Journal of Obstetrics, Gynecology and Cancer Research | ISSN: 2476-5848

Approaches to Infertility Management in Overweight Patients with Polycystic Ovary Syndrome

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Article Info

10.24200/jogcr.10.11.835

Received: 2025/02/01
Accepted: 2025/03/11
Published Online: 05 Oct. 2025

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ABSTRACT

Background & Objective: Overweight patients with Polycystic Ovary Syndrome (PCOS) often face infertility due to insulin resistance and hormonal imbalances. This study aimed to evaluate the impact of a structured weight management intervention on both metabolic parameters and reproductive outcomes in this population.

Materials & Methods: A cross-sectional, observational study conducted at the Zawiya Fertility Center, 26 women aged 22-42 years diagnosed with PCOS. All participants had confirmed ovarian cysts by ultrasound and were further screened for associated criteria, such as ovulation problems and hirsutism. The patients underwent baseline assessments, which included measurements of fasting insulin and glucose (for HOMA-IR calculation), Body Mass Index (BMI), waist circumference, and body weight. They then participated in a lifestyle intervention program involving dietary modifications and increased physical activity for 2-6 months. After treatment, the cohort was divided into two groups (pregnant vs. non-pregnant) based on the achievement of pregnancy, and post-intervention metabolic and reproductive parameters were reassessed.

Results: After the intervention, significant improvements were observed. The mean HOMA-IR decreased from 3.8 to 1.9, BMI reduced from 31.4 to 26.5, and average body weight dropped from 83 kg to 70 kg. Furthermore, 50% of the participants achieved pregnancy, with lower post-intervention HOMA-IR values correlating with successful conception.

Conclusion: The study demonstrates that targeted lifestyle interventions that improve metabolic function can significantly enhance reproductive outcomes in overweight women with PCOS. Emphasizing metabolic improvement rather than BMI reduction alone may provide a more effective strategy for managing infertility in this patient population.

Keywords: Polycystic ovary syndrome, Lifestyle, Infertility, Overweight

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1. Introduction

Infertility is a complex and multifaceted issue, particularly prevalent among women with Polycystic Ovary Syndrome (PCOS). PCOS is a hormonal disorder that affects a significant proportion of women of reproductive age and is characterized by irregular menstrual cycles, excessive androgen levels, and polycystic ovaries **(1,2)**. One of the major challenges for women with PCOS is the increased prevalence of obesity, which can exacerbate the symptoms of the syndrome and further complicate fertility issues **(3,4)**.

Managing infertility in overweight patients with PCOS requires a comprehensive approach that addresses both weight management and reproductive health **(5)**. Strategies may include lifestyle modifications such as dietary changes and increased physical activity, medical interventions such as pharmacotherapy to regulate menstrual cycles and ovulation and assisted reproductive technologies when necessary **(6,7)**. Understanding the interplay between weight, hormonal balance, and reproductive function is crucial for developing effective management plans **(8, 9)**.

This exploration of strategies for managing infertility in overweight patients with PCOS aims to provide insights into evidence-based interventions and the importance of a multidisciplinary approach to optimize fertility outcomes **(10,11)**.

Objective

Investigate the efficacy of weight loss interventions on improving metabolic parameters (HOMA-IR2, BMI, and weight) and their potential influence on fertility outcomes in PCOS patients.

2. Materials and Methods

Study Design and Setting

This investigation was designed as a descriptive, cross-sectional observational study conducted at the Zawiya Fertility Center to evaluate and compare the clinical, metabolic, and reproductive parameters in infertile women diagnosed with PCOS who attended the center for infertility treatment. Participants were recruited from the infertility center, where they underwent a structured weight management intervention. Data were collected over a six-month period, from February 2024 to July 2024, with final participant classification based on treatment outcomes: Group A comprised women who achieved pregnancy, and Group B included those who did not.

Study Population and Sample

A total of 26 women with a confirmed diagnosis of PCOS were recruited based on stringent inclusion and exclusion criteria. PCOS was diagnosed via ultrasonographic detection of ovarian cysts, accompanied by clinical features such as ovulatory dysfunction and hirsutism. Eligible participants, aged 22-42 years, were not receiving pharmacological treatment for PCOS or using contraception during the study period.

Participants were stratified into two groups

- Group A: 13 women who, upon completion of the intervention, achieved pregnancy.
- Group B: 13 women who did not achieve pregnancy following the six-month intervention.

Intervention

Participants engaged in a structured weight management program tailored to individual needs. The intervention, lasting between 2 and 6 months, incorporated personalized dietary modifications and prescribed physical activity regimens aimed at enhancing metabolic health and fertility outcomes.

Data Collection

Data was systematically collected through structured interviews, detailed clinical examinations, and comprehensive reviews of medical records. The following assessments were performed.

Demographic and Clinical Data

Baseline demographic information, including age, duration of infertility, and relevant clinical history, was obtained via structured interviews and corroborated with medical records.

Metabolic Assessments

Baseline Measurements

Prior to the intervention, participants underwent assessments of body weight, waist circumference, and Body Mass Index (BMI). Insulin resistance was quantified using the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR1).

Anthropometric Measurements

Weight was recorded using a calibrated digital scale, and height was measured with a stadiometer. BMI was computed using the formula BMI=weight (kg)/height (m^2).

Post-Intervention Measurements

Following completion of the weight management program, all baseline measurements were repeated to assess the intervention's impact on metabolic parameters.

Reproductive Health Assessment

Data on ovulation problems, oligomenorrhea, and hirsutism were collected through self-reported questionnaires and clinical evaluations.

Reproductive health outcomes were assessed based on ovulatory function, menstrual regularity, and signs of hyperandrogenism, including oligomenorrhea and hirsutism

Statistical Analysis

Data were analyzed using SPSS version 21 (IBM, USA). Continuous variables were expressed as means±standard deviations, and categorical variables as frequencies and percentages. Independent samples t-tests were employed to compare metabolic parameters between pregnant and non-pregnant groups. Pearson correlation coefficients were calculated to evaluate associations between baseline HOMA-IR values and anthropometric measures (BMI, waist circumference, and weight). A P-value of<0.05 was considered statistically significant.

3. Results

The demographic data of patients with PCOS provides essential insights into their clinical characteristics and treatment outcomes. The mean age of participants was 33.19 years, indicating that many are in their prime reproductive years. The average duration of infertility was 6.19 years, highlighting the prolonged challenges these women face (Table 1).

Before initiating a weight loss program, the participants exhibited a mean HOMA-IR1 of 3.83, indicating significant insulin resistance, alongside a mean BMI1 of 31.4 and an average weight of 82.92 kg. These metrics underscore the metabolic difficulties commonly associated with PCOS. Following the weight loss intervention, HOMA-IR2 decreased to a mean of 1.89, and the participants achieved an average weight of 69.81 kg with a BMI of 26.48. This significant improvement in metabolic parameters suggests that weight management strategies can

effectively enhance insulin sensitivity and potentially improve fertility outcomes.

Reproductive health data indicate that 53.8% of participants reported ovulation problems, and 50% experienced oligomenorrhea, both of which are characteristic of PCOS. Notably, all participants (100%) reported hirsutism, emphasizing its prevalence. Additionally, 65.4% experienced primary infertility, which points to the critical need for targeted interventions (Table 2).

This study explores the factors influencing pregnancy outcomes in patients with PCOS, categorizing participants into two groups: those who became pregnant and those who did not. The mean age of pregnant participants was 31.77 years, notably younger than the 34.62 years average for non-pregnant individuals. This age difference suggests that younger women may experience better fertility outcomes, consistent with existing research highlighting age as a critical factor in reproductive success (Table 3).

The duration of infertility was longer in the pregnant group (6.62 years) compared to the non-pregnant group (5.77 years). This finding may indicate that prolonged treatment efforts can lead to successful pregnancies, emphasizing the importance of persistence in managing infertility.

Metabolic parameters showed meaningful differences between groups. Before the weight loss program, pregnant participants had a mean HOMA-IR1 of 3.97, compared to 3.69 in non-pregnant participants, indicating prevalent insulin resistance in both groups. However, after weight loss, HOMA-IR2 values improved significantly, with pregnant patients showing a mean of 1.69 versus 2.09 in those who did not conceive. This improvement highlights the beneficial effects of weight management on insulin sensitivity and fertility.

Regarding weight, pregnant individuals had a higher mean weight (85.15 kg) compared to their non-pregnant counterparts (80.69 kg) at the start of pregnancy attempts, suggesting that effective weight loss (14.77 kg compared to 12.77 kg) may facilitate conception. The average BMI for pregnant participants was 32.55, while non-pregnant participants had a BMI1 of 30.25 before treatment, further reinforcing the role of obesity in fertility issues.

Ovulation problems were reported by a significant percentage of pregnant patients (71.4%) compared to 28.6% in the non-pregnant group (P=0.018), indicating that ovulatory dysfunction is crucial for enhancing fertility outcomes. While the prevalence of oligoamenorrhea and primary versus secondary infertility did not show significant differences, these factors still contribute to the overall complexity of managing PCOS (Table 4).

This study found that patients with ovulation problems had a mean HOMA-IR1 of 4.36, significantly higher than 3.21 in those without ovulation issues (P=0.02), indicating that insulin resistance is a key factor in ovulatory dysfunction in PCOS. While BMI_2 was similar between groups (26.47 vs. 26.48, P=0.99) and initial BMI_1 (31.72 vs. 31.02, P=0.62) showed no significant differences, waist circumference did reveal a trend towards greater central obesity in those with ovulation issues (85.50 cm vs. 82.75 cm, P=0.08) (Table 5).

Weight loss averages were not significantly different (13.93 kg vs. 13.58 kg, P=0.91), and neither age nor duration of infertility was significantly associated with ovulatory function.

The study found significant positive correlations between HOMA-IR1 and body metrics in women with PCOS infertility: BMI (r=0.623, P=0.001), waist circumference (r=0.697, P=0.000), and weight (r=0.729, P=0.000). These results indicate that higher insulin resistance is associated with increased body weight and central obesity (Table 6).

Table 1. Demographic Characteristics of Participants with PCOS Patients (N=26)

Items	Max	Min	Mean	SD
Age (yr)	22.00	42.00	33.19	5.63
Duration of infertility (yr)	3.00	15.00	6.19	2.88
HOMA-IR1	2.10	7.10	3.83	1.31
HOMA-IR2	0.80	5.40	1.89	0.91
BMI_1	25.64	41.29	31.4	3.49
Weight (kg)	64.00	125.00	82.92	12.89
loss Weight (kg)	5.00	35.00	13.77	7.79
Time for loss (month)	2.00	6.00	3.92	1.15
Weight (kg) pregnant	54.00	90.00	69.81	8.55
BMI_2	21.63	30.44	26.48	26.76

HOMA-IR1: Before Weight Loss. HOMA-IR2: After Weight Loss. BMI1: Before Weight Loss. BMI_2: After Weight Loss. SD: Stander deviation

Table 2. Clinical Characteristics of PCOS patients (N=26)

Items	Response	PCOS Patients N (%)
Infertility	1ry infertility	17(65.4%)
	2ry infertility	9(34.6%)
Do you have any ovulation problems?	Yes	14(53.8%)
	No	12(46.2%)
Oligoamenorrhoea	Yes	13(50.0%)
	No	13(50.0%)
Hirsutism	Yes	26(100.0%)
	No	0(0.0%)
Pregnant after weight loss program	Yes	13(50.0%)
	No	13(50.0%)

HOMA-IR1: Before Weight Loss. HOMA-IR2: After Weight Loss. BMI_1: Before Weight Loss. BMI_2: After Weight Loss. SD: Stander deviation

Table 3. Comparison of Factors Influencing Pregnancy Outcomes in PCOS Patients

Items	(13) Pregnant				(13) Non-Pregnant				P-Value
	Max	Min	Mean	SD	Max	Min	Mean	SD	
Age (yr)	22.00	40.00	31.77	5.86	22.00	42.00	34.62	5.22	0.203
Duration of infertility (yr)	3.00	15.00	6.62	3.40	3.00	11.00	5.77	2.31	0.466
HOMA-IR1	2.40	6.10	3.97	1.23	2.10	7.10	3.69	1.42	0.600
HOMA-IR2	0.80	2.80	1.69	0.57	.80	5.40	2.09	1.14	0.271
Weight (kg)	64.00	125.00	85.15	14.54	68.00	104.00	80.69	11.12	0.388
BMI1	25.64	41.29	32.55	3.99	25.97	35.32	30.25	2.57	0.094
Weight loss (kg)	9.00	35.00	14.77	7.99	5.00	30.00	12.77	7.78	0.524
Time for loss weight (month)	2.50	6.00	3.69	1.01	2.00	6.00	4.15	1.28	0.318
Weight (kg) for Starting Pregnancy Attempts	54.00	90.00	70.38	8.83	59.00	89.00	69.23	8.58	0.738
BMI_2	21.63	30.44	26.47	2.46	22.76	28.26	26.74	2.17	0.291

HOMA-IR1: Before Weight Loss. HOMA-IR2: After Weight Loss. BMI_1: Before Weight Loss. BMI_2: After Weight Loss. SD: Stander deviation. P-values are considered significant at the 0.05 level. Independent Samples t-Test applied.

Table 4. Pregnancy Outcomes and Clinical Features in PCOS Patients

Items	Response	(13) Pregnant N(%)	(13) Non-Pregnant N(%)	P- value
Do you have any ovulation problems?	Yes	10(71.4%)	4(28.6%)	0.018
	No	3(25.0%)	9(75.0%)	
Oligoamenorrhoea	Yes	6(46.2%)	7(53.8%)	0.695
	No	7(53.8%)	6(46.2%)	
Infertility	1ry Infertility	9(52.9%)	8(47.1%)	0.680
	2ry Infertility	4(44.4%)	5(55.6%)	

Chi-Square Test applied. P-values are considered significant at the 0.05 level (*).

Table 5. Impact of Clinical Factors on Ovulation Dysfunction in Infertile PCOS Patients

Items	(14) Yes Ovulation Problems Mean±SD	(12) No Ovulation Problems Mean±SD	P-value
Age (yr)	32.64±5.67	33.83±5.77	0.60
Duration of Infertility (yr)	6.86±3.32	5.42±2.15	0.21
Weight (kg)	84.07±10.30	81.58±15.76	0.63
Waist Circumference (cm)	85.50±3.48	82.75±4.22	0.08*
BMI_1	31.72±2.94	31.02±4.14	0.62
HOMA-IR1	4.36±1.35	3.21±0.98	0.02*
Weight Loss (kg)	13.93±7.19	13.58±8.76	0.91
Weight (kg) at Start of Pregnancy Attempts	70.14±8.57	69.42±8.90	0.83
BMI_2	26.47±2.46	26.48±2.25	0.99
HOMA-IR2	2.11±1.09	1.63±0.59	0.18

HOMA-IR1: Before Weight Loss. HOMA-IR2: After Weight Loss. BMI_1: Before Weight Loss. BMI_2: After Weight Loss. SD: Stander deviation. P-values are considered significant at the 0.05 level. Independent Samples T-Test applied.

Table 6. Relationship Between HOMA-IR1 and Anthropometric Indices in Infertile Women with PCOS

	HOMA-IR1 (r)	P- value
BMI	0.623**	0.001
Waist (cm)	0.697**	0.000
Weight (kg)	0.729**	0.000

Pearson Correlation: (**): Correlation is highly significant at the 0.01 level. (*):Correlation is significant at the 0.05 level.

4. Discussion

Our study sought to elucidate the clinical and metabolic factors that influence pregnancy outcomes in overweight women with PCOS, and the findings provide robust evidence supporting the critical role of metabolic improvement in enhancing reproductive success. In our cohort, women who ultimately achieved pregnancy were generally younger and had experienced a longer duration of infertility, a finding that concurs with previous observations that advanced age adversely impacts female fertility, the chronic nature of infertility in PCOS is well recognized, and our results further reinforce the need to address long-standing reproductive challenges in this population. **(12,13)**.

Anthropometric assessments revealed that, on average, our study participants were obese, which is consistent with the literature reporting a high prevalence of obesity among women with PCOS **(14,15)**.

Although the subgroup that achieved pregnancy had a marginally higher BMI and weight, both groups reached comparable BMI values following intervention. This observation underscores an important point: it is not solely the absolute BMI at the time of attempting conception that matters, but rather the extent of metabolic improvement achieved through weight loss. In our study, the weight loss observed was associated with marked improvements in insulin sensitivity, as indicated by a substantial decrease in the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) values. These findings are in line with earlier reports demonstrating that even modest reductions in weight-on the order of five to seven percent-can lead to significant metabolic and endocrine benefits, including enhanced insulin sensitivity and restoration of ovulatory function **(12,16,17)**.

The role of insulin resistance in the pathophysiology of PCOS has been extensively documented. Our data demonstrated that women who reported ovulatory dysfunction exhibited a notably higher level of insulin resistance at baseline compared with those who did not, a finding that supports the notion that hyperinsulinemia plays a critical role in disrupting normal ovarian function **(18,19)**.

Moreover, the tendency for increased waist circumference in women with ovulatory problems, although not reaching conventional levels of statistical significance, emphasizes the importance of central adiposity as a key contributor to metabolic dysregulation. Previous studies have shown that measures of central fat distribution, such as waist circumference and waist-to-hip ratio, can be more predictive of adverse metabolic outcomes than overall BMI alone **(20,21)**

This relationship is particularly relevant in PCOS, where central obesity exacerbates insulin resistance, leading to increased ovarian androgen production and a consequent disruption in follicular development.

In comparing our results with the broader literature, it becomes apparent that effective lifestyle interventions yielding even partial weight loss can significantly improve insulin sensitivity and, in turn, reproductive outcomes. The improvements in metabolic parameters observed in our study resonate with findings from previous clinical trials that have documented enhanced ovulatory function and higher pregnancy rates following modest weight reductions in obese PCOS patients **(12,17)**. Moreover, our observation that similar post-intervention BMI values were achieved in both the pregnant and non-pregnant groups, yet the group with greater metabolic improvement had a higher pregnancy rate, underscores the critical importance of targeting insulin resistance rather than focusing exclusively on absolute weight or BMI.

These findings have important implications for clinical practice. While current guidelines from authorities such as the National Institute for Clinical Excellence (NICE) and the British Fertility Society often advocate for deferring fertility treatment until a patient's BMI is reduced below a certain threshold, our study as well as the work of Pandey et al., **(22)**

Suggests that metabolic improvement, particularly the reduction in insulin resistance, may be a more meaningful target. This perspective is particularly salient in light of the high prevalence of obesity among reproductive-aged women in many developed countries **(13,23)**. Given that strict BMI cut-offs may inadvertently exclude many women who could benefit from timely intervention, an individualized treatment approach that incorporates metabolic, anthropometric, and age-related factors appears warranted.

5. Conclusion

In conclusion, our study confirms that among overweight patients with PCOS, enhanced insulin sensitivity following lifestyle intervention is strongly associated with improved pregnancy outcomes. Our findings add to the growing body of evidence that modest weight loss can lead to significant metabolic improvements, which in turn facilitate the restoration of normal ovarian function and increase the likelihood of conception. Future research should aim to refine individualized treatment protocols that prioritize metabolic health-especially the reduction of central adiposity and insulin resistance-as a means of optimizing fertility in this challenging patient population.

6. Declarations

Acknowledgments

None.

Ethical Considerations

The study was approved by the Zawiya Fertility Center, and informed consent was obtained from all participants prior to data collection.

Authors' Contributions

Lujayn Rajab Mohammed: Conceived and designed the study; collected cases, performed diagnoses; and developed the treatment protocol. Fathia Ali Sadik Godid: Confirmed PCOS diagnoses, monitored participants' weight, and drafted and revised the manuscript for important intellectual content. Jumaa Abuajila Salem Salama: Performed the analysis and interpretation of data.

Conflict of Interest

The authors declare no conflict of interest.

Fund or Financial Support

This study did not receive any external funding or financial support from public, commercial, or not-for-profit agencies, and no financial relationships are associated with this work.

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How to Cite This Article:

Rajab Alnaeli, L., Sadik Godid, F.A., Abuajila Salem Salama, J. Approaches to Infertility Management in Overweight Patients with Polycystic Ovary Syndrome. J Obstet Gynecol Cancer Res. 2025;10(11):835-42.

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