.5)	3 (0.8)	< 0.001*
Miscarriage				
None	141 (70.5)	104 (52.0)	245 (61.3)	
One	43 (21.5)	63 (31.5)	106 (26.5)	
≥ two	16 (8.0)	33 (16.5)	49 (12.3)	< 0.001**
Total	200 (100.0)	200 (100.0)	400 (100.0)	

*By Fisher's exact test. **By Chi-square test. †By unpaired t-test.

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The rate of hirsutism in the obese group (59%) which was significantly (*P* <0.001) higher than the rate in the non-obese group (39.5%). The irregular cycle was present in 66% of the women in the obese group, compared with 50% of the women in the non-obese group (*P* = 0.002).

The proportion of acne among women of the obese group (34%) was significantly (*P* <0.001) higher than the proportion among women of the non-obese group (18%). The rate of infertility was 84% in the obese group, compared with 38.5% in the non-obese group (*P* <0.001). Regarding the type of infertility, it was the primary type in around two thirds (65.5%) of the women in the obese group, compared with 42.9% of the women in the non-obese group (*P* = 0.001). All the infertile women of the obese group had taken treatment for infertility, compared with 80.5% of the women of the non-obese group (*P* <0.001) as presented in Table 2.

Table 2 The related Clinical findings of the Study Sample

	Obese	Non-obese	Total	
	No. (%)	No. (%)	No. (%)	*P* -Value
Hirsutism				
Present	118 (59.0)	79 (39.5)	197 (49.3)	
Absent	82 (41.0)	121 (60.5)	203 (50.8)	< 0.001
Cycle				
Regular	68 (34.0)	99 (49.5)	167 (41.8)	
Irregular	132 (66.0)	101 (50.0)	233 (58.3)	0.002
Acne				
Present	68 (34.0)	36 (18.0)	104 (26.0)	
Absent	132 (66.0)	164 (82.0)	296 (74.0)	< 0.001
Infertility				
Present	168 (84.0)	77 (38.5)	245 (61.3)	
Absent	32 (16.0)	123 (61.5)	155 (38.8)	< 0.001
Type of infertility†				
Primary	110 (65.5)	33 (42.9)	143 (58.4)	
Secondary	58 (34.5)	44 (57.1)	102 (41.6)	0.001
Treatment of infertility†				
Yes	168 (100.0)	62 (80.5)	230 (93.9)	
No	0 (0.0)	15 (19.5)	15 (6.1)	< 0.001*
Total	200 (100.0)	200 (100.0)	400 (100.0)	

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The total was 168 obese people and 77 non-obese by fisher's exact test. All the other *P* values were calculated by Chi-square test. It evident in Figure 1 that the rate of pregnancy in the obese group was 32.1%, (who took treatment for infertility), compared to 24.7% in the non-obese group (who took treatment for infertility), but the difference was not significant. (*P* = 0.235). No significant differences were detected between the two-study group regarding the following laboratory investigations: LH (*P* = 1.000), FSH (*P* = 0.749), and prolactin (*P* = 0.174), as presented in Table 3. The ultra-sonographic finding presented in the table showed that 60% of the obese women had PCOS, compared with 44.5% of the non-obese women (*P* = 0.002).

Table 3 Laboratory Investigations and Ultrasonography Results of the Study Groups

	Obese No. (%)	Non-obese No. (%)	Total No. (%)	*P*-Value
LH				
< 2.4	2 (1.0)	2 (1.0)	4 (1.0)	
2.4 - 12.6	198 (99.0)	198 (99.0)	396 (99.0)	1.000*
FSH				
< 2.2	23 (11.5)	21 (10.5)	44 (11.0)	
2.2 - 9.5	177 (88.5)	179 (89.5)	356 (89.0)	0.749**
Prolactin				
≤ 25	59 (29.5)	47 (23.5)	106 (26.5)	
> 25	141 (70.5)	153 (76.5)	294 (73.5)	0.174**
Ultrasound				
PCOS	120 (60.0)	89 (44.5)	209 (52.3)	
No PCOS	80 (40.0)	111 (55.5)	191 (47.8)	0.002**
Total	200 (100.0)	200 (100.0)	400 (100.0)	

*By Fisher's exact test. **By Chi square test.

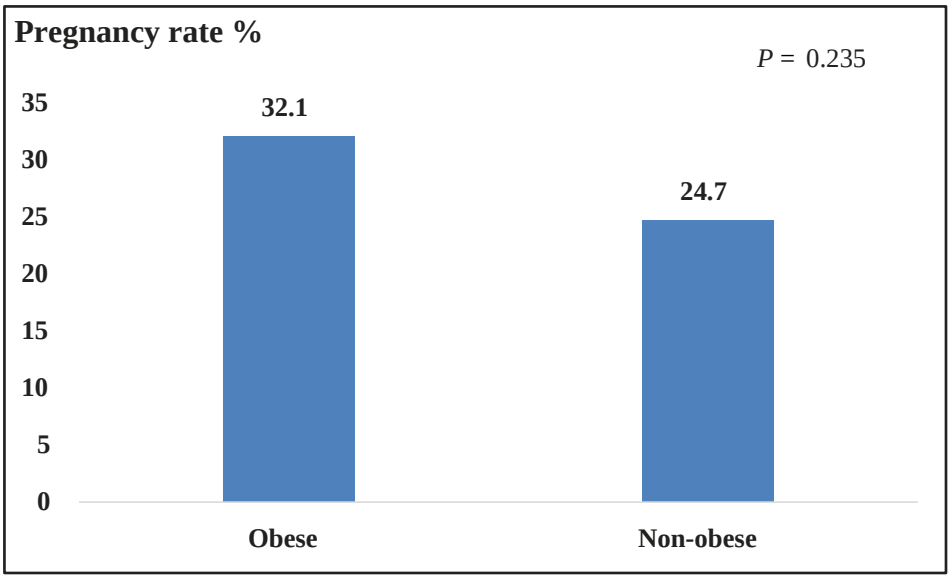

Figure 1 Rate of Pregnancy in the Study Groups

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Discussion

Obesity affects women today, particularly older women, which is in line with research showing that obesity and overweight are serious public health issues impacting around half of the world's adult population.[27] According to the current findings, women of older ages were more likely than women of other ages to be obese, and the risk of obesity rises with age.. These results were consistent with the previous results,[28] which indicated that about 28% to 32% of childbearing-aged women in the United States are obese. Because obese women are less likely to ovulate consistently, have lower fecundity, and have a higher chance of miscarriage, conception may be more challenging for them.[29]

The current study found that more than half (55%) of the obese women did not get pregnant as compared with non-obese women (38%), and presented a liner relationship between obesity and infertility. According to current findings, obesity is more prevalent in multigravidas compared to primigravida's. The weight of subsequent pregnancies is affected by postpartum weight retention, according to a number of previous research.[30]

A significantly higher percentage of the obese group had no history of miscarriage (70.5%) compared with (52%) of the non-obese group. The emergence of the percentage of (21%) among pregnant women with high obesity confirms the role of obesity in causing problems during pregnancy, and among these problems is the occurrence of repeated miscarriages, and the fact that the highest value for ages in the current study was greater than ≥ 35 contributed to the presence of a significant percentage of abortion in the groups those who are obese, this percentage came from the problems in the menstrual cycles of women and the confusion in the hormones responsible for the pregnancy. This study's findings are consistent with those of a 2013 study by Conner et al. that examined the link between obesity and an increased risk of miscarriage.[31]

In the current study, hirsutism was more common, the results showed significant differences between obese and non-obese women, these results are compared with observations of other studies, indicating that the hirsutism was more common in patients with increased BMI. The results of this study also showed that there were significant differences (P <0.001) in the irregularity of cycle and incidence of acne among obese women compared to non-obese women. The findings are in agreement with another study by He and Li (2020),[22] which showed a positive correlation between (BMI) value and the severity of acne.

Similar to the other studies, this one discovered a significant and distinct difference in the incidence of infertility in obese women compared to non-obese women, an increase in body mass index (BMI), and numerous events that go along with an increase in weight, such as impaired ovarian follicle development, qualitative and quantitative defects of oocyte maturation, altered fertilization. All of these and other factors have a direct impact on female fertility and the increased chances of infertility of all kinds in obese women, this is consistent with many previous studies.[33,34]

The results of the ultra-sonographic finding showed that (60%) of the obese women had PCOS, compared with (44.5%) of the non-obese women (P = 0.002), The information presented above makes it clear that weight gain and obesity play a role in the morphology of PCOS. In women who are genetically predisposed to the condition, weight gain and obesity are common clinical manifestations of PCOS.

Conclusion

In our study we concluded that obesity has effect on the occurrence of sub-fertility and polycystic ovary syndrome at all reproductive ages.

Funding

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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