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Polycystic Ovary Syndrome: Impact of Lifestyle Modifications Among Overweight and Obese Infertile Women

Hanan Elzeblawy Hassan[1*], Fatma Hosny Abd-ELhakam[2], Enas Kasem Ali[3]

[1]*Professor of Maternal and Newborn Health Nursing, Faculty of Nursing, Beni-Suef University, Egypt*

[2]*Assistant lecturer of Maternal and Newborn Health Nursing, Faculty of Nursing, Beni-Suef University, Egypt*

[3]*Professor of Maternal and Newborn Health Nursing, Faculty of Nursing, Menoufia University, Egypt*

Corresponding Author:** ***Hanan Elzeblawy Hassan, *Professor of Maternal and Newborn Health Nursing, Faculty of Nursing, Beni-Suef University, Egypt.*

Abstract

Background: *Polycystic ovarian syndrome is one of the most common reasons contributing to female an ovulatory infertility. Due to its detrimental effects on menstruation, ovulation, pregnancy rates, and live birth rates, obesity which affects almost half of women with PCOS worsens infertility.*

Aim *of the study was to evaluate the effect of Lifestyle modification intervention among infertile overweight and obese women with polycystic ovary syndrome.*

Subjects and Methods: ***Design*****:** *A quasi-experimental design was utilized in conducting the study.* ***Settings****: The study was conducted at gynecological and infertility outpatient clinics and inpatients and Specialized medical center for the treatment of infertility and delayed childbearing at Beni-Suef University Hospital.*

Tools: *A structured interview questionnaire, Lifestyle and habits characteristics, the Block Adult Physical Activity (PA) Screener and Follow-up card.*

Results: *It revealed that 72.4%% and 82% of the study group had poor and mild physical activity before the intervention, compared to 29.3% and 26% after intervention, respectively. 70.7% of the studied women were obese and had BMI ≥30.0 before intervention, compared to 34.5% after intervention. Additionally, 25.8%, 12.1%, and 30% of the study group had moderate acne, in stage III alopecia, and severe hirsutism before the intervention, compared to 12.1%, 3.4%, and 11.0% after intervention, respectively. Significant associations between hyper-androgenic features and lifestyle habits was found (p<0.001). Moreover, 36.2% had positive pregnancy test after intervention. A highly statistically significant differences between dietary and physical activity habits after the intervention (p<0.001) was found.*

Conclusion: *There were improvement in menstrual cycle irregularities, BMI, waist circumference, symptoms suggesting hyper-androgenic and improvements in fertility and ovulation after six months of the lifestyle modification intervention.*

Recommendations: *Lifestyle modifications in the form of diet and exercise should be placed as the first-line treatment for PCOS symptoms able to address clinical and metabolic characteristics.*

Keywords: *infertility, obesity, lifestyle modification*

1. INTRODUCTION

Polycystic ovarian syndrome (PCOS) is one of the most common reasons contributing to female anovulatory infertility. Due to its detrimental effects on menstruation, ovulation, pregnancy rates, and live birth rates, obesity—which affects almost half of women with PCOS-worsens infertility [1-2].

Polycystic ovarian syndrome is a hormonal imbalance that results in elevated levels of estrogen, testosterone, and luteinizing hormone (LH) and decreased follicle-stimulating hormone release (FSH). This disease is associated with other problems related to the hypothalamic-pituitary-ovarian axis in addition to cancers that generate testosterone [3].

Obesity is a global pandemic that has serious clinical, social, and economic repercussions in both developed and developing countries [4]. Obesity raises the risk of sub-fecundity and

infertility, which is mostly attributed to the hypothalamic-pituitary-ovarian (HPO) axis dysfunction, low oocyte quality, and reduced endometrial receptivity [5-9].

Another side effect of obesity is infertility, which is manifested by irregular menstrual cycles, lower spontaneous and aided pregnancy rates, and higher miscarriage rates. The risk of normal-gonadotrophic anovulation is increased by the distribution of body fat in the center and general obesity [10-13].

A higher body mass index (BMI) is linked to a worse fertility prognosis; and obese women exhibit lower reproductive outcomes regardless of the method of conception [5]. As the most prevalent endocrine illness among women of reproductive age, polycystic ovarian syndrome (PCOS) is one of the major causes of infertility [14].

Nurses can have a positive effect on women with PCOS through counseling and education. Support patients who are struggling with low self-esteem as a result of PCOS's physical expression. To avoid long-term health issues, educate the patient about the syndrome and the risk factors that go along with it. Encourage the patient to adopt healthier habits. Make suggestions for nearby support groups so that the patient can develop coping mechanisms [15]. Nurses are uniquely positioned to raise awareness of this issue. Along with basic tasks, they can inform women, particularly young women, about PCOS and how to manage it [16]. In the healthcare delivery system, nurses are in charge of ensuring that women receive high-quality care throughout their lives. They also play a critical role in counseling and raising women's knowledge [17].

Significance of the Study

The rising rates of obesity and overweight among Egyptians are largely attributed to their way of life, which includes unhealthy eating habits like consuming widely available junk and fast foods as well as rising sedentary lifestyles, as evidenced by reports that 63% of Egyptians aged 20 or older lead sedentary lifestyles [18-22]. Recently, many researchers examined the effect of lifestyle change in PCOS girls and suggested that diet, exercise, and weight loss are recommended as the first line of treatment for girls with PCOS; these changes should precede pharmacological treatment [23-28]. Even a 5% weight loss overall can have a favorable impact on hyperinsulinemia. As a result, testosterone levels drop, and menstrual periods return to normal. There is evidence that medical professionals can help PCOS-affected girls adjust their lifestyles [29]. So, this study will be conducted to evaluate the effect of lifestyle modifications on PCOS symptoms among infertile obese and overweight women.

2. Aim Of The Study

The current study's purpose was to evaluate the effect of Lifestyle modification intervention among infertile overweight and obese women with polycystic ovary syndrome.

3. Study Hypotheses

Obese and overweight women with polycystic ovarian syndrome who will receive Lifestyle modification interventions will experience an improvement and decrease polycystic ovarian syndrome symptoms than those who don't attend.

4. Subjects And Methods

4.1. Settings and Sample

The study was conducted at gynecological and infertility outpatient clinics and inpatients and Specialized medical center for the treatment of infertility and delayed childbearing at Beni-Suef University Hospital. A quasi-experimental design was utilized in conducting the study. A purposive sample of 85 women with infertility, overweight and obese with polycystic ovary syndrome was used. Women are medically diagnosed with polycystic ovarian syndrome (according to specific medical criteria) related to PCOs, at reproductive age (18-40 years), and Body mass index >25kg/m2 (overweight and obese women).

4.2. Tools of Data Collection

4.2.1. Predesigned questionnaire

Arabic Structured interviewing questionnaire divided into**:**

- Basic data as telephone number, age, residence, marital status, employment, length in centimeters, weight in kilograms, waist circumference, thigh circumference, and BMI; Body mass index = weight in kg/ height² (in meter)
- Women's menstrual, and reproductive/ gynecological history.
- Features of hyperandrogenism (three questions): Included questions about hirsutism, acne, and androgen-related alopecia.
    - **Scoring system for Hirsutism:** The total score was adopted from Kahraman & Erdoğan (2021) and assessed by

summation of sub-scores in the nine areas [30]:

- A total score of ≤33.3% indicates no hirsutism (0-12)
- A total score of >33.3%-66.6% indicates mild hirsutism (>12-24)
- A total score >66.6%-100% indicates moderate to severe hirsutism (>24-36)

- **Scoring system for Acne vulgaris:** The total score was adopted from Shahbag (2017) and assessed by summation of sub-scores in the six areas [31]:
  - A total score of 25% indicates no acne (0-6)
  - A total score of >25%-50% indicates mild acne (>6-12)
  - A total score >50%-75% indicates moderate acne (>12-18)
  - A total score >75%-100% indicates severe acne (>18-24)
- **Scoring system for Androgenic alopecia:** For those who had androgenic alopecia, the degree of alopecia was assessed using the Ludwig scale (Kahraman & Erdoğan, 2021) as [32]:
  - A total score of ≤ 33.3% indicates begins with thinning on the top of the head (0-3)
  - A total score of >33.3%-66.6% indicates the scalp starts to show (>3-6)
  - A total score >66.6%-100% indicates all the hair at the crown of the head may be lost (>6-9).

4.2.2. Lifestyle and habits characteristics. : It was done using the following instruments:

- Women's lifestyle nutrition habits; It includes data about food and soft drinks [32]. (Shahar, et al., 2003).
  - Poor habits if score < 60% of total scores that mean (0-24).
  - Good habits if score ≥ 60 % of the total score, that means (25-40).
  - Block Adult Physical Activity (PA) Screener was the predictor for physical activity [31]. (Sternfeld et al., 2009).
  - Mild physical activity (sedentary life) if score is < 25% of total score that mean (9-15).
  - Moderate physical activity if score is 25%-50% of the total score, that means (16-30).
  - Vigorous physical activity if score is 50%-75% of the total score, that means (30-45).

4.2.3. Follow-up card: Arabic card was constructed by the researcher to assess the outcome measures:

- Changing in menstrual cycle;
- Changing in anthropometric measurements (body mass index (BMI)
- Waist circumference.

4.3. Administrative Approvals

An official letter was taken from the Dean of the Faculty of Nursing, Menoufia University contain the title and objectives of the study and was submitted to the director of Beni-Suef university hospital to obtain the official agreement to conduct the study. An official permission was obtained to carry out the study from the directors of the above mentioned settings.

4.4. Ethical Considerations

An approval from the Committee of Hearing and Ethics was obtained from the Faculty of Nursing, Menoufia University. Approaches to ensure ethics were considered in the study regarding confidentiality and informed consent. Each woman had been informed that participation in the study was voluntary and that they had the right to withdraw from the study whenever they decided to do so.

4.5. Pilot study

The pilot study was carried out on 10% of the total study sample (10 women) to evaluate the applicability, efficiency, clarity of tools, and assessment of the feasibility of fieldwork, besides detecting any possible obstacles that might face the researcher and interfere with data collection.

4.6. Study Field Work

Data collection of the study was started at the beginning of October 2023 and completed by the end of March 2024 (6 months). The fieldwork of this study was carried out through preparatory, assessment, planning, implementation, follow, and evaluation phases.

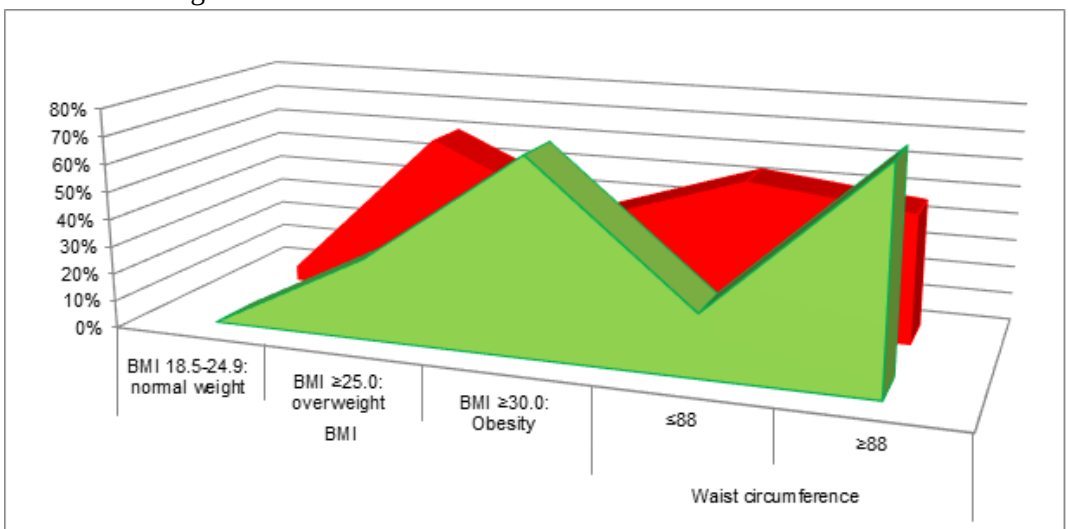
4.7. Statistical Analysis

Upon the completion of data collection, each answer was coded and scored. The researcher coded the data into a coding sheet so that it could be prepared for computer use. Data were

statistically analyzed using Statistical Package for the Social Sciences, version 22, SPSS Inc. The level of significance was at P value ≤ 0.05.

5. RESULTS

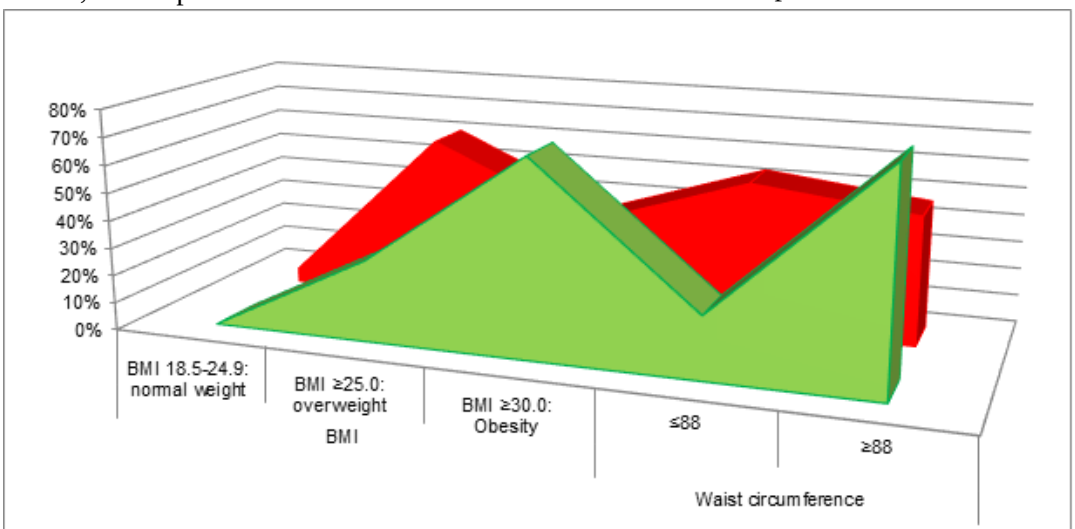
Figure (1): shows the total lifestyle and daily habit levels among the studied infertile overweight and obese women with polycystic ovary syndrome. It revealed that 72.4%% and 82% of the study group had poor and mild physical activity before the intervention, compared to 29.3% and 26% after intervention, respectively.



	BMI			Waist circumference	
	BMI 18.5-24.9: normal weight	BMI ≥25.0: overweight	BMI ≥30.0: Obesity	≤88	≥88
Pre-Intervention	0%	29.30%	70.70%	22.40%	77.60%
Post-Intervention	5.20%	60.30%	34.50%	53.40%	46.50%

Figure 1. *Total lifestyle Daily (Dietary and Physical Activity) Habits among the Studied Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n = 58)*

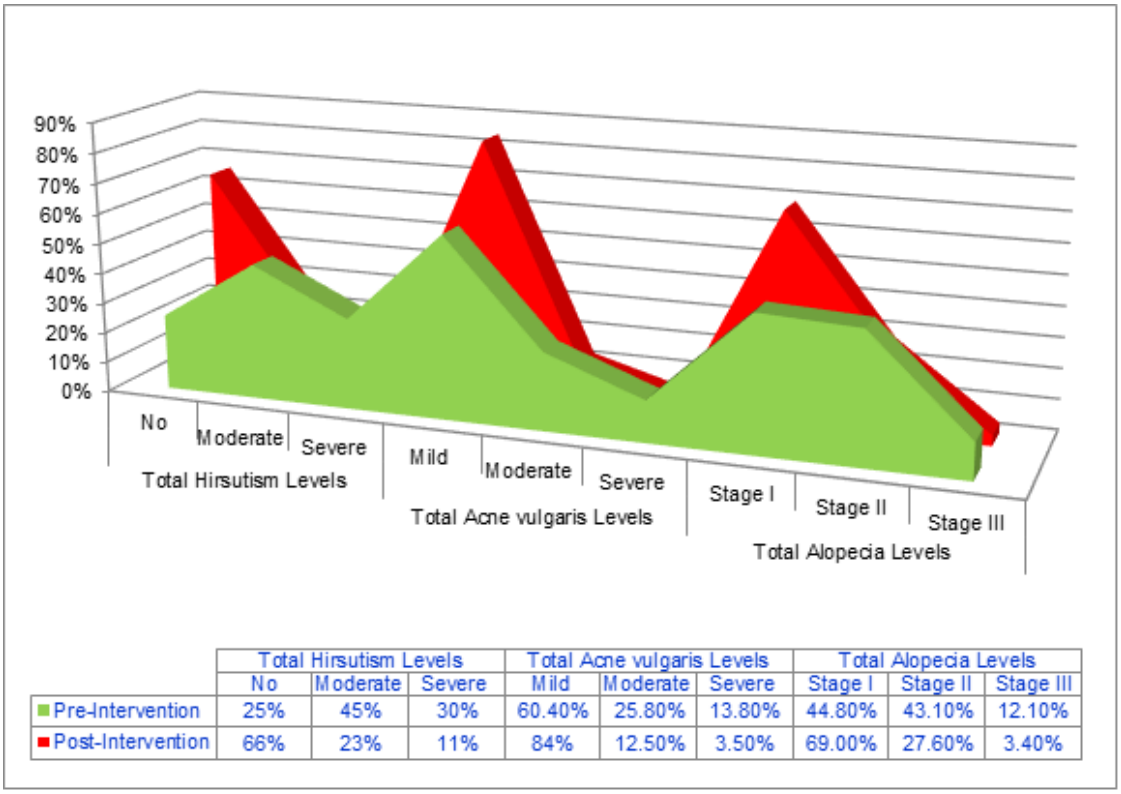
Figure (2) revealed that 70.7% of the studied women were obese and had BMI ⩾30.0 before intervention, compared to 34.5% after intervention. In addition, 77.6% of them their waist circumference more than 88cm before the intervention, compared to 46.5 after intervention.



	BMI			Waist circumference	
	BMI 18.5-24.9: normal weight	BMI ≥25.0: overweight	BMI ≥30.0: Obesity	≤88	≥88
Pre-Intervention	0%	29.30%	70.70%	22.40%	77.60%
Post-Intervention	5.20%	60.30%	34.50%	53.40%	46.50%

Figure 2. *Anthropometric measures of the Studied Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n = 58)*

Figure (3): shows hyper-androgenic symptoms (hirsutism, acne vulgaris, alopecia) among the study group infertile overweight and obese women with polycystic ovary syndrome. It revealed that 25.8%, 12.1%, and 30% of the study group had moderate acne, in stage III alopecia, and severe hirsutism before the intervention, compared to 12.1%, 3.4%, and 11.0% after intervention, respectively.



	Total Hirsutism Levels			Total Acne vulgaris Levels			Total Alopecia Levels		
	No	Moderate	Severe	Mild	Moderate	Severe	Stage I	Stage II	Stage III
Pre-Intervention	25%	45%	30%	60.40%	25.80%	13.80%	44.80%	43.10%	12.10%
Post-Intervention	66%	23%	11%	84%	12.50%	3.50%	69.00%	27.60%	3.40%

Figure 3. *Hyper-Androgenic Symptoms (Hirsutism, Acne vulgaris, Alopecia) among the Study group Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n=58)*

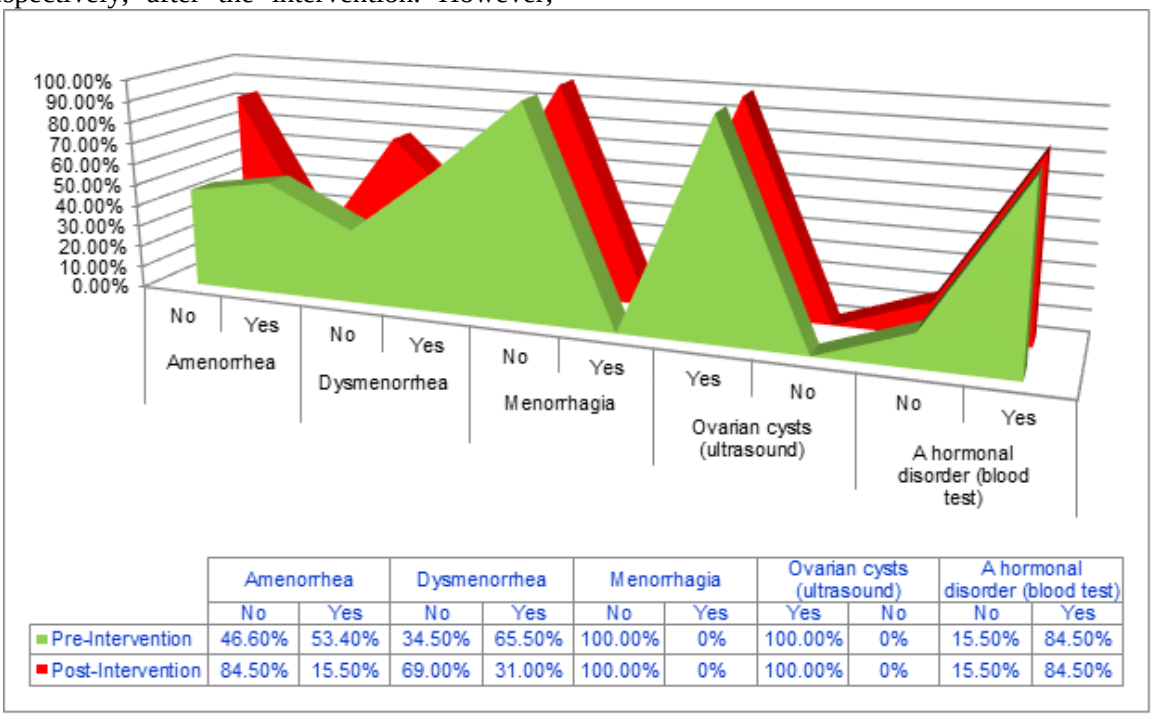
Table (1): Portrays relationship between hyper-androgenic features and lifestyle habits among the study group of infertile overweight and obese women with polycystic ovary syndrome. It showed that there were significant associations between hyper-androgenic features (Alopecia, Acne, and Hirsutism) and lifestyle habits (dietary and physical activity) among the study group of infertile overweight and obese women with polycystic ovary syndrome after program implementation (p value < 0.001).

Table 1. *Relationship between hyper-Androgenic Features and Lifestyle Habits among the Study Group of Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n=58)*

Variables	Before the intervention						After the intervention					
	Dietary Habit		Physical Activity Habit			χ^2 P-value	Dietary Habit		Physical Activity Habit			χ^2 P –value
	Poor N=42	Good N=16	Mild (sedentary) N=47	Moderate N=11	Severe N=0		Poor N=17	Good N=41	Mild (sedentary) N=15	Moderate N=36	Severe N=7	
Androgenic Alopecia Levels												
Stage I	61.5%	38.5%	76.9%	23.1%	0%	1.476	5%	95%	7.5%	80%	12.5%	0.686
Stage II	80%	20%	88%	12%	0%	>0.05	81.2%	18.8%	62.5%	25%	12.5%	<0.05*
Stage III	85.7%	14.3%	71.4%	28.6%	0%	ns	100%	0%	100%	0%	0%	
Acne vulgaris Levels												
Mild	68.6%	31.4%	82.9%	17.1%	0%	0.610	22.4%	77.6%	20.4%	67.3%	12.3%	14.19
Moderate	66.6%	33.4%	80%	20%	0%	>0.05	71.4%	28.6%	57.1%	28.8%	14.1%	<0.01**
Severe	100%	0%	75%	25%	0%	ns	50%	50%	50%	50%	0%	
Hirsutism Levels												
No	35.7%	64.3%	50%	50%	0%	3.685	7.7%	92.3%	10.2%	79.6%	10.2%	24.907
Moderate	80.8%	19.2%	88.5%	11.5%	0%	>0.05	69.2%	30.8%	53.8%	23.1%	23.1%	<0.001*
Severe	88.9%	11.1%	94.4%	5.6%	0%	ns	83.3%	16.7%	66.6%	33.4%	0%	*

NB: *ns non- statistically significant (p≥0.05)* ***highly statistically significant (p≤0.001)*

Figure (4): shows the symptoms experienced by the studied infertile overweight and obese women with polycystic ovary syndrome. It revealed that 53.4% and 65.5%of the study group had amenorrhea and dysmenorrhea before the intervention, compared to 15.5%, and 31%, respectively, after the intervention. However, 100.0% of the study group had no ovarian cysts that were diagnosed with sonar before and after the intervention. Otherwise, 84.5% the study group had a hormonal disorder detected by a blood test before and after the intervention, respectively.



	Amenorrhea		Dysmenorrhea		Menorrhagia		Ovarian cysts (ultrasound)		A hormonal disorder (blood test)	
	No	Yes	No	Yes	No	Yes	Yes	No	No	Yes
Pre-Intervention	46.60%	53.40%	34.50%	65.50%	100.00%	0%	100.00%	0%	15.50%	84.50%
Post-Intervention	84.50%	15.50%	69.00%	31.00%	100.00%	0%	100.00%	0%	15.50%	84.50%

Figure 4. *Symptoms Experienced by Studied Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n = 58)*

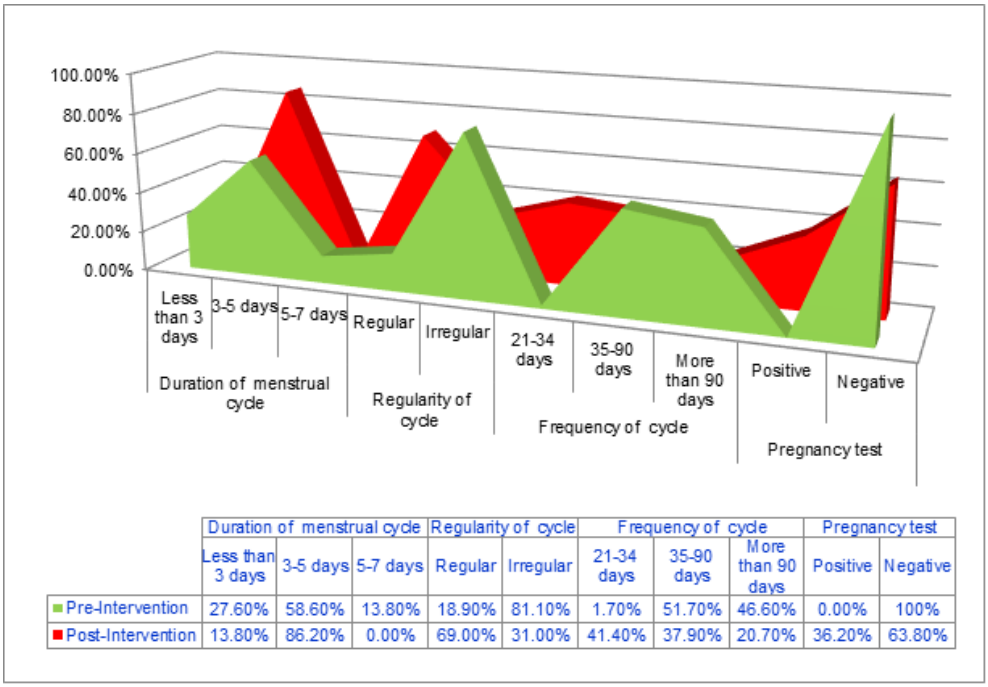
Table (2): Presents relationship between ovulatory function/menstrual regularity and lifestyle habits in the study group of infertile overweight and obese women with polycystic ovary syndrome. It showed that there was a significant association between the ovulatory and lifestyle in the study group of infertile overweight and obese women with polycystic ovary syndrome. It revealed that there were highly statistically significant differences between dietary and physical activity habits after the intervention (p value < 0.001

Table 2. *Relationship between Ovulatory Function/Menstrual Regularity and Lifestyle Habits In The Study Group Of Infertile Overweight And Obese Women With Polycystic Ovary Syndrome (N = 58)*

Variables	Before the intervention					After the intervention				
	Dietary Habit		Physical Activity Habit			Dietary Habit		Physical Activity Habit		
	Poor N=42	Good N=16	Mild (sedentary) N=47	Moderate N=11	Severe N=0	Poor N=17	Good N=41	Mild (sedentary) N=15	Moderate N=36	Severe N=7
Duration of menstrual cycle										
Less than 3	87.5%	12.5%	87.5 %	12.5%	0.00	75%	25%	62.5%	25%	12.5%
3-5 days	64.7%	35.3%	82.3%	17.7 %	0.00	22%	78%	20%	68 %	12%
5-7 days	75%	25%	62.5%	37.5%	0.00	0.0%	0.00	0.0%	0.0%	0.00
Regularity of menstrual cycle										
Regular	27.3%	72.7%	27.3%	72.7%	0.00	53%	75.6%	5%	80%	15%
Irregular	83%	17%	93.6%	6.4%	0.00	47%	24.4%	72.2%	22.2%	5.6%
Frequency of menstrual cycle										
21-34 days	0.0%	100%	0.0%	100%	0.00	16.4%	83.3%	0.00	83.3%	16.7%
35-90 days	66.6%	33.4%	66.6%	33.4%	0.00	27.3%	72.7%	22.7%	63.6%	13.7%
>90 days	77.7%	22.3%	77.7%	22.3%	0.00	58.3%	41.7%	83.3%	16.7%	0.00
P- Value	**> 0.05 ns**		**> 0.05 ns**			**≤ 0.001****		**≤ 0.001****		

NB: *ns non- statistically significant (p≥0.05)* ***highly statistically significant (p≤0.001)*

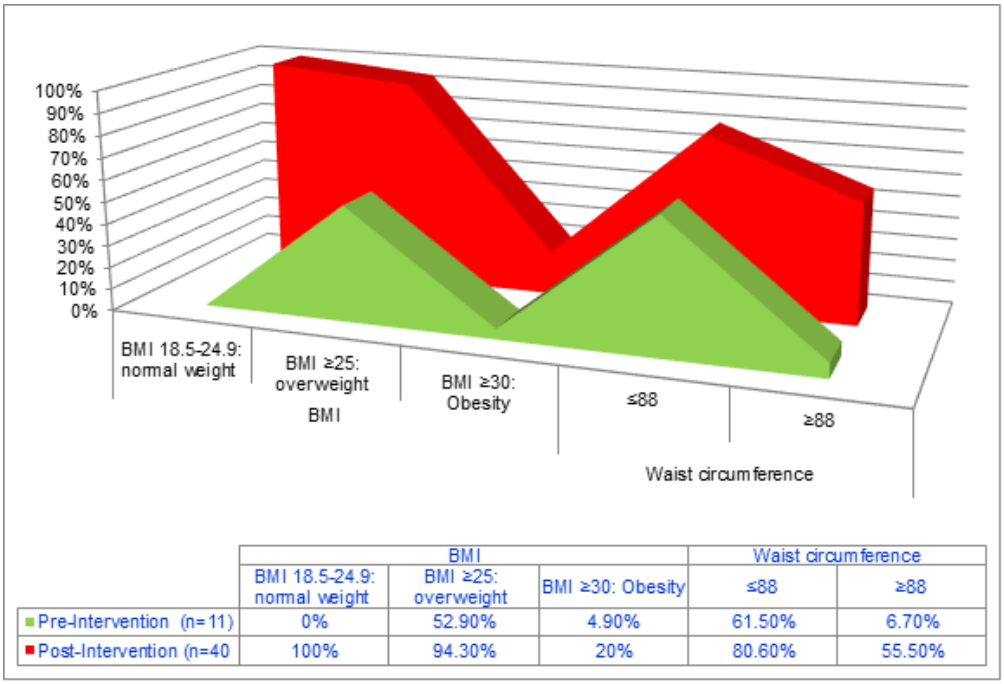
Figure (5) portrays menstrual characteristic and pregnancy features in the studied infertile overweight and obese women with polycystic ovary syndrome. It revealed that 58.6% & 81.1% of the study had a 3–5-day duration and irregular menstrual cycle before the intervention, compared to 86.2% & 31.0% after intervention, respectively. Moreover, 100% of the study had negative pregnancy tests before intervention, while 36.2% were had positive after intervention.



	Duration of menstrual cycle			Regularity of cycle		Frequency of cycle			Pregnancy test	
	Less than 3 days	3-5 days	5-7 days	Regular	Irregular	21-34 days	35-90 days	More than 90 days	Positive	Negative
Pre-Intervention	27.60%	58.60%	13.80%	18.90%	81.10%	1.70%	51.70%	46.60%	0.00%	100%
Post-Intervention	13.80%	86.20%	0.00%	69.00%	31.00%	41.40%	37.90%	20.70%	36.20%	63.80%

Figure 5. *Menstrual and Pregnancy Features of the Studied Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N = 58)*

Figure (6): shows the Relationship between anthropometric measures and menstrual cycle regularity among the study group of infertile overweight and obese women with polycystic ovary syndrome. It revealed that 4.9% of BMI ≥30: obesity in the study group had regular menstrual cycles before intervention, compared to 20% after the intervention. Moreover, 6.7%of the study group had regular menstrual cycles are ≥88 waist circumference before intervention compared to 55.5% of them after intervention.



	BMI			Waist circumference	
	BMI 18.5-24.9: normal weight	BMI ≥25: overweight	BMI ≥30: Obesity	≤88	≥88
Pre-Intervention (n=11)	0%	52.90%	4.90%	61.50%	6.70%
Post-Intervention (n=40	100%	94.30%	20%	80.60%	55.50%

Figure 6. *Relationship between Anthropometric Measures and Menstrual Cycle Regularity among the Study Group Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N=58)*

6. DISCUSSION

The current study conducted to evaluate the effect of Lifestyle modification intervention among infertile overweight and obese women with polycystic ovary syndrome. Regarding lifestyle and daily dietary habits, in the present study, there was a highly statistically significant difference between data for habits and lifestyle modification of the pre and post-intervention after 6 months. The current study findings revealed that there is an improvement in lifestyle and daily habit levels among the studied infertile overweight and obese women with polycystic ovary syndrome. It reveals that most of the study group had poor habits before the intervention, which improved to less than three quarter of the study had good habits after the intervention. These results came in agreement with **Eleftheriadou et al., (2015),** that found those poor eating habits were demonstrated in this group of adolescent PCOS patients [34]. Furthermore, these findings were supported by **George, (2021)**, who concluded that most of the studied participants suffered from poor lifestyle dietary habits [35-37]. This may attributed to development of obesity in later life. Increased body weight increases long-term health risks and should be tackled with lifestyle interventions early in life.

Also, the current study findings revealed that there is improvement in physical activity engagement after program implementation. Regarding total physical activity levels among the studied infertile, overweight, and obese women with polycystic ovary syndrome. The current study findings revealed that there is an improvement in total physical activity. Majority of the study group had mild physical activity (sedentary lifestyle) before the intervention; compared to two-thirds of the study after intervention had Moderate physical activity.

These results came in agreement with **Wang et al., (2021) study.** Their results showed that all women in our study who followed a 6-month lifestyle intervention decreased their intake of high-calorie snacks and beverages and increased their moderate to vigorous physical activity compared with women without lifestyle intervention. This may be justified as exercise training improves an array of health-related outcomes, including protection against the development of cardiovascular disease (CVD) and diabetes, reduced morbidity and mortality, and psychological benefits including improvements in mood and psychological well-being. Participation in regular exercise is also a key predictor of long-term weight maintenance [38].

Many studies have pointed to the positive effects of lifestyle modification interventions on the reduction of weight in patients with obesity and PCO. Regarding BMI, The findings of the current study revealed that the mean BMI in the study group was 32.4±4.21 before the intervention, compared to 29.5±3.42 after the intervention. These findings came in agreement with **Lass et al., (2011)**. They revealed that the mean BMI in the study group was 32.2 ±3.7 before the intervention, compared to 28.3± 3.4 in the study group after the intervention [39]. Also, In line with the present findings, these results agreed with **Haqq et al., (2014),** who pointed to the positive effects to the positive effects of lifestyle modification interventions on the reduction of weight in patients with obesity and PCO [40].

The findings of the current study revealed that the mean waist circumference in the study group was 86.0±6.37 before the intervention, compared to 85.0±6.09 after the intervention. These findings came in agreement with **Öberg, (2022).** The study revealed that there was a significant reduction in waist circumference before and after intervention in the study group [41]. On the contrary, these findings were incongruous with those of **Serrao, (2013),** who revealed that the lifestyle interventions did not affect waist circumference [42]. This incongruence between the current and previous studies may be related to the patient's residence rural area and not having adequate access to adherence to sports and adequate exercise.

The current study revealed that there was marked improvement related to symptoms suggesting hyper-androgenic (hirsutism) after the intervention of program. These findings came in agreement with **Niranjani et al. (2022),** who revealed that Modified Ferriman Gallwey scale (Hirsutism), during Pre-test through Post-test 2, the non-interventional group showed no improvement in score, whereas Group A and Group B showed 1 score decrease [43]. On the contrary, these findings were incongruous with those of **Pramod (2023)**, who studied dietary and physical activity patterns in PCOS women and who showed that less than one-quarter of the respondents had dark hair growth [44]. These differences might be because of the different populations in their study on overweight and obese women with PCOS. Which mean weight in their study is 65kg.

Regarding acne vulgaris levels, the current study findings revealed that there is an improvement in acne vulgaris levels after the intervention for the study group after the intervention. This was in concordance with **Niranjani et al., (2022)** [43]. They revealed that in the global acne grading scale (acne), during pre-test through post-test 2, the non-interventional group showed no improvement in score, whereas Group A and Group B showed 2 scores decrease. This may be explained by the fact that the majority of girls had a wish to good body image and conceive in the future and, therefore, had a greater incentive to adhere to the change in their lifestyle. These findings were supported by **Roya et al., (2021)** [45]. They revealed that Hyperandrogenism symptoms and the severity of PCOS can be improved through lifestyle modification (LSM). This may be justified as lifestyle modifications in terms of an active lifestyle and healthy dietary habits are the first line of management and can significantly reduce the symptoms and morbidity related to the disorder. In which a healthy diet reduces weight and leads to reduced insulin resistance and free testosterone which reduce hair loss.

Regarding the duration of the menstrual cycle, the findings of the current study showed that the present study revealed that, there were significant improvements in menstrual cycle irregularities in the study, more than half of the study group had 3–5-day duration of the menstrual cycle before the intervention compared to the majority of the study group had 3-5 day duration of the menstrual cycle after the intervention. These findings are similar to the study done by **Öberg, (2022)** [41]. They studied "Effects of Lifestyle Intervention in Overweight Women with Polycystic Ovary Syndrome. On the contrary, these findings were incongruous with those of **Abd Elmenim et al., (2016)**. They showed that the mean duration of menstruation was 5-7 days [18]. This attributed to the fact that lifestyle interventions have been shown to have positive effects in terms of improved menstrual cycle irregularities, which help to lower insulin levels, which have the direct effect of lowering the androgen level that helps to restore normal ovulation and menstruation.

Regarding menstrual regularity, the current study findings revealed that there is an improvement in menstrual regularity after intervention. About major of the study group had irregular menstrual cycles before the intervention, compared to after the intervention. These findings came in agreement with **Öberg, (2022),** who revealed that a higher proportion of the women in the behavioral modification intervention group improved their menstrual cycle at 4 months [41]. Another study conducted by **Abdolahian et al., (2020)** revealed that after three–to 12 months of intervention and documented improvement in menstrual cycle irregularities after the program [46]**.** In addition, these findings came in agreement with **Marzouk et al., (2015)** [47].They revealed that the dietary weight loss in adolescent women with PCOS resulted in significant improvement in menstrual regularity. Another investigation was carried out in Stockholm, Sweden's Karolinska University Hospital [48]. **Nybacka et al., (2011).** It was determined that dietary control and exercise, either alone or in combination, are equally beneficial in enhancing ovarian function in women with PCOS. This study compared the effects of three months of food management and/or physical exercise (three interventions) on ovarian function in women with PCOS. This may due to those lifestyle interventions reduces the levels of SHBG and the circulating androgens (primarily free testosterone), creates better conditions for ovulation, and facilitates the action of drugs used to induce ovulation.

In addition, the current study findings showed that the number of menstrual cycles increased from pre-intervention to post-intervention. It revealed that more than half of the study had a duration of menstrual rhythm was 35–90 days before the intervention, compared to nearly half of the study group having a duration of menstrual rhythm 21–34 days after the intervention. These findings are similar to the study done by **Turan et al., (2015),** who revealed that there are positive results of decreasing menstruation period from 46.1 days to 27.3 days from females in the experimental group were reported by the structured exercise that lasted for 8 weeks and applied to females of normal body weight suffering PCOS [49].

Regarding symptoms experienced by studied infertile overweight and obese women with polycystic ovary syndrome. The current study findings revealed that there is an improvement in dysmenorrhea after intervention. These findings came in agreement with **Küçükakça, (2023),** who revealed that lifestyle modifications reduce painful menstrual cycles [50]. This may be justified as lifestyle modifications, particularly exercise and diet, have effectively managed the symptoms and reduced the risk factors associated with PCOS as dysmenorrhea. Exercising due to the release of endorphins, relaxation, stress relief

and improved blood flow can reduce the severity and duration of dysmenorrhea [51-53]. On the contrary, these findings were incongruous with those of **Hailemeskel et al., (2016),** who showed that there is an association between the current or previous attempts of going on a diet to lose weight and the intensity of dysmenorrhea. Consistently, a positive association between following a diet to lose weight and dysmenorrhea was reported [54]. Regarding menorrhagia, all of the study did not suffer from bleeding between the menstrual cycle before and after the intervention. On the contrary, these findings were incongruous with **George, (2021),** who revealed that one-quarter had bleeding during the menstrual cycle. From the researchers' point of view, this discrepancy might be related to differences in studied populations and sitting [35].

Regarding pregnancy rate, the current study findings revealed that there were significant improvements in fertility and ovulation after the lifestyle modification intervention; about more than one-third of the study had positive pregnancy tests after intervention. These findings came in agreement with **Rothberg et al. (2016),** who studied the feasibility of a brief, intensive weight loss intervention to improve reproductive outcomes in obese, sub-fertile women" [55]. Also, current results supported by **Alwahab et al., (2018)** who studied "A ketogenic diet may restore fertility in women with polycystic ovary syndrome", and revealed that half of the study group had a positive pregnancy test after intervention [56].

Regarding relationship between anthropometric measures and menstrual cycle regularity among the study group infertile overweight and obese women with polycystic ovary syndrome; the current study findings revealed that there is a positive correlation between anthropometric measures and menstrual cycle regularity about most of obese of the study group had irregular menstrual cycles before intervention. Compared to most and almost all of the study group overweight and normal weight the study group had regular cycles after intervention. These findings came in agreement with **Marzouk et al., (2015**) [47]. They showed that menstrual regularity was recorded with weight reduction. This may be justified as obesity is associated with much comorbidity and obese women frequently suffer from reproductive disorders, including menstrual irregularity. Lifestyle interventions significantly reduce weight (kg) and body mass index (BMI) improve secondary reproductive outcomes like the free androgen index (FAI), testosterone (T), sex hormone-binding globulin (SHBG), which improves menstrual regularity. In contrast, **Neubronner et al., (2021),** a study on healthy women between the ages of 21 and 45 who were selected from participants in an annual health screen at Singapore's National University Hospital (NUH) found that women with normal or high BMIs were equally at risk for oligomenorrhea.

7. Conclusion

Based on the findings of the present study, it can be concluded that there were improvement in menstrual cycle irregularities, BMI, waist circumference, Symptoms suggesting hyper-androgenic and improvements in fertility and ovulation after six months of the lifestyle modification intervention. This supported the research hypotheses; therefore, the findings of the current study fail to accept the null hypothesis.

8. Recommendations

- Lifestyle modifications in the form of diet and exercise should be placed as the first-line treatment for PCOS symptoms able to address clinical and metabolic characteristics.
- As an initial therapy for PCOS management, primary care clinicians should actively support lifestyle modification program as a way to improve the disease's clinical characteristics and avoid or treat metabolic problems.
- Increase awareness about effect and important of lifestyle modification among women.
- Design and disseminate brochures work on the health effect and important of lifestyle modification among women in health centers and hospitals.

Conflicts Of Interest Disclosure

The authors declare that there is no conflict of interest.

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