https://menj.journals.ekb.eg
Print ISSN: 2735-3974
Online ISSN: 2735-3982
DOI:10.21608/menj.2025.447639

MNJ
Menoufia Nursing Journal
Faculty of Nursing
Menoufia University

Effect of Lifestyle Modifications on Fertility and Menstrual Regularity among Infertile Obese Women with Polycystic Ovarian Syndrome

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Abstract: Background: Infertility was the main symptom first linked to PCOS. Later, epidemiological data revealed that PCOS is the most common cause of ovulatory problems and that oligo anovulation is linked to an increased risk of infertility. Purpose was to assess the Effect of Lifestyle Modifications on fertility and Menstrual Irregularity among Infertile Obese Women with Polycystic Ovarian Syndrome. **Design**: A quasi-experimental (study and control groups) design was utilized. Sample: A purposive sample of 115 women with infertility, overweight and obese with polycystic ovary syndrome. Settings: The study was conducted at gynecological and infertility outpatient clinics and inpatients at Beni-Suef University Hospital. Specialized medical center for infertility. **Instruments**: a structured interview questionnaire, Lifestyle and habits characteristics, the Block Adult Physical Activity (PA) Screener and Follow-up card. **Results**: The present study revealed that there were improvement in menstrual cycle irregularities, fertility and ovulation after six months of the lifestyle modification intervention. **Conclusion**: 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. **Recommendations:** A study can be conducted to assess obstacles that affect adherence to lifestyle change program on overweight/ obese women.

Keywords: *infertility, life style modification, obesity, polycystic ovary syndrome (PCOS).*

Introduction

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 (Hajivandi et al., 2020).

The prevalence of PCOS is estimated to be between 12 and 21% of females of reproductive age worldwide. According to Motlagh et al. (2022), there was a 1.45% increase in the age-standardized incidence rate of PCOS among women of reproductive age in 2017 to 82.44 per 100,000 inhabitants. Women with PCOS can have up to 70% of diagnoses go undetected (McEwen et al., 2018).

Obesity is one of the most common concerns among patients with PCOS. In addition, there is a high correlation between obesity and the prevalence of PCOS. The prevalence of PCOS is 4.3% among women with a body mass index (BMI) less than or equal to 25 kg/m2 and 14% among women with a BMI above 30 kg/m2 (Kim, & Lee, 2022). Moreover, it has been reported that the risk of obesity is four times higher among patients with PCOS than among healthy controls (Cochrane, et al., 2021).

Almost 50% of women with polycystic ovary syndrome (PCOS) are obese. Through many processes, obesity in PCOS impacts fertility. A key role is played by hyperandrogenism, elevated luteinizing hormone (LH), and insulin resistance. Leptin, adiponectin, resistin, and visfatin are a few molecules made by adipose tissue that may be involved in the pathophysiology of PCOS. Anovulation is connected to infertility in PCOS (Mizgier et al., 2020).

Polycystic ovary syndrome can lead to several serious implications. Elevated levels of estrogen raise the risk of endometrial hyperplasia and ultimately endometrial cancer. As a result of often raised androgen levels, the risk of metabolic syndrome and hirsutism is increased. It's possible to have hyperinsulinemia from insulin resistance, which can lead to more androgens being produced by the ovaries. Long-term androgen overproduction raises the risk of cardiovascular diseases, such as hypertension (Sidra, et al., 2019).

First-line treatment for PCOS involves Lifestyle modifications (including diet, exercise, sleep, and so on). Are regarded to play roles in the development of PCOS by regulating insulin sensitivity and keeping the weight balanced as well as governing normal androgen production. It was reported that lifestyle changes also appear to influence the restoration of ovulation and regular menstrual cycles and increased the pregnancy rates in overweight or obese anovulatory patients with PCOS (Gu, et al., 2022).

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 (Wright, et al., 2020).

Significance of the study

The rising rates of obesity among Egyptians are largely attributed to their way of life, which includes unhealthy

eating habits like consuming widely available junk food and fast food as well as rising sedentary lifestyles, as evidenced by reports that 63% of Egyptians aged 20 or older lead sedentary lifestyles (Abd Elmenim, et al., 2016).

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 (Afefy, et al., 2019). 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 (Mani, et al., 2018).

Purpose of the Study

To evaluate the effect of lifestyle modifications on fertility and menstrual irregularity among infertile obese women with polycystic ovarian syndrome.

Research Hypothesis

Obese and overweight women with polycystic ovarian syndrome who will receive lifestyle modification interventions are expected to experience a reduction in menstrual irregularity (as measured by frequency and duration of menstrual cycle) and lead to improved fertility and ovulation function after the intervention program than those who do not receive it.

Operational definitions of study variables

- **Lifestyle Modification Interventions** is theoretically defined as behavioral interventions that attempt to create change in multiple lifestyle health behaviors (Carlson, 2020). While in this study, it means providing instruction in behavioral principles and techniques that are designed to modify dietary intake and physical activity. It was assessed through data on lifestyle and daily habits (food and drinks questionnaire) and weekly physical activity (self-assessment questionnaire).
- **Polycystic ovary syndrome** are theoretically defined as a the most common endocrine disorder among women of reproductive age and is hallmarked by hyperandrogenism, oligo-ovulation, and polycystic ovarian morphology. In this study it refers to the polycystic ovary syndrome (PCOS) is a condition in which the ovaries produce an abnormal amount of androgens, male sex hormones that are usually present in women in small amounts. Features of hyperandrogenism it was assessed through Ludwig scale, Global Acne Grading System (GAGS), and Modified Ferriman-Gallwey (mFG).

Infertility

Theoretically defined as a Incapacity to achieve pregnancy after a reasonable period of sexual intercourse without contraception.

Research Design:

A quasi –experimental design (study and control groups) was used to carry out the present study.

Settings:

The study was conducted at gynecological and infertility outpatient clinics and inpatients at Beni-Suef University Hospital. Specialized medical center for the treatment of infertility and delayed childbearing affiliated with Beni-Suef University Hospital.

Sample type and size:

A purposive sample of 116 women with infertility, overweight and obese with polycystic ovary syndrome. The study group consisted of 58 patients who received lifestyle modification intervention, while the 58 patients in the control group received only routine care.

Instruments:

Data was collected using instruments, which are developed by the researcher and revised by qualified experts, then tested for validity and reliability.

Instrument one: (Arabic Structured interviewing questionnaire). Adapted from (Mostafa et al., 2012).

The instrument consisted of four parts that were revised by three professors at the Maternal and Newborn Health Department and then tested for validity and reliability.

- **Part 1**. Basic data (nine questions): Telephone number, Age, Residence, marital status, employment, Length in centimeters, Weight in kilograms, Waist circumference, and Thigh circumference
- **Part 2**: This part is concerned with women's menstrual, and reproductive/ gynecological history.
- **Part 3**: Included questions about Disease History (20questions): included questions related to the age was the diagnosis of PCO made , the time of onset of symptoms, the treatment line followed by your doctor, symptoms experiencing among PCOS.

Instrument two: Lifestyle and habits characteristics:

- **Part 1** Data about Nutrition Habits (10 questions): It includes data about food and soft drinks.

Scoring system for each item:

The responses of the women were measured on five points, ranging from (0=daily, 1=4-5 per week, 2= 2-3 times a week, 3=once, and 4=rarely). The total score was adopted from (Shahar, et al., 2003)

Total scores:

- 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).
- **Part 2** the Block Adult Physical Activity (PA) Screener was the predictor for physical activity. This instrument assessed the frequency and duration of job-related, daily life, and leisure activities. The responses of the women towards the nine items were measured on five points, ranging from 1 to 5, and the total score was adopted from (Sternfeld et al., 2009). And

assessed by summation of sub-scores as follows:

- 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).

Follow-up card:

Arabic card was constructed by the researcher to assess the outcome measures.

All participants included assessment of the following:

1) Anthropometric measures (Body mass index, Waist circumference)

a) Body mass index = weight in kg /height^2 (in meter)

BMI categories:

- Underweight: < 18.5 kg/m^2
- Normal: 18.5- 24.9 kg/m^2
- Overweight: 25 -29.9 kg/m^2
- Obese: 30- 39.9 kg/m

b) Waist circumference: Start measuring with a tape measure at the level of the umbilicus at the top of the hipbone, and then wrap it around the body without being too loose or too tight (Zeng et al., 2022)

Waist circumference categories:

- Normal (≤ 88 cm).
- Increased (> 88 cm).

2) Signs of hyperandrogenism

- Hirsutism
- Acne
- Androgenic alopecia

Supportive material (Arabic Booklet):

It was designed by the researcher based on a literature review. It was designed in the form of a handout (booklet) using simple Arabic language and different illustrative pictures to facilitate understanding its content. It contained information about polycystic ovary syndrome. Part I e.g. (Definition of polycystic ovary syndrome, signs, symptoms, risk factors, diagnosis, and medical treatment. Part II: lifestyle modification interventions (such as; exercise and diet).

Validity and Reliability:

The face validity of the study instruments was assessed by a jury group consisting of three experts in the obstetrics and gynecological nursing department of the Faculty of Nursing, Menoufia University for comprehensiveness, accuracy, and clarity in language.

Reliability

Cronbach's α scores ranging from 0.80 to 0.95 for instruments one and two.

Ethical consideration:

Approval of the Faculty of Nursing Ethical and Research Committee, Menoufia University was obtained A written consent was obtained from all participants who met the inclusion criteria to participate in the study. Confidentiality and anonymity of nurses was assured through coding all data and all informations obtained would only be used for the purpose of th study. All participants were informed

about the purpose, procedure and benefits of the study. They were informed that participation in the study was voluntary and they can withdraw from the study at any time without penalty. Moreover, they were assured that the nature of instruments would not cause any physical or emotional harm to them.

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. All pregnant women who participated in the pilot study were excluded from the study participants because the researcher rephrased some questions and sentences and then set the final fieldwork schedule.

Procedure:

An official letter was submitted from the Dean of the Faculty of Nursing, Menoufia University to the director of medical center for the treatment of infertility including the purpose of the study and methods of data collection. Data collection of the study was started at the beginning of October 2023 and completed by the end of March 2024 (6 months).

Preparatory phase:

Data was collected about PCO and life style of infertile and obese women.

Planning phase:

Based on the analysis of the data obtained from the assessment phase, and review of the66 related literature a life style educational intervention was planned

Implementation phase (for the study group only):

The lifestyle modification intervention was implemented in the training halls in the study settings. The researcher started to explain the lifestyle modification intervention for the women was used for comparison between two groups having qualitative variables.

The level of significance was set at a

- A P value of > 0.05 was considered statistically non-significant.
- A P value of ≤ 0.05 was considered statistically significant.
- A P value of ≤ 0.001 was considered highly statistically significant.

Results

Table 1 shows characteristics of the studied infertile, overweight, and obese women with polycystic ovary syndrome. It revealed that there were no statistically significant differences between the study and control groups regarding their socio-demographic data in terms age, level of education, residence, marital status, employment (p value > 0.05).

Table (2) shows menstrual characteristic and history in the studied infertile overweight and obese women with polycystic ovary syndrome. It revealed that there were highly statistically significant differences

between the study and control groups regarding duration of the menstrual cycle, regularity of the cycle and frequency of cycle after the intervention (p value > 0.001). Meanwhile, there were no statistically significant differences between the study and control groups before the treatment (p value > 0.05).

Table (3) 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 there were highly statistically significant differences between anthropometric measures and menstrual cycle regularity between the study groups after the intervention (p value ≤ 0.001). Meanwhile, there were no statistically significant differences between the study groups before the intervention (p value > 0.05).

Figure 1 shows pregnancy rate levels among the study group of infertile, overweight, and obese women with polycystic ovary syndrome. It reveals that 100% of the study and control had negative pregnancy tests before intervention. Compared to 36.2%, 12% of the study and control had positive pregnancy tests after intervention.

Table 4 showed that there was a significant association between menstrual regularity and lifestyle habits in the study group of infertile overweight and obese women with polycystic ovary syndrome (n = 58). It revealed that there were highly statistically significant differences between the study and control groups after the intervention (p value < 0.001). Also revealed that there were statistically significant differences between the study and control groups after the intervention regarding menstrual regularity (p value < 0.05). Furthermore, it was revealed that there were no statistically significant differences between the study and control groups before the intervention (p value > 0.05).

Table 5 showed that there was a significant association between the ovulatory function and physical activity level in the study group of infertile overweight and obese women with polycystic ovary syndrome (n = 58). It revealed that there were statistically significant differences between the study and control groups after the intervention regarding duration and menstrual regularity (p-value < 0.05). Meanwhile, there were highly statistically significant differences between the study and control groups after the intervention regarding the frequency of menstruation (p-value < 0.001). It also revealed that there were no statistically significant differences between the study and control groups before the intervention (p-value > 0.05).

Table 6 showed that there was a significant association between the obstetric history and lifestyle dietary habits in the study group of infertile, overweight, and obese women with polycystic ovary syndrome (n = 58). It revealed that there were highly statistically significant differences between the study and control groups after the intervention (p-value < 0.001). It also revealed that there were no statistically significant differences

between the study and control groups before the intervention (p-value > 0.05). This means that when the number of pregnancies decreases and increases, the period of marriage and the period of infertility and compliance with diets and good lifestyle dietary habits increase.

Table 1: Characteristics of the Studied Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (n = 116)

Variables	Study n=58		Control n=58		χ2	χ2 P –value
	No.	%	No.	%		
Age (years)						
18-24	4	6.9%	6	10.3%	0.09ns	> 0.05
25-30	31	53.4%	28	48.3%		
31-35	23	39.7%	19	32.7%		
≥36	0	0.00	5	8.7%		
Mean±SD	28.7±2.87		28.8±3.00			
Level of education						
Primary education	9	15.5%	13	22.4%	2.05ns	> 0.05
Secondary education	17	29.3%	18	31%		
Higher education	32	55.2%	27	46.6%		
Residence						
Urban	32	55.2%	31	53.4%	0.03ns	> 0.05
Rural	26	44.8%	27	46.6%		
Marital status						a
Married	58	100.0%	58	100.0%		a
Employment						
Employed	28	48.3%	26	44.8%	0.13ns	> 0.05
Unemployed	30	51.7%	32	55.2%		

Table (2): Menstrual History and Characteristic In The Studied Infertile Overweight And Obese Women With Polycystic Ovary Syndrome (N = 116)

Variables	Before the intervention				$\chi 2$ P –value	After the intervention				χ^2 P –value
	Study n=58		Control n=58			Study n=58		Control n=58		
	No	%	No	%		No	%	No	%	
Age at menarche										
<15	45	77.6%	33	56.8%	0.04 > 0.05 ns	45	77.6%	33	56.8%	0.04 > 0.05 ns
>15	13	22.4%	25	43.2%		13	22.4%	25	43.2%	
Mean±SD	12.16 ± 1.27		13.15 ± 1.21			12.16 ± 1.27		13.15 ± 1.21		
Duration of the menstrual cycle										
Less than 3	16	27.6%	17	29.3%	0.09 > 0.05 ns	8	13.8%	20	34.5%	15.09 ≤ 0.001**
3-5 days	34	58.6%	34	58.6%		50	86.2%	32	55.2%	
5-7 days	8	13.8%	7	12.1%		-	0.0%	6	10.3%	
Mean±SD	4.2±1.2		4.1± 1.33			3.5±1.2		4.1± 1.33		
Regularity of the cycle										
Regular	11	18.9%	13	22.4%	5.32 < 0.05*	40	69.0%	19	32.8%	15.21≤ 0.001**
Irregular	47	81.1%	45	77.6%		18	31.0%	39	67.2%	
How long was your average menstrual cycle (the time from the first day of the cycle to the first day of the next cycle (Select only one)										
21-34 days	1	1.7%	0	0.0%	2.95 > 0.05 ns	24	41.4%	0	0.0%	32.01 ≤ 0.001**
35-90 days	30	51.7%	23	39.7%		22	37.9%	29	50.0%	
More than 90 days	27	46.6%	35	60.3%		12	20.7%	29	50.0%	
Mean±SD	68.6±3.2		67.5±4.3			41.2±3.1		63.5±3.4		

Table 3: Relationship between Anthropometric Measures and Menstrual Cycle Regularity among the Study Group Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N=58)

Variables	Before intervention					χ^2 P – value	After intervention					χ^2 P –value
	Regular cycle N= 11		Irregular cycle N=47		Total		Regular cycle N=40		Irregular cycle N=18		Total	
	No	%	No	%			No	%	No	%		
BMI												
BMI 18.5-24.9: normal weight	0	0.00			0	5.32* < 0.05	3	100%	0	0.00	3	27.80 ≤ 0.001**
BMI ≥25: overweight	9	52.9%	8	47.1%	17		33	94.3%	2	5.7%	35	
BMI ≥30: Obesity	2	4.9%	39	95.1%	41		4	20%	16	80%	20	
Waist circumference												
≤88	8	61.5%	5	38.5%	13	0.09ns > 0.05	25	80.6%	6	19.4%	31	23.10≤ 0.001**
≥88	3	6.7%	42	93.3%	45		15	55.5%	12	44.5%	27	

Figure 1: Pregnancy Rate Levels Among the Study Group of Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N = 58)

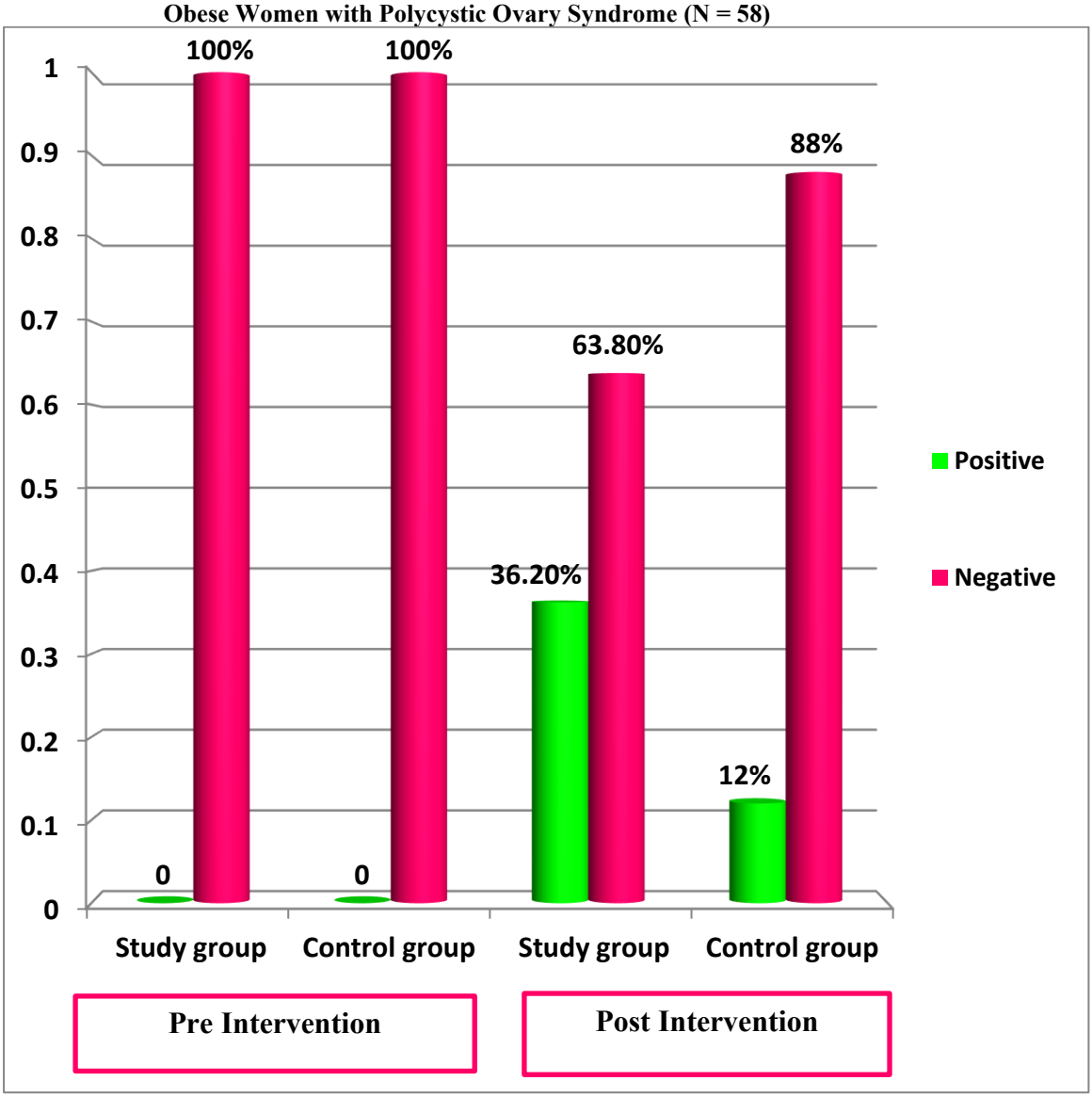

Table 4: Relationship between Menstrual Regularity and Lifestyle Habits In the Study Group of Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N = 58)

Variables	Before the intervention				χ^2 P –value	Total	After the intervention				χ^2 P –value	Total
	Poor habits N=42		Good habits N=16				Poor habits N=17		Good habits N= 41			
	No.	%	No	%			No.	%	No.	%		
Duration of the menstrual cycle												
Less than 3	14	87.5%	2	12.5%	3.06 ns > 0.05	16	6	75%	2	25%	27.80 ≤ 0.001**	8
3-5 days	22	64.7%	12	35.3%		34	11	22%	39	78%		50
5-7 days	6	75%	2	25%		8	0	0.0%	0	0.00		0
Regularity of the cycle												
Regular	3	27.3%	8	72.7%	0.24 ns > 0.05	11	9	53%	31	75.6%	15.105 * < 0.05	40
Irregular	39	83%	8	17%		47	8	47%	10	24.4%		18
How long was your average menstrual cycle (the time from the first day of the cycle to the first day of the next cycle (Select only one)												
21-34 days	0	0.0%	1	100%	2.000 ns > 0.05	1	4	16.4%	20	83.3%	88.12** ≤ 0.001	24
35-90 days	20	66.6%	10	33.4%		30	6	27.3%	16	72.7%		22
More than 90 days	21	77.7%	6	22.3%		27	7	58.3%	5	41.7%		12

Table 5 Relationship between Menstrual Regularity and Physical Activity Level among the Study Group of Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N = 58)

Variables	Before the intervention						Total	χ2 P – value	After the intervention						Total	χ2 P – value
	Mild activity (sedentary lifestyle N=47		Moderate Activity N=11		Severe activity N=0				Mild activity (sedentary lifestyle N=15		Moderate Activity N=36		Severe activity N=7			
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Duration of the menstrual cycle																
Less than 3	14	87.5 %	2	12.5%	0	0.00	16	0.00ns > 0.05	5	62.5%	2	25%	1	12.5%	8	8.02* <0.05
3-5 days	28	82.3%	6	17.7 %	0	0.00	34		10	20%	34	68 %	6	12%	50	
5-7 days	5	62.5%	3	37.5%	0	0.00	8		0	0.0%	0	0.0%	0	0.00	0	
Regularity of the cycle								3.694 >0.05ns								
Regular	3	27.3%	8	72.7%	0	0.00	11		2	5%	32	80%	6	15%	40	0.390 <0.05*
Irregular	44	93.6%	3	6.4%	0	0.00	47		13	72.2%	4	22.2%	1	5.6%	18	
How long was your average menstrual cycle (the time from the first day of the cycle to the first day of the next cycle (Select only one)																
21-34 days	0	0.0%	1	100%	0	0.00	1	3.685 >0.05ns	0	0.00	20	83.3%	4	16.7%	24	42.960 <0.001 **
35-90 days	20	66.6%	10	33.4%	0	0.00	30		5	22.7%	14	63.6%	3	13.7%	22	
More than 90 days	21	77.7%	6	22.3%	0	0.00	27		10	83.3%	2	16.7%	0	0.00	12	

Table 6: Relationship between Obstetric History and Lifestyle Dietary Habits in the Study Group of Infertile Overweight and Obese Women with Polycystic Ovary Syndrome (N = 58)

Variables	Before Intervention					After Intervention					Total
	Poor habits N=42		Good habits N=16		$\chi 2$ P –value	Poor habits N=17		Good habits N= 41		χ^2 P –value	
	No.	%	No.	%		No.	%	No.	%		
Age at marriage (years)											
<20yrs	7	58.3	5	41.7	7.09ns >0.05	4	33.3	8	66.7	44.04** <0.001	12
21-25yrs	32	78	9	22		12	29.3	29	70.7		41
>25yrs	3	60	2	40		1	20	4	80		5
Duration of marriage											
1-3yrs	10	71.4	4	28.6	3.90ns >0.05	8	57.1	6	42.9	45.87** <0.001	14
4-6yrs	28	73.7	10	26.3		8	21	30	79		38
>6	4	66.7	2	33.3		1	16.7	5	83.3		6
Period of infertility											
1-3 yrs.	29	87.9	4	12.1	3.20ns >0.05	8	24.2	25	75.8	65.35** <0.001	33
4-6yrs	10	50	10	50		8	40	12	60		20
>6yrs	3	60	2	40		1	20	4	80		5
Number of pregnancies											
No pregnancy	12	80	3	20	1.99ns >0.05	2	13.3	13	86.7	70.97**< 0.001	15
1-2	24	66.7	12	33.3		9	25	27	75		36
3-4	6	85.7	1	14.2		6	85.7	1	14.2		7
Number of abortions											
No abortion	25	69.4%	11	30.6 %	2.46ns >0.05	9	25	27	75	53.27** <0.001	36
1-2	16	80	4	20		7	35	13	65		20
>2	1	50	1	50%		1	50	1	50		2
Number of births											
Nullipara	20	80%	5	20%	12.76ns >0.05	7	28	18	72	45.56** <0.001	25
1-2	20	66.7%	10	33.3%		7	23.3	23	76.7		30
>2	2	66.7%	1	33.3%		3	100	0	0.00		3

Discussion

The findings of the current study revealed that the mean age in the study and control groups was twenty-eight years, respectively. This finding might be because the incidence of PCOS increases among women at reproductive age. This finding came in agreement with Amirjani et al. (2019), who studied the "dietary intake and lifestyle behavior in different phenotypes of polycystic ovarian syndrome", in Iran. From the researcher's point of view, these results may be justified that PCOS is a very common endocrine disorder among women of reproductive age.

Regarding weight and BMI, The findings of the current study revealed that the mean weight in the study and control groups was eighty-five before the intervention, compared to seventy-six and eighty-five after the intervention, respectively. However, the mean BMI in the study and control groups was thirty-two before the intervention, compared to twenty-nine and thirty-two after the intervention, respectively. This finding might be because the prevalence of overweight and obesity in women is as high as 80%.

These findings came in agreement with Lass et al. (2011), who studied the "Effect of lifestyle intervention on features of the polycystic ovarian syndrome". They revealed that the mean BMI in the study and control groups was above thirty-two before the intervention, compared to twenty-eight in the study group after the intervention.

Also, in line with the present findings, these results agreed with Haqq et al. (2014), who pointed to the positive effects of lifestyle modification interventions on the reduction of weight in patients with obesity and PCO.

From the researcher's point of view, many studies have pointed to the positive effects of lifestyle modification interventions on the reduction of weight in patients with obesity and PCO. And more than half of the study group is young, aged twenty-five to thirty years.

The findings of the current study revealed that the mean waist circumference in the study and control groups was eighty-six and eighty-eight before the intervention, compared to eighty-five and eighty-eight after the intervention, respectively. Additionally, the mean thigh circumference in the study and control groups was one hundred and ten before the intervention, compared to one hundred seven and one hundred ten after the intervention, respectively. This may be rationalized by confirming that lifestyle interventions have been shown to have positive effects on improved body sculpture.

These findings came in agreement with Öberg (2022 who studied "Effects of Lifestyle Intervention in Overweight Women with Polycystic Ovary Syndrome" in Sweden. His study revealed that there was a significant reduction in waist circumference before and after intervention in the study group.

On the contrary, these findings were inconsistent with Serrao (2013) in Saskatoon, who revealed that lifestyle interventions did not affect waist circumference. From the researcher's point of view, this incongruence between the current and previous studies may be related to the patient's residence in a rural area and not having adequate access to

adherence to sports and adequate exercise.

The current study findings revealed that 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. According to the researcher's point of view, 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.

These findings came in agreement with Marzouk et al. (2015), who studied the "Effect of dietary weight loss on menstrual regularity in obese young adult women with polycystic ovary syndrome" in Mansoura, Egypt.

Moreover, there was a significant relationship between menstrual dysfunction and WC. Most of the study group had irregular menstrual cycles and a waist circumference of ≥88 before intervention compared to the majority of the study group, who had regular menstrual cycles of ≤88 and a waist circumference after intervention. According to the researcher, this may be justified as menstrual disorders.

These findings are similar to the study done by Taheri et al. (2020), who studied "Nutritional status and anthropometric indices were concerning menstrual disorders," which showed that there was a significant statistic between menstrual irregularity and WC.

Regarding pregnancy rate, the current study findings revealed that there were significant improvements in fertility and ovulation after the lifestyle modification intervention; more than one-third of the study had positive pregnancy tests after the intervention. Compared to one-tenth in the control group.

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" in Australia.

The agreement between the current and previous studies from the researcher's point of view reflects the efficiency of the lifestyle interventions resulting in modest weight loss (2-5% total body weight) to improve ovulation and menstrual regularity. Losing >5% of weight is also associated with being able to conceive,

On the contrary, these findings were inconsistent with Hamadi (2018), who studied "Public Health Nutrition Intervention to Enhance Healthy Eating and Lifestyle Modification among Lebanese women with polycystic ovarian syndrome"

From the researchers' point of view, these differences might be because of the different population cultures and lifestyles between Egyptian and Lebanese women.

The current study findings revealed that there was a significant association between menstrual regularity and physical activity level in the study group of infertile overweight and obese women with polycystic ovary syndrome. The

majority of the sedentary lifestyle of the study group women had menstrual irregularities problems such as (hypo-menorrhea), irregular cycles, and a long average menstrual cycle is more than 90 days (oligo-amenorrhea) before intervention. Compared to most moderate physical activity had improvement in the menstrual cycle as a normal duration of the menstrual cycle three to four days, regular cycle, and long average of the menstrual cycle is twenty one to thirty four days after intervention.

These results came in agreement with Abdolahian et al. (2020) and Amiri et al. (2016), who studied the "Effect of interventions based on lifestyle modification on clinical, hormonal, and metabolic findings in the patients with polycystic ovary syndrome " .

But it was not similar to the meta-analysis of 14 studies involving 617 adult women achieved by Benham et al. (2018), who studied "The role of exercise training in polycystic ovary syndrome" in the United States and found out the impact of exercise interventions on reproductive function remained unclear. According to the researcher's point of view, this disagreement could be due to differences in the type and duration of interventions and populations studied.

Regarding the relation between obstetric history and lifestyle habits in the study group of infertile, overweight, and obese women with polycystic ovary syndrome. About the majority of poor nutrition habits of the study group women are twenty-one to twenty-five. Age at marriage: four to six years; duration of marriage: one to three years; period of infertility: three to four; number of pregnancies: one to two; number of abortions: nulliparous before intervention. Compared to most of the good habits, it is more than twenty-five years of age at marriage, more than six years of duration of marriage, more than six years of period of infertility, no pregnancy, and no abortion. Meanwhile, 100% of the poor nutrition habits of the study group women had more than one child after intervention.

This finding may be related to the educational level that can highly affect a patient's adherence to diet. A motherhood dream that increases women's motivation for losing weight and restoring fertility to achieve pregnancy.

These results came in accordance with Olmedo-Requena et al. (2014), who studied the "Factors associated with a low adherence to a Mediterranean diet pattern in healthy Spanish women before pregnancy" in Spain.

According to the researcher's point of view, this agreement between the current and previous studies can be linked to the fact that more than half of the participants are highly educated and urban residents.

Conclusion

Based on the findings of the present study, it can be concluded that there were improvement in menstrual cycle irregularities, 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.

Recommendations

Based on the findings of the present study, the following recommendations can be suggested:

- A study can be conducted to assess obstacles that affect adherence to lifestyle change program on overweight/ obese women.
- Assessment tools should be developed to measure the effect of exercise on the quality of life of women with PCOS.

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