Physical-Nutritional program effect in women with Polycystic Ovary Syndrome (PCOS)

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ABSTRACT

This study aimed to prepare a program (physical-nutritional) for women with polycystic ovary, as well as to identify the effect of this program on some body measurements and the incidence of polycystic ovarian syndrome in the research sample. A total of 12 women (aged 20-25 years) with Polycystic Ovary Syndrome (PCOS) participated in the randomized controlled trial design. They were divided equally into two groups (experimental and control group). The experimental group received the physical-nutritional program accompanying the treatment program, while the control group received only the instructions of the specialist doctor and the treatment program prepared by them. The two researchers applied their nutritional program over a period of two months and a day. As for the physical program, it was applied by 3 units per week, for a period of two months, which included a set of aerobic exercises. The assessments were done using the ultrasound assessment for radiographic examination and other body measurements such as BMI (Body Mass Index). The statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 25. The results of the current study showed that there were statistically significant differences between pre and post-test results of the experimental and control group for the study variables, in favor of the post-test ($p < 0.05$). Statistically significant differences were also found between the post-test score averages of the experimental and the control group, in favor of the experimental group ($p < 0.05$). In conclusion, diet helps to improve the work of vital organizations by targeting insulin resistance to reduce it, as it is one of the indicators that works to increase polycystic ovaries. About sports activities, they contribute to the regulation of the hormonal system and in this way reduce the incidence of PCOS.

KEYWORDS

Diet; Exercise; Polycystic Ovary Syndrome; Women.

1. INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the predominant pathological conditions in the majority of women which results from endocrine disorders. Approximately 6-10% of women of childbearing age suffer from this syndrome between the ages of 12-45 years. This condition leads to a lack or loss of fertility in females, due to an increase in androgens in women, resulting in a lack of ovulation and an increase in body weight and the emergence of obesity, as well as irregular or interrupted menstruation (Stadnicka et al., 2015).

PCOS is caused by a combination of genetic and environmental factors. Obesity is one of the risk factors for the development of this syndrome, in addition to lack of exercise and the presence of similar cases in the family. The diagnosis of PCOS depends on two or three things that can be found in the syndrome, namely anovulation, an increase in the level of androgens and ovarian cysts which can be detected by ultrasound. There is no specific treatment for PCOS, and treatment depends on lifestyle changes, weight loss and exercise.

One of the ways that doctors try to decrease the incidence of polycystic ovaries is by reducing weight and regulating the hormones within the woman's body. Perhaps the most prominent of these, in addition to the therapeutic intervention for the patient, is a healthy diet to reduce weight gain, in addition to practicing sports activities that target depletion and energy drainage by burning excess body fat, especially fat, which has an impact on the development of PCOS in women (La Vignera et al., 2018).

Perhaps the difficulty of changing lifestyle and the lack of healthy diet habits for individuals leads to an increased exposure to these diseases, so following healthy diets that contain balanced proportions in calories of (carbohydrates, fats and protein) that go with what the individual consumes in his daily life (or what is called nutritional specification), helps to ensure that the individual enjoys a healthy body and stays away from fat stacking in unwanted parts in the body and reaching a level of obesity, whether due to overeating or for other health issues or both. (Katzel et al., 1997). The morphology of the woman's body, is considered a real indicator that threats her health. For example, the accumulation of fat in the waist area poses a danger to the liver, uterus and other functional organs. It is worth mentioning that continuing to exercise and do activities, especially those aimed at making an additional effort to burn fat, play an important role in improving the respiratory fitness of women, and improving the appearance of the body. Nolte points out that aerobic training and nutritional specification not only leads to improvement in the appearance of fat, but also to a decrease in the incidence of diseases (Nolte et al., 1997).

When the two researchers observed and surveyed many cases of young women with PCOS in Baghdad Teaching Hospital, Obstetric and Gynecology Department, it promoted them to search and study solutions that may contribute to reducing the incidence of this syndrome according to the causes or the symptoms resulting from it and identify them with obesity and some indicators that are associated with it and affect it. During the examination and inference through the body mass index (BMI), it was found that the majority of the cases that were identified suffer from the risk of obesity. The two researchers sought to infer the effect of the program (physical-nutritional) on some physical measurements such as mass, body mass index (BMI), some circumferences of the hip, thigh and abdomen, thickness of the skin folds of the abdomen and upper thigh, in addition to identifying the amount of follicles after applying the physical diet program.

Based on the above, the aim of this study is to prepare an integrated program (physical-nutritional) for women with polycystic ovary, and to determine the effects of this program on some body measurements and the extent of polycystic ovary syndrome in the study sample.

2. METHODS

2.1. Study Design and Participants

The two researchers followed the experimental method during a period from 01/12/2021 to 1/2/2022, by designing two equal groups (the experimental group and the control group) to suit the nature and objectives of the study. The study was conducted at Al-Shifa Medical Laboratory, F45 for fitness and bodybuilding.

The study sample included 12 women with polycystic ovary syndrome, aged 20-25 years, in Baghdad, who wanted to participate in the study. The researcher took the approval of the specialist doctor and the patients to conduct and implement the research and the condition of all the instructions to be followed during this period. The study sample was divided equally into two groups (experimental and control group). The experimental group received the physical-nutritional program accompanying the treatment program, while the control group received only the instructions of the specialist doctor and the treatment program prepared by them. The researchers ensured that all conditions, influences and other factors that may affect directly on the study, were taken into account and controlled. To ensure that the study sample starts from a single starting point, the two researchers performed homogeneity in the extraneous variables (Table 1) and homogeneity of the variance (equivalence) between the two research groups in the studied variables (Table 2).

As we can see from the results of Table 1, the research variables of the sample are homogeneous.

Table 1. Results of homogeneity test analysis

Variables		Measuring unit	Mean	Median	Standard Deviation	Kurtosis
Ovary size	right	Cubic cm	11.77	11.125	2.566	0.307
	left	Cubic cm	12.166	11.25	2.336	0.417
The number of vesicles	right	No.	13.166	13	2.657	0.274
	left	No.	14.333	13.5	2.57	0.143
Mass		kg	82.666	83	6.286	0.245
BMI		%	31.59	31.427	2.635	-0.017
Hip circumference		cm	64.666	65	3.2	-0.136
Abdominal circumference		cm	117.416	116.5	5.16	0.57
Thigh circumference		cm	69.666	69.5	3.025	-0.563
Abdominal folds thickness		mm	41.666	41.5	2.605	0.291
Thickness of the folds of the upper thigh		mm	33.416	33	2.353	0.703

The following table shows the equivalence test results between the two research groups in the studied variables (Table 2).

Table 2. The equivalence test results between the two research groups

Variables		Experimental Group		Control Group		Levene's value	P value
		Mean	Standard Deviation	Mean	Standard Deviation		
Ovary size	right	13.333	2.523	14.5	3.016	0.035	0.856
	left	14.042	1.706	13.583	2.01	0.276	0.611
The number of vesicles	right	15.167	1.941	15.333	1.632	0.043	0.84
	left	16.5	1.643	16.333	1.632	0.01	0.977
Mass		87.833	3.71	88.666	3.386	0.221	0.648
BMI		33.56	1.765	32.591	1.7	0.445	0.52

						0.236
Hip circumference	66.5	3.017	67.166	2.926	1.593	
Abdominal circumference	119.833	5.345	118.666	5.1639	0.12	0.736
Thigh circumference	71.333	2.658	70.666	3.204	0.204	0.661
Abdominal folds thickness	43.667	1.862	43	2.828	0.403	0.54
Thickness of the folds of the upper thigh	34.667	2.422	34.5	3.674	0.104	0.754

There is homogeneity in the variance of the values of the individuals of each group in the variables under study, indicating that both groups are equal and homogeneous in the extent of variance for them and the two researchers can start implementing the curriculum (Table 2).

2.2. Study Procedures

2.2.1. Ultrasound Assessment

The radiographic examination was conducted by ultrasound, which revealed the thickness of the endometrium, ovarian cysts and other changes in the ovaries.

2.2.2. Body Measurements Methods

The following body measurements were chosen:

1- Mass and BMI (Body Mass Index) was measured using a BMI equation.

2- The circumference of the hips, abdomen and thighs was measured using a tape measure.

3- The thickness of the skin folds in the abdomen and upper thigh area was measured using a caliper by taking 3 measurements and determining the average of the measurements.

The researcher took into account all the necessary conditions and procedures in carrying out the body measurements that were recommended by the scientific sources and references.

2.2.3. Application of the Physical–Nutritional Program

After conducting physical tests and measurements, the nutritional program was applied daily for two months, while the physical program was applied by practicing some exercises and physical activities that target the internal fat of the body, such as aerobic exercises and exercises that consume all the energy stored in the body to target burning fat and energy production. Therefore, the researchers worked by applying these exercises at a rate of 3 units per week over a period of two months, to accompany the (physical - nutritional) program in addition to the treatment program that was diagnosed by the specialist doctor. The researchers were also keen to

find an alternative in the event that there was an intentional error or not in the food program and the research sample was not committed to eating meals by forcing it to perform reverse fasting for a period of not less than 12 hours.

The food program included three main meals (breakfast, lunch and dinner), in addition to two secondary meals without calories or very few, which the individual eats when urgently needed. The researchers took into consideration the quality and quantity of meals in a way that is appropriate for the sample members, depending on the body mass index and specific calories, as well as containing nutritional elements, as the diets contain carbohydrates, fats and proteins in very healthy ratios. Also, the two researchers were keen to determine the times of eating food with drinking water and in good quantities for each period (breakfast from 7am-8am), lunch (1am-12pm), dinner at (7pm-6pm), while the secondary meals were determined at 10am in the morning and 4pm in the afternoon.

The researchers calculated the basic calories for each meal using the following equation (Al-Hasanat, 2008):

- Basic calories = 655 + (9.6 x weight in kilograms) + (1.8 x height in centimeters) - (4.7 x age in years). As for the physical program, it included the practice of some aerobic exercises and sports activities according to the aerobic system, as it is considered the most appropriate in women's disease. The two researchers relied on the method of low-intensity interval training and the ratio of work to rest was (1:1), provided that rest is negative either by walking or standing. They took into account the following points when applying the physical program:

-Warming-up by jogging or fast walking for a period of 5-8 minutes, followed by performing Swedish exercises for all parts of the body.

Taking into account the pulse when warming up, that the pulse rate does not exceed (131 beats / minute) to ensure the work of the aerobic system.

-Performing some exercises with free weights (such as dumbbells, Karts and ropes) in times ranging between 30-45 seconds, to target fatigue and exhaust the effort and use fats to burn and restore energy within the body, and they are always performed as a set of exercises at the beginning and end of the training unit.

2.3. Statistical Analysis

The statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS). First, the two researchers analyzed the homogeneity by using the standard deviation, mean and kurtosis, and equivalence of groups by using the Levene's test. Then, they used the T-test to

find the differences between the values of the pre and post-test. For all statistical tests, a p-value of <0.05 was considered statistically significant.

3. RESULTS

We start the presentation of the results by comparing the mean values of the experimental group pre and post-test for all study variables. There are statistically significant differences between the pre and post-test results for all study variables ($p < 0.05$) (Table 3).

Table 3. Comparison of pre and post-test mean values of the experimental group for all study variables

Variables		Experimental Group					
		Pre-Test		Post-Test			
		Mean	Standard Deviation	Mean	Standard Deviation	t value	p value
Ovary size	Right	13.333	2.523	10.208	1.503	4.948	0.004
	Left	14.042	1.706	10.292	0.813	6.057	0.002
The number of vesicles	Right	15.167	1.941	11.167	1.472	5.477	0.003
	Left	16.5	1.643	12.167	0.753	7.769	0.001
Mass		87.833	3.71	77.5	3.017	6.812	0
BMI		33.56	1.765	29.621	1.69	8.876	0
Hip circumference		66.5	3.017	62.833	2.317	7.416	0.001
Abdominal circumference		119.833	5.345	115	4	6.874	0.001
Thigh circumference		71.333	2.658	68	2.525	1.038	0.027
Abdominal folds thickness		43.667	1.862	39.667	1.366	5.746	0.001
Thickness of the folds of the upper thigh		34.667	2.422	32.167	1.602	5.839	0.002

The following table (Table 4) shows the comparison of pre and post-test mean values of the control group for all study variables. There are statistically significant differences between the pre and post-test results for the following variables: ovary size (right and left), the number of vesicles (right and left), mass and abdominal folds' thickness ($p < 0.05$).

Table 4. Comparison of pre and post-test mean values of the control group for all study variables

Variables		Pre-Test Mean	Pre-Test Standard Deviation	Post-Test Mean	Post-Test Standard Deviation	t value	p value
Ovary size	Right	14.5	3.016	12.833	2.401	3.953	0.011
	Left	13.583	2.01	12.333	1.633	2.825	0.037
The number of vesicles	Right	15.333	1.632	12.833	1.472	11.18	0
	Left	16.333	1.632	13.833	2.137	4.038	0.01
Mass		88.666	3.386	82.167	1.722	7.344	0.001
BMI		32.591	1.7	31.403	1.446	1.274	0.259
Hip circumference		67.166	2.926	62.833	2.317	2.191	0.08
Abdominal circumference		118.666	5.1639	116.333	3.266	1.2	0.284
Thigh circumference		70.666	3.204	69.167	5.419	0.508	0.633
Abdominal folds thickness		43	2.828	39.667	1.366	2.774	0.039
Thickness of the folds of the upper thigh		34.5	3.674	32.167	1.602	1.222	0.276

Table 5 shows the differences between the two study groups (control and experimental) in the post-test results. Statistically significant differences were found between the post-test score averages of the experimental and the control group in ovary size (right and left), the number of vesicles, mass and BMI ($p < 0.05$).

Table 5. Differences between the two study groups (control and experimental) in the post-test results.

Variables		Experimental Group Mean	Experimental Group Standard Deviation	Control Group Mean	Control Group Standard Deviation	t value	p value
Ovary size	Right	10.208	1.503	12.833	2.401	2.269	0.043
	Left	10.292	0.813	12.333	1.633	2.742	0.021
The number of vesicles	Right	11.167	1.472	12.833	1.472	1.961	0.044
	Left	12.167	0.753	13.833	2.137	1.802	0.047

Mass	87.833	3.71	82.167	1.722	3.291	0.008
BMI	33.56	1.765	31.403	1.446	1.962	0.049
Hip circumference	66.5	3.017	62.833	2.317	0	1
Thigh circumference	71.333	2.658	69.167	5.419	0.478	0.643
Abdominal folds thickness	43.667	1.862	39.667	1.366	0	1
Thickness of the folds of the upper thigh	34.667	2.422	32.167	1.602	0	1

4. DISCUSSION

The results of the current study showed that there are statistically significant differences between pre and post-test results of the experimental and control group for the study variables, in favor of the post-test ($p < 0.05$). Statistically significant differences were also found between the post-test score averages of the experimental and the control group, in favor of the experimental group ($p < 0.05$).

The researchers explain that the significant differences in favor of the post-tests, represented by the size of the ovaries and the vesicles of each ovary, indicate the effectiveness of the program to which the experimental group was exposed (the physical and nutritional program), by noting the mean which indicate that there is a decrease in the size of the ovary and the number of vesicles and it is closer to the normal range, which explains that whenever the size of the ovary is less than 10, it is suitable for egg production. In addition, the lower number of vesicles, is an indicator of the presence of a cyst in one or both ovaries due to the irregularity of female hormones such as androgens and estrogens that work to produce incomplete vesicles inside the ovary with larger numbers than normal and with incomplete maturation to become a full egg capable of fertilization.

The researchers attribute this decrease, which is a positive indicator, to the direct effect of the program prepared by the researchers, as the low-calorie diet program worked by reducing the amount of carbohydrates in the diets, which in turn contained natural substances, the majority of which were vegetarian. The diets that the research sample ate over a period of two months as a healthy diet, led to the targeting of insulin blood levels and insulin resistance in order to reduce them, as insulin has a close correlation with the endocrine glands, which in turn contributes to increased androgen stimulation, leading to an increase in the number of vesicles inside each ovary.

A study by (Douglas et al., 2007), indicated that low-carb diet reduces ovarian syndrome in women, because the diet reduces fasting insulin and thus androgens. These are associated with the endocrine glands that lead to irregularity or a distortion in its function when suffering from polycystic ovarian syndrome. As for some physical indicators such as BMI and mass, as well as the physical indicators represented by hip circumference, abdomen and thigh, and the thickness of the skin folds of the waist and upper thigh, which are indicators of obesity and its impact on the presence of polycystic ovaries, the decrease in both Mass and BMI is a result of the effectiveness of the nutritional and physical program that the research sample was exposed to.

The researchers attribute the work done to target mass index by reducing the energy spent through two aspects. The first represented in targeting physical effort in the research sample of women with PCOS by applying exercises and aerobic physical activities and the anaerobic ones that worked to unload the body from the energy stores and exhaust the effort and thus use the fats stored in the body to burn them, which in turn provided a source of energy for the body, which was positively reflected on the decrease in weight and body mass index as well as the circumference and thickness of the skin folds, which are directly related to weight. On the other hand, the researchers attribute this to building a diet program that contains daily healthy foods that are low in fat and carbohydrates (low in calories).

A study by Farshichi et al. (2007) indicated the possibility of losing between 0.5 to 1 kg per week by decreasing the total calories by 1000 calories, in proportion to the amount of energy expended for metabolism and the performance of daily effort, which is difficult in cases of PCOS. Another study by Abdel-Fattah & Hassanein (1997) explained the process of getting rid of obesity in the abdominal area through the direct influence of exercise in reducing the percentage of fat in the abdominal area."Physical exercise for a long time works not to significantly increase the appetite for food and may lead to a decrease in it, and the reasons for this lie in the increase of destructive hormones that accompany these exercises and bring it to an average level" (Al-Selmi et al., 2019).

5. CONCLUSIONS

From the foregoing, the researchers concluded as follows:
- Physical activity and a healthy diet contribute significantly to reduce the incidence or risk of developing polycystic ovaries.

- The quality of food and its basic components, especially carbohydrates, contribute to improve the work of vital organizations by targeting insulin and insulin resistance to reduce it, as it is one of the indicators that function to increase polycystic ovaries.

- Physical activities that target fat stored in the body help to reduce the fat surrounding the body, especially around the uterus, and help to reduce weight and fat, thus reducing the incidence or severity of polycystic ovaries.

- Sports activities, in addition to their work in regulating blood circulation, contribute to regulate the function of the hormonal system, especially the anabolic hormones, whose regularity will contribute to improve the level of female hormones and in this way reduce the incidence of polycystic ovaries.

In light of the results of the study, the authors recommend as follows:

- The necessity of adhering to a healthy nutritional program, especially for women with polycystic ovary syndrome, as diet plays an important role in improving the incidence of this disease.

- The necessity of continuing to engage in aerobic and anaerobic sports activities for women with ovarian syndrome because they have an important role in improving the functioning of functional organs, including regulating the function of building hormones.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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