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Research Article

Role of Tirzepatide in Obesity Management Among Women with Polycystic Ovary Syndrome

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Abstract

Introduction: Polycystic ovary syndrome (PCOS) is a common endocrine disorder in women, often associated with obesity, insulin resistance, and metabolic complications. Managing weight is crucial for improving PCOS symptoms and overall health. This study aimed to evaluate the effectiveness of Tirzepatide, a novel dual GIP/GLP-1 receptor agonist, in obesity management and symptom improvement among women with PCOS. Methods: This retrospective observational study was conducted in the Department of Cardiology, Uttara Adhunik Medical College Hospital, LabAid Cancer Hospital & Super Speciality Centre, LabAid Diagnostics Center, Uttara, Dhaka, Bangladesh, from July 2024 to February 2025. In this study, we included 56 women with polycystic ovary syndrome associated with obesity who were referred to a consultant gynecologist or cardiologist for menstrual problems, obesity, and hypertension. Result: In this study, we found that after treatment, there was a significant weight reduction of 9.54% ($p = 0.0004$), with BMI decreasing from 36.51 ± 6.14 to 32.49 ± 4.68 kg/m² ($p = 0.0002$). Glycemic control improved significantly, with fasting blood sugar dropping from 6.89 ± 0.78 mg/dl to 5.57 ± 0.42 mg/dl ($p < 0.0001$) and HbA1c decreased from $5.7 \pm 0.6\%$ to $4.9 \pm 0.4\%$ ($p < 0.0001$). PCOS symptoms showed remarkable improvement, with irregular menstrual cycles decreased from 85.7% to 32.1% ($p < 0.0001$), and ovarian cyst prevalence dropped from 89.3% to 41% ($p < 0.0001$). Insulin resistance improved significantly (80.4% to 50%, $p = 0.0008$). The most common side effects were heartburn (42.86%), nausea/vomiting (39.29%), and general weakness (33.93%). Conclusion: In this study, Tirzepatide showed promising results in managing obesity and improving metabolic outcomes in women with PCOS. Significant weight reduction, glycemic control, and symptom improvement were observed in our study patients. Our study suggests that Tirzepatide could be a valuable therapeutic option for obese women with PCOS.

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Keywords

Tirzepatide, Obesity, Women, Polycystic Ovary Syndrome

1. Introduction

Polycystic ovary syndrome (PCOS) is the most common hormonal disorder affecting women of reproductive age. Its prevalence varies between 5% and 21%, depending on the diagnostic criteria used, and it is more common in women with obesity and certain ethnic backgrounds. The main symptoms of PCOS include high levels of androgens, irregular menstrual cycles due to ovulation issues, and ovaries with multiple small cysts. [1-3] According to the Rotterdam criteria, a diagnosis requires at least two of these three features. PCOS is a leading cause of infertility due to lack of ovulation and is often associated with other symptoms of excess androgens, such as excessive hair growth (hirsutism) and acne. [4] In addition, PCOS is commonly associated with metabolic disorders, such as obesity, insulin resistance, type-2 diabetes (T2D), dyslipidemia, and cardiovascular dysfunction. [5, 6] Indeed, 40-90% of women with PCOS are overweighed or obese, and display insulin resistance, which is also frequently observed in lean women with PCOS, affecting roughly 60%. [7, 8] Hence, women with PCOS are prone to T2D and cardiovascular dysfunction, increasing mortality risk.

According to the Rotterdam criteria, PCOS is diagnosed when at least two out of three key features are present, after ruling out other conditions such as congenital adrenal hyperplasia, thyroid disorders, and hyperprolactinemia. These criteria include irregular menstrual cycles, high androgen levels (hyperandrogenism), and enlarged ovaries (≥10 mL) with or without 12 or more small antral follicles (2-9 mm) in one or both ovaries. [9]

Weight gain is a common issue for women with PCOS, and it plays a significant role in worsening reproductive symptoms. Obesity is closely linked to insulin resistance, which is a major factor in the development of PCOS. Studies have shown that insulin resistance is far more prevalent in obese women with PCOS (64%) compared to those who are not obese (20%). [10] Additionally, high insulin levels caused by obesity can further increase androgen production, exacerbating symptoms like irregular cycles and infertility. [11]

There is also a direct link between weight gain and an increase in adipocytes, which leads to greater aromatization of androgens into estrogens. This disrupts the body's hormonal balance by suppressing gonadotropin production, further contributing to infertility. In essence, obesity creates a cycle where hormonal imbalances increase reproductive and metabolic complications in PCOS. [12]

Although the etiology of PCOS remains unknown, the goal of finding an effective treatment for this metabolic dysfunction has become a challenge. In recent years, glucagon-like peptide-1 (GLP-1) receptor agonists have garnered increasing interest in the context of obesity treatment, including among women with PCOS. These substances initially used mainly in the treatment of type 2 diabetes, demonstrate several beneficial metabolic effects, including the ability to reduce body weight. [13]

The Endocrine Society guidelines recommend lifestyle changes and weight loss as the first step in managing PCOS. This includes regular physical activity, a balanced diet, and behavioral modifications to support long-term health. [14] PCOS treatment primarily focuses on addressing infertility due to lack of ovulation and managing symptoms related to high androgen levels, which often require long-term therapy. This approach helps alleviate common PCOS-related issues, such as irregular periods, acne, excessive hair growth (hirsutism), and obesity. [15] In addition to lifestyle changes, medications like liraglutide, metformin, and orlistat are often prescribed to help regulate metabolism and hormone levels. [16]

The paradigm for treatment is evolving as women around the world deal with various PCOS-related problems. New researches suggest that targeting the glucagon-like peptide-1 receptor (GLP-1R) could be a promising approach. Tirzepatide, a dual GLP-1, and glucose-dependent insulinotropic peptide (GIP) receptor agonist often referred to as a "twincretin" is emerging as a potential therapy for obesity and insulin resistance in women with PCOS. [17] Given its ability to tackle key metabolic features of the condition, Tirzepatide may play a significant role in future PCOS management. [18]

Therefore, in this study, we aimed to evaluate the effectiveness of Tirzepatide, a novel dual GIP/GLP-1 receptor agonist, in obesity management and symptom improvement among women with PCOS.

2. Methodology & Materials

This retrospective observational study was conducted in the Department of Cardiology, Uttara Adhunik Medical College Hospital, LabAid Cancer Hospital & Super Speciality Centre, LabAid Diagnostics Center, Uttara, Dhaka, Bangladesh from June 2024 to February 2025. In this study, we included 56 women with polycystic ovary syndrome associated with obesity who were referred to a consultant gynecologist or cardiolo-

gist for menstrual problems, obesity, and hypertension.

These are the following criteria to be eligible for enrollment as our study participants: a) Women aged above 18 years; b)Women with polycystic ovary syndrome; c) Women with obesity; d) Women with Body Mass Index (BMI) ≥30 kg/m² (or ≥27 kg/m² with obesity-related comorbidities) were included in the study and a) Women with pregnancy; b) Women showing any known allergic reaction to study drug; c) Women with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma etc.); d) Women who were unwilling to participate were excluded from our study.

Drug Dosage: Patients received a Tirzepatide injection as follows: 2.5 mg pre-filled syringe once weekly for 4 weeks, followed by a 5 mg pre-filled syringe once weekly for another 4 weeks. Finally, a 7.5 mg pre-filled syringe will be continued once weekly until the end of treatment.

Data Collection: Informed verbal consent was taken from the patients. Baseline Characteristics like age, comorbidities, and medication history were collected from case records of each patient, and the data of BMI, HbA1c, Fasting blood sugar (FBS), SGPT were collected from the blood test report and USG reports of ovarian cysts if any were also collected from the patient. The percentage change in body weight from baseline, reduction in HbA1c levels, changes in FBS, PCOS symptoms improvement, adverse effects, and patients' satisfaction levels after treatment were evaluated.

Statistical Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation; qualitative data was expressed as frequency distribution and percentage. The data were analyzed using the t-test, and chi-square (X^2) test. A p-value <0.05 was considered as significant. Statistical analysis was performed by using SPSS 22 (Statistical Package for Social Sciences) for Windows version 10. The study was approved by the ethical review committee of Uttara Adhunik Medical College Hospital, Dhaka, Bangladesh.

3. Results

Table 1. *Baseline characteristics of our study subjects.*

Baseline	N=56	P (%)
Mean age (years)	29.73 ± 8.24	
Mean Height (cm)	152.34 ± 1.79	
Mean Weight (kg)	86.80±12.74	
BMI (kg/m^2)	36.51 ± 6.14	
SGPT (U/L)	46.41 ± 26.74	
Obesity stage		
Class I (30 to 34.9 kg/m^2)	17	30.36
Class II (35 to 39.9 kg/m^2)	28	50.00
Class III (≥40 kg/m^2)	11	19.64
Comorbidities		
Hypertension	22	39.29
DM	19	33.93
Hypothyroidism	17	30.36
Dyslipidemia	12	21.43
DM duration		
≤5 years	7	36.84
>5 years	12	63.16
PCOS duration (years)	2.32 ± 1.14	
Physical activity		
Sedentary	19	33.93
Moderate	21	37.50
Active	16	28.57

Table 1 shows that the mean age of the participants was 29.73 ±8.24 years. The mean weight was 84.80±12.74 kg. The mean BMI of patients was 36.51 ± 6.14 kg/m². Obesity classification shows that most participants fall into Class II obesity (50%), followed by Class I (30.36%) and Class III (19.64%). The mean SGPT level was 46.41 ± 26.74 U/L. Regarding comorbidities, 39.29% had hypertension, 33.93% had DM, 30.36% had hypothyroidism, and 21.43% had dyslipidemia. Most individuals (63.16%) had DM for over five years. The mean PCOS duration among patients was 2.32 ± 1.14 years.

Figure 1 shows that of all PCOS symptoms, irregular menstrual cycles were common, affecting about 85.7% of them, with periods often skipping months or being unusually heavy or light. Around 67.9% struggled with persistent cystic acne. Insulin resistance was present in 80.4%, 90% had ovarian cysts detected through ultrasound. Dark, velvety patches of skin (acanthosis nigricans) were seen in 50%. Mental health was also a significant concern, with 71.4% experiencing depression or anxiety, followed by fatigue affecting 62.5%, and 57.1% suffering from sleep apnea.

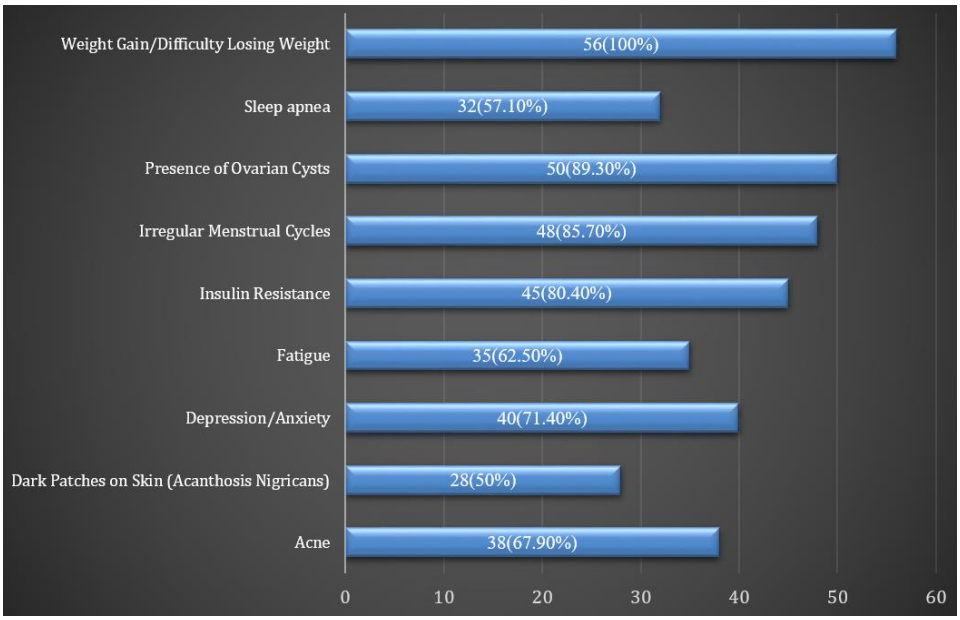

Figure 1. *Distribution of study patients by PCOS symptoms.*

Table 2. *Distribution of our study subjects by their treatment outcome.*

Weight loss	**Before treatment**		**After treatment**		**P-value**
Weight (kg)	84.80±12.74		76.71 ± 10.84		0.0004
BMI (kg/m²)	36.51 ± 6.14		32.49 ± 4.68		0.0002
(%) Change in weight	9.54%				
Glycemic control parameters					
Fasting Blood Sugar (mg/dl)	6.89 ± 0.78		5.57± 0.42		< 0.0001
HbA1c (%)	5.7 ± 0.6		4.9 ± 0.4		< 0.0001
PCOS symptoms improvement					
Irregular Menstrual Cycles	48	85.7%	18	32.1%	< 0.0001
Acne	38	67.9%	19	33.9%	0.0003
Weight Gain/Difficulty Losing Weight	56	100%	9	16%	< 0.0001
Insulin Resistance	45	80.4%	28	50%	0.0008
Presence of Ovarian Cysts	50	89.3%	23	41%	< 0.0001
Dark Patches on Skin (Acanthosis Nigricans)	28	50.0%	12	21.4%	0.0017
Depression/Anxiety	40	71.4%	22	39.3%	0.0007
Fatigue	35	62.5%	24	42.9%	0.038
Sleep apnea	32	57.1%	18	32.1%	0.0081

Table 2 shows that the mean weight decreased from 84.80 ± 12.74 kg to 76.71 ± 10.84 kg, reflecting a 9.54% reduction in body weight ($p = 0.0004$). BMI also showed a notable decline from 36.51 ± 6.14 kg/m² to 32.49 ± 4.68 kg/m² ($p = 0.0002$). Glycemic control improved significantly, with fasting blood sugar levels dropping from 6.89 ± 0.78 mg/dl to 5.57 ± 0.42 mg/dl ($p < 0.0001$) and HbA1c levels reducing from 5.7 ± 0.6% to 4.9 ± 0.4% ($p < 0.0001$). There were also remarkable improvements in PCOS symptoms. The prevalence of irregular menstrual cycles dropped from 85.7% to

32.1% ($p < 0.0001$). Insulin resistance improved notably, dropping from 80.4% to 50% ($p = 0.0008$), and the presence of ovarian cysts decreased from 89.3% to 41% ($p < 0.0001$). Depression and anxiety levels dropped from 71.4% to 39.3% ($p = 0.0007$). Lastly, sleep apnea prevalence significantly dropped from 57.1% to 32.1% ($p = 0.0081$).

Table 3. *Distribution of our study subjects by adverse effects and their satisfaction level after treatment.*

Adverse effects	N=56	P (%)
Heartburn	24	42.86
Nausea /Vomiting	22	39.29
General weakness	19	33.93
Itching at the injection site	16	28.57
Feeling feverish on 1st day of injection	8	14.29
Anorexia	6	10.71
Loose motion	5	8.93
Abdominal pain	3	5.36
Body ache	3	5.36
Increased SGPT	6	10.71
Satisfaction level		
Satisfied	47	83.93
Dissatisfied	9	16.07

Table 3 shows that the most common side effect was heartburn (42.86%), followed by nausea and vomiting (39.29%), general weakness (33.93%), and itching at the injection site, affecting 28.57%, while 14.29% reported feeling feverish on the first day of injection. Anorexia was noted in 10.71%, loose motion was reported in 8.93%, and only 3 women (5.36%) experienced both abdominal pain and body ache. Increased SGPT was observed in 6 women (10.71%). Out of 56 women, 47 (83.93%) reported satisfaction with the results, indicating significant improvements in their PCOS symptoms and weight management.

4. Discussion

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder with metabolic and reproductive consequences. As seen in the study data, obesity is a common factor among women with PCOS, with the majority classified as having Class II obesity (50%). This aligns with previous research indicating that obesity is a key contributor to insulin resistance, hyperandrogenism, and reproductive dysfunction in PCOS patients. [19] Notably, a significant proportion of participants had comorbidities such as hypertension (39.29%), diabetes mellitus (DM) (33.93%), hypothyroidism (30.36%), and dyslipidemia (21.43%), reinforcing the idea that PCOS is associated with a higher risk of metabolic disorders. [20]

Lifestyle interventions, including dietary modifications and physical activity, remain the first-line approach for managing obesity in PCOS patients. [21] A healthy diet not only facilitates weight loss but also improves insulin sensitivity, regulates menstrual cycles, and lowers androgen levels. [22] However, dietary interventions alone have not been shown to effectively treat biochemical hyperandrogenism. [23] The key to successful dietary management is creating a sustained caloric deficit rather than following a specific diet. [24] Exercise has also proven beneficial in improving metabolic health in women with PCOS. A randomized controlled trial involving 130 morbidly obese PCOS women found that exercise significantly reduced waist circumference and liver fat mass compared to a control group. [25] However, excessive or strenuous physical activity should be approached with caution, as it may trigger platelet activation and cardiovascular stress. [26] Mental well-being plays a crucial role in adherence to lifestyle interventions. Depression (71.4%) and anxiety (42.9%) were prevalent among participants but improved significantly following weight loss ($p = 0.0007$). However, lifestyle changes remain challenging to implement and maintain, leading to low adherence rates among PCOS patients enrolled in lifestyle intervention programs. [27]

Given the challenges of weight management in PCOS, pharmacological agents such as GLP-1 receptor (GLP-1R) agonists, including liraglutide and Tirzepatide, are gaining traction as therapeutic options. A newly FDA-approved drug named Tirzepatide, a dual GLP-1R, and glucose-dependent insulinotropic peptide (GIP) receptor agonist, has shown potential in addressing PCOS-related obesity and insulin resistance. [28] This "twincretin" mimics the action of both GLP-1 and GIP, enhancing metabolic benefits compared to GLP-1R agonists alone. [29] Tirzepatide's structure, which includes a fatty-acid component, extends its half-life, allowing for once-weekly dosing and improving patient compliance. [30, 31] GLP-1R agonists play a significant role in lipid metabolism, reducing triglyceride and cholesterol levels while modulating adipocyte function. [32, 33] By inhibiting fatty acid synthase and inducing phosphorylation of key transcription factors, these agents prevent excessive fat accumulation and promote metabolic balance. [34]

Oxidative stress is another major contributor to PCOS pathophysiology, with research indicating a strong link between oxidative stress, insulin resistance, and cardiovascular disease risk. Women with PCOS have been found to have a 19% higher likelihood of developing cardiovascular disease compared to non-PCOS individuals. Lower levels of antioxidants, such as glutathione, have also been reported in these women. [35, 36]

The study highlights the importance of weight management in PCOS treatment. Participants who achieved an aver-

age weight loss of 9.54% showed significant improvements in metabolic and reproductive parameters. The mean BMI decreased from 36.51 kg/m² to 32.49 kg/m² ($p = 0.0002$), and glycemic control improved, as evidenced by reductions in fasting blood sugar (from 6.89 mg/dl to 5.57 mg/dl, $p < 0.0001$) and HbA1c levels (from 5.7% to 4.9%, $p < 0.0001$). These findings support the Endocrine Society's recommendation that women with PCOS should aim for a 5-10% weight loss to experience clinical benefits. [24]

Additionally, PCOS symptoms showed remarkable improvements following weight loss. The prevalence of irregular menstrual cycles dropped from 85.7% to 32.1% ($p < 0.0001$), and hirsutism decreased from 75.0% to 37.5% ($p = 0.0001$). The presence of ovarian cysts also significantly declined (from 89.3% to 41%, $p < 0.0001$), suggesting that weight loss may contribute to the normalization of ovarian function.

Despite their benefits, GLP-1R agonists can cause gastrointestinal side effects, including nausea (39.29%), vomiting, diarrhea, constipation, and abdominal pain. [37] Injection site reactions, such as pruritus and erythema, have also been reported. [38, 39] Additionally, GLP-1R agonists are contraindicated in patients with gastroparesis, inflammatory bowel disease, and a history of pancreatitis. [39] Similarly, the present study also found side effects like heartburn (42.86%), followed by nausea and vomiting (39.29%), general weakness (33.93%), and itching at the injection site (28.57%) and 14.29% reported feeling feverish on the first day of injection.

The findings from this study show that dual agonists like Tirzepatide offer promising therapeutic options for managing obesity and insulin resistance in PCOS women as well as improving their symptoms.

5. Limitations of the Study

This study took a small sample size due to the short study period, so it does not represent the whole community.After evaluating those patients, follow up was not performed in all patients and it was not possible to know other possible interference that may happen in the long term with these patients within this period of time.

6. Conclusion and Recommendations

This study found that Tirzepatide has a promising role in managing obesity in women with PCOS. The treatment led to notable weight loss, improved glycemic control, and reduced insulin resistance. Additionally, significant improvements were observed in irregular menstrual cycles and ovarian cysts, contributing to better reproductive health outcomes. Tirzepatide effectively improves insulin sensitivity, normalizes glucose levels, prevents type 2 diabetes, and regulates menstrual cycles. It is considered a safe medication for PCOS, particularly for managing weight gain, insulin resistance, and metabolic imbalances with a low risk of severe side effects.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to evaluate its safety, sustained effectiveness, and potential impact on fertility in women with PCOS.

Abbreviations

PCOS Polycystic Ovary Syndrome

Ethical Approval

This study was approved by the ethical review committee.

Author Contributions

Jannatul Ferdous: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Muhammad Mobarock Hossain: Funding acquisition, Project administration, Resources, Software, Validation, Visualization, Writing – review & editing

Mst Jakanta Faika: Investigation, Methodology, Software, Validation, Visualization, Writing – review & editing

Monowara Begum: Formal Analysis, Investigation, Methodology, Resources, Software, Validation, Visualization

Samira Mahjabeen: Investigation, Validation, Writing – review & editing

Iffat Ara Jahan: Methodology, Resources, Software

Mahira Zehreen Khan: Formal Analysis, Resources, Validation

Moktadir Mobarock Monsur Hossain: Data curation

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Conflicts of Interest

The authors declare no conflicts of interest.

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