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Effect of Myo-Inositol Supplementation on Anthropometric Parameters among PCOS Women in Gujranwala

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Abstract

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Keywords: PCOS, Myo-Inositol, Weight, Anthropometrics, BMI, WHR, Supplementation

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Effect of Myo-Inositol Supplementation on Anthropometric Parameters among PCOS Women in Gujranwala

Abstract

Polycystic Ovarian Syndrome Metabolic and endocrine disorder PCOS affects many premenopausal women. Ovarian dysfunction and androgen excess symptoms and signs explain it. High BMI and WHR, or visceral obesity, are more common in PCOS women. The study aims to evaluate myo-inositol (MI) supplementation on anthropometric measurements in Gujranwala PCOS women. Participants were selected from Life Care Hospital, Gujranwala. Each of the three groups included 30 members. The 3-month intervention concluded. The participants were instructed to consume 2000mg of myo-inositol at night. At the 0, 30, 60, and 90th days of study, weight, height, BMI, and waist-to-hip ratio were measured. The study ended with a comparison of pre-and post-intervention findings. The study found that Myo-inositol considerably($p<0.0001$) improved anthropometric parameters. Weight, BMI, and WHR decreased among participants, although significant differences exist between groups($P<0.005$) despite minimal variation in mean values. This study found that feeding PCOS women MI decreased weight, BMI, and WHR.

Keywords: PCOS, Myo-Inositol, Weight, Anthropometrics, BMI, WHR, Supplementation

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Introduction

Polycystic ovary syndrome (PCOS) was primarily defined by Leventhal and Drs. Stein in 1935 (Escobar-Morreale, 2018). At that time, it was believed that PCOS may be related to hormonal disabilities and metabolic, menstrual irregularities, and ovarian rupture (Jin & Xie, 2017; Naz et al., 2019). The absence of ovulation could be a key issue in women who are diagnosed with PCOS. For the diagnosis of PCOS; the present definition of PCOS involves the nearness of 2 of the 3 following conditions according to Rotterdam Criteria: (1) hyperandrogenism (increased production

of androgens) (2) chronic oligo-ovulation or anovulation and (3) the nearness of twelve follicles measuring 2–9mm in breadth in both ovaries either related to expanded ovarian volume (10ml, which can be identified by examination through ultrasound technique (Zhang et al., 2018).

One in six women is diagnosed with this disorder and it could be a major contributor to infertility, especially in developing countries (Maqbool et al., 2019). It means that ten percent of women of fertility age are suffering from PCOS and it seems to be a foremost cause of infertility in developing countries (Andriana & Sumarni, 2019). However, the fact is that both the etiology and diagnosis of the disorder are still unclear and debatable (Selma F Witchel et al., 2019).

Moreover, PCOS is a common hormonal condition that often manifests during puberty in women who are of reproductive age. Its complex nature and unexplained cause contribute to its heterogeneity. In addition to hormone imbalances, metabolic diseases like diabetes, insulin resistance, and poor glucose tolerance are associated with PCOS. The most common PCOS symptoms can be relieved by a number of medications. Metformin is one of the drugs that is most commonly used to treat this condition (Cappelli et al., 2017).

The pathophysiology of PCOS is not clear yet but it was supposed that it may be caused by insulin resistance which ultimately leads to hyperandrogenism or other associated complications. Thus, the impacts of insulin resistance on reproductive and metabolic processes appear to be involved in the initiation and progression of polycystic ovary syndrome (PCOS). Some genetic factors and other environmental causes including sedentary lifestyle, being obese/overweight, eating habits as well as stress also play a role in the pathogenesis of PCOS (Burgert & Paprocki, 2022).

However, almost, 50% of women suffering from PCOS are either obese or overweight (Orio et al., 2016), but this rate is thought to differ geographically. A high prevalence of obese and overweight women was seen within the USA and Australia, Approximately 61% to 76% of PCOS-afflicted women are deemed fat or overweight. (Pundir et al., 2018).

The hypothalamic-pituitary-ovarian (HPO) axis, which regulates female fertility, can be disrupted by obesity, which can also have an impact on insulin resistance and hyperinsulinemia. Obesity and elevated insulin levels have been related to increased androgen production in the ovaries. This could disrupt regular ovulatory activity, leading to irregular menstrual cycles, anovulation, and diminished fertility (Broughton & Moley, 2017).

This has led to the use of insulin-lowering drugs such as troglitazone, metformin, and pioglitazone to help make the tendency of ovaries to function properly and a reduction of high secretion of androgens. This gives an added assurance to counter the resistance to insulin, which in PCOS pathogenesis, is widely implicated. These drugs also present some adverse effects including nausea, vomiting, and diarrhea when taking metformin as well as increased body weight when taking pioglitazone. These side effects could reduce patient compliance and thus reduce or limit the intake of these drugs (Huang et al., 2017).

Hence the following objectives of the study; To determine the impact of Myo-inositol supplementation on anthropometric measurements of women with pod in Gujranwala Pakistan which includes BMI, waist circumference, hip circumference, and body weight

The aim of the study is to determine whether Myo-inositol supplementation can enhance these parameters in women with this disorder and possibly function as a non-pharmacological intervention for metabolic and hormonal disorders associated with PCOS.

Rationale of Study

PCOS, which is characterized by a variety of symptoms, is the primary cause of infertility in women who are of reproductive age. It has been observed that Pakistani women have a greater prevalence of PCOS (52%) than women who are Western Caucasian (Zulfiqar et al., 2022). It was observed that PCOS women are likely to have insulin resistance. Anthropometric parameters representing insulin resistance are obesity (increased BMI) and WHR>0.85 (NEHRA et al., 2017). Myo-inositol, also called inositol (cyclohexanehexol), is a sugar-alcohol that has six hydroxyl groups. It is known to be an essential part of the phospholipids in cell membranes. Previous research has demonstrated how inositol enhances insulin sensitivity to mediate glucose absorption. (DiNicolantonio & O'Keefe, 2022). PCOS is responsible for infertility, hence to counter the situation, this research was underway to assess the impact of Myo-Inositol on Anthropometric Parameters among PCOS women of Gujranwala.

Research Question

The research question for this study was whether PCOS causes infertility, to address the problem this study was conducted to determine the impact of Myo-

Inositol on Anthropometric Parameters with reference to PCOS women of Gujranwala.

Review of Related Literature:

Polycystic Ovary Syndrome

Polycystic ovary syndrome can be described as an endocrine dysfunction of significant prevalence among women in the reproductive period of their lives. It is a condition that causes the growth of cysts in the ovaries and is characterized by other symptoms such as; irregular menstrual bleeding, hyperandrogenaemia, insulin resistance, and inability to conceive. This hormonal dysfunction is certainly one of the most significant factors that define PCOS and produce this condition (Joham et al., 2022).

The NIH held an international conference in 1990 in the United States of America. At this meeting, diagnostic guidelines for PCOS were proposed which included anovulation, and hyperandrogenemia, which could be either biochemical, clinical, hirsutism/ acne, or both (Wawrzkiewicz-Jałowiecka et al., 2020). Subsequently, the last report of the task force included the results of the expert meeting during the joint 2003 ESHRE ASRM conference in Rotterdam. During that discussion, it was suggested that the examination of PCOS should only require the occurrence of two of the following three criteria: abnormality in the morphological appearance of ovaries by ultrasonography, irregularity in ovulation, and elevated levels of androgens in the blood (Ginary et al., 2004).

Cutler and Heron the authors of the recent study in identifying with the subject indicate that irregular menstrual cycle throughout adolescence is a marker for the development of the PCOS in the future. Caanen et al., 2020 noted that females with oligomenorrhea in adolescence were 22. 5% of them developed PCOS in adulthood as compared to those with regular cycles 5. 1% (Caanen et al. , 2020).

Etiology and Pathophysiology of PCOS

In a study, the common evolutionary origin theory postulates that complex diets high in carbohydrates and proteins, physical activity, prolonged periods of famine, trauma, and infection, and other stressful environmental conditions that humans faced in the past led to the emergence of common metabolic disorders like obesity, diabetes mellitus, and polycystic ovary syndrome (PCOS) (Escobar-Morreale, 2018).

Insulin resistance may have had a major impact on thrifty genotypes and phenotypes, and the benefits that this condition may have provided during evolution may account for the frequent co-occurrence of insulin-resistant genotypes and phenotypes with those linked to PCOS. The processes underlying the suggested longevity advantages in carriers of congenital adrenal hyperplasia, a frequent variety defined by adrenal androgen excess, 21-hydroxylase deficiency, may also apply to other illnesses involving androgen excess, such as PCOS (Kh & Boboev, 2022).

Ovulation disorders, which include irregular ovulation or its complete absence, are a major cause of infertility in women. PCOS is identified as the primary etiological factor in anovulatory infertility, accounting for approximately 70% of infertile cases. Furthermore, patients with PCOS may have an amplified risk of pregnancy complications such as gestational diabetes mellitus and miscarriage due to hormonal imbalances (Escobar-Morreale, 2018).

Role of Genetics in PCOS

Variations in genes coding for components of steroidogenesis, proteins associated with steroid hormone activity, and gonadotrophin release and control may all have a role in the development of PCOS. Genetics is a major aspect of the disorder's development. Insulin secretion and adipose tissue metabolism could possibly be involved. PCOS is linked to several significant genes, including CYP11A1, CYP17A1, and CYP19A1. Furthermore, research has indicated that epigenetic modifications made during fetal development may also affect an individual's chance of subsequently developing PCOS (Heidarzadehpilehrood et al., 2022).

Ninety-nine Chilean women with PCOS and their single-child daughters participated in the study; nearly two-thirds of them had reached puberty. There were 88 women and their daughters in the control group. The research found that during infancy and early childhood, the daughters of PCOS-affected women had higher serum levels of anti-Müllerian hormone (AMH). These daughters' ovaries started to grow in mid-childhood and they had a more robust response to an oral glucose tolerance test (GTT) than daughters of non-PCOS moms. At the onset of puberty, they had higher mean DHEAS levels and higher baseline and stimulated GnRHag testosterone and 17OHP. Daughters of menarche-aged PCOS women had higher levels of testosterone than any other control daughter as the result of heredity distribution of hyperandrogenemia (Rosenfield & Ehrmann, 2016).

A new study examined the incidence of the three main features of PCOS in daughters born to mothers with and without PCOS, several years after menarche: abnormality of androgen, ovulation irregularity, and polycystic ovary shape or PCOS. The study further revealed that while any of the three features was shown by only 7 of the 43 girls born to mothers with PCOS, the same was not the case among those who were born to mothers who did not have PCOS with the figure standing at 0 of the 28 (Crisosto et al., 2018).

Complications of PCOS

Some of the metabolic complications associated with PCOS include insulin resistance, hyperinsulinemia, NAFLD, IGT, hypertension, MS, T2DM, dyslipidemia, GDM, cardiovascular disease risk, and gestational diabetes (Self et al., 2020).

Conn et al for their study recruited 38 premenopausal women with type 2 diabetes from a hospital diabetes clinic. This study indicates that 82% of the women had polycystic ovaries as demonstrated by ultrasonography. Among these women, 32 % had hirsutism, 6% had moderate to severe acne and 26% had oligo-amenorrhea (Moghetti & Tosi, 2020).

An assessment of the anthropometric parameter patterns and lipid profile in eighty-six women with clinical PCOS was undertaken. The majority of the female participants had their anthropometric measures exceeding the threshold cut-off value. The commonest anthropometric abnormality detected in the study was the waist circumference (88. 37 %) followed by waist-to-hip ratio (87. 21 %), BMI (81. 4 %), and WHtR (81. 39 %). The lipid profile abnormally was observed in 38 patients of which most of them had low levels of High-density lipoprotein cholesterol (HDL) 65. 11%, slightly more than when half of the patients had high levels of Low-density lipoprotein cholesterol (LDL) 53. 48% and Triglycerides 53. 5%. In parts per palate, only VLDL was slightly elevated with more than 14% and 9. 3% of study participants falling within the cut-off >2. 5THD of TC levels as put by (Himabindu et al., 2017).

In the context of a meta-analysis, patients' mood of PCOS was investigated. The results showed that women with PCOS were more likely to experience moderate/severe depressive symptoms (OR: For any depressive disorder, random effects were observed with OR 4. 18 (95% CI, 2. 68–6. 52) in 11 studies; for any depressive symptoms, OR was 5. 62 (95% CI, 3. 22–9. 80) in 9 studies; for any anxiety disorder of any kind, OR was 6. 55 (95% CI, 2. 87–14. Even if participants were matched for BMI, women with PCOS had higher odds of exhibiting depression (OR: 3. 25, 95% CI: 1. 73 to 6. 09 and anxiety (OR: 6. 30 95% CI: 1. 88 to 21. 09, four studies) symptoms respectively.

Insulin Resistance in PCOS

One hormonal disorder that is well-known to affect women with PCOS is insulin resistance. The organ cells develop an impulsive nature and become unresponsive to insulin which controls blood glucose levels and thus develops insulin resistance. In relation to this, blood insulin levels can become higher since the pancreas has to release more insulin in other to maintain the blood sugar levels. This may result in a number of difficulties including an increase in weight, lipids, and cholesterol, and also predisposes the patient to T2DM (Armanini et al., 2022).

In light of the above-stated studies, Gut microbiota seems to play a role in influencing inflammation insulin resistance, and increased BMI in PCOS patients. Low-quality diets can lead to disruption in gut microbiota balance and this leads to the production of lipopolysaccharides by Gram-negative bacteria that pass through the circulation. This could lead to insulin resistance, hyperandrogenism, and activation of the immune system (Shan et al., 2022).

Hyperandrogenism in PCOS

Azziz et al. (2010) in his study also reviewed the diagnostic criteria of PCOS and concluded that hyperandrogenism either clinical or biochemical is an essential feature of this disease. The current study showed that most of the participants with PCOS had high androgen levels as compared to the control group. Moreover, the research also demonstrated that insulin insensitivity, dyslipidemia CVD danger hyperandrogenism, or metabolic dysfunction were related (Wekker et al., 2020).

By today's standards, pathogenetic mechanisms of PCOS are described in terms of hormonal and metabolic dysregulation of the cycle. Hyperandrogenism is known to trigger the development of abdominal and visceral obesity which causes insulin resistance coupled with hyperinsulinemia. This leads to excessive production and secretion of androgens from the ovaries and the adrenal glands, the hypothalamic-pituitary axis dysfunction plays a part in the pathogenesis of ovarian dysfunction and ultimately anovulation and infertility (Bruni et al., 2021).

Acne and hirsutism are common manifestations of hyperandrogenism which most teenagers go through during the period of adolescence. Often it becomes

challenging to distinguish between these normal signs of maturity and other signs that may depict a negative view. To come up with an appropriate differential diagnosis, we also need history and physical examination questions. Hence, while comedoneal acne, particularly moderate is a prevalent issue, severe acne should alert the clinician to the possibility of PCOS (Meczekalski et al., 2023).

Management of PCOS

The present management approach to female infertility due to PCOS has three management principles. The first form of management involves exercise and weight loss of 5 to 10% within a period of 6 months assistance in the ability to respond to ovarian stimulation. The second line treatment therefore is pharmacological and a surgical technique for the purpose of inducing ovulation and maturation of eggs is; Laparoscopic ovarian drilling. Lastly, where other treatment modalities have not worked or in the presence of other underlying indications, the effectiveness of ART to achieve conception is the highest, and therefore the third line of treatment is IVF.

In research, a 1200-calorie diet was prescribed along with suggestions regarding physical activity to the patients of PCOS. Study outcomes of weight reveal that twenty-five of thirty-three patients (76%) whether they had an eating disorder or not shed at least 5 % of their body weight, and eleven of the patients (33%) lost at least 10% of their body weight. Weight loss of 5 % and 10 % was accompanied by a significant reduction in BMI, FM %, four skin folds, hip girth, and WCH. It is also important to note that diet affected ovarian morphology and produced negative shifts in the volume of ovaries and the number of microfollicles per ovary. Among the 27 women who complained of oligo-amenorrhea, 15 had spontaneous ovulation while 18 had regained their normal menstruation cycle. Ten cases of ovulation in patients who had a minimum of 5% decrease in body weight were also reported by the study (Fong et al., 2021).

Drug treatments used in the management of PCOS may include Metformin, combination oral pills, Estrogens, and Estroprogestins if lifestyle changes have been carried out as mentioned above. Among them, COCP is usually recommended to be the first treatment for teenagers due to its ability to regulate menstrual cycles and decrease hyperandrogenemia. COCP and some of the other drugs that a woman might take can have side effects and therefore, deciding to start taking such drugs should be well deliberated and the decision made must be explained to the patient (Ibáñez et al., 2017).

Myo-Inositol Supplementation

Myo-inositol impacts on ovarian function as well as metabolic parameters in women with PCOS were investigated in the present randomized placebo-controlled trial. Insulinemia was found to be reduced after myo-inositol supplementation while insulin sensitivity was improved In addition, ovulation and the monthly regularity were improved (Facchinetti et al., 2020).

To know the impact of Myo-inositol supplementation, Postmenopausal women with MS were selected for a study in the year 2016. During the trial, 80 postmenopausal women with metabolic syndrome were planned to be involved

in the study. In continuation of a low-energy diet, 40 of the women were randomly assigned to either take 2 g of myo inositol b. i. d or placebo. The subjects' blood pressure, insulin, triglycerides, serum glucose, waist circumference, BMI, total cholesterol, HDL, and insulin levels were recorded before and after the completion of the therapy in 12 months. Conditioned Myo-inositol was reported to have a positive bearing on lipid profile performance, inflammatory indicators, and insulin sensitivity after twelve months of treatment (Medina et al., 2018).

The participants were two groups of thin and teenage females suffering from PCOS; the first group was 13–16 years of age while the second group was 17–19 years of age. During the study period which was for three months, the patient was given drospirenone/ethinylestradiol (group A), myoinositol (myo-Ins) (group B), or an OCP & myo-Ins (group C). This nonpharmacological intervention resulted in a significant reduction of weight as well as body mass index in 13–16-year-old lean myo-Ins treated teenagers with lowered hormonal and metabolic indices. The data revealed that the combined therapy with myo-Ins and OCP provided protection against the increase in weight and BMI, improvement of the patient's metabolic profile, and significant change in the hormonal parameter under consideration, specifically for older teenagers, aged 17-19 (Pkhaladze et al., 2021).

Research Methodology

Basically, the objective of this cross-sectional study was to assess the effects of Myo-inositol (MI) supplementation on Anthropometric

parameters of women with PCOS in Gujranwala. Myo-inositol supplement is available in the market under the name of "MEFO PLUS" of MEDLIFE Pharmaceuticals.

The study design was interventional. A sort of research approach used to assess the efficacy or effectiveness of a specific intervention or course of therapy is the interventional study design, also referred to as an experimental study or a clinical trial.

Women diagnosed with PCOS according to Rotterdam Criteria were selected from Life Care Hospital of Gujranwala for the purpose of the study. The study population consisted of those participants who were diagnosed with PCOS by their gynecologist according to Rotterdam criteria.

Polycystic ovarian syndrome (PCOS) is defined by the presence of 2 of 3 of the following criteria Oligo□anovulation, Hyper-androgenism, Polycystic ovaries (at least one ovary with more than 12 follicles with a diameter of 2–9 mm, and/or an ovarian volume greater than 10 mL) (Huddleston & Dokras, 2022). The interventional study was completed over the duration of 90 days, 04 times anthropometric measurements were taken on the 0th, 30th, 60th, and 90th day to determine the effect of myo-inositol supplementation among PCOS women of Gujranwala.

Women diagnosed with PCOS according to Rotterdam Criteria. Overweight (BMI 23-27.5 kg/m^2), Obese (BMI >27.5 kg/m^2) PCOS women of reproductive age group (15-30 yrs.). Women with PCOS above 30 years of age. Patients with any other chronic disease or ailment and Dropouts of the study.

Data Collection Procedure

PCOS women according to Rotterdam Criteria were taken in our study by convenience sampling method from Life Care Hospital, Gujranwala. Three groups consisted of at least 30 participants in each group.

Group A consisted of 30 overweight (BMI 23-27.5 kg/m^2); Group B consisted of 30 obese (BMI >27.5 kg/m^2) women who were diagnosed with PCOS by their gynecologist were provided with Myo-inositol (2000 mg) for a period of 03 months. Group C was the control group.

The participants were prescribed to consume 2000 mg of Myo-inositol per day in the evening after a meal with a glass of water. Participants of Group C (control group) continued consuming a normal routine diet without any dietary modifications with no ailment. The results of both the groups (pre and post-intervention) were compared with each other at the end of the 3rd month.

To assess the impact of Myo-inositol on the anthropometric parameters, a self-structured nutritional assessment form was comprised of the following considerations;

1. Personal information: Patients were asked to give information about their age, no. of siblings, area of residence, socio-economic status, and give information that either they are students or job holders.
2. From all these questions, we assessed the social background of the patient.
3. Anthropometric Measurements: In this section, the patient's weight, height, BMI, waist circumference, hip circumference, and waist-to-hip ratio were measured before and after the intervention.

Body Mass Index

Early in the 1800s, a Belgian by the name of Lambert Adolphe Jacques Quetelet introduced the BMI. A popular technique for assessing overweight and obesity is the body mass index (BMI), which is based on two anthropometric measurements: height and weight.

BMI = weight/height2

Table 1

BMI Classification

	WHO Asian BMI classification
Underweight	< 18.5 kg/m^2
Ideal	18.5-23 kg/m^2
Overweight	23-27.5 kg/m^2
Obese	>27.5 kg/m^2

Materials

The height and weight of patients were taken at the time of data collection. To measure height (Stadiometer, Weighing Scale)

Waist Circumference

A common measurement linked to obesity and visceral fat accumulation, or insulin resistance, is waist circumference, which can be found with a measuring tape. When measuring a woman's waist circumference, measurements falling between 80 and 88 cm (31.5 and 34.6 in) are considered high risk, whereas beyond 88 cm (34.6 in) are considered extremely high risk (Mahajan et al., 2023).

Hip Circumference

Taking a measurement around the hips' widest point is a simple method for calculating hip circumference. Greater hip circumferences are typically associated with higher subcutaneous fat levels, which are thought to be less harmful than visceral fat. It's important to keep in mind that various ethnic groups may have varying optimal hip circumference ranges. Women's hip circumferences average 98.2 cm (Mohajan et al., 2023).

Waist-to-Hip Ratio

The division of values obtained from the measurement of the two parameters; namely, waist circumference and hip circumference to a fraction delivers a simple figure that stands for the ratio of waist to hips. This ratio relates to potential health risks and is one of the valuable means for assessing the spread of fat in the body. Large Wt/ Ht means that many layers of fat are accumulated around the waist and this is usually linked to an increased susceptibility to developing health complications such as diabetes and cardiovascular diseases among others. In particular, a smaller WHR is viewed as preferable since it reflects optimal fat distribution in the body.

Table 2

Waist to Hip Ratio Ranges

Women	Health risk	Body shape
0.80 or below	Low	Pear
0.81-0.85	Moderate	Avocado
0.85+	High	Apple

Supplement Intake

Table 3

Supplement intake pattern

Groups	Interventional Group	Number of patients	Anthropometric data collection	Dosage intake	Duration of Dosage
A Overweight (BMI 23-27.5 kg/m^2)	Overweight PCOS patients consuming Myo-inositol	30	At 0 day, 4th week (30th day), 8th week (60th day) and 12th week (90th day) of study	2000 mg Myo-inositol Once a day in the evening	30 + 30 +30 days (3 months)
B Obese (BMI >27.5 kg/m2)	Obese PCOS patients consuming Myo-inositol	30	At 0 day, 4th week (30th day), 8th week (60th day) and 12th week (90th day) of study	2000 mg Myo-inositol Once a day in the evening	30 + 30 +30 days (3 months)
C	Control Group	30	0	0	--

Ethical approval

Hence the participants were given their informed consent in written form and the information given by the participants was kept confidential. Permission of the Institutional Review Board of NIU, Lahore and Life

Care Hospital, Gujranwala was taken prior to conducting this research investigation for ethical approval for the study.

Results and Discussions:

Comparison of Effect of Myo-Inositol Supplementation on Weight on All the Three Groups

Table 4

Comparison of Weight

Post Hoc Test for the Mean Differences					
Measure: Weight					
(I) Time	**(J) Time**	**Mean Difference (I-J)**	**Sig.**	**95% Confidence Interval for Difference**	
				Lower Bound	**Upper Bound**
0th day	30th day	1.389*	.000	1.202	1.576
	60th day	2.588*	.000	2.326	2.849
	90th day	3.886*	.000	3.563	4.209
30th day	0th day	-1.389*	.000	-1.576	-1.202
	60th day	1.198*	.000	1.011	1.386
	90th day	2.497*	.000	2.244	2.749
60th day	0th day	-2.588*	.000	-2.849	-2.326
	30th day	-1.198*	.000	-1.386	-1.011
	90th day	1.298*	.000	1.120	1.477
90th day	0th day	-3.886*	.000	-4.209	-3.563
	30th day	-2.497*	.000	-2.749	-2.244
	60th day	-1.298*	.000	-1.477	-1.120

The post hoc analysis shows that Myo-Inositol treatment reduced weight at all time points; 0th day, 30th day, 60th day, and 90th day in a statistically significant manner. Particularly, the means difference of weight by time were all significant at $p < .05$ and the data showed that weight loss increased as the supplementation period was prolonged. These results are also corroborated by the 95% confidence intervals suggesting that the manipulation in question influenced the weight of PCOS women in Gujranwala over time and the effect was quite substantiated
.

Comparison of Effect of Myo-Inositol Supplementation on BMI On All The Three Groups

Table 5

Comparison of BMI

Post Hoc Test for the Mean Differences					
Measure: BMI					
(I) Time	**(J) Time**	**Mean Difference (I-J)**	**Sig.**	**95% Confidence Interval for Difference**	
				Lower Bound	**Upper Bound**
0th day	30th day	.532*	.000	.461	.604
	60th day	-.903	.739	-6.284	4.477
	90th day	1.511*	.000	1.382	1.639
30th day	0th day	-.532*	.000	-.604	-.461
	60th day	-1.436	.597	-6.809	3.937

Post Hoc Test for the Mean Differences					
Measure: BMI					
(I) Time	(J) Time	Mean Difference (I-J)	Sig.	95% Confidence Interval for Difference	
				Lower Bound	Upper Bound
60th day	90th day	.978*	.000	.874	1.083
	0th day	.903	.739	-4.477	6.284
	30th day	1.436	.597	-3.937	6.809
	90th day	2.414	.374	-2.959	7.788
90th day	0th day	-1.511*	.000	-1.639	-1.382
	30th day	-.978*	.000	-1.083	-.874
	60th day	-2.414	.374	-7.788	2.959

In the course of the Myo-Inositol supplementation, the post hoc test of BMI also suggests differences at some particular time points. In detail, 0 to 30 days BMI significantly increased at 0. 532, $p < 0.05$, and 0 to 90 days increased at 1. 511, $p < 0.05$ and 30 to 90 days increased at 0. 978 units, $p < 0.05$. Nevertheless, the differences at sixty days and other time intervals such as the 0th, 30th and 90 th day were found not to be significant with the p-value analysis bigger than 0. 05. Hence it is clear that although there was a general increase in BMI at the start of the supplementation period, the extent of the increase did not vary much between the 60th and 90th days.

Comparison of Effect of Myo-Inositol Supplementation on WHR On All The Three Groups

Table 6

Comparison of WHR

Post Hoc Test for the Mean Differences					
Measure: WHR					
(I) Time	(J) Time	Mean Difference (I-J)	Sig.[b]	95% Confidence Interval for Difference	
				Lower Bound	Upper Bound
0 day	30 day	.000	.973	-.022	.022
	60 day	.009	.395	-.012	.031
	90 day	.019	.094	-.003	.041
30 day	0 day	.000	.973	-.022	.022
	60 day	.009*	.000	.005	.013
	90 day	.019*	.000	.014	.023
60 day	0 day	-.009	.395	-.031	.012
	30 day	-.009*	.000	-.013	-.005
	90 day	.009*	.000	.005	.014
90 day	0 day	-.019	.094	-.041	.003
	30 day	-.019*	.000	-.023	-.014
	60 day	-.009*	.000	-.014	-.005

The post hoc test results for the Waist-to-Hip Ratio (WHR) indicate that there were significant changes in WHR at various time points during the Myo-Inositol supplementation period. Specifically, the WHR did not change significantly between the 0th day and the 30th, 60th, or 90th days. However, significant differences

were observed between the 30th day and both the 60th day (0.009, $p < 0.05$) and the 90th day (0.019, $p < 0.05$), as well as between the 60th day and the 90th day (0.009, $p < 0.05$). This suggests that the most notable changes in WHR occurred between the 30th day and later time points, indicating that the supplementation's effect on WHR became more pronounced after the first 30 days.

Conclusion

Insulin resistance is linked to polycystic ovarian syndrome (PCOS), a prevalent endocrine condition in women of reproductive age that causes hyperandrogenism, anovulation, infertility, and weight gain. Just as improved insulin resistance helps people lose weight, and vice versa. Metformin and myo-inositol, two insulin sensitizers, improved anthropometric measurements in PCOS.

Obesity and insulin resistance (IR) exhibit a close association, wherein obesity contributes to heightened insulin resistance, exacerbating both metabolic and reproductive symptoms in PCOS. The gynoid pattern of fat distribution, established during female adolescence, persists throughout fertile adulthood. Notably, androgens undergo aromatization into estrogens within peripheral fat tissue, particularly in the lower body. Consequently, this fat tissue becomes a significant source of additional ovarian estrogen synthesis. The primary endocrine manifestation of PCOS, hyperandrogenicity, is distinctly linked to an excess of concentrated fat in the upper body.

As a result, Myo-inositol might be an additional option in the PCOS treatment arsenal. Since the underlying pathology of PCOS is insulin resistance, insulin sensitizers combined with lifestyle changes need to be considered as a unique integrative therapy that can lead to weight loss and improve PCOS symptoms.

Recommendation

A small sample size may result in lower statistical power, which makes it difficult to extrapolate results to larger populations. The capacity to identify minute effects or differences in human reactions may be hampered by small sample sizes. Despite the challenge of gathering study samples from a larger number of patients due to time constraints, the investigation was carried out as accurately as possible with the resources at hand. The dependability of the results is impacted by participant adherence to the intervention program, which varies. Inadequate adherence could potentially add confounding variables and jeopardize the study's internal validity. It is recommended that more research be done to find out how MI affects anthropometric and biochemical parameters in PCOS women and how long it takes for results to show up.

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