QUALITY IN SPORT
eISSN 2450-3118 · Open Access · Peer-reviewed
apcz.umk.pl/QS Nicolaus Copernicus University in Toruń

WALDMAN, Anna, KOWALCZYK, Maja, WOLFF, Magdalena, SOBCZAK, Agata, KREFT, Kalina and GŁUSZKIEWICZ, Lena. Physical Activity in the Management of Polycystic Ovary Syndrome: Current Perspectives on Clinical, Metabolic, and Endocrine Health. Quality in Sport. 2026;73:75314. https://doi.org/10.12775/QS.2026.73.75314

ARTICLE TIMELINE
Received: 13.08.2026. Accepted: 07.09.2026. Published: 14.09.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).
Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

Physical Activity in the Management of Polycystic Ovary Syndrome: Current Perspectives on Clinical, Metabolic, and Endocrine Health

Anna Waldman

Poznan University of Medical Sciences,

ul. Aleksandra Fredry 10, 61-701 Poznań, Poland

https://orcid.org/0009-0001-2332-1814

anna.waldman29@gmail.com

Maja Kowalczyk

Karol Marcinkowski University Hospital in Zielona Góra

Zyty 26 65-046 Zielona Góra, Poland

https://orcid.org/0009-0000-0074-1405

maja.u.kowalczyk@gmail.com

Magdalena Wolff

Karol Marcinkowski University Hospital in Zielona Góra

Zyty 26, 65-046 Zielona Góra, Poland

https://orcid.org/0009-0003-8972-0273

magda.wolff@o2.pl

Agata Sobczak

University Clinical Center in Gdańsk

Dębinki 7, 80-952 Gdańsk, Poland

https://orcid.org/0009-0009-0396-3578

asobczak@uck.gda.pl

Kalina Kreft

Karol Marcinkowski University Hospital in Zielona Góra

Zyty 26, 65-046 Zielona Góra, Poland

https://orcid.org/0009-0001-9584-7305

kreft.kalina@gmail.com

Lena Głuszkiewicz

University Clinical Center in Gdańsk

Dębinki 7, 80-952 Gdańsk, Poland

https://orcid.org/0009-0009-3627-0364

lgluszkiewicz@uck.gda.pl

Corresponding Author Anna Waldman, anna.waldman29@gmail.com

Abstract

Background.

Polycystic ovary syndrome (PCOS) is a common endocrine disorder associated with metabolic, hormonal, and clinical disturbances. Physical activity is a first-line non-pharmacological intervention, although heterogeneity in exercise modalities and outcomes limits consistent clinical conclusions.

Objective.

To synthesize current evidence on the effects of physical activity on clinical, metabolic, and hormonal outcomes in women with PCOS.

Methods.

PubMed, Scopus, and Web of Science were searched (2020–2026) for peer-reviewed systematic reviews, meta-analyses, randomized controlled trials, and position statements evaluating structured exercise interventions, metabolic and hormonal outcomes, and patient-reported outcomes in women with PCOS.

Results.

Regular physical activity improves metabolic health in women with PCOS, particularly insulin sensitivity, waist circumference, and cardiometabolic risk factors, with additional benefits for menstrual regularity and psychological well-being. Hormonal effects are variable, with modest improvements in androgen levels and sex hormone-binding globulin. Resistance and combined training appear particularly beneficial for metabolic outcomes.

Conclusions.

Physical activity is a key component of PCOS management, providing meaningful metabolic and clinical benefits. Individualized and sustainable exercise approaches should be prioritized, while future research should address standardized outcomes and longer intervention durations.

Keywords: polycystic ovary syndrome; physical activity; exercise training; insulin resistance; metabolic health; hormonal parameters

Introduction

Polycystic ovary syndrome (PCOS) is one of the most prevalent endocrine disorders affecting women of reproductive age, with an estimated global prevalence ranging from 6% to 20%,

depending on diagnostic criteria and population characteristics (1). The syndrome is clinically heterogeneous and characterized by ovulatory dysfunction, hyperandrogenism, and polycystic ovarian morphology (2), frequently accompanied by metabolic abnormalities such as insulin resistance, dyslipidemia, obesity, and increased cardiometabolic risk (3). Beyond reproductive dysfunction, PCOS is increasingly recognized as a chronic metabolic condition with long-term health implications (4).

Insulin resistance is considered a central pathophysiological feature of PCOS and is present in a substantial proportion of affected women, independent of body mass index (5). Compensatory hyperinsulinemia enhances ovarian androgen production and suppresses sex hormone-binding globulin (SHBG), thereby exacerbating hyperandrogenic manifestations and menstrual irregularities (3,5). Chronic low-grade inflammation, altered adipokine secretion, and impaired skeletal muscle insulin signaling further contribute to metabolic dysregulation and increased cardiovascular risk (6).

Lifestyle modification is recommended as first-line therapy for PCOS management (7). Among lifestyle components, physical activity plays a pivotal role due to its ability to improve insulin sensitivity and cardiometabolic health independently of weight loss (8). International guidelines and position statements emphasize physical activity as a cornerstone of PCOS management across phenotypes and body weight categories (9).

A growing body of evidence has investigated the effects of aerobic, resistance, and combined physical activity interventions on clinical, metabolic, and hormonal outcomes in PCOS (10). Meta-analyses demonstrate improvements in insulin resistance, waist circumference, and lipid profiles, often without significant reductions in body weight (11). In contrast, evidence regarding reproductive and hormonal outcomes remains heterogeneous, likely due to methodological variability and differences in exercise prescription (1).

PCOS is also associated with increased psychological burden, including anxiety, depression, and reduced quality of life. Physical activity has been shown to improve psychological well-being and patient-reported outcomes in women with PCOS (12). Mechanistic studies further suggest that improvements in skeletal muscle insulin signaling, mitochondrial function, and inflammatory profiles may underlie these benefits (13).

Given the rapid expansion of research over the past five years and ongoing heterogeneity in outcomes, an updated synthesis of contemporary evidence is warranted. This narrative review aims to synthesize evidence published between 2020 and 2026 regarding the effects of physical activity on clinical, metabolic, and hormonal parameters in women with PCOS.

Methods of Literature Review

This narrative review synthesizes peer-reviewed literature published between 2020 and 2026 addressing the effects of physical activity on PCOS-related outcomes. Searches were conducted in PubMed, Scopus, and Web of Science using combinations of terms including "polycystic ovary syndrome," "PCOS," "physical activity," "exercise," "aerobic training," "resistance training," "insulin resistance," and "hormonal outcomes."

Eligible publications included systematic reviews, meta-analyses, randomized controlled trials, observational studies, and international guidelines or position statements evaluating physical activity interventions in women with PCOS. Studies focusing exclusively on dietary interventions were excluded. Priority was given to high-level evidence with clear clinical relevance. Data were synthesized descriptively and organized into clinical, metabolic, and hormonal domains. Given the narrative nature of this review, no quantitative synthesis or formal risk-of-bias assessment was performed.

Effects of Physical Activity on Clinical Parameters

Clinical manifestations of polycystic ovary syndrome (PCOS) are heterogeneous and encompass reproductive, anthropometric, dermatological, and psychological domains. These features contribute substantially to symptom burden and reduced quality of life. Physical activity has been widely investigated as a non-pharmacological intervention targeting clinical outcomes, with growing evidence suggesting benefits that extend beyond weight reduction alone (2).

Anthropometric outcomes and body composition

Changes in body mass index (BMI) and body composition represent some of the most frequently reported clinical outcomes in physical activity interventions among women with

PCOS (14). Meta-analyses indicate that aerobic and combined physical activity programs lead to modest but statistically significant reductions in BMI and waist circumference (15). However, the clinical relevance of these changes is better understood when body composition and fat distribution are considered (7).

Several intervention studies demonstrate reductions in central adiposity and visceral fat mass following regular physical activity, even in the absence of significant changes in total body weight (16). This finding is particularly relevant given the strong association between visceral adiposity, insulin resistance, and cardiometabolic risk in PCOS. Resistance training and combined aerobic–resistance programs appear to be particularly effective in improving lean body mass and reducing waist circumference, supporting their role in optimizing body composition rather than solely focusing on weight loss (7).

Importantly, the emphasis on anthropometric parameters rather than body weight aligns with emerging clinical perspectives that prioritize metabolic health and functional outcomes over absolute weight reduction. This approach may also improve patient adherence, as many women with PCOS experience frustration with weight-centered treatment goals (17).

Menstrual regularity and ovulatory function

Menstrual irregularity and chronic anovulation are core diagnostic features of PCOS and major contributors to infertility (18). The impact of physical activity on menstrual cyclicity has been examined in multiple randomized controlled trials and systematic reviews, although results remain heterogeneous (10).

Some studies report improvements in menstrual regularity and ovulatory function following structured physical activity protocols, particularly when aerobic exercise is combined with resistance training and delivered over longer durations (18). These improvements appear more pronounced in women who experience concurrent metabolic benefits, suggesting that restoration of ovulatory function may be mediated indirectly through enhanced insulin sensitivity and reduced hyperinsulinemia rather than direct endocrine effects (7).

However, not all trials demonstrate significant changes in menstrual outcomes, and variability in outcome definitions, intervention duration, and baseline phenotype limits comparability across studies (9). Short intervention periods and reliance on self-reported menstrual patterns further complicate interpretation (18). Consequently, while physical activity may contribute to

improved menstrual function in some women with PCOS, it should not be viewed as a universal or stand-alone intervention for restoring ovulation (7).

Clinical manifestations of hyperandrogenism

Hyperandrogenic symptoms, including hirsutism, acne, and androgenic alopecia, are among the most distressing clinical features of PCOS (18). While biochemical androgen concentrations are commonly assessed, fewer studies evaluate changes in clinical manifestations of hyperandrogenism following physical activity interventions (1).

Available evidence suggests that sustained physical activity may lead to modest improvements in clinical hyperandrogenic symptoms, particularly hirsutism scores, although changes are often small and variable (19). These improvements are thought to result primarily from increases in sex hormone-binding globulin and reductions in free androgen availability rather than substantial decreases in total androgen production (16).

Assessment of dermatological outcomes remains limited by reliance on subjective scoring systems and short follow-up periods (20). Consequently, while physical activity may contribute to gradual improvement in hyperandrogenic symptoms, expectations should be managed carefully in clinical practice (7).

Psychological well-being and quality of life

Psychological distress is highly prevalent in women with PCOS and includes increased rates of anxiety, depression, body image dissatisfaction, and reduced health-related quality of life (21). These factors significantly impact daily functioning and treatment adherence, underscoring the importance of addressing mental health as a core component of PCOS management (22).

Systematic reviews and interventional studies consistently demonstrate that regular physical activity improves psychological well-being in women with PCOS (14,21). Improvements

have been reported in depressive symptoms, anxiety scores, self-esteem, and perceived health status following aerobic, resistance, and combined training programs(1).

Notably, several studies indicate that improvements in quality of life occur even when objective clinical or hormonal parameters remain unchanged (21). This finding highlights the independent value of physical activity as a therapeutic tool that addresses psychosocial dimensions of PCOS and supports long-term engagement with lifestyle interventions (17).

Resistance training may offer particular benefits for body image and self-efficacy, while aerobic exercise is commonly associated with improvements in mood and perceived vitality (23). These modality-specific effects further support the need for individualized physical activity prescriptions based on patient preferences and psychological needs (9).

Clinical outcomes in adolescent populations

Adolescents with PCOS represent a distinct clinical population due to ongoing pubertal development and heightened psychosocial vulnerability (24). Emerging evidence suggests that structured physical activity interventions may improve clinical symptoms, menstrual patterns, and psychological well-being in adolescent girls with PCOS (25).

Interventions incorporating aerobic exercise, resistance training, and mind–body approaches such as yoga have been associated with reductions in symptom severity and improvements in menstrual regularity and quality of life (19). However, data in this population remain limited, and interpretation is complicated by physiological variability during adolescence and differences in diagnostic criteria (24).

Further high-quality, age-specific studies are required to establish evidence-based physical activity recommendations for adolescents with PCOS and to assess the long-term impact of early intervention on disorder trajectory.

Effects of Physical Activity on Metabolic Parameters

Metabolic dysfunction constitutes a core feature of polycystic ovary syndrome (PCOS) and represents a major determinant of long-term morbidity (3). Insulin resistance, compensatory hyperinsulinemia, dyslipidemia, chronic low-grade inflammation, and increased cardiovascular risk are highly prevalent in women with PCOS, regardless of obesity status

(26). Consequently, metabolic outcomes have been a primary focus of physical activity intervention studies in this population (7).

Insulin resistance and glucose metabolism

Insulin resistance is widely regarded as a hallmark metabolic abnormality in PCOS and is present in up to 70% of affected women, including those with normal body mass index (5). Numerous systematic reviews and meta-analyses consistently demonstrate that regular physical activity improves insulin sensitivity in women with PCOS, as reflected by reductions in fasting insulin concentrations and homeostasis model assessment of insulin resistance (HOMA-IR) (27).

Both aerobic and resistance-based physical activity interventions have been shown to confer metabolic benefits, although their mechanisms may differ (7). Aerobic training primarily enhances peripheral glucose uptake through improvements in cardiorespiratory fitness and skeletal muscle oxidative capacity (11), whereas resistance training increases lean muscle mass and improves insulin-mediated glucose disposal (23). Combined training programs appear to offer additive benefits and are associated with more pronounced improvements in insulin sensitivity compared with single-modality interventions (7).

Importantly, several studies demonstrate that improvements in insulin resistance occur independently of significant weight loss (26). This observation challenges the traditional weight-centric model of PCOS management and underscores the intrinsic metabolic benefits of regular exercise (20). Observational data further indicate that habitual exercise levels are inversely associated with insulin resistance in women with PCOS, even after adjustment for body composition and dietary intake (8). These findings suggest that physical activity itself, rather than weight reduction per se, is a critical determinant of metabolic health in this population (7).

Skeletal muscle adaptations and insulin signaling

Skeletal muscle plays a central role in whole-body glucose homeostasis, accounting for the majority of insulin-stimulated glucose uptake (26). Mechanistic studies indicate that women with PCOS exhibit intrinsic impairments in skeletal muscle insulin signaling, including reduced insulin receptor substrate phosphorylation and altered downstream signaling pathways (16).

Physical activity induces multiple adaptations within skeletal muscle that may counteract these defects (7). Exercise training has been shown to increase glucose transporter type 4 (GLUT4) expression, enhance insulin receptor signaling, and improve mitochondrial oxidative capacity (16). These adaptations facilitate more efficient glucose uptake and utilization, thereby improving insulin sensitivity at the tissue level (10).

Emerging evidence also suggests that exercise may attenuate muscle fibrosis and improve muscle quality in women with PCOS, further supporting its role in restoring metabolic flexibility (26). While mechanistic studies remain limited in number and sample size, available data provide strong biological plausibility for the observed clinical improvements in insulin resistance following regular physical activity (7).

Lipid profile and cardiometabolic risk

Dyslipidemia is commonly observed in PCOS and contributes to increased cardiovascular disease risk later in life (3). Characteristic lipid abnormalities include elevated triglyceride levels, reduced high-density lipoprotein cholesterol (HDL-C), and increased low-density lipoprotein cholesterol (LDL-C) (11).

Meta-analyses demonstrate that regular physical activity leads to favorable changes in lipid profiles, particularly reductions in triglyceride concentrations and modest increases in HDL-C (10). Changes in LDL-C are less consistently reported; however, exercise-induced improvements in lipid metabolism may still translate into meaningful reductions in cardiovascular risk when sustained over time (7).

Combined aerobic and resistance training interventions appear particularly effective in improving cardiometabolic risk factors, likely due to complementary effects on fat oxidation, muscle mass, and insulin sensitivity (16). In addition to lipid parameters, physical activity improves blood pressure, endothelial function, and cardiorespiratory fitness, all of which are important determinants of cardiovascular health (22).

Low cardiorespiratory fitness has emerged as an independent predictor of cardiometabolic morbidity in women with PCOS (7). Improvements in maximal oxygen uptake (VO2max) following structured physical activity interventions may therefore represent a clinically meaningful adaptation with implications for long-term cardiovascular risk reduction (10).

Inflammation and adipose tissue function

Chronic low-grade inflammation is increasingly recognized as a contributor to metabolic dysfunction in PCOS. Elevated circulating levels of inflammatory markers, including C-reactive protein, interleukin-6, and tumor necrosis factor-α, have been reported in women with PCOS and are closely linked to insulin resistance and visceral adiposity (28).

Physical activity has been shown to attenuate inflammatory burden through multiple mechanisms (14). Interventional studies report reductions in inflammatory markers following regular physical activity, particularly when interventions are of sufficient duration and intensity. These anti-inflammatory effects are thought to be mediated by reductions in visceral fat mass, improvements in adipokine secretion, and exercise-induced modulation of immune cell activity (28).

However, findings across studies remain heterogeneous, with some trials reporting minimal or no changes in inflammatory markers (11). Variability in baseline inflammation, intervention characteristics, and outcome measurement methods likely contributes to these discrepancies (28). Nevertheless, the potential anti-inflammatory effects of physical activity represent an important adjunct mechanism underlying metabolic improvement in PCOS (14).

Mitochondrial function and metabolic flexibility

Recent research has focused on mitochondrial dysfunction as a potential contributor to insulin resistance in PCOS. Alterations in mitochondrial density, oxidative enzyme activity, and substrate utilization have been reported in skeletal muscle of women with PCOS (16).

Exercise training is a potent stimulus for mitochondrial biogenesis and improved oxidative capacity (7). Several studies suggest that physical activity may enhance mitochondrial function in women with PCOS, although findings are inconsistent and limited by small sample sizes (26). High-intensity and resistance-based training modalities may be particularly effective in stimulating mitochondrial adaptations, but further research is required to clarify modality-specific effects (7).

Improvements in mitochondrial function may enhance metabolic flexibility, defined as the ability to switch between lipid and glucose oxidation in response to physiological demands

(16). Enhanced metabolic flexibility may partly explain improvements in insulin sensitivity observed following physical activity interventions, even in the absence of weight loss (26).

Weight-independent metabolic benefits

A consistent and clinically important finding across the literature is that metabolic improvements induced by physical activity frequently occur independently of significant weight loss (10). This observation challenges the prevailing emphasis on weight reduction as the primary therapeutic target in PCOS and supports a paradigm shift toward prioritizing metabolic health and functional outcomes (7).

From a clinical perspective, emphasizing weight-independent benefits may improve patient motivation and adherence to exercise programs (21). Women with PCOS often experience difficulty achieving sustained weight loss, and repeated failure to meet weight-based goals can undermine engagement with lifestyle interventions (17). Reframing success in terms of improved insulin sensitivity, cardiometabolic health, and physical fitness may therefore enhance long-term adherence and clinical outcomes (29).

Effects of Physical Activity on Hormonal Parameters

Hormonal dysregulation is a defining characteristic of polycystic ovary syndrome (PCOS) and underlies many of its reproductive and clinical manifestations. Core endocrine abnormalities include hyperandrogenism, altered gonadotropin secretion—often reflected by an increased luteinizing hormone (LH) to follicle-stimulating hormone (FSH) ratio—and reduced concentrations of sex hormone-binding globulin (SHBG) (18). Given the close interrelationship between metabolic and endocrine pathways in PCOS, physical activity has been investigated as a potential modulator of hormonal function through both direct and indirect mechanisms (10).

Androgen concentrations and SHBG

Hyperandrogenism, expressed biochemically and clinically, represents a hallmark of PCOS and is closely linked to insulin resistance and compensatory hyperinsulinemia. Numerous intervention studies and systematic reviews have examined the impact of exercise training on circulating androgen levels, including total testosterone, free testosterone, and free androgen index (18). Overall, the evidence indicates that physical activity is associated with modest but

potentially clinically relevant reductions in androgen bioavailability, particularly in structured and supervised interventions of sufficient duration (1).

Importantly, reductions in free androgen concentrations appear to be mediated predominantly through increases in SHBG, rather than through marked suppression of ovarian androgen production. Exercise-induced improvements in insulin sensitivity reduce hepatic inhibition of SHBG synthesis, thereby lowering circulating free testosterone levels (18). This mechanism is consistent with findings that hormonal improvements are most consistently observed in studies demonstrating concurrent metabolic adaptations, such as reductions in fasting insulin or HOMA-IR (8).

Resistance training and combined aerobic–resistance interventions may confer greater benefits for androgen-related outcomes compared with aerobic exercise alone. Some trials report larger increases in SHBG and greater reductions in free androgen index following resistance-based programs, potentially reflecting the strong influence of increased lean muscle mass and improved insulin signaling on hepatic and endocrine function (23). Nevertheless, heterogeneity in exercise prescription, baseline phenotype, and hormonal assessment methods limits definitive conclusions regarding modality-specific superiority (10).

Gonadotropins and hypothalamic–pituitary–ovarian axis regulation

Altered gonadotropin secretion, characterized by an increased LH/FSH ratio, is commonly observed in PCOS and contributes to ovarian androgen excess and anovulation. Evidence regarding the effects of physical activity on gonadotropin dynamics remains inconsistent (18). While some intervention studies report partial normalization of LH/FSH ratios following regular physical activity, others demonstrate no significant changes (1).

The variability in findings likely reflects differences in baseline endocrine status, intervention duration, and methodological rigor (10). Many studies rely on single time-point hormonal measurements and do not account for cycle phase or pulsatile gonadotropin secretion, which may obscure subtle adaptations (7). Consequently, current evidence does not support a consistent or direct effect of exercise training on gonadotropin regulation (10).

Ovulatory function and menstrual cyclicity

Ovulatory dysfunction is a central feature of PCOS and a major contributor to subfertility (27). Improvements in ovulatory function and menstrual regularity have been reported in some physical activity intervention studies, although these outcomes are often secondary and inconsistently assessed (1).

Evidence suggests that improvements in ovulatory function are more closely associated with metabolic adaptations than with exercise training exposure per se (18). Enhanced insulin sensitivity and reduced hyperinsulinemia may restore ovarian responsiveness to gonadotropins, thereby facilitating ovulation (5). This indirect pathway aligns with observations that hormonal and reproductive improvements are most pronounced in women who experience significant metabolic benefits from physical activity interventions (10).

However, not all studies demonstrate improvements in ovulatory outcomes, and short intervention durations may limit the ability to detect meaningful reproductive changes (9). As such, physical activity should be viewed as a supportive strategy that may enhance reproductive function in some women, rather than a stand-alone treatment for anovulation (14).

Hormonal outcomes in adolescent populations

Adolescent girls with PCOS represent a distinct population in which hormonal regulation is influenced by pubertal maturation and ongoing development of the hypothalamic–pituitary–ovarian axis (24). Emerging evidence suggests that structured physical activity interventions may contribute to improvements in androgen profiles and menstrual regularity in adolescents with PCOS (19).

Interventions incorporating aerobic exercise, resistance training, and mind–body approaches such as yoga have been associated with reductions in biochemical hyperandrogenism and improvements in cycle patterns (25). However, interpretation of these findings is complicated by physiological variability during adolescence, differences in diagnostic criteria, and limited sample sizes. Longitudinal studies with standardized endocrine assessment are needed to clarify the long-term hormonal effects of physical activity in this age group (24).

Methodological considerations and sources of heterogeneity

Across the literature, heterogeneity in hormonal outcomes reflects substantial methodological variability (18). Differences in diagnostic criteria, obesity status, baseline endocrine phenotype, timing of hormonal sampling, and use of hormonal contraception all influence reported results (7). Additionally, many studies lack adequate power to detect small but potentially clinically meaningful endocrine changes (10).

The reliance on short-term interventions further limits interpretation, as hormonal adaptations may require longer durations to manifest (14). Few trials stratify outcomes by PCOS phenotype or assess dose–response relationships between physical activity and hormonal change, representing important gaps in the evidence base (18).

Clinical relevance of hormonal adaptations

Although exercise-induced hormonal changes are generally modest, their clinical relevance should be considered within the broader context of PCOS management (1). Even small reductions in free androgen levels or increases in SHBG may translate into gradual improvements in hyperandrogenic symptoms over time, particularly when combined with sustained metabolic benefits (18). Moreover, improvements in ovulatory function, when present, hold important implications for reproductive health (10).

It is also noteworthy that patient-centered outcomes, such as quality of life and symptom perception, often improve independently of measurable hormonal changes (21). This observation underscores the multifaceted benefits of physical activity and cautions against overreliance on biochemical endpoints when evaluating intervention success (17).

Summary

This narrative review highlights physical activity as a key component of polycystic ovary syndrome (PCOS) management. The strongest and most consistent evidence supports metabolic benefits, including improvements in insulin sensitivity, cardiometabolic risk factors, inflammatory markers, and physical fitness, frequently occurring independently of weight loss. Clinical outcomes such as body composition and health-related quality of life improve more variably, while effects on menstrual regularity and hyperandrogenic symptoms appear largely dependent on concurrent metabolic adaptation. Hormonal responses to physical activity are generally modest and heterogeneous, with reductions in androgen bioavailability observed mainly in structured exercise programs associated with improved insulin resistance. Overall,

the findings support the integration of individualized and sustainable physical activity interventions into standard PCOS care, with emphasis on metabolic health and quality of life rather than isolated hormonal endpoints.

Conclusions

Physical activity plays a fundamental role in the management of PCOS, providing robust metabolic benefits and moderate improvements in clinical outcomes. Hormonal responses are variable and modest but may contribute to symptom improvement when accompanied by metabolic adaptations. Individualized, patient-centered physical activity programs should be prioritized, and future research should focus on standardized outcome measures, longer intervention durations, and mechanistic integration to optimize therapeutic strategies.

Disclosure:

1. **Author's contribution:**

Conceptualization: Anna Waldman, Maja Kowalczyk, Magdalena Wolff
Methodology: Kalina Kreft, Agata Sobczak, Lena Głuszkiewicz
Formal analysis: Anna Waldman, Lena Głuszkiewicz
Investigation: Lena Głuszkiewicz, Kalina Kreft, Anna Waldman
Writing-rough preparation: Agata Sobczak, Maja Kowalczyk, Magdalena Wolff
Writing review and editing: Anna Waldman, Lena Głuszkiewicz
Supervision: Anna Waldman
All authors have read and agreed with the published version of the manuscript.

2. **Funding Statement:** The study did not receive special funding.
3. **Institutional Review Board Statement:** Not applicable (narrative review).
4. **Informed Consent Statement:** Not applicable.
5. **Data Availability Statement:** Not applicable.
6. **Acknowledgments:** Not applicable.
7. **Conflict Of Interest:** The authors declare no conflict of interest.

Declaration of AI Use:

Artificial intelligence (AI) was used only for language enhancement purposes, such as grammar correction and stylistic refinement.

References:

1. Butt MS, Saleem J, Zakar R, Aiman S, Khan MZ, Fischer F. Benefits of physical activity on reproductive health functions among polycystic ovarian syndrome women: a systematic review. BMC Public Health. 2023 May 12;23(1):882. doi:10.1186/s12889-023-15730-8 PubMed PMID: 37173672; PubMed Central PMCID: PMC10176874.

2. Stańczak NA, Grywalska E, Dudzińska E. The latest reports and treatment methods on polycystic ovary syndrome. Ann Med. 2024 Dec;56(1):2357737. doi:10.1080/07853890.2024.2357737 PubMed PMID: 38965663; PubMed Central PMCID: PMC11229724.

3. Scarfò G, Daniele S, Fusi J, Gesi M, Martini C, Franzoni F, et al. Metabolic and Molecular Mechanisms of Diet and Physical Exercise in the Management of Polycystic Ovarian Syndrome. Biomedicines. 2022 Jun 2;10(6). doi:10.3390/biomedicines10061305 PubMed PMID: 35740328; PubMed Central PMCID: PMC9219791.

4. Teede HJ, Khomami MB, Morman R, Laven JSE, Joham AE, Costello MF, et al. Polyendocrine metabolic ovarian syndrome, the new name for polycystic ovary syndrome: a multistep global consensus process. The Lancet. 2026 Jun;407(10545):2329–39. doi:10.1016/S0140-6736(26)00717-8

5. Xu Y, Qiao J. Association of Insulin Resistance and Elevated Androgen Levels with Polycystic Ovarian Syndrome (PCOS): A Review of Literature. J Healthc Eng. 2022;2022:9240569. doi:10.1155/2022/9240569 PubMed PMID: 35356614; PubMed Central PMCID: PMC8959968.

6. Różańska-Smuszkiewicz G, Smuszkiewicz-Różański P, Kmiotek W, Ragan D, Oronowicz R, Staszczak P, et al. The influence of physical activity, diet, and lifestyle of patients on the course of polycystic ovary syndrome (PCOS) in women. Qual Sport. 2024 Jul 28;19:53209. doi:10.12775/QS.2024.19.53209

7. Sabag A, Patten RK, Moreno-Asso A, Colombo GE, Dafauce Bouzo X, Moran LJ, et al. Exercise in the management of polycystic ovary syndrome: A position statement from Exercise and Sports Science Australia. J Sci Med Sport. 2024 Oct;27(10):668–77. doi:10.1016/j.jsams.2024.05.015 PubMed PMID: 38960811.

8. Jurczewska J, Ostrowska J, Chełchowska M, Panczyk M, Rudnicka E, Kucharski M, et al. Physical Activity, Rather Than Diet, Is Linked to Lower Insulin Resistance in PCOS Women-A Case-Control Study. Nutrients. 2023 Apr 27;15(9). doi:10.3390/nu15092111 PubMed PMID: 37432289; PubMed Central PMCID: PMC10180891.

9. Cowan S, Lim S, Alycia C, Pirotta S, Thomson R, Gibson-Helm M, et al. Lifestyle management in polycystic ovary syndrome - beyond diet and physical activity. BMC Endocr Disord. 2023 Jan 16;23(1):14. doi:10.1186/s12902-022-01208-y PubMed PMID: 36647089; PubMed Central PMCID: PMC9841505.

10. Patten RK, Boyle RA, Moholdt T, Kiel I, Hopkins WG, Harrison CL, et al. Exercise Interventions in Polycystic Ovary Syndrome: A Systematic Review and Meta-Analysis.

Front Physiol. 2020;11:606. doi:10.3389/fphys.2020.00606 PubMed PMID: 32733258; PubMed Central PMCID: PMC7358428.

11. Breyley-Smith A, Mousa A, Teede HJ, Johnson NA, Sabag A. The Effect of Exercise on Cardiometabolic Risk Factors in Women with Polycystic Ovary Syndrome: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health. 2022 Jan 26;19(3). doi:10.3390/ijerph19031386 PubMed PMID: 35162403; PubMed Central PMCID: PMC8835550.

12. Kogure GS, Lopes IP, Ribeiro VB, Mendes MC, Kodato S, Furtado CLM, et al. The effects of aerobic physical exercises on body image among women with polycystic ovary syndrome. J Affect Disord. 2020 Feb 1;262:350–8. doi:10.1016/j.jad.2019.11.025 PubMed PMID: 31735408.

13. Malamouli M, Levinger I, McAinch AJ, Trewin AJ, Rodgers RJ, Moreno-Asso A. The mitochondrial profile in women with polycystic ovary syndrome: impact of exercise. J Mol Endocrinol. 2022 Mar 1;68(3):R11–23. doi:10.1530/JME-21-0177 PubMed PMID: 35060480; PubMed Central PMCID: PMC8942332.

14. Gautam R, Maan P, Jyoti A, Kumar A, Malhotra N, Arora T. The Role of Lifestyle Interventions in PCOS Management: A Systematic Review. Nutrients. 2025 Jan 16;17(2). doi:10.3390/nu17020310 PubMed PMID: 39861440; PubMed Central PMCID: PMC11767734.

15. Dos Santos IK, Ashe MC, Cobucci RN, Soares GM, de Oliveira Maranhão TM, Dantas PMS. The effect of exercise as an intervention for women with polycystic ovary syndrome: A systematic review and meta-analysis. Medicine (Baltimore). 2020 Apr;99(16):e19644. doi:10.1097/MD.0000000000019644 PubMed PMID: 32311937; PubMed Central PMCID: PMC7220722.

16. Lőrincz CE, Börzsei D, Hoffmann A, Varga C, Szabó R. Mechanisms and Target Parameters in Relation to Polycystic Ovary Syndrome and Physical Exercise: Focus on the Master Triad of Hormonal Changes, Oxidative Stress, and Inflammation. Biomedicines. 2024 Mar 1;12(3). doi:10.3390/biomedicines12030560 PubMed PMID: 38540173; PubMed Central PMCID: PMC10968456.

17. Ee C, Pirotta S, Mousa A, Moran L, Lim S. Providing lifestyle advice to women with PCOS: an overview of practical issues affecting success. BMC Endocr Disord. 2021 Nov 23;21(1):234. doi:10.1186/s12902-021-00890-8 PubMed PMID: 34814919; PubMed Central PMCID: PMC8609880.

18. Shele G, Genkil J, Speelman D. A Systematic Review of the Effects of Exercise on Hormones in Women with Polycystic Ovary Syndrome. J Funct Morphol Kinesiol. 2020 May 31;5(2). doi:10.3390/jfmk5020035 PubMed PMID: 33467251; PubMed Central PMCID: PMC7739243.

19. Babaei Bonab S, Parvaneh M. Effect of 12-week of aerobic exercise on hormones and lipid profile status in adolescent girls with polycystic ovary syndrome: A study during COVID-19. Sci Sports. 2023 Apr 4. doi:10.1016/j.scispo.2022.11.001 PubMed PMID: 37362083; PubMed Central PMCID: PMC10070775.

20. Dashti S, Abdul Hamid H, Mohamad Saini S, Tusimin M, Ismail M, Jafarzadeh Esfehani A, et al. A randomised controlled trial on the effects of a structural education module among women with polycystic ovarian syndrome on nutrition and physical activity changes. BMC Womens Health. 2022 Jul 6;22(1):277. doi:10.1186/s12905-022-01861-4 PubMed PMID: 35794564; PubMed Central PMCID: PMC9258047.

21. Patten RK, Pascoe MC, Moreno-Asso A, Boyle RA, Stepto NK, Parker AG. Effectiveness of exercise interventions on mental health and health-related quality of life in women with polycystic ovary syndrome: a systematic review. BMC Public Health. 2021 Dec 20;21(1):2310. doi:10.1186/s12889-021-12280-9 PubMed PMID: 34930180; PubMed Central PMCID: PMC8690971.

22. Wang Z, Groen H, Cantineau AEP, van Elten TM, Karsten MDA, van Oers AM, et al. Effectiveness of a 6-Month Lifestyle Intervention on Diet, Physical Activity, Quality of Life, and Markers of Cardiometabolic Health in Women with PCOS and Obesity and Non-PCOS Obese Controls: One Size Fits All? Nutrients. 2021 Sep 28;13(10). doi:10.3390/nu13103425 PubMed PMID: 34684438; PubMed Central PMCID: PMC8538637.

23. Wright PJ, Corbett CF, Pinto BM, Dawson RM, Wirth M. Resistance Training as Therapeutic Management in Women with PCOS: What is the Evidence? Int J Exerc Sci. 2021;14(3):840–54. doi:10.70252/NEEX8658 PubMed PMID: 34567361; PubMed Central PMCID: PMC8439708.

24. Mizgier M, Jarząbek-Bielecka G, Formanowicz D, Jodłowska-Siewert E, Mruczyk K, Cisek-Woźniak A, et al. Dietary and Physical Activity Habits in Adolescent Girls with Polycystic Ovary Syndrome (PCOS)-HAstudy. J Clin Med. 2021 Aug 5;10(16). doi:10.3390/jcm10163469 PubMed PMID: 34441766; PubMed Central PMCID: PMC8396824.

25. Selvaraj V, Vanitha J, Dhanaraj FM, Sekar P, Babu AR. Impact of yoga and exercises on polycystic ovarian syndrome risk among adolescent schoolgirls in South India. Health Sci Rep. 2020 Dec;3(4):e212. doi:10.1002/hsr2.212 PubMed PMID: 33305014; PubMed Central PMCID: PMC7717472.

26. Stepto NK, Hiam D, Gibson-Helm M, Cassar S, Harrison CL, Hutchison SK, et al. Exercise and insulin resistance in PCOS: muscle insulin signalling and fibrosis. Endocr Connect. 2020 Apr;9(4):346–59. doi:10.1530/EC-19-0551 PubMed PMID: 32229703; PubMed Central PMCID: PMC7219141.

27. Gu Y, Zhou G, Zhou F, Wu Q, Ma C, Zhang Y, et al. Life Modifications and PCOS: Old Story But New Tales. Front Endocrinol. 2022;13:808898. doi:10.3389/fendo.2022.808898 PubMed PMID: 35498415; PubMed Central PMCID: PMC9045543.

28. Hafizi Moori M, Nosratabadi S, Yazdi N, Kasraei R, Abbasi Senjedary Z, Hatami R. The Effect of Exercise on Inflammatory Markers in PCOS Women: A Systematic Review and Meta-Analysis of Randomized Trials. Int J Clin Pract. 2023;2023:3924018. doi:10.1155/2023/3924018 PubMed PMID: 36817281; PubMed Central PMCID: PMC9934983.

29. Woodward A, Broom D, Dalton C, Metwally M, Klonizakis M. Supervised exercise training and increased physical activity to reduce cardiovascular disease risk in women with polycystic ovary syndrome: study protocol for a randomized controlled feasibility trial. Trials. 2020 Jan 20;21(1):101. doi:10.1186/s13063-019-3962-7 PubMed PMID: 31959233; PubMed Central PMCID: PMC6972016.