Exercise in polycystic ovarian syndrome: An evidence-based review

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Date: September-December 2017
From: Saudi Journal of Sports Medicine(Vol. 17, Issue 3)
Publisher: Medknow Publications and Media Pvt. Ltd.
Document Type: Report
Length: 2,439 words
Lexile Measure: 2100L

Full Text:
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Polycystic ovarian syndrome (PCOS) is a common endocrine disorder affecting female adolescent and adulthood globally. The most annoying complications of PCOS are obesity and infertility. Exercise is proved to be a best therapeutic and supportive management in PCOS patients in reducing infertility. Exercise reduces the risk and restores fertility and quality of life in PCOS patients through inducing hormonal changes of testosterone, androstenedione, combating obesity, metabolic syndrome, reducing inflammatory markers, and increasing immunity. Earlier systematic reviews and metaanalyses have proved the effectiveness of exercise in PCOS. This current systematic review will add to the current evidence of cumulative effects on exercise and shall be an update to the current proof of physical activity in PCOS patients.

Introduction

Polycystic ovarian syndrome (PCOS) is a common endocrine disorder affecting chiefly the women at reproductive ages (late adolescent and early adulthood). It is caused by the imbalance of female sex hormones.[1] The prevalence rate is about 9.13% in Indian adolescents and 3.7% in young women.[2] A study carried out in an urban population in India showed a prevalence rate of about 22.5% of Rotterdam classification and 10.7% by Androgen Excess Society criteria.[3] The clinical features comprise of reproductive manifestations such as reduced frequency of ovulation, menstrual irregularity, reduced fertility, abdominal obesity, sonographic evidence of ovarian cysts, and high levels of male hormones such as testosterone and androstenedione.[1]

PCOS is associated with metabolic features including elevated levels of insulin secretion and resistance, diabetes and cardiovascular disease risk factors such as abnormal cholesterol levels and free plasma lipids.[1] The causative factors behind PCOS are unknown. The probable cause may be related to the dysregulation in female reproductive hormones as demonstrated in earlier studies.[1],[2] Insulin resistance (IR) and its compensatory hyperinsulinemia are proposed as significant etiological factors of PCOS.[4] All these factors are said to be substantial cause for hyperandrogenism in PCOS patients.[1] Overweight and obesity worsen these underlying hormonal imbalances by increasing androgen and excess blood insulin levels thus making the clinical features very evident in women with PCOS.[5]

Pathophysiology of Polycystic Ovarian Syndrome

The exact etiology of metabolic syndrome is unknown, but the excessive visceral fat contributes to the development of clinically significant disorders such as IR, dyslipidemia, high blood pressure, impaired fibrinolysis, glucose intolerance, and endothelial dysfunction.[6] Pathogenesis of multiple sclerosis (MS) in PCOS women may be due to (i) IR, (ii) hyperinsulinemia and (iii) glucose intolerance, which are caused mainly due to dysregulation of insulin signal transduction pathways, and (iv) failure in fatty acid uptake in muscle and liver.[6]

PCOS, Polycystic Ovarian Syndrome (COS) is associated with the development of cardiovascular disorders and type 2 diabetes. IR, one of the dynamic components of MS, is observed in about 50%-80% of women with PCOS.[7] Insulin receptors are present in significant amount in ovaries and impairment of insulin signaling in theca cells increases the production of androgens.[8] IR impairs insulin action in tissues, such as skeletal muscle, adipocytes, and liver. In skeletal muscle, the primary effect of insulin is to stimulate glucose uptake and metabolism. In insulin-resistant state, the glucose uptake is markedly reduced in skeletal muscle. Hence, poor exercise capacity due to reduced muscular efficiency, early fatigue, and hence exercise tolerance are inevitable in PCOS patients.[9]

Obese individuals exhibit marked skeletal muscle IR as compared that of lean individuals who are related to higher body mass index in PCOS women.[10] Weight loss in obese individuals improves or reverses IR in skeletal muscle of PCOS women. Obesity tends to

aggravate the clinical presentation of PCOS. Indeed, the incidence of hirsutism and menstrual irregularity is greater in the obese population as compared to nonobese PCOS.[11] Owing to the above reasons, quality of life with PCOS individual might get worse as it progresses.

Exercise and Its Impact on Polycystic Ovarian Syndrome Pathophysiology

Weight reduction may lead to a decrease in glucose intolerance which in turn may lead to improvement in reproductive and metabolic derangements in PCOS.[12] Exercise training has shown significant improvement in irregularity of menstrual cycles and ovulation in about 50% women diagnosed with PCOS which improves body composition.[13] Further weight loss may reduce pulse amplitude of luteinizing hormone (LH) in turn reducing androgen production.[14] The key factor responsible for these effects is the reduction of hyperinsulinemia and IR.

Exercise has shown to modulate insulin sensitivity and lipid metabolism in skeletal muscle. Exercise improves insulin sensitivity by increasing intramyocellular triacylglycerol concentration.[15] Improvement in insulin sensitivity could be due to more efficient lipid turnover resulting in increased muscle lipid uptake, transport, utilization, and oxidation. The literature states the efficacy of exercise training in combating metabolic syndrome in PCOS patients by marking improvements in apolipoprotein, adiponectin in the process of lipid turnover, and uptake in skeletal muscles.[16]

Endurance exercise also increases capillary density, mitochondrial density, number, hyperplasia of muscle fibers, neural sensitization, motor learning, and adaptations thereby increasing exercise capacity and reducing exercise intolerance in PCOS individual.[17] Improved blood flow to skeletal muscles, mitochondrial proliferation, and sensitivity to activity enhance the stability of essential protein involved in insulin signal transduction in PCOS patients.[10]

Evidence Search Strategy

The literature claiming the effectiveness of exercise in PCOS is searched through electronic databases such as ProQuest and Ovid and public databases such as PubMed Central and Biomed Central. The MeSH items used for searching online are exercise training AND PCOS, physical activity AND PCOS, exercise AND fertility OR ovulation. Only full-text articles published in English are reviewed. Two authors (DS and AW) hand searched the articles, and any consensus among the authors was solved through third author (JO). The research findings are shown in [Table 1].{Table 1}

Recommendation of Exercise Training in Polycystic Ovarian Syndrome

Based on the literature reviewed in [Table 1], the dosage of exercise recommended in PCOS for potential health benefits may be as follows:

Exercise training session

Warm-up: At least 5-10 min.

Conditioning phase:

Aerobic training:

*Frequency: 5 days/week for 12-24 weeks *Intensity: 20-60 min of aerobic (high-intensity interval training 70%-70% VO[sub]2 peak repetitive exercise bouts of 10 min, six episodes/session with 15 min of active pause 55%-60% VO[sub]2 peak between the bouts. Continuous practice sessions 60%-70% heart rate (HR) max inculcating large muscles such as running or cycling for 30-60 min) *Time: 30-45 min. Fatigue-free level *Mode: Treadmill or bicycle *Progression: 10% VO[sub]2 peak or HR max every 2 weeks. After 4 weeks, new VO[sub]2 peak test to be determined from maximal or submaximal exercise testing.

Resistance exercise training:

*Frequency: 2-3 days/week for 12-24 weeks *Intensity: Initial 60%-70% of 1 repetition maximum comprising three sets of 8-10 resistance stations (lateral pull down, military press, chest press, biceps and triceps curl, abdominal curl ups, split squats, leg curls, and extensions). 2-3 sets of 8-12 repetition/set. 1 min rest between set. Avoid Valsalva maneuver during lifting *Time: 30-45 min. Fatigue-free level *Mode: Dumbbell, barbell, thera tubes, and weighted pulley machines *Progression: Repetitions or sets can be increased based on the rating of perceived exertion or maximal voluntary contraction using the weights.

Cool down: Calisthenics 5-10 min, active recovery.

Conclusion

Exercise training and physical activity in PCOS have shown to have a good impact on improving the anthropometric measurements such as body mass index, waist circumference, and metabolic parameters such as total cholesterol, IR, and lipid profile thus reducing metabolic syndrome and other risk factors associated with PCOS. Exercise training should be included in the routine medical management to augment the benefits of ovulation chances, reducing cardiovascular risks and improving the quality of life in PCOS women.

Acknowledgments

The author Baskaran Chandrasekaran would like to thank Dr. Fiddy Davis Ph.D., Associate Professor/Head, Center for Sport Science

Medicine and Research for the valuable suggestion and passion toward research in the field of health promotion and physical activity.[34]

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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