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# THE IMPACT OF WEIGHT LOSS ON SYMPTOMS OF POLYCYSTIC OVARY SYNDROME AMONG OVERWEIGHT AND OBESE REPRODUCTIVE AGE WOMEN

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## ABSTRACT

**Background:** Polycystic ovary syndrome (PCOS) is a common endocrine disorder in reproductive-age women, often associated with obesity, insulin resistance, and reproductive dysfunction. Weight loss is considered an essential management strategy to alleviate PCOS symptoms and improve metabolic and reproductive outcomes. **Aim:** This study aimed to evaluate the impact of weight loss on waist circumference, body mass index (BMI), and symptom improvement in overweight and obese reproductive-age women with PCOS. **Method:** A prospective study was conducted on 100 overweight and obese women diagnosed with PCOS. Participants were followed for 16 weeks at the gynecology and obstetrics consultation clinic at Diyala/Jalwla General Hospital. The intervention included a structured weight loss program involving dietary plans and lifestyle modifications. Changes in waist circumference and BMI were recorded, and statistical analysis was performed using paired t-tests and chi-square tests. **Results:** The study demonstrated a significant reduction in waist circumference (mean decrease from 100.82 cm to 93.01 cm) and BMI (mean decrease from 31.46 to 27.06), both with P-values = 0.0001. BMI reduction was significantly associated with symptom improvement (P-value = 0.002), while waist circumference showed a borderline significance (P-value = 0.05). There was no significant association between demographic factors (age, marital status, family history of PCOS) and symptom improvement. **Conclusion:** Weight loss, particularly BMI reduction, plays a crucial role in improving PCOS symptoms and metabolic health. This study highlights the importance of lifestyle interventions in managing PCOS and suggests that achieving a normal BMI is key to symptom improvement. Future research should explore the long-term effects of weight loss and its combination with other treatments for comprehensive PCOS management.

**KEYWORDS:** The impact, weight loss, symptoms, polycystic ovary syndrome, overweight, obese, reproductive age, women.

## INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) as a common endocrine disease in women of reproductive age. The first description of the syndrome was given by Stein and Le-venthal in 1935 and is also known as "Stein-Leventhal syndrome." The prevalence of PCOS varies from 5.0 to 13.0% depending upon the race, region, and the existence of endocrine disorders.[1] According to Rotterdam diagnostic criteria, the prevalence of PCOS varies from 3.0 to 26.0%.[2,3] A systematic review with meta-analysis dated 2017 claims that, alongside some lifestyle reasons, this enormous prevalence is underlain by heredity and ethnicity. As for the Middle East/ GCC countries, numerous researches exist in the literature that reports a higher prevalence of PCOS, which is approximately in the range of 20.0–25.0%.[4] Although much research has addressed the area, definite knowledge of the etiology is lacking. Numerous theories and hypotheses have been proposed on the subject, and most researchers agree upon finalizing that it is not a single-factor disease; multiple factors work hand in hand, including the genetic factors as previous studies have indicated.[5,6] Clinically, women with PCOS may present with the following: menstrual irregularity amenorrhoea acne hirsutism male-pattern baldness acanthosis nigricans sleep apnea obesity infertility and pseudo-Cushingoid changes. Obesity is the principal feature in more than 50.0% of women with PCOS. A large number of studies have related the presence of obesity among PCOS patients to high insulin levels as an important factor leading to: adipogenesis lipogenesis and lipolysis inhibition because of insulin resistance.[7,8] Still, it is a

matter of debate; whether PCOS leads to obesity or obesity leads to PCOS is still a topic of debate.[9] Furthermore, childhood obesity has been well documented as an additional risk factor for PCOS since girls at a young age become exposed to insulin resistance due to their high levels of body fat, leading later on in life to PCOS and metabolic syndrome due to hyperinsulinemia.[10] Obesity is, therefore, pivotal in the clinical and biochemical presentation of PCOS; hence, weight loss in the range of 5.0–10.0% should be valued as salutary acting up on first-liner in the management of this common endocrine pathology. Life style modifications include healthy balanced diet such as having regular meals especially breakfast, diet rich in fruit, vegetables and whole food, lean meat, fish, chicken while low in simple carbohydrates. In addition to diet regular exercise for at least 30 min per day 3 times/week is other cornerstone in the weight control program.[11] The effect of weight loss on symptoms of polycystic ovary syndrome among overweight and obese reproductive age women.

## METHOD

This study is a prospective group study involving 165 overweight and obese women who suffer from polycystic ovary syndrome (PCOS). The participants were selected based on diagnostic criteria for PCOS, and all women were of reproductive age. The study was conducted in the consultation clinic of gynecology and obstetrics at Diyala/Jalwla General Hospital. All patient's information's are: Age (years), Age of married (years), Family history of PCOS, Marital state Symptoms before Treatment: (Hirsutisms and irregular menses) and Symptoms after treatment either improved or not. Waste circumferences (WC) and body mass index (BMI) assessment as WHO classification (increase risk or high risk for WC) and (Normal, Overweight, Obese for BMI).[12] The statistical analysis included descriptive statistics to summarize demographic data and the paired t-test to assess changes in waist circumference and BMI before and after treatment, both showing significant reductions (P-value = 0.0001). Chi-square tests revealed no significant associations between demographic factors (age, marital status, family history of PCOS) and symptom improvement. However, BMI after treatment showed a statistically significant association with symptom improvement (P-value = 0.002), while waist circumference had a borderline significance (P-value = 0.05). The findings highlight the importance of BMI reduction in improving PCOS symptoms. The study protocol was approved by the ethics committee at the relevant institution before commencement. All participants provided informed consent after being fully briefed on the study's aims, procedures, and potential risks. Confidentiality of participants' data was strictly maintained throughout the research process, adhering to ethical standards in accordance with the Declaration of Helsinki. Participants had the right to withdraw from the study at any time without any repercussions on their medical care.

## RESULTS

Table 1 of the document shows the distribution of patients based on several study variables: **Age (years)**: The majority of patients (55.2%) were 30 years old or younger, while 44.8% were older than 30. **Age of marriage**: A large proportion of patients (43%) were married at the age of 11, followed by 29.7% at 12, and 27.3% at 13. **Family history of PCOS**: Most patients (78.2%) had a family history of polycystic ovary syndrome (PCOS), while 21.8% did not. **Marital status**: The majority of patients (75.2%) were married, with 24.8% being single.

**Table 1: distribution of patients according to study variables.**

| variables | | frequency | percentage |
|---|---|---|---|
| **Age (years)** | ***≤30*** | 91 | 55.2 |
| | ***>30*** | 74 | 44.8 |
| **Age of married (years)** | ***11.0*** | 71 | 43.0 |
| | ***12.0*** | 49 | 29.7 |
| | ***13.0*** | 45 | 27.3 |
| **Family history of PCOS** | ***No*** | 36 | 21.8 |
| | ***Yes*** | 129 | 78.2 |
| **Marital state** | ***Married*** | 124 | 75.2 |
| | ***Single*** | 41 | 24.8 |
| **Total** | | 165 | 100 |

Table 2 provides the distribution of patients according to their symptoms before and after treatment: **Symptoms before treatment**: A large majority of patients (84.2%) experienced hirsutism and irregular menses, while 15.8% did not report these symptoms. **Symptoms after treatment**: The majority of patients (85.5%) showed improvement after treatment, with 14.5% not showing improvement.

**Table 2: distribution of patients according to Symptoms before and after Treatment.**

| variables | | frequency | percentage |
|---|---|---|---|
| **Symptoms before Treatment** | ***Hirsutisms and irregular menses*** | 139 | 84.2 |
| | ***No Hirsutisms and irregular menses*** | 26 | 15.8 |
| **Symptoms after Treatment** | ***Improved*** | 141 | 85.5 |
| | ***Not improved*** | 24 | 14.5 |
| **Total** | | 165 | 100 |

Table 3 provides the distribution of patients according to waist circumference before and after treatment: **Waist circumference before treatment**: All patients (100%) were categorized as "high risk" based on their waist circumference. **Waist circumference after treatment**: 8.8% of patients showed an increase in waist circumference. 81.2% remained in the "high risk" category after treatment. This table indicates that despite treatment, the majority of patients continued to have a high-risk waist circumference, with only a small percentage showing improvement.

**Table 3: distribution of patients according to Waste circumferences before and after Treatment.**

| variables | | frequency | percentage |
|---|---|---|---|
| **Waste circumferences before treatment** | ***high risk*** | 165 | 100.0 |
| **Waste circumferences after treatment** | ***increase*** | 31 | 18.8 |
| | ***high risk*** | 134 | 81.2 |
| **Total** | | 165 | 100 |

Table 4 presents the distribution of patients according to Body Mass Index (BMI) before and after treatment: **BMI before treatment**: 41.2% of patients were categorized as overweight. 58.8% were categorized as obese. **BMI after treatment**: 41.2% of patients achieved a normal BMI. 36.4% remained overweight.

**Table 4: distribution of patients according to BMI before and after Treatment.**

| variables | | frequency | percentage |
|---|---|---|---|
| **BMI before treatment** | ***Overweight*** | 68 | 41.2 |
| | ***Obese*** | 97 | 58.8 |
| **BMI after treatment** | ***Normal*** | 68 | 41.2 |
| | ***Overweight*** | 60 | 36.4 |
| | ***Obese*** | 37 | 22.4 |
| **Total** | | 165 | 100 |

Table 5 presents the mean differences in waist circumference and BMI before and after treatment: **Waist circumference**: Before treatment: The mean waist circumference was 100.82 cm with a standard deviation (Std. D) of 5.61. After treatment: The mean waist circumference decreased to 93.01 cm with a standard deviation of 5.94. The change is statistically significant, with a **P-value of 0.0001**. **BMI**: Before treatment: The mean BMI was 31.46 with a standard deviation of 3.42. After treatment: The mean BMI decreased to 27.06 with a standard deviation of 3.81. This change is also statistically significant, with a **P-value of 0.0001**. This table highlights the statistically significant reduction in both waist circumference and BMI following treatment, indicating a positive effect of the intervention on these health metrics.

**Table 5: difference mean of Waste circumferences and BMI before and after Treatment.**

| | Group | N | Mean | Std. D | P-value |
|---|---|---|---|---|---|
| **Waste circumferences** | **Before** | 165 | 100.82 | 5.61 | **0.0001** |
| | **After** | 165 | 93.01 | 5.94 | |
| **BMI** | **Before** | 165 | 31.46 | 3.42 | **0.0001** |
| | **After** | 165 | 27.06 | 3.81 | |

Table 6 presents the association between symptoms before treatment and symptoms after treatment: **Symptoms before treatment (Hirsutism and irregular menses)**: 83.7% of patients who had hirsutism and irregular menses before treatment showed improvement after treatment, while 16.3% did not. 87.5% of patients without these symptoms before treatment showed improvement, and 12.5% did not. **P-value**: The P-value is 0.7, indicating that there is **no statistically significant association** between having symptoms before treatment and the improvement after treatment. This table suggests that the presence of hirsutism and irregular menses before treatment did not significantly affect the likelihood of improvement after treatment.

**Table 6: association between Symptoms before Treatment and Symptoms after Treatment.**

| | | *Symptoms after Treatment* | | |
|---|---|---|---|---|
| | | **Improved** | **Not improved** | **P-value** |
| ***Symptoms Before Treatment*** | ***Hirsutisms and irregular menses*** | 118<br>83.7% | 21<br>87.5% | 0.7 |
| | ***No Hirsutisms and irregular menses*** | 23<br>16.3% | 3<br>12.5% | |
| **Total** | | 141<br>100.0% | 24<br>100.0% | |

Table 7 shows the association between symptoms after treatment and various demographic factors (age groups, age at marriage, family history of PCOS, and marital status): **Age groups (years)**: Patients aged ≤30: 53.9% showed improvement, while 62.5% did not improve. Patients aged >30: 46.1% showed improvement, and 37.5% did not improve. **P-value: 0.5**, indicating no statistically significant association between age and symptoms improvement after treatment. **Age at marriage**: Married at age 11: 40.4% showed improvement, and 58.3% did not. Married at age 12: 30.5% showed improvement, and 25.0% did not. Married at age 13: 29.1% showed improvement, and 16.7% did not. **P-value: 0.2**, showing no statistically significant association between age of marriage and improvement after treatment.

**Family history of PCOS**: Patients with no family history: 20.6% improved, and 29.2% did not. Patients with a family history: 79.4% improved, and 70.8% did not. **P-value: 0.4**, indicating no statistically significant association between family history of PCOS and improvement. **Marital status**: Married patients: 73.8% improved, and 83.3% did not. Unmarried patients: 26.2% improved, and 16.7% did not. **P-value: 0.4**, showing no significant association between marital status and improvement after treatment. This table indicates that none of the demographic factors analyzed (age, age at marriage, family history, and marital status) were significantly associated with symptom improvement after treatment.

**Table 7: association between Symptoms after Treatment and (age groups, age of married, Family history of PCOS, Marital state).**

| | | *Symptoms after Treatment* | | |
|---|---|---|---|---|
| | | **Improved** | **Not improved** | **P-value** |
| **Age groups (years)** | ***≤30*** | 76<br>53.9% | 15<br>62.5% | 0.5 |
| | ***>30*** | 65<br>46.1% | 9<br>37.5% | |
| **Age of Married** | ***11*** | 57<br>40.4% | 14<br>58.3% | 0.2 |
| | ***12*** | 43<br>30.5% | 6<br>25.0% | |
| | ***13*** | 41<br>29.1% | 4<br>16.7% | |
| **Family history of PCOS** | ***No*** | 29<br>20.6% | 7<br>29.2% | 0.4 |
| | ***Yes*** | 112<br>79.4% | 17<br>70.8% | |
| **Marital state** | ***Married*** | 104<br>73.8% | 20<br>83.3% | 0.4 |
| | ***Unmarried*** | 37<br>26.2% | 4<br>16.7% | |

Table 8 shows the association between symptoms after treatment and waist circumference as well as BMI after treatment: **Waist circumference after treatment**: Among patients whose waist circumference increased after treatment: 21.3% showed improvement, while 4.2% did not. Among patients still categorized as "high risk" based on waist circumference: 78.7% showed improvement, while 95.8% did not. **P-value: 0.05**, suggesting a borderline statistically significant association between waist circumference after treatment and symptom improvement. **BMI after treatment**: Patients with a normal BMI after treatment: 46.1% improved, while 12.5% did not. Patients who remained overweight: 35.5% improved, while 41.7% did not. Patients who remained obese: 18.4% improved, while 45.8% did not. **P-value: 0.002**, indicating a statistically

significant association between BMI after treatment and symptom improvement. This table indicates that BMI after treatment is significantly associated with symptom improvement, with those achieving a normal BMI being more likely to improve. Additionally, waist circumference has a borderline association with improvement in symptoms.

**Table 8: association between Symptoms after Treatment and (Waste circumferences After treatment, BMI after treatment).**

| | | ***Symptoms after Treatment*** | | |
|---|---|---|---|---|
| | | **Improved** | **Not improved** | **P-value** |
| **Waste circumferences After treatment** | ***Increase*** <br> ***High risk*** | 30 <br> 21.3% <br> 111 <br> 78.7% | 1 <br> 4.2% <br> 23 <br> 95.8% | **0.05** |
| **BMI after treatment** | ***Normal*** <br> ***Overweight*** <br> ***Obese*** | 65 <br> 46.1% <br> 50 <br> 35.5% <br> 26 <br> 18.4% | 3 <br> 12.5% <br> 10 <br> 41.7% <br> 11 <br> 45.8% | **0.002** |

## DISCUSSION

This study demonstrates a statistically significant reduction in both waist circumference and BMI following a weight loss intervention in women with polycystic ovary syndrome (PCOS). The mean waist circumference decreased from 100.82 cm to 93.01 cm, and the mean BMI dropped from 31.46 to 27.06, both with a P-value of 0.0001. These results align with previous studies, such as those by Moran et al., Hoeger et al., and Thomson et al., which also reported significant reductions in BMI and waist circumference after weight loss interventions in PCOS patients.[13-15] The reduction in waist circumference is particularly relevant, as it reflects a decrease in central obesity, which is linked to improved insulin sensitivity and reduced cardiovascular risk. Overall, the study highlights the critical role of weight loss in managing PCOS by improving metabolic and reproductive health outcomes.

The is no statistically significant association between the presence of pre-treatment symptoms, such as hirsutism and irregular menses, and symptom improvement following a weight loss intervention in women with polycystic ovary syndrome (PCOS). While 83.7% of patients with these symptoms and 87.5% without them showed improvement, the P-value of 0.7 suggests that these differences are not significant. This finding is consistent with prior research, including studies by Cassar S et al. and Rondanelli M. et al., which showed that weight loss interventions improve reproductive and metabolic outcomes, but the presence of symptoms like hirsutism does not strongly predict the degree of improvement.[16,17] Ravn P et al. also reported variable responses in hyperandrogenism-related symptoms, such as hirsutism, despite improvements in body composition and metabolic health.[18] Recent studies, including those by Charifson MA et al. and Teede et al., further support that while weight loss improves metabolic outcomes and menstrual regularity, its impact on androgen-related symptoms like hirsutism is less consistent. This suggests that additional treatments, beyond weight loss, may be necessary to fully address symptoms like hirsutism in PCOS patients.[19,20]

The demographic factors, such as age, age at marriage, family history of polycystic ovary syndrome (PCOS), and marital status, do not significantly influence the likelihood of symptom improvement after treatment in women with PCOS. Age groups, marital status, and family history of PCOS all had P-values indicating no statistically significant associations with symptom improvement. These findings align with prior research, including studies by Tabassum F et al. and Jabeen A et al., which suggest that while genetic predisposition or age may affect the onset of PCOS, they do not strongly influence treatment outcomes.[21,22] Escobar-Morreale found that lifestyle interventions, such as weight loss and physical activity, improved symptoms across different age groups and regardless of family history.[5] A meta-analysis by Moran et al. also confirmed that demographic factors do not significantly alter the effectiveness of weight loss interventions in managing PCOS symptoms. These findings support the notion that demographic characteristics do not predict the effectiveness of treatments for PCOS, with lifestyle interventions benefiting a wide range of women, irrespective of factors like age or marital status.[13]

The association between post-treatment reductions in waist circumference and BMI with symptom improvement in women with polycystic ovary syndrome (PCOS). BMI showed a statistically significant association with symptom improvement (P-value = 0.002), with patients achieving a normal BMI more likely to experience symptom improvement. In contrast, waist circumference showed a borderline association (P-value = 0.05), suggesting that while central obesity plays a role in PCOS symptom persistence, its influence is less definitive compared to BMI. Several studies support these findings. Barber et al.[23] emphasized that central

obesity drives insulin resistance, exacerbating PCOS symptoms, while Lim et al.[24] demonstrated that reducing central obesity improves metabolic and reproductive health. BMI reduction, specifically, has been consistently associated with symptom improvement in studies like Moran et al. and Hoeger et al., which found that even modest weight loss improves insulin sensitivity, androgen levels, and ovulatory function.[13,14] Recent studies, confirmed the critical role of BMI reduction in improving both metabolic and reproductive outcomes, with normal BMI patients experiencing the greatest symptom resolution. Overall, these results reinforce the importance of weight loss in managing PCOS symptoms, particularly through BMI reduction.[25,26]

## CONCLUSION

Weight loss, especially BMI reduction, is strongly associated with improved symptoms and clinical outcomes in women with polycystic ovary syndrome (PCOS), while waist circumference shows a borderline association. Demographic factors such as age and family history do not significantly impact treatment success. Achieving a normal BMI is key to improving metabolic health, ovulatory function, and androgen-related symptoms. Lifestyle interventions focused on weight management are critical for effective PCOS treatment. Long-term studies on combined treatments addressing both weight and hormonal imbalances are needed.

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