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Exercise Prescription in Polycystic Ovary Syndrome: A Review of Recent Findings

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Abstract
Introduction: Polycystic ovary syndrome (PCOS) is a common endocrine and metabolic disorder affecting women. It is characterized by irregular menstrual cycles, hyperandrogenism and insulin resistance. PCOS is associated with increased cardiometabolic risk and psychological burden. Lifestyle modification, particularly exercise, is a cornerstone of non-pharmacological treatment. This review summarizes recent findings (2022–2025) on the impact

of different exercise modalities including high-intensity interval training (HIIT), moderate-intensity continuous training (MICT), aerobic, resistance, combined, Pilates, and yoga on metabolic, hormonal, reproductive, and psychological outcomes in women with PCOS.

Aim of study: The aim of this study is to determine whether any specific exercise modality provides greater clinical benefits than others in women with PCOS.

Material and methods: The review was conducted using two electronic databases: PubMed and Google Scholar. Searches were performed using the following keywords in various combinations: *polycystic ovary syndrome, PCOS, exercise, physical activity, high-intensity interval training, moderate-intensity continuous training, aerobic training, resistance training, combined training, yoga,* and *Pilates.*

Conclusions: Evidence indicates that all types of exercise confer benefits, though no single modality demonstrates clear superiority. Overall, exercise prescriptions should be individualized, patient-centered, and aligned with personal preferences and capabilities to ensure long-term adherence and maximize therapeutic impact. Further research involving larger cohorts and longer intervention periods is needed to identify the most effective exercise strategies for optimizing clinical outcomes.

Keywords: PCOS, exercise, physical activity. lifestyle intervention, insulin resistance, reproductive health

1. Introduction

Polycystic ovary syndrome (PCOS) is a metabolic disorder characterized by a combination of clinical manifestations [1]. Key features include irregular menstrual cycles, hyperandrogenism, and ovulatory dysfunction [2]. Its prevalence is estimated to range from 5% to 18% [3]. Among women of reproductive age, PCOS is the most diagnosed endocrine disorder [3]. Irregular menstruation affects approximately 75–85% of women with PCOS, although cycle regularity tends to improve with age [4].

Clinically, hyperandrogenism presents as acne, hirsutism, and androgenic alopecia. The severity of symptoms does not necessarily correlate with circulating androgen levels [4]. Moreover, the condition is frequently associated with significant psychological stress [1]. Many patients report disturbances in body image and self-esteem, which often contribute to a reduced quality of life. [4,5,6] An elevated risk of eating disorders has also been documented [4]. In midlife, women with PCOS are more likely to display emotional and uncontrolled eating behaviors [7]. Clinical features such as hirsutism, acne, impaired fertility, and obesity are strongly associated with higher rates of depression and anxiety. [4,5] PCOS is the leading cause of anovulatory infertility. [3,8,9]

Women with PCOS also exhibit increased cardiometabolic risk, including higher susceptibility to myocardial infarction and hypertension [4]. Moreover, the condition is associated with an earlier onset of type 2 diabetes [3,10]. Insulin resistance and elevated serum luteinizing hormone (LH) levels are commonly observed in affected women [10].

Multiple factors contribute to the development of PCOS, including genetic predisposition, lifestyle, environmental pollutants, neuroendocrine disturbances, gut microbiota imbalance, and obesity [11]. The pathophysiological mechanisms involved in PCOS include hyperinsulinemia, androgen excess, oxidative stress, chronic inflammation, and central (abdominal) obesity. Hyperinsulinemia promotes insulin resistance, which in turn stimulates increased ovarian androgen production, driving hyperandrogenism. Central obesity further exacerbates androgen excess, enhances cytokine secretion, and intensifies oxidative stress. Collectively, these processes contribute to chronic low-grade inflammation and impaired oocyte quality [12].

2. Diagnosis

Establishing a diagnosis of PCOS and initiating appropriate treatment can be challenging due to the heterogeneity of clinical manifestations [3]. Symptom presentation varies with age and disease progression, and the wide range of available guidelines and diagnostic criteria further complicates clinical decision-making [9].

According to the 2023 international guidelines, a diagnosis of PCOS can be established when at least two of the following three features are present: polycystic ovarian morphology, hyperandrogenism, and menstrual irregularities. The diagnostic algorithm outlined in the 2023 recommendations emphasizes the initial exclusion of other potential causes of these symptoms. This includes measurement of prolactin, FSH, TSH, and 17-hydroxyprogesterone. If conditions

such as Cushing's syndrome or adrenal tumors are suspected, further investigations are indicated. In cases where hypogonadotropic hypogonadism is suspected, measurement of LH and FSH is recommended, with consideration of contributing factors such as intense physical activity and low body fat [2].

In the first step of the diagnostic algorithm, if a patient presents with both irregular menstrual cycles and clinical signs of androgen excess, a diagnosis of PCOS can be established. In the absence of clinical hyperandrogenism, the algorithm proceeds to the second step, which involves biochemical assessment of androgen levels. Elevated androgen levels in combination with irregular cycles are sufficient to confirm the diagnosis. When either hyperandrogenism or menstrual irregularities are present alone, pelvic ultrasound (USG) is recommended to evaluate ovarian morphology. Detection of polycystic ovarian morphology on ultrasound supports the diagnosis of PCOS [2]. It is important to note that the presence of polycystic ovarian morphology is not required for diagnosis [3].

Characteristic features of a polycystic ovary on ultrasound (USG) include an ovarian volume of 10 mL or greater and a follicle count of at least 10 per cross-section. These criteria should be met in at least one ovary in adults for it to be considered polycystic. Ultrasound evaluation should assess ovarian volume, total follicle count, and the number of follicles per cross-section [2].

Compared to the 1990 criteria, the Rotterdam criteria, introduced in 2003, added polycystic ovarian morphology as a diagnostic feature and require that at least two of the three criteria be met to establish a diagnosis. According to these criteria, polycystic ovarian morphology is defined as the presence of 12 or more follicles per ovary measuring 2–9 mm in diameter and/or an ovarian volume exceeding 10 mL [10].

3. PCOS Care Model

Patients with PCOS often report concerns regarding the way information is communicated, as well as challenges in diagnosis and treatment. They frequently highlight feeling that their condition is not taken seriously [1]. It is essential to avoid stigmatization during clinical consultations [2]. Melson et al. (2023) identified ten key elements of a comprehensive care model for individuals with PCOS, which include:

- systematic screening for cardiometabolic risk factors,
- lifestyle interventions, including diet and physical activity,
- assessment of mental health,

- patient education on the long-term consequences of PCOS,
- evaluation of fertility and reproductive health,
- diagnosis and management of dermatological issues,
- a multidisciplinary care team,
- diagnosis guided by established clinical guidelines,
- assessment of patient satisfaction,
- evaluation of healthcare providers.

The authors emphasized the importance of a patient-centered approach and the comprehensive integration of care services within the management model [1].

4. Physical Activity as a Component of Non-Pharmacological Therapy

Physical activity, as part of lifestyle modification, is recognized as a fundamental intervention in the management of PCOS [2,4,8]. This intervention should be implemented for all affected patients [2]. Exercise has been shown to alleviate multiple symptoms associated with PCOS. Regarding mental health, it reduces symptoms of depression and anxiety, improves quality of life, and decreases body image distress [5]. Additionally, it enhances cardiorespiratory fitness. [5].

Weight loss resulting from physical activity may reduce the risk of cardiovascular disease [4]. It also facilitates the maintenance of body weight and reduces waist circumference. Exercise increases muscular strength and endurance and helps preserve lean muscle mass [5]. Physical activity improves insulin sensitivity [5,13]. By increasing circulating growth factors, it stimulates pancreatic beta-cell proliferation. Through its effects on glucose metabolism, exercise plays a crucial role in both the treatment and prevention of insulin resistance and metabolic disturbances [13].

Meta-analytic evidence suggests that physical activity exerts a modest beneficial effect on lipid profiles [14]. In individuals with overweight or obesity, it reduces markers of systemic inflammation [15]. Physical activity also positively influences reproductive health in women with PCOS [5,16,17]. It contributes to improved ovulatory function and menstrual regularity. Exercise increases circulating sex hormone-binding globulin (SHBG), leading to a reduction in free androgen levels [5].

There is also evidence of mediators linking physical activity to mental health outcomes. These include self-esteem, self-efficacy, satisfaction with body appearance, physical self-worth, social connections, social support, pain, fatigue, and overall mental well-being. Considering these

factors when designing physical activity programs may enhance the positive effects on mental health [18].

5. Comparing Exercise Modalities

5.1. High-Intensity Interval Training (HIIT) vs. Moderate-Intensity Continuous Training (MICT).

High-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) are commonly recommended interventions for managing PCOS [19]. Patten et al. evaluated the effects of HIIT and MICT on mental health in women with PCOS. The study included 29 participants who were randomly assigned to either the HIIT or MICT group, and the intervention lasted 12 weeks. HIIT led to reductions in anxiety, stress, and depressive symptoms, whereas MICT primarily reduced stress levels. These findings suggest that HIIT may be particularly beneficial for improving quality of life in overweight women with PCOS [6]. Among this population, HIIT was also perceived as more enjoyable than MICT and elicited a more positive longitudinal remembered affective response [20].

Both HIIT and MICT exert beneficial effects on insulin resistance and testosterone levels. HIIT appears to have a greater impact on insulin, while MICT more effectively lowers testosterone [21]. Mohammadi et al. investigated the effects of 8 weeks of HIIT at maximum aerobic velocity (MAV) of 100–110% in women with PCOS. The study included 28 participants, 14 in the intervention group and 14 in the control group. HIIT resulted in reductions in BMI, waist-to-hip ratio, insulin levels, and insulin resistance; it increased insulin sensitivity, decreased LDL cholesterol, cortisol, and the atherogenic index, and improved aerobic capacity and VO_2 max [22].

Philbois et al. compared cardiovascular autonomic modulation after 16 weeks of HIIT or MICT in 25 participants per group. Both interventions significantly increased VO_2 peak, reduced testosterone levels, and decreased resting heart rate. Given the similar improvements across measured parameters, the authors concluded that both HIIT and MICT are appropriate for women with PCOS [23]. Patten et al. also assessed the effects of 12 weeks of HIIT versus MICT on cardiometabolic and reproductive outcomes in 29 overweight women with PCOS. The HIIT group demonstrated greater improvements in insulin sensitivity and increased SHBG levels, while both groups experienced improvements in VO_2 peak [24].

A meta-analysis by Zhao et al. indicated no clear superiority of HIIT over MICT in women with PCOS. No significant differences were observed between the two modalities regarding metabolic, hormonal, cardiovascular, or anthropometric outcomes [19].

5.2. **Mind-Body Exercises**

Nazir et al. investigated the effects of a three-month Pilates program on menstrual cycle regulation in women with PCOS. The study included 26 participants. Pilates was found to improve menstrual cycle regularity and reduce menstrual pain. Additionally, by promoting weight loss, Pilates may contribute to better menstrual regulation [25].

Yoga can be recommended for women with PCOS due to its beneficial effects on well-being. Patil et al. evaluated the effects of a 12-week yoga intervention in infertile women with PCOS, including 26 participants in the intervention group and 26 in the control group. The intervention resulted in statistically significant reductions in body weight, post-glucose insulin, total cholesterol, LDL cholesterol, ALT, AMH, and follicle number per ovary. Within one year of the study, 13 participants in the intervention group and 7 in the control group became pregnant. Regular yoga practice, when integrated into standard infertility treatment, may improve both quality of life (QoL) and metabolic parameters in infertile women with PCOS prior to conception [26]. Yoga also has favorable effects on insulin resistance and testosterone levels in women with PCOS [21].

5.3. **Aerobic vs. Resistance and Combined Training**

Riaz et al. compared the effects of 12 weeks of high-intensity aerobic and resistance training on mental health and quality of life in women with PCOS. The study included 60 women aged 18–30, who were randomly assigned to one of the training groups. Both forms of exercise led to improvements in mental health and quality of life [27].

Babaei Bonab et al. investigated the impact of 12 weeks of aerobic exercise on lipid profiles and hormone levels in female students with PCOS. Forty women were randomly assigned to either the intervention or control group. Aerobic training in these young women resulted in reductions in body weight, prolactin, estrogen, total cholesterol, triglycerides, and low-density lipoproteins, along with an increase in high-density lipoproteins [28].

Nasiri et al. examined the effects of combined training (resistance plus aerobic) on metabolic, hormonal, inflammatory, and oxidative stress markers. The study included 15 participants in both the intervention and control groups. After 8 weeks, significant reductions were observed in insulin, HOMA-IR, total cholesterol, LDL cholesterol, total testosterone, AMH, FAI, and MDA, along with improvements in insulin sensitivity. Combined training appears to confer multiple benefits for women with PCOS [29].

6. Practical Recommendations for Physical Activity

The 2023 International Evidence-Based Guideline for the Assessment and Management of Polycystic Ovary Syndrome does not designate any specific type of exercise as superior. The guidelines emphasize the development of lifestyle interventions in collaboration with patients, considering their individual preferences and goals. It is important to recognize that any form of physical activity is preferable to inactivity. Lack of weight loss should not be interpreted as a failure to achieve the benefits of lifestyle modifications [2].

General physical activity recommendations for the adult population can be applied to women with PCOS. Adults are advised to engage in 150–300 minutes per week of moderate-intensity activity or 75–150 minutes per week of vigorous-intensity activity. An equivalent combination of both intensities is also acceptable. Muscle-strengthening exercises should be performed regularly, and prolonged sedentary behavior should be minimized [2,30]. Behavioral strategies, such as goal setting and assertiveness training, may support the achievement of lifestyle modification goals [4]. Activity-monitoring devices can also aid in maintaining regular physical activity [2].

7. Conclusions

Polycystic ovary syndrome (PCOS) is a common endocrine and metabolic disorder affecting women. Lifestyle modifications, including regular physical activity combined with dietary interventions, constitute the cornerstone of non-pharmacological management of PCOS. Although these interventions do not replace pharmacotherapy, they can significantly complement medical treatment.

Incorporating regular exercise into the management of PCOS has been shown to improve quality of life and mental health, which are often impaired in affected women. Physical activity enhances cardiorespiratory fitness, supports the maintenance of healthy body weight, improves insulin sensitivity, regulates menstrual cycles and ovulation, and alleviates symptoms of hyperandrogenism. Exercise exerts beneficial effects on multiple physiological and psychological levels, underscoring its integral role in the management of PCOS.

A patient-centered, individualized approach that emphasizes mindfulness, understanding, and realistic goal setting is essential to support adherence to and engagement in lifestyle interventions. Despite the high prevalence of PCOS, an optimal exercise prescription has not yet been established. The studies reviewed in this article generally involve small sample sizes, which limits the certainty of the evidence. Therefore, further well-designed studies on larger

cohorts are urgently needed to identify the most effective exercise strategies and optimize clinical outcomes in women with PCOS.

Disclosure

Supplementary Materials

Not applicable.

Author's contribution

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AI.

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