

Effect of Lifestyle Modifications on Reproductive Function among Infertile Obese Women with Polycystic Ovarian Syndrome

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Abstract

Polycystic ovary syndrome (PCOS) is a common endocrine disorder that is characterized by menstrual irregularity and elevated serum androgens and is often accompanied by obesity and infertility. **Aim:** the study aimed to evaluate the effect of lifestyle modifications on reproductive function among infertile obese women with polycystic ovarian syndrome. **Setting:** the study was conducted at the outpatient gynecology and obstetrics clinic at Ain Shams University Maternity Hospital. **Subjects and methods:** A quasi-experimental design of one group "pre/post-test" was utilized to achieve the aim of the current study. Sample: A purposive sample included 60 infertile overweight or obese women diagnosed with PCOS. Four tools were utilized to collect data; collect data; 1) Structured interviewing questionnaire, 2) Menstrual feature assessment, 3) Reproductive hormonal assay report, and 4) Follow-up assessment tool **Results:** Based on a comparison between pretest and posttest related to reproductive function and BMI, data revealed that there was improvement in the menstrual disorders with statistically significant differences in menstrual irregularity, bleeding with menstruation, amenorrhea and oligomenorrhea ($P=0.004$; $P=0.001$; $P=0.011$; $P=0.05$). Hormonal assessment pre/post-test indicated statistically significant differences regarding LH, FSH, and LH/FSH ratio ($P=0.053$; $P=0.007$; $P=0.02$), with no statistically significant differences about total testosterone and estrone ($P=0.261$; $P=0.801$). Concerning pre/post-test weight and BMI, there were highly statistically significant differences regarding weight and BMI ($p=0.001$; $p=0.001$). **Conclusion:** weight loss through lifestyle modifications has a positive effect on reproductive function regarding menstrual regularity and hormonal results. **Recommendation:** Adopting a healthy lifestyle and weight loss have a significant role in the improvement of reproductive function among obese infertile women with PCOS.

Keyword: Infertility, Lifestyle Modifications, Reproductive Function, Obesity

Introduction

Polycystic ovarian syndrome (PCOS) is a common endocrine and metabolic condition affecting approximately 6-20% of females during reproductive age. The Rotterdam criteria is the most often used diagnostic standard which includes two of the last three symptoms (oligo- or an-ovulation, polycystic ovaries, and hyperandrogenism). Associated symptoms with PCOS include hirsutism, acne, infertility, obesity, insulin resistance, dyslipidemia, cardiovascular disease, abdominal obesity, and psychological issues (Siddiqui, Mateen, Ahmad, & Moin, 2022).

Obesity and overweight are on the rise globally, and they have detrimental effects on reproductive health. Obese women are more likely to have abnormalities of the hypothalamic-pituitary-ovarian axis, which may lead to irregular menstruation, anovulation, and infertility.

(Silvestris, de Pergola, Rosania, & Loverro, 2018). PCOS is a highly common endocrine disorder that affects 8% to 13% of women during the childbearing period and obesity exacerbates all of the clinical symptoms of PCOS (Lim, et al., 2019). Hirsutism, irregular menses, persistent anovulation, and infertility are all common clinical characteristics of PCOS (Ibrahim, Elsayed, Reyad; Azzam, 2017 & Palomba, Daolio, & La Sala, 2017).

The prevalence of PCOS is variable due to the lack of a universal definition and it depends on the diagnostic criteria used. World Health Organization 2020 estimated that PCOS affects 116 million women (3.4%) worldwide (Zeng et al., 2022). According to a recent systematic review, the mean prevalence of PCOS was 21.27 % based on various diagnostic criteria among 27 surveys included in the review (Deswal, Narwal, Dang, & Pundir, 2020). The prevalence

of PCOS among 719 studied women in Saudi Arabia was 32.5%, with 54.9% of them had menstrual irregularities detected (**Alraddadi, et al., 2018**). As well as, among Kashmiri women, the prevalence of PCOS was 34.3% according to AE-PCOS criteria, and 28.9% according to NIH standards (**Ganie, et al., 2020**).

Obesity and weight gain are common findings in PCOS, these aggravate the syndrome's clinical features of insulin resistance, hyperandrogenism, and reproductive dysfunctions including oligomenorrhea and infertility (**Barber & Franks, 2021**). There was a highly significant correlation between the prevalence of PCOS and high BMI (**Sanad, 2014**).

Lifestyle modifications including a healthy diet and adopting regular exercise are the first line of treatment for weight loss and also for the improvement of insulin sensitivity, decreasing incidence of metabolic syndrome and type 2 diabetes. Moreover, weight loss has fertility benefits by restoring ovulatory cycles and other symptoms of PCOS; hirsutism, hyperandrogenism, anovulation, and menstrual irregularity can be resolved completely (**Ionescu, Popescu, Banacu, & Dimitriu, 2018**).

Obese women with PCOS can improve their health and lipoprotein profile by losing weight through aerobic activity (**Abazar, Taghian, Mardanian, & Forozandeh, 2015**). **Hakimi & Cameron, (2017)** reported that adopting regular exercise led to a reduction in insulin and free androgen levels in overweight and obese women (with or without PCOS), allowing ovulation to resume and be regulated. As well as, **Ibrahim, Elsayed, Reyad, & Azzam, (2018)** in their study concluded that the diet and exercise instructional program improved the participants' awareness and reduced the clinical features of PCOS.

Significance of study

Women with PCOS have a high risk of developing insulin resistance, type 2 diabetes mellitus (T2DM), and infertility. Clinically, hyperandrogenism in women presents as hirsutism, acne, androgenic alopecia, and/or increased amounts of testosterone. **Rasool, et al., (2019)**. Furthermore, a study conducted in Egypt by **Sanad, (2014)**, reported that the prevalence of PCOS was 27.4 percent among (1450) women, with 14 percent in (620) fertile women and 37.5

percent in (830) infertile women having PCOS. Ovulatory dysfunction, hirsutism, and PCO were seen in 73.3%, 60.4, and 79.4% respectively of infertile women with PCOS.

Previous research has demonstrated the benefits of lifestyle modifications for PCOS-affected women. However, further research is required to determine the impact of these modalities among Egyptian infertile obese women with PCOS. Therefore, the current study aimed to assess the impact of Lifestyle modifications on reproductive function among infertile obese women with polycystic ovarian syndrome.

Operational definition

Reproductive function: Assessment of menstrual regularities and hormonal assay (such as serum testosterone, follicular stimulating hormone (FSH), luteinizing hormone (LH), and estrone).

Lifestyle modifications: This research includes a first-line treatment of obese infertile women with PCOS and its accompanying moderate weight loss and is also expected to improve the metabolic index and the ovulatory function through using a combination of dietary interventions to reduce caloric intake and regular exercise.

Aim of the study

The study aims to evaluate the effect of lifestyle modifications on reproductive function among infertile obese women with polycystic ovarian syndrome.

Hypothesis

Lifestyle modifications has a positive effect on reproductive function in term of menstrual regularity and hormonal assay among infertile obese women with polycystic ovarian syndrome.

Subjects and Methods

Study design

A quasi-experimental design of one group "pre/post-test" was utilized to achieve the aim of the current study.

Study setting

The study will be conducted in Gynecology and obstetrics outpatient clinics at Ain Shams University Hospitals.

Sample

A non-probable purposive sampling of 60 women was recruited from the Gynecology and obstetrics outpatient clinics at Ain Shams University Hospitals during 6 months for recruitment, according to the following inclusion criteria: women diagnosed with PCOS using Rotterdam (2003) criteria, at childbearing period, able to read and write in Arabic, infertile woman (primary or secondary), overweight or obese (BMI: $\geq 25\text{-kg/m}^2$), on Metformin regimen only and willing to participate in the study. Rotterdam's (2003) criteria include at least two of the following parameters: a) oligo- and/or anovulation; b) clinical and/or biochemical hyperandrogenism; and c) polycystic ovaries by ultrasound with the exclusion of other etiologies. Women who received hormonal therapy or ovulation induction, chronic disease as an endocrine disorder, cardiac disease, and psychiatric illness, as well as pregnancy that occurred during the implementation of the intervention, were excluded from the study.

Tools of data collection

Four tools were utilized to collect data for the current study and were developed by the researcher after extensive literature reading. (Kim, & Lee, 2022; Dos Santos, et al., 2020 & Shele, Genkil, & Speelman, (2020).

- 1-Structured Interviewing Questionnaire.** It was developed by the researcher and includes two parts: The first part: Includes data related to socio-demographic characteristics such as age, residence, educational level, and occupation. Second part: It includes data related to obstetric profile and infertility type.
- 2- Menstrual features assessment:** This tool was adopted from (Ibrahim, Elsayed, Reyad, and Azzam, 2018), and included data related to a) menstrual history such as oligomenorrhea (interval more than 35 days), amenorrhea (no menstruation more than 6 months), irregular bleeding that starts and stops intermittently.
- 3- Hormonal essay report:** Which includes the biochemical parameters; serum testosterone, follicular stimulating hormone (FSH), luteinizing hormone (LH), and estrone.
- 4- Follow-up Assessment Tool.** This tool included lifestyle follow-up for diet and

adopting exercise, and their compliance and weight and BMI.

Instruction program and booklet. It was developed by researchers after an extensive literature review, consisting of the anatomy and physiology of the female reproductive system, and knowledge related to PCOS (definition, incidence, etiologies, clinical manifestations, diagnosis, complications, and medical treatment). Strategies for adopting a healthy lifestyle through regular exercise and a healthy diet. The nutritional program included instructions about a healthy diet such as; eating a high fiber, low sugar diet, reducing the total intake of refined carbohydrates (sugars and starches), and replacing them with complex carbohydrates (fruits and vegetables). Increasing intake of fruits, vegetables, enough amount of protein, and foods high in polyunsaturated fatty acids, while avoiding processed and fatty foods such as cakes, pizza and all junk foods also dividing meals into three main meals and three snacks throughout the day.

Validity and Reliability of the Tools

The developed tools were formulated and submitted to three experts in Maternity Health Nursing and Community Health Nursing to assess the content validity, needed modification was done. Cronbach's Alpha was used to determine the internal reliability of the tool. The reliability of the tools was tested by (Cronbach's alpha =0.84), which indicated a strong significant positive correlation between the items of the tools.

Ethical consideration

Ethical approval was obtained from the ethical committee of the nursing faculty, at Ain Shams University. Official permission will be obtained from the administrative authorities of the gynecology and obstetrics outpatient clinics at Ain Shams University Hospitals, to conduct the proposed study. The aim and the nature of the study have been explained and written consent was obtained from the recruited women. Also emphasized that the study posed no risks or hazards to participants' health. All women were informed that participation in the research is voluntary and anyone can withdraw from this study at any time without giving any reason. Data was treated confidentially, and women were identified in the computerized database by a number.

Pilot Study

The pilot study was done on (10 %) of the total sample to examine the clarity of tools and time needed to complete the study tools, based on the findings, minimal changes were made.

Fieldwork

Data collected throughout 12 months (starting from July 2022 to July 2023). All ethical consideration was followed before data collection started. The Data was collected through five phases: interviewing and recruitment, assessment, implementation, follow-up, and evaluation phase.

- 1) **Interviewing and recruitment:** Eligible women were recruited from the infertility outpatient clinic. The researcher interviewed the woman who met the inclusion criteria, described the nature of the study, and got her approval for participation by signing the written consent. Data were gathered two days/per week, by interviewing each woman individually in a special room in gynecology clinics to collect the needed demographic data, and obstetric history using (Structured Interviewing Questionnaire), each interview took 15–20 minutes approximately.
- 2) **Assessment phase:** The researcher assessed the preliminary data for menstrual history as; oligomenorrhea, amenorrhea, irregular bleeding, as well as body mass was calculated through the formula. A reproductive hormonal assay that included (serum testosterone, follicular stimulating hormone (FSH), luteinizing hormone (LH), and estrone) was carried out for each woman before starting the program, conducting this required hormonal assay in the main hospital's laboratories, and the findings were documented in a hormonal assay report. The procedure for the hormonal assay included taking a blood sample on the 2nd or 3rd day of menstruation for women who had oligomenorrhea, while for those who had amenorrhea blood sample was taken at any time after at least one month of amenorrhea (Ibrahim, Elsayed, Reyad, & Azzam, (2018). The assessment took about 10-15 minutes approximately.
- 3) **Implementation of the program:** In this phase, the researcher provided an instructional program for each woman, about lifestyle

modification through one instruction session in small groups (n =2- 4 women) total number of sessions of about 20 sessions at Gynecology outpatient clinics at Ain Shams University Hospital in a special room with a duration of approximately 45-60 minutes for a session. PCOS definition, symptoms, and complications, in addition to the importance of weight reduction, energy-restricted diet, eating behaviors, physical activity, and aerobic exercises, and advise the women to do the exercise 3 times/week for 30 min. Sessions were presented in a PowerPoint presentation by the researcher. All women were provided with an instructional brochure to be used as a guide for the permitted and forbidden foods and behaviors and aerobic exercises CD.

- 4) **Follow up.** Throughout six months the researchers followed up with the women through regular meetings individually or by phone calling each one every month to ensure that they followed the diet and exercise program. As well as advise the women to continue regular follow up with an infertility physician
- 5) **Evaluation.** Finally, at the end of the six months after starting the program of lifestyle modifications for each woman who completed the diet and aerobic exercises, evaluation was done for the women's weight and BMI, menstrual history, and reproductive hormonal assay and documented all data in the designed tools.

Statistical Analysis.

Statistical package for the social science (SPSS) software, version 21 was used for data entering and analysis. Data management was done by coding and entering responses into the computer. The investigator checked all data to avoid any discrepancies. Descriptive statistics were used to analyze the sample population. Mean, standard deviations, and frequency distributions were used. Inferential statistics paired "t" test was used to determine the differences between the pretest and post-test evaluation of the same group and chi-square was used test for qualitative data.

Level of significance: For all statistical tests done, the threshold of significance was fixed at the 5%

level (P-value). A P-value > 0.05 indicates a statistically non-significant result a P-value ≤ 0.05 indicates a statistically significant result, P-value ≤ 0.01 indicates a highly significant result.

Results

The age range of women in the current study was (24-35) years old with a mean age of 29.5±2.93, 38.3% of the women had a university level of education, while 30% of them had secondary school education. More than three-quarters of the women in the current study were housewives, and 70% of them live in urban areas (table 1).

Results of (table 2) showed that 40% of the women in the study were primigravida while 35% of them were nulligravida. Concerning the parity, nearly half (48.3%) of the women were nulliparous while 43.3% of them were primiparous. Thirty percent of the women had a history of abortion, and 65% of the women had a history of secondary infertility.

Table (3) showed that 48.3% of women their weight was between (81-90 kg) and 26.7% of the subjects their weight was ≥ 90 kg with mean of (85.8±8.13) in their initial assessment, as compared to % 41.7% of them their weight was

ranged between 81-90 kg and 41.7% of them their weight was ranged between (70-80 kg) with mean of (80.5±7.9) in their final follow up visit, with highly statistically significance difference (t=28.106, p= 0.001). Regarding BMI 78.3% of the women were obese with a mean score of (31.8±2.7) in their initial assessment, as compared to 50% of them who were obese with a mean score of (29.8±2.5) in the final follow-up visit, with highly statistically significance difference (t=24.474, p= 0.001)

Figure (1) illustrated that there were statistically significant differences regarding menstrual irregularity, bleeding with menstruation, amenorrhea, and oligomenorrhea in the initial visit as compared to the last follow-up visit, (χ²=8.373, P= 0.004; χ²=12.204, P=0.001; χ²=6.477, P= 0.011; χ²=1.517, P= 0.05) respectively.

Table (4) showed the hormonal essay results for baseline assessment and posttest which indicated statistically significant differences regarding LH, FSH, and LH/FSH ratio (P= 0,053; P= 0.007; P= 0.02) respectively; While there were no statistically significant differences about total testosterone and estrone (P= 0.261; P=0.801) respectively.

Table (1): Distribution of women according to their demographic characteristics (N=60).

Items	Studied sample. (N = 60)	
	N	%
Age: Mean ± SD	29.5±2.39	
Age group: (24-35)	36	60
• 24-30	24	40
• 31-35		
Level of education:		
• Read and write.	3	5
• Primary level	6	10
• Preparatory level	8	13.3
• Secondary level	18	30
• University level	23	38.3
• Postgraduate level	2	3.3
Occupation		
• Working	9	15
• Housewife	51	85
Residence:		
• Urban	42	70
• Rural	18	30

Table (2): Distribution of the women according to their obstetric history

Characteristics	N= 60	
	Freq.	%
Gravidity		
Nulligravida	21	35
Primigravida	24	40
Second Gravida	15	25
Parity		
Nulliparous	29	48.3
Primiparous	26	43.3
Multipara	5	8.3
Number of abortion		
No abortion	42	70
One/ Two	18	30
Type of infertility		
Primary infertility	21	35
Secondary infertility	39	65

Table (3): Distribution of the women according to their initial assessment and final follow-up visit related to weight and body mass index (N=60).

Characteristics	N=60					
	Initial assessment		Final visit		t	p
	Freq.	%	Freq.	%		
Weight						
70 < kg	0	0	4	6.7	28.106	0.001
70-80 kg	15	25	25	41.7		
81-90 kg	29	48.3	25	41.7		
> 90	16	26.7	6	10		
Mean ± SD	85.8± 8.13		80.5±7.9			
Body mass index (BMI)						
Overweight 26-29.9 kg/m ²	13	21.7	30	50	24.474	0.001
Obese 30-38.2 kg/m ²	47	78.3	30	50		
Mean ± SD	31.8±2.7		29.8±2.5			

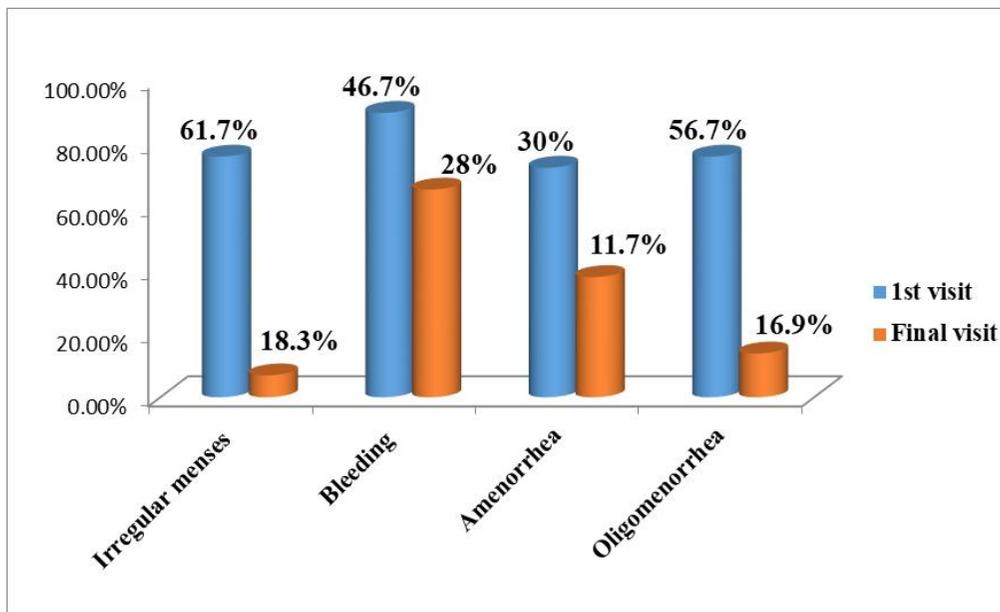


Figure (1): Distribution of the women according to their improvement of the menstrual disorders (N=60)

Table (4): Distribution of the women according to their baseline assessment and posttest results of reproductive hormonal assay (n= 60).

Characteristics	Baseline assessment		posttest		t	P
	Mean ±SD		Mean ±SD			
Total testosterone	0.6	0.12	0.41	0.11	1.133	0.261
luteinizing hormone (LH)	12.2	5.5	8.3	4.9	1.798	0.053
Follicular stimulating hormone (FSH)	4.1	1.5	5.7	1.3	2.930	0.007
LH/FSH ratio	2.8	0.87	1.5	.81	3.377	0.002
Estrone (E2)	68.2	52	63.3	54.9	-0.254	0.801

Discussion

Lifestyle modification plays an important role in the improvement of reproductive outcomes in PCOS patients with obesity. The current study was to evaluate the effectiveness of lifestyle modification on reproductive function among infertile obese women with polycystic ovarian syndrome. The results of the current study are discussed within the following frame; demographic characteristics, obstetric history, weight and BMI, menstrual assessment, and hormonal results.

The age range of women in the current study was (24-35) years old with a mean age of 29.5 ± 2.93 , and more than one-third of the women had a university level of education and one-third of them had a secondary school certificate. More than three-quarters of the women in the current study were housewives, and about two-thirds of them live in urban areas. This finding is in agreement with the study conducted by **Ramadan & Said (2018)** At Benha, Egypt, researchers studied the demographics of infertile women and detected that the majority of them were housewives with secondary education and rural residences, ranging in age from 25 to 30 years old, with a mean age of (27.89) years.

Concerning gravidity and parity, two-fifths of the women in the study were primigravida and nearly half of the women were nulliparous, about one-third of the women had a history of abortion. This contrasts with a study conducted in Egypt by **El-Sayed, El-fattah, Taha, & Saeed, (2022)** found, the incidence of abortion was considerably higher in the PCOS obese group compared to the non-PCOS group ($p=0.041$), despite there being no statistically significant difference in gravidity or parity. These differences may be due to different study samples.

The current study showed that two-thirds of the women had a history of secondary infertility, while one-third of them had a history of primary infertility. These findings are consistent with research done in Iran by **Zarif, et al. (2020)**, which found that more than half (54.8%) of cases of infertility were secondary, whereas less than half (45.2%) were primary. These results were incompatible with **Ramadan & Said (2018)** who reported that a quarter of the sample of infertile women had a history of primary infertility and only one-quarter of them with secondary infertility. This may be due to different study sample settings.

Concerning BMI more than three-quarter of the women in the current study were obese, this result is in the same line with the study conducted in Tehran by **Amiri & Ramezani, (2020)** who reported that obesity not only affects one's outward appearance but also disrupt affects the balance of hormones and enzymes in the body. Infertility is more prevalent among women who have high BMI than those who have normal weight, and 70% of infertile women also experience obesity. Moreover, **Deswal, et al., (2020)** reported that over than half (54.26%) of the studied sample diagnosed with PCOS were obese.

The current study donated that, there is a lowering in BMI and weight in the post-program conduction, with a highly statistically significant difference, this may be due to the effect of intervention. These results in the same direction as **Lim, et al., (2019)** found that the BMI and body weight of the group that adopted the lifestyle intervention were significantly lower than those how who did not have BMI in women with PCOS. As well as, **Siam, Soliman, Ali, and Abdallah (2020)** BMI and fat mass significantly decreased after following exercises for 12 weeks among women with PCOS. In the same line **Kareem, Khalil, Badr, & El-Shamy (2014)** in obese women with

polycystic ovaries, regular aerobic exercise improves abdominal fat distribution and lower body weight. The aforementioned finding is concurrent with the most recent international evidence-based recommendations for the treatment of PCOS patients, a healthy lifestyle that includes eating well and engaging in regular exercise demonstrated the benefits of symptomatic relief and weight loss (**Teede, et al., 2018**). These similarities may be due to the lifestyle interventions have a positive effect on lowering BMI and weight among obese women.

For menstrual disorders associated with PCOS and obesity in the current study, two-thirds of the women had a history of menstrual irregularity, nearly half complained of bleeding with menstruation, and about one-third had amenorrhea and oligomenorrhea detected among more than half of the sample. These findings are by the systematic review conducted by **Deswal, et al., (2020)** concluded that the prevalence of oligomenorrhea was 88.21 % and 11.57% had amenorrhea among PCOS women. On the contrary, **Gupta et al., (2018)** menstrual irregularity prevalent among 3.8% of the study sample in India. This variation is due to different study samples as the recruited sample were obese and infertile women.

The results of the current study illustrated that there is an improvement in menstrual disorders among women, regarding menstruation irregularity, bleeding with menstruation, amenorrhea, and oligomenorrhea after adopting a lifestyle modification program. These findings are in line with a meta-analysis study conducted in Mansoura, Egypt, by **Marzouk & Ahmed (2015)** which discovered that there is an improvement in the menstrual cycle among the PCOS group that underwent lifestyle changes more than those that don't follow. These findings are in the same direction as the study done by **Abdolahian, et al., (2020)**, lifestyle modifications as exercise interventions for participants with PCOS associated with significant changes in the menstrual cycles and hormonal findings. As well as **Silvestris, et al., (2018)** concluded that obese women who participate in weight loss programs with lifestyle changes have been shown to boost their chances of getting pregnant by reestablishing menstrual cyclicity and

ovulation. While there is disagreement with **Samadi, Bambaiechi, Valiani, & Shahshahan, (2019)** indicated enhancement of oligomenorrhea, while regarding amenorrhea and irregular menstruation, no change was detected. The difference may be due to the differences in the anthropometrics and hormonal profiles of the included females.

The findings of the current study indicated improvement in the hormonal essay, there is enhancement regarding LH, FSH, and LH/FSH ratio, while there is no improvement in total testosterone and estrone. These results are in accordance with **Kim, & Lee, (2022)**. found that there was no statistically significant difference in the levels of testosterone among women with PCOS post lifestyle modification program. This result is in contrast with the study conducted by **Siam, et al., (2020)** levels of FSH and free testosterone rose in subjects with PCOS after exercising for 12 weeks. In contrast, there was no change in the levels of total testosterone or luteinizing hormone. **Lim, et al., (2019)** in women with PCOS, lifestyle changes may enhance the free androgen index. In the same line, **Kirthika, Paul, Selvam, & Priya, (2019)** found that the hormone levels were improved in women with PCOS who engaged in aerobic exercise and lifestyle changes. On the contrary **Shele, et al., (2020)** reported the LH or FSH levels in PCOS women were unaffected by adopting aerobic exercise. This difference may be due to different study sample or types of intervention.

Conclusion:

The current study concluded that two-thirds of the women had a history of secondary infertility, while one-third of them had a history of primary infertility. Weight loss through lifestyle modification has a positive effect on reproductive function regarding menstrual irregularity, and hormonal results. The is improvement in the menstrual disorders regarding menstruation irregularity, bleeding with menstruation, amenorrhea, and oligomenorrhea. The findings of the current study indicated improvement in the hormonal essay, there is enhancement regarding LH, FSH, and LH/FSH ratio, while there is no improvement in total testosterone and estrone.

Recommendation:

Based on the findings of this study the following recommendations are suggested the following:

- Adopting healthy Lifestyles and weight loss have a significant role in the improvement of reproductive function among obese infertile women with PCOS and reduce the long-term health complications associated with PCOS.
- Upgrading women's knowledge concerning PCOS with a periodic screening of women for early detection and management of PCOS using evidence-based guidelines and educational programs.
- Further study to assess the impact of PCOS condition on pregnancy outcomes.
- The study can be replicated using randomized clinical trials on large probability samples and in other settings to have a wider generalization of findings.

Limitation of the study:

- Some women reported difficulty in compliance with the exercise and nutrition regimen.
- Difficult communicating with some women for continuing follow-up.

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