Original Article

# Efficacy of cinnamon, exercise and counselling (Multi - interventional Package) on insulin resistance among young girls with Polycystic Ovarian Syndrome

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## Abstract

Background: Women with PCOS often have insulin resistance; they can produce insulin but it can't be used effectively. They also have high levels of androgens which leads to an ovulation, irregular menstrual cycle, acne issues, hair loss, and hirsutism on the face and body. Insulin resistance occurs in 70-95% of people with PCOS. Lifestyle and hereditary can have an impact on insulin resistance, especially if a woman is overweight because of an unhealthy diet and lack of physical activity. Losing weight will often help to reduce symptoms, despite of any reason for the insulin resistance.

Aim: To determine the efficacy of cinnamon, exercise and counselling (Multi – interventional Package) on insulin resistance among young girls with Polycystic Ovarian Syndrome

Methods: Experimental pre and posttest design was used in this study.150 PCOS young girls who had impaired glucose level were selected as study participants. self-administered questionnaire was used to collect the baseline data and all the study participants underwent OGTT(oral glucose tolerance test) at the beginning and also at 3rd and 6th month of the study. Their Fasting blood glucose and 2 hr blood glucose levels after consuming 75 grams of glucose were assessed. Girls who met with inclusion criteria were selected and they were partitioned into 3 groups, 50 in each group – control group (no intervention), experimental group 1 (all three interventions), experimental group 2 (selected interventions). Interventions were planned for 6 months. Post-test I, II were conducted after 3rd and 6th month respectively. Non probability Purposive sampling technique was used. consent was acquired from all the study participants.

Results: The Fasting and 2 hr glucose blood sugar levels of Control group were increased to 2.05% and 3.82% respectively, whereas in Experimental group 1 and Experimental group 2, the Fasting and 2 hr glucose blood sugar levels were reduced to 7.9% and 7%, 3.3% and 4.8% respectively. This shows that both the experimental groups shown reduction in the fasting and 2 hr glucose blood sugar level whereas the Experimental group 1 was found to be superior to other interventions.

Conclusion: This study focused on the beneficial role of multi interventional package(cinnamon tea, exercise program and counselling) in reducing the Fasting and 2 hr blood glucose levels among young girls with Polycystic ovarian syndrome. Hence, this study recommends the multi interventional package to reduce insulin resistance among young girls with PCOS.

**Keywords:** effectiveness, cinnamon, exercise, counselling, Multi-interventional package, insulin resistance, Polycystic ovarian syndrome, young girls.

## INTRODUCTION

In recent times, there has been a tremendous change in the lifestyle of people. These changes do have an impact on the health of the people and make them prone to certain diseases and its complications. Polycystic ovarian syndrome (PCOS) is one such disease. In the early 20th century, polycystic ovaries were considered as a result of inflammation due to infection and congestion. And after that Michael L. Leven thal and Irving F. Stein together described elaborately about the syndrome in 1935. Hence Polycystic ovarian syndrome is also called as Stein-Leventhal Syndrome. Polycystic ovarian Syndrome (PCOS) is one of the most widely recognized endocrinological, metabolic and reproductive disorders among young girls and women. These Syndrome exhibit symptoms as complex with amenorrhea, hyper androgenic symptoms like hirsutism, acne, Acanthosis

nigricans, alopecia and enlarged ovaries with multiple cysts. They also exhibit symptoms like obesity, insulin resistance, high blood pressure and hyperlipidemia. The lack of ovulation alters the level of estrogen, progesterone, FSH, and LH. Progesterone levels are lower than usual, while androgen levels are higher than usual. Insulin resistance and hyperinsulinemia can occur in both normal-weight and overweight women with PCOS. Both hormonal changes and symptoms like unwanted hair growth can negatively affect the emotions of many girls with PCOS eventually experience depression, anxiety and sleep apnea (11). The prevalence of PCOS ranges between 5% and 15% depending on the diagnostic criteria applied. The prevalence of PCOS was 16.6% according to the Rotterdam criteria (12). Early determination of Polycystic ovarian disorder (PCOS) among young girls is vital as it has been connected to an increased risk for developing several medical conditions including type 2 diabetes, high cholesterol, hypertension, endometrial cancer (13), Miscarriage or premature birth, Infertility, Non-alcoholic steatohepatitis, and certain cardiac disease.

## MATERIALS AND METHODS:

Experimental pre and post-test design was used in this study. A total of 824 young girls from different colleges in Chennai were screened for PCOS based on Rotterdam criteria and those girls with PCOS were then underwent for OGTT (oral glucose tolerance test). Fasting blood sugar and 2 hr blood sugar levels after consuming 75 grams of glucose were assessed. 150 PCOS girls who had impaired glucose level and who are ready to give consent for the procedure and the interventions were selected for the study. self-administered questionnaire was used to elicit the baseline data. All the participants followed intervention adherence dairy for reinforcement. Multi stage sampling technique was used. The study was approved by Tagore institutional ethics committee. Written consent was acquired from every one of the study participants. After recruiting the participants, they were partitioned into three groups (50 participants in every group).

Control group(n=50):only education related to PCOS

Experimental group 1 (n=50): cinnamon tea (1.5 grams of cinnamon powder mixed in 100ml of warm water consumed daily during break time once in a day for 5 days in a week) exercise program(One-hour exercise program - Cardio exercise and strength training exercises were practiced in the alternate days for 5 days in a week) and counselling(regarding lifestyle modification. Session conducted once a month)

Experimental group 2 (n=50): exercise program (One-hour exercise program - Cardio exercise and strength training exercises were practiced in the alternate days for 5 days in a week) and counselling (regarding lifestyle modification. Session conducted once a month)

Ethical consideration:

The present study was approved by Institutional Ethics Committee, Tagore Medical College and Hospital IEC NO: 32/MAR/2021 Dated: 18.03.202.

## Results:

**Table 1: Comparison of control and experimental group 1 and experimental group 2 of pre-test, post-test 1 and post-test 2 on FBS and 2 hr blood glucose level among young girls with polycystic ovarian syndrome.**

| S.No. | Group comparison | Test comparison | FBS | PPBS |
|---|---|---|---|---|
| 1 | Control | Pre-test | 101.24 ± 1.59 | 137.34 ± 1.59 |
| | Experimental 1 | | 104.08 ± 0.92 | 146.00 ± 1.20 |
| | Experimental 2 | | 99.08 ± 1.32 | 137.64 ±1.85 |
| | Control | Post-test 1 | 104.80 ± 3.13 | 141.20 ± 2.90 |
| | Experimental 1 | | 99.60 ± 2.91 | 134.60 ± 6.09 |
| | Experimental 2 | | 98.20 ± 2.91 | 127.80 ± 3.58 |
| | Control | Post-test 2 | 103.32 ± 1.24 | 142.60 ± 1.17 |
| | Experimental 1 | | 96.44 ± 0.36 | 136.48 ± 0.51 |
| | Experimental 2 | | 95.88 ± 0.84 | 131.36 ± 1.42 |

| | | | |
|---|---|---|---|
| 2. | Significance within Control (Pre-test and Post-test 1) | t = 1.248<br>P = 0.641 | t = 1.545<br>P = 0.373 |
| | Significance within Control (Pre-test and Post-test 2) | t = 1.145<br>P = 0.530 | t = 1.326<br>P = 0.461 |
| | Significance within Control (Post-test 1 and Post-test 2) | t = 0.024<br>P = 1.000 | t = 0.634<br>P =1.000 |
| | Significance within Experimental 1 (Pre-test and Post-test 1) | t = 4.172<br>P < 0.001 | t = 4.954<br>P < 0.001 |
| | Significance within Experimental 1 (Pre-test and Post-test 2) | t = 9.347<br>P < 0.001 | t = 7.886<br>P < 0.001 |
| | Significance within Experimental 1 (Post-test 1 and Post-test 2) | t = 0.502<br>P = 1.000 | t = 1.011<br>P = 0.941 |
| | Significance within Experimental 2 (Pre-test and Post-test 1) | t = 1.774<br>P = 0.233 | t = 2.295<br>P = 0.069 |
| | Significance within Experimental 2 (Pre-test and Post-test 2) | t = 3.915<br>P < 0.001 | t = 5.202<br>P < 0.001 |
| | Significance within Experimental 2 (Post-test 1 and Post-test 2) | t = 0.184<br>P = 1.000 | t = 0.307<br>P = 1.000 |
| Values are mean $\pm$ SE (n = 50 each) | | | |

The fasting blood sugar level of Control, Experimental 1 and Experimental 2 groups are given in Table 1. The mean values of fasting blood sugar of Control Pre-test, Experimental 1 Pre-test, Experimental 2 Pre-test, Control Post-test 1, Experimental 1 Post-test 1, Experimental 2 Post-test 1, Control Post-test 2, Experimental 1 Post-test 2 and Experimental 2 Post-test 2 are 101.24, 104.08, 99.08, 104.80, 99.60, 98.20, 103.32, 96.44 and 95.88 (mg/dL) respectively. Comparison within the Control group of Pre-test and post-test 1, Pre-test and Post-test 2, and Post-test 1 and Post-test 2 did not show significance (P = 0.641, 0.530,1.000 respectively). Comparison within the Experimental 1 group of Pre-test and post-test 1, Pre-test and Post-test 2 shown significance(P <0.001, P< 0.001 respectively) whereas Post-test1 and Post- test 2 did not show any significance (P = 1.000). Comparison within the Experimental 2 group of Pre-test and post-test 1 and Post-test 1 and Post-test 2 did not show significance (P = 0.233, P = 1.000 respectively) whereas comparison of Pre-test and Post-test 2 revealed significance (P < 0.001). In the Control group 2.05% increase was observed. In the Experimental 1 and Experimental 2 groups 7.9% and 3.3% decrease was observed respectively. This shown that both the experimental groups shown reduction in fasting blood sugar level whereas the Experimental group 1 was superior to other interventions.

The glucose level after 2 hr consumption of 75 grams of glucose in Control, Experimental 1 and Experimental 2 groups are given in Table 1. The mean values of 2 hr blood glucose level of Control Pre-test, Experimental 1 Pre-test, Experimental 2 Pre-test, Control Post-test 1, Experimental 1 Post-test 1, Experimental 2 Post-test 1, Control Post-test 2, Experimental 1 Post-test 2 and Experimental 2 Post-test 2 are 137.34 ,146.00, 137.64, 141.20, 134.60, 127.80, 142.60, 136.48, 131.36 (mg/dL) respectively. Comparison within the Control group of Pre-test and post-test 1, Pre-test and Post-test 2, and Post-test 1 and Post-test 2 did not show significance (P = 0.373, 0.461, 1.000 respectively). Comparison within the Experimental 1 group of Pre-test and post-test 1, Pre-test and Post-test 2 shown significance (P < 0.001, P < 0.001 respectively) whereas Post-test 1 and Post 2 did not show any significance (P = 0.941). Comparison within the Experimental 2 group of Pre-test and post-test 1 and Post-test 1 and Post-test 2 did not show significance (P = 0.069,1.000 respectively) whereas comparison of Pre-test and Post-test 2 revealed significance (P < 0.001). In the Control group 3.82% increase in glucose levels was observed. In the Experimental 1 and Experimental 2 groups 7% and 4.8% reduction in blood glucose levels was observed respectively. This revealed that both the experimental groups shown reduction in 2 hr blood glucose level whereas the Experimental group 1 was found to be superior to other interventions.

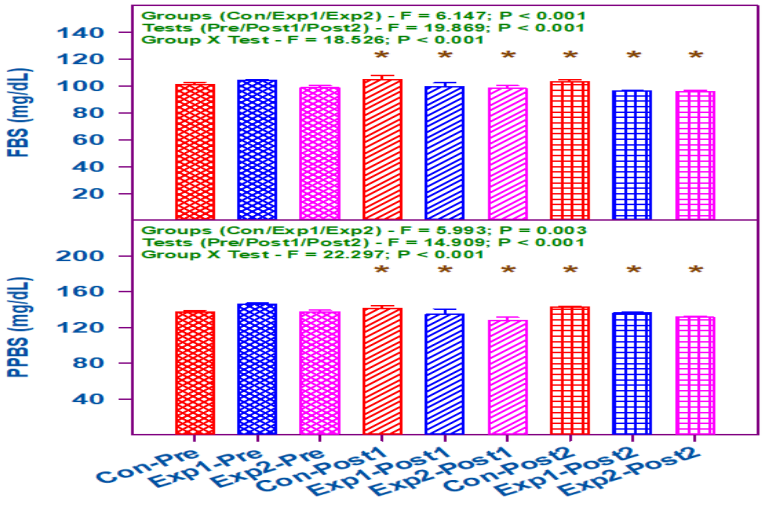


Figure 1: Comparison of control (Con), experimental 1 (Exp 1) and experimental 2 (Exp 2) groups of pre-test (pre), post-test 1 (Post 1) and post-test 2 (Post 2) on fasting and 2 hr blood glucose level among young girls with poly cystic ovary syndrome. The 'F' and 'P' values are by two-way RM ANOVA with Bonferroni 't' test.

*Significantly different from the respective pre-test.

## Discussion:

The main aim of the study is to investigate the effect of cinnamon, exercise and lifestyle modification counselling on insulin resistance among young girls with PCOS. Insulin is a hormone produced by the pancreas to control the amount of sugar in the blood. It helps to move glucose from blood into cells, where it's broken down to produce energy. Insulin resistance means the body's tissues are resistant to the effects of insulin. The body therefore has to produce extra insulin to compensate. High levels of insulin causes the ovaries to produce too much testosterone, which interferes with the development of the follicles (the sacs in the ovaries where eggs develop) and prevents normal ovulation. Insulin resistance can also lead to weight gain, which can make PCOS symptoms worse, as having excess fat causes the body to produce even more insulin. It is now clear that PCOS is often associated with profound insulin resistance as well as with defects in insulin secretion. These abnormalities, together with obesity, explain the substantially increased prevalence of glucose intolerance in PCOS. Moreover, since PCOS is an extremely common disorder, PCOS-related insulin resistance is an important cause of NIDDM in women. The insulin resistance in at least 50% of PCOS women appears to be related to excessive serine phosphorylation of the insulin receptor. A factor extrinsic to the insulin receptor, presumably a serine/threonine kinase, causes this abnormality and is an example of an important new mechanism for human insulin resistance related to factors controlling insulin receptor signaling. Serine phosphorylation appears to modulate the activity of the key regulatory enzyme of androgen biosynthesis. It is thus possible that a single defect produces both the insulin resistance and the hyperandrogenism in some PCOS women. (1).

Cinnamon the well-known spice which crossed centuries has got very good anti- diabetic property in it, which is evident with the study conducted by Zare, R et al and they found that the Cinnamon supplementation led to improvement of all anthropometric, glycemic (FPG, 2hpp, HbA1C, Fasting Insulin, and Insulin Resistance), and lipids outcomes. (9).

Jeff G. Wangfound that cinnamon extract would improve insulin sensitivity in women with PCOS. During the 8-week treatment period, oral cinnamon extract resulted in a significant reduction in fasting glucose as well as insulin resistance, as measured by various indices of insulin sensitivity from fasting and OGTT values.(13) which is concordance with the present study result, the Fasting and 2 hr glucose blood sugar levels of Control group were increased to 2.05% and 3.82% respectively, whereas in Experimental group 1 and Experimental group 2, the Fasting and 2 hr glucose blood sugar levels were reduced to 7.9% and 7%, 3.3% and 4.8% respectively. This shows that both the experimental groups shown reduction in the fasting and 2 hr glucose blood sugar level whereas the Experimental group 1 was found to be superior to other interventions.

This was also in agreement with Garcia-Hermoso et al. [6], who reported improvements (only in fasting insulin) after an aerobic exercise program for more than 12 weeks, three sessions per week, and over 60 min of aerobic exercise per session. This meta-analysis provides insight about the effectiveness of aerobic exercise interventions on insulin resistance markers in the obese young girls.

To judge the glucose tolerance status of the patients against that of the control group, this study measured fasting glucose and 2 hr blood glucose level after consuming 75 grams of glucose solution; we found there is statistically significant reduction in both the fasting and 2 hr blood glucose level between control and experimental groups. The control shown significant increase in the both values whereas the experimental group 1 shown marked reduction in the fasting and 2 hr blood glucose levels when come to experimental group II and control group.

The main pre – disposing factor of PCOS is genetic, hormonal imbalance and the poor lifestyle. Eating unhealthy foods, sedentary lifestyle, stress, irregular sleep pattern altogether contributes to PCOS. Lifestyle modification is serving as the first line management for PCOS and also in balancing the hormones like androgen and insulin. Reducing the oxidative stress by consuming some anti – oxidants, good eating habits, exercising regularly, good rest and sleep and stress free life together will help the young generations to get rid of PCOS.

## Conclusion:

The present study results support the beneficial effects of cinnamon, exercise and lifestyle modification counselling in reducing the insulin resistance and hyperinsulinemia among young girls with Polycystic ovarian syndrome. These interventions are cost-effective, less time consuming and it is effective in decreasing the fasting and 2 hr glucose levels. Hence, the study recommends cinnamon, exercise and lifestyle modification counselling for young girls with Polycystic ovarian syndrome. However, we want further investigations with larger participants to research the impact of cinnamon, exercise program and counselling in reducing the different factors like physiological factors, lipid profile and total testosterone levels among young girls with Polycystic ovarian syndrome.

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Conflicts of Interest: The authors declared no competing interests.

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