

# Effect of Aerobic Exercises in Polycystic Ovarian Syndrome (PCOS) Females - A Systematic Review

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DOI: <https://doi.org/10.52403/ijrr.20240681>

## ABSTRACT

**INTRODUCTION:** PCOS (Polycystic Ovary Syndrome) is complex hormonal conditional in which the female of reproductive age has ovarian hormonal imbalance. This leads to multiple health related concerns including insulin resistance, abnormal increase in androgens, obesity, depression etc. various treatment approaches are used in treatment of PCOS and exercises is one of those. The aim of current study was to evaluate various randomized control trial and strengthen the literature focusing multidimensional effects of aerobic exercises in PCOS.

**METHODOLOGY:** The present systematic review was conducted as per PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Two researchers completed the review process. Total 390 articles were screened and 14 articles matching inclusion criteria were included in review process through search engines like PubMed, PEDRO, Google Scholar and Research gate by keyword 'PCOS', 'Aerobic exercises in PCOS', 'Exercises in PCOS' and 'PCOS and Exercises'

**RESULTS:** In the present systematic review data from 14 articles (total 456 PCOS females) were analysed using Windows 11, 23H2 Microsoft excel version 2405. PCOS females from age 18-40 years (Average 25.29 year) were included in the studies.

**CONCLUSION:** The effects of exercises were found significant in hormonal imbalance particularly insulin and ovarian hormones, complement-immune system, lipid profiles, weight control, mood and quality of life but is questionable in function of complement system and immunity.

**ABBREVIATION:** PCOS (Polycystic Ovary Syndrome) IR (Insulin Resistance) CRP (C reactive protein) Luteinizing hormone (LH) follicle stimulating hormone (FSH) VO<sub>2</sub>max (Maximal Oxygen Consumption) Low-density lipoprotein (LDL), Very Low-density lipoprotein (VLDL) High-density lipoprotein (HDL) tumour necrosis factor-alpha (TNF-alpha) and interleukin-6 (IL-6).

**Keywords:** PCOS (Polycystic Ovary Syndrome), Exercises in PCOS, Aerobic exercises in PCOS

## INTRODUCTION

According to American college of Obstetrician and Gynaecologist Polycystic ovary syndrome (PCOS) is a condition in which hormones are imbalanced in ovaries. PCOS occurs in females of fertile age. Common characteristics of PCOS are irregularity in menstruation, increased levels of androgens and cysts formation in ovaries. Anovulation is also seen in PCOS. The higher rate of male sex hormones released in female ovaries in PCOS. (1,2)

The ovaries in PCOS females develops numerous small cysts (fluid-filled sacs).

These cysts make hormones called androgens, an abnormal amount of androgens, male sex hormones that are usually present in women in small amounts which cause numerous undesirable health effects in females such as obesity, infertility, mood swing, obesity, insulin resistance and others. Women with PCOS often have high levels of androgens. This can cause more problems with a woman's menstrual cycle.(3,4)

The effect of exercises has been evaluated in females with PCOS in past on several health-related problems.(1,5) The aerobic exercises are seen effective in improving insulin sensitivity, weight management, hormonal imbalance and others.(6,7) Several randomized controlled trials were done in past still there are not many comprehensive and exhaustive literature available enlightening the effects of exercises on physical, metabolic hormonal and psychological aspects of health hence the need of a study arises. The aim of current study was to evaluate various randomised control trial and strengthen the literature focusing multidimensional effects of aerobic exercises in PCOS.

## MATERIALS & METHODS

The present systematic review was conducted as per PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Two researchers completed the process of reviewing titles, abstract, full text screening, checking inclusions etc and the difference in opinions were resolved through discussions. Literature search was done through search engines like PubMed, PEDRO, Google Scholar and Research gate by keyword 'PCOS', 'Aerobic exercises in PCOS', 'Exercises in PCOS' and 'PCOS and Exercises'. After retrieving all the articles, primary screening was done through inclusion and exclusion criteria. Total 390 articles were screened and 14 articles matching inclusion criteria were included in review process. The procedure is shown in figure 1.

Inclusion Criteria were set as, prospective interventional studies which included PCOS females, studies in which aerobic exercises was given as an intervention, articles in English language, studies done from year 2011 to 2024. The articles which were not available as full text, conference papers, and any studies other than interventional studies were excluded from the study. The overview of articles included in the study is demonstrated in table 1.

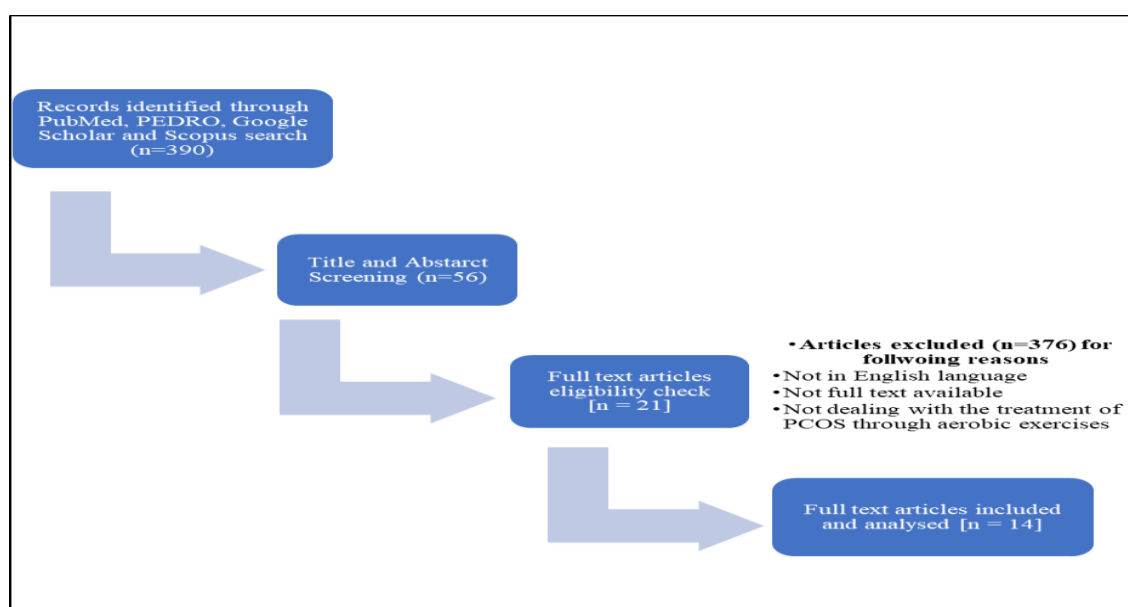


Figure 1: Study flow chart.

Overview of articles included in the study is demonstrated in Table 1 (3,4,6-17)							
Sr. No	Authors	Study Design	Treatment Groups	Outcome Measures	Intervention Program	Results	Conclusion
1	Veena Kirthika, Jibi Paul et al.	randomized controlled trial.	(Total Participant=30) 2 groups, each group consisting of 15 subjects. Group A (Aerobic Exercises) Group and Group B (Active Stretching Exercises)	LH:FSH, free testosterone, IR, CRP	Group-A 45 mins brisk jog, 6km/hr, 10 min warm up-10 min cool down, 3 days/wk Group-B Active stretching, Upper Limb, Lower Limb, 20sec hold/rep, 10 reps/session, 1 session/day, 12 weeks	Significant decrease, p<0.001 in post-test Group A in LH: FSH ratio, free testosterone hormone level, Insulin resistance and high sensitivity C Reactive compare to Group B	A 12-week aerobic exercise and life style intervention was effective in improving PCOS-Q50 scores and hormonal levels among young women with PCOS.
2	Manjunath Ramanjaneya, Ibrahim Abdalhakam et al.	Experimental Study	(Total Participant=21) 10 controls and 11 PCOS subjects, supervised exercise program that consisted of 1-h supervised exercise three times per week for 8 weeks	14 proteins related to complement system	On treadmill 60% of VO2 max exercises intensity, Warm up and cool down for approx. 5 mins, 4.5 km/hour	Baselines compliment protein was high on PCOS compare to Health subject; post-test complement protein reduced in healthy subject (p<0.05) but not reduced in PCOS female	Exercise is helpful in reducing insulin resistance but does not alter the function of complement pathways
3	S. Babaei Bonaba, M. Parvanehb	Experimental Study	(Total Participant=40) 20-20 participants were randomly and equally divided into two groups: the exercise group (aerobics) and the control group.	BMI, Testosterone, oestrogen, Prolactin, Lipid profile. Anthropometric measurements	45-60 min walking, moderate intensity, 3 session/week, 12 weeks	Significant reduction in BMI (p=0.002) Testosterone(p=0.041), oestrogen (p=0.001), Prolactin(p=0.001), Lipid profile.	Home based aerobic exercise is significantly improving hormonal imbalance and cholesterol profile in female with PCOS
4	A.M. ELBANDRAWY A.M. YOUSEF et al.	randomized controlled trial.	(Total Participant=40) 20-20 the aerobic exercise group (AEM), and the metformin group (M). The AEM group performed aerobic	TNF- $\alpha$ , IL-6, CRP, other proteins	3 session/week, 12 weeks, approx. 60 min/session, 60-70% of MHR 30 min walking on treadmill, 0% slope, 30% MHR during warm up and cool	Significant reduction in TNF- $\alpha$ , IL-6, CRP (p=0.001)	Aerobic exercises is beneficial in reducing TNF- $\alpha$ , IL-6, CRP in PCOS female, further research recommended

			exercise three times a week for 12 weeks in addition to metformin treatment. The M group received metformin only.		down		
5	V. Pradhap Sankar, M. Manoj Abraham et al.	Single group Experimental Study	(Total Participant=20) 20 participant in single group	BMI, SF-36	3 sessions per week each lasting 40-60 minutes. The first 5-6 minutes in each session was for warm up, the next 30-45 minutes for exercise and last 5-7 minutes for cooling down.	Statistical analysis improvement seen in BMI and SF-36	BMI and Quality of life improved with exercises in PCOS females.
6	Jayabalan Prakash, Tittu Thomas James et al.	Experimental Study	(Total Participant=20) 10-10 participants in each group, Group A received combined aerobic, Swiss ball exercise programme whereas Group B received only aerobic training.	Weight, abdominal fat, Girth measurement, Menstrual irregularity questionnaire.)	12 week, 6 days/week, Exercise Protocol – Group A Warm Up (10 Mins) [20 mins, 3 Circuits, Intensity – Borg Scale 12-13 (somewhat hard)] and Swiss Ball Exercises (20 mins, 3 Circuits), Cool down 10 mins Exercise Protocol – Group B [40 mins, 6 Circuits, Intensity – Borg Scale 12-13 (somewhat hard)] Cool down 10 mins	Body weight reduced, MIQ improved in both groups but higher in Group A (p<0.05)	Adding Swiss ball activity in PCOS females weight reduction training increased rate of weight loss
7	Somayeh Mohammadi, Amirabbas Monazzami et al.	randomized controlled trial.	(Total Participant=28) 14- 14 participant in two groups, Group-A high-intensity interval training (HIIT) and Group-B Control Group	Weight, height, BMI, VAT, CPR, Lipid Profile, IR	low intensity run in 15 min warm up, then high intensity aerobic exercises, 30-sec sprint, 30 sec slow run, dynamic stretching, recovery for 3 sessions/week, 8 wee	BMI, fat, weight, reduced in HIIT (p<0.005) in Ex group, remain unchanged in control group	HHIT improved weight, BMI and IR and Lipid profile in PCOS females. .

8	Elaheh Abazar, Farzaneh Taghian et al	Experimental Study	(Total Participant=24) 12-12 the participants were equally divided into two groups: the exercise group (aerobics) and the control group.	BMI, WHR, percent body fat, weight and body fat mass were measured. In fasting blood samples, the level of HDL, LDL, VLDL, triglyceride and cholesterol were measured.	12 weeks, 60-70% MHR, 3 session/week, including 10 min warm up and cool down	Statistically reduced BMI, Cholesterol, VLDL, LDL remain unchanged or not statically significant, BMI reduced,	Moderate intensity aerobic exercise can improve BMI, HDL, Weight and effects are questionable in LDL, VLDL
9	Mohammad Reza Kordi, Zahra Motie et al.	Experimental Study	(Total Participant=24) 12-12 the participants were equally divided into two groups: the exercise group (aerobics) and the control group.	Ovarian morphology, Body fat, WHR, IR,	5 min warm up and cool down, 30 mins bicycle, 65-70% of MHR	IR, Body fat and WHR reduced significantly	3 month aerobic exercises improves physical fitness and hormonal balance in PCOS females
10	Masoud Nasiri, Amirabbas Monazzami et al.	randomized controlled trial	(Total Participant=45) all divided into three groups receiving High intensity interval training HIIT (n=15), COM combined (resistance and endurance) interventions (n=15) or control group (n=15)	Some anthropometric indices factors including weight, body mass index (BMI), waist to hip ratio (WHR), body fat percent (FP), and visceral adipose tissue (VAT) as well as VO2max	In COM-24 session, in 8 weeks, 50-70% of 1 RM, 60-70% of THR warm and cool down In HIIT 50% of max aerobic speed, 30 sec sprint, 30 sec slow run, 5 min stretching,	BMI, WHR, VAT improved with HIIT and COM but not in Control group (P=0.011).	Aerobic exercise in combination of resisted Ex improved anthropometry measurements in PCOS females.
11	Isis K. Santos, Gabriel S. Pichini et al	A randomized controlled trial	(Total Participant=23) 12 participants in HIIT Group and 11 in Control Group	DASS, SF-36	HIIT walking/running, 1:3 Interval/recovery ration for 10 week, last 2 weeks- 1:1 ration	SF-36 and DASS improved statically significant	HIIT is a useful treatment strategy for improving Quality of life and Stress and depression in PCOS females
12	Laura E. McBreaitya, Maryam Kazemia et al	A randomized controlled trial	(Total Participant=60) Group-A, 31 participants in therapeutic lifestyle	Bone and body composition measures, Total testosterone and	Both groups performed aerobic exercise 5 days per week for 45 min per day with 3	Lumbar BMD higher, Femoral BMD lower (p < 0.05). IR and Body composition improved	In PCOS females, BMD, Body weight and IR improved with diet and

			changes (TLC) diet including aerobic exercises and Group B 29 Participant Aerobic Exercises including pulse-based diet	oestradiol,	required sessions at an intensity of at least 60% of their age-predicted maximal heart rate. Group A Pulses (e.g., chickpeas, beans, split peas, lentils 150 g per day of pulses dry weight (250 g per day wet weight)) and Group B tailored based therapeutic lifestyle changes (TLC) diet		aerobic exercises
13	Jamie L. Benham Jane E. Booth et al	A randomized controlled trial	(Total Participant=47) 16 in high-intensity interval training (HIIT), 14 in continuous aerobic exercise training (CAET) and 17 in no-exercise control	Height and weight, Body mass index, Waist circumference, total cholesterol, high-density lipoprotein cholesterol (HDL-C), triglycerides, alanine transferase (ALT) and gamma-glutamyl transferase (GGT)	HIIT 5 min warm up, 5 min cool down, 90% of Heart Rate reserved (HRR), 18/20 on Borg scale CAET moderate intensity ex, 50-60% of HRR or 4-6/10 Borg scale	BMI improved with both groups, weight reduction, IR and cholesterol profile improved	CEAT and HIIT both are effective in reducing weight and improving cholesterol profile in PCOS female
14	Samantha K. Hutchison, Nigel K. Stepto et al	Experimental Study	(Total Participant=34) 20 overweight PCOS and 14 overweight non-PCOS women	insulin-resistant, body composition including abdominal visceral fat distribution	12-week, 3 session/week, 1 hour/session, 75-85 % of MHR, along with warm up and cool down	Visceral fat recued in both groups (p=0.03)	IR, Visceral fat and body composition can be proved in female with PCOS with Aerobic exercise s



## RESULT

In the present systematic review data from 14 articles (total 456 PCOS females) were analyzed using Windows 11 23H2 Microsoft excel version 2405. PCOS females from age 18-40 years (Average 25.29 year) were included in the studies. The effects of exercises were found significant in hormonal imbalance particularly insulin and ovarian hormones, complement-immune system, lipid profiles, weight control, mood and quality of life. The detailed results of articles are mentioned in Table 1, The various effects are discussed in further section of this review.

## DISCUSSION

In the current systematic review, 14 articles investigating effects of aerobic exercise in PCOS female of reproductive age were analyzed. The effect of exercises was found significant in more than one physiological system. The highest significant was found in insulin resistance, lipids profiles and reducing abnormally high androgens. The effects were broadly categorized as below.

### **Effect of Exercises on Insulin and other hormones in PCOS females**

In PCOS females, life style modification and Moderate Aerobic exercises reduced Insulin Resistance and improves Insulin sensitivity, additionally it reduced the amount of free testosterone and improved LH:FSH ratio. Aerobic exercises improve Quality of life in PCOS females. Home based aerobic exercises, had significant effect on hormones and lipid profile in females with PCOS. Level of prolactin is found higher in PCOS females compare to normal subject. Higher prolactin leads to irregularities in menstruation. 12 weeks of moderate aerobic exercises reduced the prolactin level. Effect of exercises may vary with difference in intensity, duration. Exercises improves level of serotonin. Thus, it improves mood so drug included increase in prolactin can be improved with exercises. Exercises also improves the dopamine, estrogenic and testosterone which

furthermore improves the function of ovaries. The effects of exercises in reduction of prolactin are still been evaluated and contradictory results are also found in several researches.(8,10)

### **Effect of Exercises on immune system in PCOS females**

The complement system is an integral part on human immune system. In PCOS females, the complement pathway proteins are increased in PCOS females and its association with IR and obesity is also known. PCOS alters the mechanism of complement pathways and innate immunity. Aerobic exercises can activate alternative pathways hence in facilitates normal functioning of complement system in normal subjects. In the research it was found that moderate aerobic exercises improve IR but does not show any effect of complement pathways in PCOS females. Inflammatory markers such as TNF- $\alpha$ , IL-6, and C-reactive protein are found higher suggestive of low-grade inflammatory patterns in PCOS females. Supervised aerobic exercises in addition to metformin, reduced higher inflammatory makers. Aerobic exercises decrease cytokinin, TNF and IL to some extent. Exercise furthermore improves autonomic and cardiopulmonary functions. Aerobic exercises and linked to regulation of cytokines regulation through adipose tissue, muscle and mononuclear cell. (8,14,18)

### **Effect of Exercises on lipid profile in PCOS females**

In PCOS females, moderate aerobic exercises showed increases in HDL and reduction in serum triglyceride but LDL, VLDL and total cholesterol remained unchanged. Triglycerides decomposition id related to the synthesis of HDL. Hence when HDL level is increased the triglyceride reduction is understandable. There can be more than one reason of increasing in HDL and one of the reasons can be increased production of HDL in liver. (10,12,15)

### **Effect of Exercises in weight control in PCOS females**

Obesity is associated with PCOS. Moderate to high intensity Exercises can help in weight management in PCOS females. Exercises influence the hormones (ovarian and adrenal cortical hormones) and antioxidants, that helps in weight management. Aerobic exercises induce intramyocellular lipid in skeletal muscle. Thus, effects of exercises can be different in PCOS and non PCOS females during weight management. In management of PCOS females exercise plays multidimensional role Weight reduction through the exercise regime benefits the individuals by improving hormonal balance, promoting ovulation, and correcting irregular menses. Along with traditional aerobic exercises addition of Swiss ball training is found beneficial in weight management in PCOS females. Swiss ball exercises activate the local and global core muscles which plays role in postural control and weight reduction. Other effect of obesity such as reduced strengths, altered biomechanics, and poor posture are also found improved with addition of Swiss ball in aerobic exercise regime. Increasing physical activity through aerobic exercises control weight, balances metabolic derangements and improves body composition. Adding diet modification in terms of reduced calories significantly improves ovulatory functions, circulatory androgen levels and inflammatory patterns. (7,12,15) these results are found in line with cross sectional study done by Afsaneh Khademi et al. they found that obese women with PCOS have more difficulty in losing weight compare to lean patients with PCOS. Hence weight control in lean PCOS females and weight reduction in obese PCOS females through diet and various forms of exercises should be an important part of treatment strategies of PCOS females.(19)

### **Effect of exercises on mood, quality of life in PCOS females**

PCOS female are more prone to depression and poor Quality of life for various reasons such as altered hormonal balance and higher weight. As discussed earlier, exercise have multidimensional role in management of PCOS and hence it not only balances ovarian hormones but also increases release of serotonin and dopamine which improve mood and weight reduced enhances the self-esteem and body image in females. (10,20)

### **CONCLUSION**

PCOS is complex hormonal condition and have various effect of multiple effects in body. Various treatment strategies are under research for treatment of PCOS including exercises. Based on the review of articles included in the study it can be concluded that aerobic exercises of moderate to high intensity have significant improvement in insulin resistance, reducing testosterone and reducing body weight, BMI, mood and quality of life in PCOS females. Aerobic exercises did not show significant effect in function of complement pathways. Prevalence of PCOS is high hence more concrete evidence for treatment approaches are desirable that allows a scope of further research in this area.

#### **Declaration by Authors**

**Ethical Approval:** N/a

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

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- How to cite this article: Shreya Trivedi, Ankita Shah. Effect of aerobic exercises in polycystic ovarian syndrome (PCOS) females - a systematic review. *International Journal of Research and Review*. 2024; 11(6): 742-751. DOI: <https://doi.org/10.52403/ijrr.20240681>

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