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From PCOS to PMOS: The Impact of Physical Activity, Diet, and Metabolic Health on the Course of Polyendocrine Metabolic Ovarian Syndrome

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Abstract

Introduction: Polyendocrine Metabolic Ovarian Syndrome (PMOS), previously called polycystic ovary syndrome (PCOS), is now recognized as a complex endocrine–metabolic disorder rather than a solely ovarian condition. Lifestyle modification is central to management, with growing focus on physical activity, nutrition, and long-term metabolic health.

Aim: To summarize current evidence on the effects of physical activity, dietary interventions, and metabolic health on PMOS, and to highlight the importance of individualized lifestyle management.

Material and methods: A narrative review was conducted using PubMed and Google Scholar publications from 2018 to 2026. The review included international guidelines, systematic reviews, meta-analyses, randomized controlled trials, and high-quality observational studies on lifestyle interventions in women with PMOS/PCOS.

Results: Evidence shows that regular physical activity and individualized dietary interventions improve insulin sensitivity, body composition, lipid profile, and cardiometabolic health. Aerobic exercise has the strongest support for metabolic improvement, while resistance training and high-intensity interval training (HIIT) may offer additional benefits for some patients. Mediterranean, low-glycaemic index, and anti-inflammatory diets are linked to better metabolic and hormonal control. Notably, metabolic improvements can occur without significant weight loss, highlighting the importance of lifestyle quality over body weight alone.

Conclusions: Lifestyle modification is the foundation of PMOS management. Individualized physical activity, high-quality dietary counseling, and regular metabolic monitoring should be integrated into multidisciplinary, patient-centered care to improve clinical outcomes and quality of life for women with PMOS.

Keywords: Polyendocrine Metabolic Ovarian Syndrome; PMOS; physical activity; exercise; diet; metabolic health; lifestyle intervention.

1. Introduction

In May 2026, a significant change in the approach to polycystic ovarian syndrome (PCOS) was introduced, and the condition's definition was changed to Polyendocrine Metabolic Ovarian Syndrome (PMOS). That was decided by international experts who wanted to emphasize the complex nature of the disease: a multifactorial background, involving endocrine, metabolic, and reproductive dysfunctions. This change raises awareness and will lead to more comprehensive diagnosis and treatment [2].

PMOS is primarily characterized by hormonal disturbances, among which hyperandrogenism plays a key role. This excess of androgens manifests as symptoms such as acne, male-pattern hair loss, and excessive body hair. Another important element is dysfunction of the hypothalamic–pituitary–ovarian axis, leading to irregular hormonal regulation and menstrual cycle disturbances. In addition, metabolic abnormalities are very common. These include insulin resistance (leading to elevated insulin secretion), impaired glucose tolerance, and a significantly increased risk of developing type 2 diabetes and dyslipidemia, characterized by high levels of cholesterol and triglycerides. Some patients may also experience hypertension and an increased risk of cardiovascular disease.

Also, it's really important to take into consideration that the PMOS impacts the reproductive functions, which can lead to reduced fertility, irregular or absent cycles.

What's more, the PMOS can negatively impact the quality of life. All these factors underscore the interdisciplinary nature of this condition and the importance of a multifaceted approach.

2. Aim of the study

The aim of this narrative literature review is to summarize and critically discuss current evidence regarding the impact of physical activity, dietary interventions, and metabolic health on the course of Polyendocrine Metabolic Ovarian Syndrome (PMOS), formerly known as polycystic ovary syndrome (PCOS). Particular attention is given to the role of lifestyle interventions in improving insulin resistance, body composition, lipid profile, menstrual function, hyperandrogenism, and long-term cardiometabolic health.

An additional objective of this review is to present the rationale behind the recently introduced terminology change from PCOS to PMOS and to highlight the importance of adopting a multidisciplinary approach to the diagnosis, monitoring, and management of this complex endocrine-metabolic disorder.

3. Methodology

This study was conducted as a narrative literature review. A comprehensive search of the scientific literature was performed using the PubMed and Google Scholar databases. The search included publications published between 2018 and 2026, with particular emphasis on recent international guidelines, systematic reviews, meta-analyses, randomized controlled trials, and high-quality observational studies addressing the relationship between lifestyle interventions and PMOS/PCOS.

The search strategy included combinations of the following keywords: *Polyendocrine Metabolic Ovarian Syndrome, PMOS, Polycystic Ovary Syndrome, PCOS, diet, nutrition, Mediterranean diet, low glycaemic index diet, physical activity, exercise, HIIT, lifestyle intervention, insulin resistance, metabolic syndrome, cardiovascular risk, hyperandrogenism, and ovulation.*

Studies were included if they investigated the effects of dietary interventions, physical activity, lifestyle modification, or metabolic health on endocrine, metabolic, or reproductive outcomes in women with PMOS or PCOS. Current international clinical guidelines were also included because of their relevance to evidence-based management. Case reports, conference abstracts without full-text availability, non-peer-reviewed publications, and studies unrelated to the objectives of this review were excluded.

The retrieved literature was analyzed qualitatively, with particular emphasis on identifying consistent findings, areas of controversy, and current recommendations regarding lifestyle management in PMOS. The available evidence was synthesized to provide an up-to-date overview of the role of diet, physical activity, and metabolic monitoring in improving both short- and long-term health outcomes in women affected by this condition.

4. Characteristics of Polyendocrine Metabolic Ovarian Syndrome (PMOS)

To diagnose Polyendocrine Metabolic Ovarian Syndrome (PMOS), one should first and foremost refer to the Rotterdam criteria, which remain the basis for its diagnosis. The latest reports – and, most importantly, the renaming of the condition – allow for a more accurate diagnosis, given the disease's interdisciplinary nature [2].

A diagnosis of PMOS can be made if at least 2 out of 3 criteria are met, after other possible causes of these disorders have been ruled out:

1. Ovulatory disorders, manifested by infrequent periods (oligomenorrhoea) or the absence of periods (amenorrhoea), indicating chronic ovulatory dysfunction.

2. Hyperandrogenism, clinical and/or biochemical. Clinical hyperandrogenism primarily involves hirsutism, acne, and female-pattern hair loss, whilst biochemical hyperandrogenism is diagnosed on the basis of elevated levels of androgens in the blood, particularly total or free testosterone.

3. An ultrasound scan showing multi-follicular ovaries or an elevated level of anti-Müllerian hormone (AMH), in accordance with current diagnostic guidelines. An ultrasound scan reveals an increased number of small ovarian follicles and/or an increased ovarian volume.

A differential diagnosis should be carried out to rule out, amongst other things:

- congenital adrenal hyperplasia,
- thyroid dysfunction
- hypothalamic hypogonadism

In addition, great importance is currently placed on diagnosing metabolic disorders. It is recommended to perform fasting blood glucose testing or an oral glucose tolerance test (OGTT), a lipid profile, blood pressure measurement, and an assessment of body weight and waist circumference. Assessing patients' metabolic profiles enables the identification of those at increased risk of developing metabolic diseases [2].

5. Metabolic Health at PMOS

Polyendocrine metabolic ovarian syndrome (PMOS, formerly polycystic ovary syndrome, PCOS), is currently recognized as a complex multisystem endocrine-metabolic disorder rather than a condition affecting only the ovaries. It is estimated that this condition affects approximately one in eight women. The change in terminology highlights the multisystem nature of the condition and the significance of coexisting hormonal, metabolic and reproductive complications in its course. PMOS is closely associated with hyperandrogenism, ovulatory dysfunction, metabolic problems, an elevated risk of type 2 diabetes and cardiovascular complications [1-3].

The coexistence of metabolic abnormalities has shifted the perception of PMOS from a purely gynecological disorder to a complex condition with long-term systemic consequences. Particular attention is currently being paid to the mechanisms responsible for the development of these disorders, among which insulin resistance plays the most significant role [2-4].

Insulin resistance is one of the key factors in the pathogenesis of PMOS. There is a decrease in the sensitivity of peripheral tissues—primarily skeletal muscle, adipose tissue, and the liver—to the effects of insulin. In response to this reduced insulin sensitivity, there is a compensatory increase in insulin secretion. Hyperinsulinemia directly stimulates ovarian theca cells, promoting androgen synthesis and enhancing the effects of luteinizing hormone (LH). At the same time, insulin suppresses hepatic SHBG production, leading to increased circulating levels of biologically active free androgens. Consequently, this may lead to the development of hyperandrogenism, manifested by hirsutism, acne, or androgenic alopecia; disorders of ovarian follicle maturation and abnormal ovulation may also occur. As a result of chronic hyperinsulinemia, the risk of developing metabolic syndrome, prediabetes or type 2 diabetes is elevated. It is also worth noting that the assessment of the risk of developing metabolic syndrome should not be based solely on BMI values; waist circumference, lipid profile, and markers of insulin resistance should also be taken into account, as metabolic abnormalities can also occur in women with normal body weight [2-4].

PMOS is closely associated with the presence of metabolic syndrome, which is one of the most common long-term consequences of this condition. Women with PMOS are more likely to present with abdominal obesity, dyslipidemia, hypertension and carbohydrate metabolism disorders, which together contribute to an increased cardiovascular risk. Lipid abnormalities are also a characteristic feature of the metabolic profile, manifesting as elevated triglyceride and LDL cholesterol levels and reduced HDL cholesterol levels. These abnormalities promote the development of endothelial dysfunction, chronic inflammation, and the formation of premature atherosclerotic lesions. At the same time, an elevated prevalence of MASLD (metabolic dysfunction-associated steatotic liver disease) has also been observed, and it is believed to be associated with insulin resistance, which leads to an increased influx of free fatty acids into hepatocytes, thereby promoting the development of fatty liver disease. For this reason, the presence of MASLD in patients with PMOS should prompt a thorough metabolic evaluation and regular monitoring of the patients' health [2-5].

A consequence of long-standing metabolic disorders is also an increased risk of developing serious complications, including type 2 diabetes and cardiovascular diseases.

It is also important to note the increased risk of developing prediabetes and type 2 diabetes in patients with PMOS. This risk is associated with chronic insulin resistance, hyperinsulinemia,

and a higher prevalence of overweight and obesity. The development of overt type 2 diabetes may also be caused by the exhaustion of the compensatory capacity of pancreatic beta cells due to the prolonged persistence of glucose metabolism disorders. Importantly, abnormalities in glucose metabolism may also occur in women with normal body weight; therefore, regular metabolic assessment should be performed regardless of BMI. Increasing evidence suggests that chronic exposure of blood vessels to adverse metabolic factors promotes oxidative stress, endothelial dysfunction, and accelerated atherosclerotic processes.. Consequently, subclinical cardiovascular markers are more frequently observed in patients, including increased arterial stiffness and elevated carotid intima-media thickness. However, this risk is not constant and may change with age; during the perimenopausal and postmenopausal periods, it may further increase as the metabolic profile worsens [2-5].

Given the chronic nature of the disease and the potential for progression of metabolic dysfunction, systematic monitoring and the timely implementation of preventive measures are of particular importance.

It is also worth noting the importance of regularly monitoring metabolic parameters, which is one of the fundamental components of long-term care for patients with PMOS. Given the chronic and multisystemic nature of the disease, monitoring should not be limited solely to gynecological and hormonal symptoms. According to current guidelines, regular glucose monitoring and individual assessment of the risk of developing type 2 diabetes are recommended. Additional assessment may include fasting insulin levels and markers of insulin resistance, such as HOMA-IR, particularly in women with additional risk factors, such as obesity, a positive family history of diabetes or coexisting hypertension. An equally important element is the periodic assessment of lipid metabolism; monitoring total cholesterol, LDL and HDL fractions, and triglycerides is of particular importance, as it allows for the early detection of dyslipidemia, which is one of the major factors increasing the risk of atherosclerosis and cardiovascular disease. Since lipid abnormalities can remain asymptomatic for long periods, regular lipid profile testing is essential for the prevention of long-term complications. It is also important to perform follow-up measurements of blood pressure and anthropometric parameters, particularly waist circumference.

Waist circumference is considered a simple, inexpensive, and readily available indicator of central obesity that strongly correlates with cardiometabolic risk. The contemporary approach

to PMOS emphasizes that metabolic monitoring should be conducted throughout the patient's lifetime, and the foundation of management remains non-pharmacological interventions focused on lifestyle modification, regular physical activity, a well-balanced diet and maintaining a healthy body weight [2-6].

The current understanding of PMOS highlights its multisystemic endocrine-metabolic nature, rather than a condition limited to ovarian dysfunction [1-3]. Insulin resistance represents the central pathophysiological mechanism linking reproductive abnormalities with metabolic consequences, including metabolic syndrome, MASLD, type 2 diabetes, and an increased risk of cardiovascular disease [2,4,5]. Patient care should extend beyond the management of gynecological symptoms and include long-term monitoring of metabolic health regardless of BMI. A multidisciplinary and individualized approach throughout all stages of a woman's life is essential [2,3]. The change in nomenclature from PCOS to PMOS reflects the current state of knowledge and emphasizes the need for a multidisciplinary and long-term approach to the diagnosis, monitoring, and treatment of this condition, in which measures aimed at improving metabolic health through lifestyle modification play a key role [1,2,6].

6. The Role of Diet in PMOS

Recent scientific reports demonstrate that diet significantly influences the progression of PMOS. An appropriately tailored diet can improve lipid profiles, carbohydrate metabolism, body weight, inflammation, and hormonal balance, all of which contribute to PMOS symptom management. No single dietary pattern is optimal for all individuals. Dietary management should be individualized according to each patient's clinical condition and specific needs. Systematic reviews and international guidelines indicate that lifestyle modification, including dietary intervention, is the first-line treatment for women with PMOS, particularly in cases of overweight, obesity, or insulin resistance, as these measures directly target metabolic and hormonal disturbances [2,9,10].

6.1. Low-Glycaemic Index Diet

A low glycaemic index (GI) diet encourages the consumption of foods that do not cause rapid increases in blood glucose levels. Evidence suggests that this approach can increase insulin sensitivity and reduce fasting insulin concentrations. It also helps to minimize fluctuations in blood glucose, which is important for women with PMOS and insulin resistance—a factor contributing to complications. Reducing postprandial insulin secretion may decrease ovarian

androgen production and increase sex hormone-binding globulin (SHBG) concentrations, leading to lower circulating free testosterone levels and improved ovulatory function.

Foods with a low glycaemic index include whole grains, plant-based and animal-based proteins, vegetables, and low-sugar fruits. Selecting these options supports the goals of a low-GI diet.

The intake of highly processed foods and foods with a high glycaemic index should be limited. Consuming foods with a lower glycaemic index also facilitates weight loss and improves metabolic parameters.

Recent systematic reviews have reported improvements in HOMA-IR, fasting insulin concentrations, and body weight; however, the quality of this evidence ranges from low to moderate due to variability among studies.

6.2. Mediterranean Diet

The Mediterranean diet is among the most extensively studied nutritional patterns in women with PMOS. Research indicates that adherence to this diet improves insulin sensitivity, reduces inflammation, and lowers the risk of cardiovascular disease. It also contributes to the regulation of menstrual cycles [11].

This dietary pattern emphasizes high consumption of vegetables and fruits. It also includes sources of omega-3 polyunsaturated fatty acids, such as oily fish and seafood, while olive oil serves as the primary source of monounsaturated fatty acids and polyphenols. The Mediterranean diet restricts red meat and processed foods.

The beneficial effects of the Mediterranean diet are caused by its high content of monounsaturated fatty acids, dietary fiber, polyphenols, and antioxidant vitamins, which collectively reduce oxidative stress and enhance endothelial function.

Adherence to the Mediterranean diet is associated with a more favorable lipid profile and increased insulin sensitivity.

The positive impact of the Mediterranean diet on the regulation of menstrual cycles should also be emphasized.

Despite these promising findings, current evidence is derived primarily from observational studies and relatively small intervention trials.

6.3. Anti-Inflammatory Diet

Women with PMOS frequently exhibit elevated concentrations of inflammatory markers, such as C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF- α), which are associated with insulin resistance and increased cardiovascular risk [12].

PMOS is linked to chronic inflammation, which exacerbates metabolic and hormonal disturbances. Consequently, an increasing number of experts emphasize the importance of an anti-inflammatory diet abundant in antioxidants, plant-based foods, and unsaturated fatty acids. Consumption of olive oil, vegetables, berries, whole grains, pulses, nuts, seeds, and sea fish is recommended.

Omega-3 fatty acids serve an important function in anti-inflammatory processes by influencing molecular pathways and modulating the immune response. This results in reduced synthesis of pro-inflammatory prostaglandins.

6.4. Individualized Dietary Approach

In summary, effective dietary management of PMOS should be tailored to each woman's individual needs, taking into account her calorie requirements, limiting simple sugar intake, and ensuring adequate protein intake, which promotes a feeling of fullness and improves glycaemic control.

According to the 2023 guidelines, no single, universal dietary model is recommended – instead, the key is to ensure a high-quality diet, promote sustainable habits, and tailor recommendations to an individual's metabolic profile, cultural preferences, and ability to maintain long-term changes.

Even moderate weight loss of 5–10% in women who are overweight or obese can significantly improve insulin sensitivity, restore regular ovulation, and increase the chances of achieving a successful pregnancy. Therefore, achieving and maintaining a healthy weight should be a primary objective of dietary management in PMOS.

7. The Impact of Physical Activity on the Course of Polyendocrine Metabolic Ovarian Syndrome

Physical activity is a key non-pharmacological component of the management of PMOS. The benefits of exercise extend beyond weight loss - it can also influence a range of clinically significant parameters, including insulin sensitivity, body composition, cardiometabolic risk, androgen excess, menstrual cycle regularity, and ovulatory function. This chapter focuses on the role of physical activity as a therapeutic intervention in modifying the metabolic, hormonal, and reproductive disorders associated with PMOS, based on current evidence from studies conducted in populations of women with PCOS.

7.1. Effects of physical activity on metabolic, hormonal and reproductive outcomes

A systematic review and meta-analysis conducted by Patten et al. demonstrated that exercise programs for women with PCOS improved a number of health indicators, particularly $\text{VO}_{2\text{peak}}$, the HOMA-IR index, and waist circumference. The authors concluded that vigorous-intensity exercise produced the greatest improvements in cardiorespiratory fitness, body composition, and insulin resistance, suggesting that exercise intensity may be more important than total exercise volume in determining metabolic benefits [13]. This supports the view that physical activity should not be treated solely as a tool for weight loss, but also as a therapeutic strategy targeting metabolic risk.

It appears that insulin resistance is one of the most important targets of exercise-based interventions. Regular physical activity increases glucose uptake by skeletal muscles and improves the body's overall insulin sensitivity, which may reduce compensatory hyperinsulinemia. This is particularly important in PCOS, where metabolic disorders may contribute not only to cardiometabolic risk but also to endocrine and reproductive abnormalities. High-intensity interval training (HIIT) has also been studied as a time-efficient form of exercise. In a systematic review and meta-analysis of randomized controlled trials, Santos et al. found that HIIT reduced the HOMA-IR index and BMI in women with PCOS [14]. However, these results should be interpreted with caution, as the included studies had a relatively small number of participants and were of short duration.

The effect of physical activity on hormonal balance is less consistent than its effect on metabolism. Physical exercise may indirectly influence excess androgens by improving insulin sensitivity, reducing adiposity, and promoting beneficial changes in body composition. However, the results of the meta-analysis do not confirm a uniform effect of exercise on all androgen-related biomarkers. Atmaca et al. found that general exercise interventions did not significantly affect levels of total testosterone, DHEA-S, or SHBG in women with PCOS. Nevertheless, a subgroup analysis showed that aerobic exercise significantly reduced total testosterone levels, whereas HIIT did not have a significant effect on total testosterone or SHBG levels [15]. These results suggest that the type of exercise performed may be important when hormonal outcomes are the therapeutic goal.

Physical activity may also affect reproductive outcomes, particularly menstrual regularity and ovulatory function. In a systematic review on menstrual symptoms, Molinaro et al. included ten studies involving women with PCOS and found that exercise improved cycle regularity across various interventions [16]. Some studies have shown an increased frequency of ovulation or a shorter cycle length, suggesting that physical exercise may contribute to the restoration of

menstrual function. These effects are likely the result of improvements in insulin sensitivity, body composition, and androgen bioavailability, rather than weight loss alone.

Overall, the strongest evidence points to a beneficial effect of physical activity on metabolic parameters in PCOS populations that currently provide the evidence base for PMOS. The effects on androgen excess and menstrual function are promising but less consistent and depend to a greater extent on the type, intensity, and duration of exercise, as well as on baseline metabolic status and adherence to recommendations. Therefore, physical activity should be presented as a clinically significant lifestyle intervention for PMOS, not merely as a recommendation for weight control, but as a strategy that can improve the metabolic, hormonal, and reproductive aspects of this syndrome.

7.2. Exercise modalities: aerobic training, resistance exercise and HIIT

Various forms of physical activity have been studied in women with PCOS, including aerobic training, resistance training, combined aerobic-resistance programs, and high-intensity interval training. Because the term PMOS is a recent development, the available data on forms of physical activity continue to be based primarily on populations of women with PCOS. Overall, current data suggest that aerobic exercise has the strongest and most consistent evidence base, while resistance training and HIIT may provide additional benefits depending on the patient's metabolic status, adherence, and therapeutic goals.

Aerobic exercise is the most commonly studied form of physical activity for polycystic ovary syndrome (PCOS). It includes continuous activities such as walking, jogging, cycling, or running, typically performed at moderate or high intensity. In a network meta-analysis conducted by Motaharinezhad et al., moderate-intensity aerobic exercise proved to be the most effective intervention for reducing BMI in women with PCOS compared to no intervention and other types of exercise [17]. Patten et al. also emphasized the importance of exercise intensity, demonstrating that high-intensity exercise resulted in the greatest improvements in cardiorespiratory fitness, body composition, and insulin resistance [13]. These findings suggest that aerobic training should be considered a core component of physical activity recommendations for PCOS, particularly when the goal is to reduce metabolic risk.

Aerobic exercise may also affect hormonal parameters and the menstrual cycle, although the evidence for this is less consistent than for metabolic parameters. Atmaca et al. found that aerobic exercise significantly reduced total testosterone levels, while the overall effect of exercise on total testosterone, DHEA-S, and SHBG levels was not significant [15]. In a review conducted by Molinaro et al., aerobic exercise protocols were also associated with improved

menstrual cycle regularity in several studies, including interventions based on cycling, running, or continuous moderate-intensity activity [16]. Therefore, aerobic exercise appears to be the method supported by the most evidence; however, its impact on hormonal and reproductive function should still be interpreted with caution.

Resistance training is less frequently studied as a standalone intervention, but it remains of great clinical importance. By increasing or maintaining lean body mass, resistance training can improve body composition and support long-term metabolic health. This is particularly relevant for PMOS, as skeletal muscle plays a key role in glucose utilization and insulin sensitivity. Evidence from studies comparing different types of exercise suggests that resistance training alone may be less effective than moderate-intensity aerobic exercise in reducing BMI, but it may still be beneficial as part of a combined program [17]. Combined aerobic and resistance interventions may be particularly valuable because they focus on both cardiorespiratory fitness and muscle mass, and some studies indicate improvements in menstrual regularity following combined training [16].

High-intensity interval training (HIIT) has gained popularity as a form of exercise that allows for the effective use of time. HIIT typically consists of short intervals performed at high intensity, interspersed with periods of active recovery. In a systematic review and meta-analysis of randomized controlled trials, Santos et al. found that HIIT reduced the HOMA-IR index and BMI in women with polycystic ovary syndrome (PCOS), using protocols typically performed three times a week for at least 10 weeks at 90–95% of maximum heart rate [14]. This suggests that HIIT may be beneficial for patients with insulin resistance or limited time for exercise. However, the evidence remains limited due to small sample sizes, short intervention durations, and insufficient data on long-term adherence to the program and reproductive outcomes.

Despite its metabolic potential, HIIT should not be presented as universally superior. Atmaca et al. found no significant effect of HIIT on total testosterone or SHBG levels [15]. Molinaro et al. reported some promising results regarding menstrual cycle regularity following HIIT. However, these results were not consistent across all studies and may depend on adherence, baseline BMI, and metabolic phenotype [16]. In clinical practice, HIIT may be appropriate for motivated patients who tolerate higher intensity well, but for others it may be unrealistic or poorly tolerated.

Overall, aerobic exercise appears to have the strongest evidence for improving metabolic outcomes related to PMOS, particularly BMI, cardiorespiratory fitness, insulin resistance, and waist circumference. Resistance training should be considered an important complement, particularly for improving body composition and maintaining lean body mass. HIIT may offer

a time-saving alternative with promising metabolic effects, but its hormonal and reproductive benefits are less certain. Therefore, the choice of exercise should be tailored to the individual rather than based on a single “best” protocol.

7.3. Exercise prescription and clinical recommendations

Recommendations for physical activity in cases of PMOS should be based on general recommendations for physical activity, current guidelines for PCOS, and the patient’s individual characteristics. The 2023 evidence-based international guidelines on PCOS state that there is insufficient evidence to recommend any specific type or intensity of exercise as superior in terms of anthropometric, metabolic, hormonal, reproductive, or psychological outcomes. Therefore, physical activity should be sustainable in the long term, individualized, and tailored to the patient’s preferences, goals, baseline physical fitness, metabolic risk, and any barriers to adherence [7].

For adults with PCOS, the general recommendation is to perform 150–300 minutes of moderate-intensity aerobic exercise per week or 75–150 minutes of high-intensity aerobic exercise per week, or an equivalent combination of both. This should be combined with muscle-strengthening exercises performed on two non-consecutive days per week. To achieve greater health benefits, moderate weight loss, or to prevent weight regain, a higher level of activity may be necessary, e.g., at least 250 minutes of moderate-intensity exercise per week or 150 minutes of vigorous-intensity exercise per week, also in combination with muscle-strengthening exercises [7].

In clinical practice, these recommendations can be translated into accessible and realistic exercise plans. Moderate-intensity activity may include brisk walking, cycling, swimming, or other continuous aerobic exercises that can be sustained for an extended period of time. High-intensity activity may include running, faster cycling, interval training, or other forms of exercise that significantly increase heart rate and breathing. Resistance training should include exercises targeting major muscle groups and can be performed using machines, free weights, resistance bands, or bodyweight exercises. The goal should be to gradually increase the workload rather than immediately achieving a high training volume, especially in patients who have not been physically active before.

Although the guidelines do not specify a single, universally optimal exercise regimen, some evidence suggests that intensity may influence metabolic outcomes. Patten et al. found that high-intensity exercise had the greatest impact on cardiorespiratory fitness, body composition, and insulin resistance in women with PCOS, with suggestions that at least 120 minutes of high-

intensity exercise per week provides beneficial health outcomes [13]. However, this should not be viewed as a universal recommendation for all patients, as tolerance, safety, motivation, and long-term adherence remain of key importance.

The duration and frequency of exercise interventions should also be taken into account. In studies evaluating menstrual outcomes, effective exercise protocols typically lasted at least 12 weeks and were performed three times a week [16]. This suggests that patients should be informed that achieving clinically significant benefits may require consistent effort over several months, rather than merely short-term changes in physical activity. Physical exercise should therefore be viewed as a long-term management strategy rather than a temporary intervention. A patient-centered approach is particularly important in the case of PMOS, where adherence to recommendations may be influenced by symptoms, body image concerns, fatigue, weight-related stigma, psychological distress, and previous negative experiences with healthcare. Exercise advice should avoid punitive or weight-focused language and instead emphasize metabolic health, strength, menstrual function, well-being, and the prevention of long-term complications. The most effective exercise plan is not necessarily the most intense one, but rather the one that the patient can realistically maintain.

Overall, current evidence supports recommending regular aerobic activity combined with resistance training as part of the management of PMOS. Exercise recommendations should be individualized, gradually increased in intensity, and sustainable over the long term. Although high-intensity physical activity and HIIT may provide additional metabolic benefits in selected patients, moderate-intensity aerobic exercise and resistance training remain practical and accessible options for most people.

7.4. Limitations and future directions

Although current findings suggest that physical activity has a beneficial effect on PMOS-related outcomes, several limitations should be taken into account. First, most of the available studies have been conducted among women diagnosed with PCOS, as PMOS is a recently introduced term and has not yet been widely adopted in clinical research. Consequently, conclusions regarding PMOS are currently drawn from the existing literature on PCOS.

A major limitation of the available evidence is the heterogeneity of exercise interventions. Studies vary in terms of exercise type, intensity, frequency, duration, supervision, assessment of adherence, and outcome measures. This makes it difficult to directly compare interventions and identify a single optimal exercise regimen. Patten et al. noted considerable variability in exercise frequency, intensity, and supervision across the included studies, with some

interventions also being inadequately described [13]. Similarly, the 2023 International Evidence-Based Guidelines on PCOS concluded that there is currently insufficient evidence to recommend any specific type or intensity of exercise as superior in terms of anthropometric, metabolic, hormonal, reproductive, or psychological outcomes [7].

Another significant limitation is the relatively small sample size and the short duration of many intervention studies. For example, studies evaluating HIIT often involved small groups and lasted only 10 to 16 weeks, which limits the ability to draw conclusions about long-term metabolic, hormonal, and reproductive effects [14]. Longer-term follow-up is particularly important because PMOS is a chronic condition requiring sustained lifestyle management, rather than merely short-term behavioral changes.

The evidence is also limited by differences in participant characteristics, including BMI, baseline insulin resistance, hyperandrogenism, menstrual phenotype, physical fitness level, and concomitant medications or dietary interventions. These factors may influence the response to exercise and partly explain why metabolic outcomes appear more consistent than hormonal or menstrual outcomes. Molinaro et al. also emphasized that studies on menstrual symptoms are limited by the heterogeneous composition of the study group, varying exercise protocols, and limited long-term follow-up [16].

Future research should focus on large, randomized controlled trials with adequate statistical power, standardized exercise protocols, and clearly defined endpoints. Studies should compare aerobic training, resistance training, HIIT, and combined programs, using consistent measures of insulin resistance, body composition, androgen profile, ovulation, menstrual regularity, quality of life, and long-term adherence. It would also be useful to stratify participants into subgroups based on PMOS phenotype, metabolic risk, and baseline physical fitness, as different subgroups may respond differently to specific forms of exercise.

Further studies should also assess sustainability and practical feasibility. An exercise program may be effective from a physiological standpoint but clinically irrelevant if it is not acceptable, affordable, or sustainable for patients. Therefore, future studies should address issues such as adherence, patient preferences, psychological barriers, weight-related stigma, and quality-of-life outcomes. This would allow for a shift from general advice on physical activity recommendations in PMOS to individualized, phenotype-based, and patient-centered recommendations.

Overall, current evidence indicates that physical activity is an important component of PMOS management, particularly in the context of improving metabolic health. However, stronger evidence is needed to determine the optimal type, intensity, frequency, and duration of physical

activity for specific outcomes related to PMOS. Until then, exercise recommendations should remain individualized, sustainable over the long term, and integrated into broader lifestyle and medical management.

8. Lifestyle interventions and clinical symptoms

Lifestyle interventions are considered the cornerstone of PMOS management. Current guidelines emphasize that appropriately tailored physical activity, dietary modifications, and long-term weight management strategies positively affect metabolic, hormonal and reproductive outcomes. Importantly, these benefits are observed not only in women with obesity but also in those with a normal body weight. Current management strategies are shifting away from treating individual symptoms toward addressing the underlying pathophysiological mechanisms of the disease. Reducing insulin resistance, decreasing visceral adipose tissue, and reducing chronic inflammation play a particularly important role, as these are key mechanisms influencing the development of PMOS. A holistic approach to therapeutic goals is also important, as it should include improving ovulatory function, reducing symptoms of hyperandrogenism, normalizing metabolic parameters, and improving the quality of life of women with PMOS. This approach forms the foundation for long-term management of PMOS [5-8].

8.1 The Effect of Weight Loss on Ovulation

One of the most important therapeutic goals is to restore reproductive function, including the restoration of normal ovulation. Excess adiposity exacerbates insulin resistance and hyperinsulinemia, which disrupt the function of the hypothalamic-pituitary-ovarian axis, leading to abnormal follicular maturation and anovulatory cycles. It has been shown that a 5-10% reduction in baseline body weight can lead to improved regularity of menstrual cycles and an increase in the frequency of spontaneous ovulation. However, these benefits are not solely attributable to weight loss itself but also to improvements in overall metabolic health [6-8].

Normalization of gonadotropin secretion also plays a significant role; reducing insulin resistance helps decrease excessive androgenic stimulation of the ovaries and gradually restore the balance between luteinizing hormone (LH) and follicle-stimulating hormone (FSH). This, in turn, increases the likelihood of normal ovulation [6-8].

The type and sustainability of physical activity are equally important. The most beneficial effects are observed when aerobic exercise is regularly combined with resistance training. This improves insulin sensitivity and helps maintain long-term therapeutic effects. It is important to emphasize the greater role of long-term, systematic physical activity—which women can sustain in their daily lives—over short-term, high-intensity weight-loss programs. The long-term maintenance of these habits promotes hormonal stabilization and reduces the risk of recurrent ovulatory dysfunction [5,6,8].

It should also be emphasized that improved ovulatory function not only has a beneficial effect on fertility but also improves quality of life and stabilizes their hormonal profile, which may indirectly contribute to limiting the further development of metabolic disorders [6,7].

8.2 Reduction of Hyperandrogenism

Reducing hyperinsulinemia leads to decreased stimulation of the ovarian theca cells, which are responsible for increased androgen production. A reduction in the concentration of free, biologically active androgens is also observed, which is a result of increased hepatic synthesis of sex hormone-binding globulin (SHBG). Consequently, partial normalization of hormonal homeostasis may occur, leading to a gradual reduction in clinical manifestations such as hirsutism, acne, and androgenetic alopecia [7,8].

Reducing the pro-inflammatory activity of visceral adipose tissue may also indirectly contribute to lower androgen production. Importantly, the severity of hyperandrogenic symptoms does not always correlate directly with BMI [5,7]. It should be noted that the improvement in symptoms of hyperandrogenism typically progresses more slowly than the improvement in metabolic parameters. This is because tissues such as hair follicles and sebaceous glands require more time to respond to hormonal changes. Therefore, clinically meaningful improvements may not become apparent for several months [6,7].

8.3. Improvement of metabolic parameters.

Improving metabolic health is one of the major therapeutic goals in women with PMOS. This is particularly important because PMOS is associated with an increased risk of insulin

resistance, type 2 diabetes, metabolic syndrome, and cardiovascular disease. Current guidelines emphasize the importance of not only weight management but also a comprehensive assessment of carbohydrate metabolism, lipid profile, blood pressure, and anthropometric parameters [7,8].

One of the most important effects of lifestyle interventions is the improvement of carbohydrate metabolism, including the normalization of glucose and insulin levels. Studies have shown that regular physical activity and a balanced diet help reduce hyperinsulinemia, increase glucose uptake and utilization by skeletal muscles, and reduce insulin resistance indices, such as HOMA-IR. Consequently, this leads to a reduced risk of prediabetes and type 2 diabetes [6,7].

It is also worth mentioning the beneficial effect of lifestyle interventions on the lipid profile. Reducing visceral fat and increasing physical activity can help lower LDL cholesterol and triglyceride levels, while raising HDL cholesterol levels. This is particularly important for the long-term prevention of atherosclerosis and cardiovascular diseases [4,7].

Waist circumference measurement is also a key component of metabolic assessment. Increased waist circumference strongly correlates with an elevated cardiometabolic risk and better reflects central obesity than BMI. The effectiveness of an intervention should not be assessed solely on the basis of weight loss. A comprehensive assessment of body composition, biochemical parameters and overall metabolic health is more informative [4,7,8].

In this context, improving metabolic health may beneficially influence both the course of the disease and the prevention of its long-term complications. Importantly, contemporary management of PMOS emphasizes that the primary therapeutic goal is not weight loss alone, but rather the long-term improvement of metabolic health [5-7].

8.4. Improvement of quality of life and mental health.

PMOS not only affects physical health but also significantly impairs quality of life. Women with PMOS more frequently experience low mood, anxiety symptoms, chronic stress, low self-esteem and dissatisfaction with their appearance compared to the general female population. This is largely attributable to the multisystem nature of the disease, which simultaneously affects reproductive, metabolic, hormonal and psychosocial health [7,8].

Visible symptoms of hyperandrogenism, such as hirsutism, acne, and androgenic alopecia, are particularly significant, as they can lead to a negative body image and negatively affect self-image and body perception. Additionally, fertility issues may lead to uncertainty about future reproductive potential and increased emotional distress. Long-term reproductive problems can also negatively impact romantic relationships and reduce patients' quality of life [6,7].

Attention should also be paid to coexisting metabolic disorders, which are frequently associated with difficulties in maintaining a healthy body weight and an increased tendency to accumulate adipose tissue. This may lead to frustration, a sense of helplessness and reduced motivation to adhere to therapeutic interventions [6,7].

There is increasing discussion about the interplay between mental health and the course of PMOS. Poor mental health may impair long-term adherence to therapeutic recommendations over the long term, which may contribute to the worsening of metabolic and hormonal disorders. This may create a vicious cycle in which psychological distress and worsening disease manifestations reinforce one another. Therefore, contemporary PMOS management emphasizes the importance of integrating psychological well-being into routine clinical care and long-term therapeutic planning [7].

9. Discussion

Polyendocrine Metabolic Ovarian Syndrome (PMOS) is increasingly recognized as a complex multisystem disorder that extends far beyond ovarian dysfunction. The recent change in terminology reflects the growing understanding that endocrine, metabolic, reproductive, and cardiovascular abnormalities are closely interconnected and should be addressed simultaneously rather than as separate clinical entities.

The literature reviewed in this paper consistently demonstrates that lifestyle interventions remain the cornerstone of PMOS management. Although no single dietary pattern or exercise modality has been shown to be universally superior, current evidence supports individualized lifestyle modification as the first-line therapeutic approach. Dietary interventions, particularly those emphasizing low-glycaemic foods, Mediterranean dietary patterns, and high-quality nutrient intake, appear to improve insulin sensitivity, lipid metabolism, and overall metabolic health. Likewise, regular physical activity contributes to improvements in insulin resistance, body composition, cardiorespiratory fitness, and, to a lesser extent, reproductive and hormonal outcomes.

An important finding emerging from the reviewed literature is that combined lifestyle interventions, integrating dietary modification with regular physical activity, appear to produce greater overall benefits than either strategy implemented in isolation. While dietary interventions primarily improve energy balance, glycaemic control, and body weight, regular physical activity exerts additional effects by enhancing skeletal muscle glucose uptake, improving insulin sensitivity, and increasing cardiorespiratory fitness. Consequently, combined interventions have been associated with more pronounced improvements in metabolic parameters, body composition, menstrual regularity, and overall cardiometabolic health. Nevertheless, the available evidence does not support a single superior dietary pattern or exercise modality. Instead, current international guidelines emphasize that lifestyle interventions should be individualized according to the patient's metabolic profile, clinical presentation, preferences, and long-term adherence.

Insulin resistance emerges as the central pathophysiological mechanism linking metabolic and reproductive dysfunction. Improvements in insulin sensitivity achieved through diet and exercise may reduce hyperinsulinemia, indirectly decrease androgen production, and promote more regular ovulation and menstrual cycles. Importantly, many studies indicate that metabolic improvements may occur even in the absence of substantial weight loss, suggesting that the therapeutic benefits of lifestyle modification extend beyond changes in body weight alone. One possible explanation is the improvement in body composition associated with regular exercise, particularly the increase in lean muscle mass. Because skeletal muscle is the primary site of insulin-mediated glucose uptake, greater muscle mass enhances glucose metabolism and insulin sensitivity, even when overall body weight changes little or not at all.

The reviewed evidence also highlights the importance of long-term metabolic monitoring. Women with PMOS have an increased risk of developing metabolic syndrome, type 2 diabetes, MASLD, dyslipidaemia, hypertension, and cardiovascular disease. Consequently, regular assessment of glucose metabolism, lipid profile, blood pressure, and anthropometric measurements should form an integral part of routine clinical care regardless of BMI. These findings further support the concept of multidisciplinary management, as effective long-term care extends beyond the treatment of reproductive symptoms alone. Given the multisystem nature of PMOS, collaboration between gynecologists, endocrinologists, dietitians, and physiotherapists or medical exercise specialists is essential to address the endocrine, metabolic, reproductive, and lifestyle-related aspects of the disease. Individualized nutritional counseling, appropriately prescribed physical activity, and regular metabolic follow-up complement medical treatment and may improve both treatment adherence and long-term clinical outcomes.

Despite the encouraging findings, several limitations should be acknowledged. Most available evidence has been generated in populations diagnosed with PCOS, as PMOS has only recently been introduced as the preferred terminology. In addition, considerable heterogeneity exists across studies regarding participant characteristics, intervention protocols, outcome measures, and follow-up duration. These differences limit direct comparisons between studies and make it difficult to establish the optimal type, intensity, and duration of lifestyle interventions. Furthermore, many intervention studies include relatively small sample sizes and short follow-up periods, limiting conclusions regarding long-term outcomes.

Future research should focus on well-designed randomized controlled trials using standardized exercise and dietary protocols in women diagnosed according to the contemporary PMOS concept. Further studies should also investigate phenotype-specific responses to lifestyle interventions, long-term adherence, quality of life, and patient-centered outcomes. Such evidence will facilitate the development of more individualized and effective management strategies.

Overall, the available literature supports the view that lifestyle modification should remain the foundation of PMOS management. Individualized dietary counseling, regular physical activity, and continuous metabolic monitoring not only improve current clinical manifestations but may also reduce the risk of long-term metabolic and cardiovascular complications. However, these interventions are likely to be most effective when implemented within a multidisciplinary, patient-centered model of care involving gynecologists, endocrinologists, dietitians, and physiotherapists or medical exercise specialists. The transition from the PCOS to the PMOS concept further emphasizes that successful management requires comprehensive, individualized, and lifelong care addressing the endocrine, metabolic, reproductive, and lifestyle dimensions of this complex disorder.

10. Conclusions

Polyendocrine metabolic ovarian syndrome should be considered a complex endocrine-metabolic disorder, rather than solely a gynecological condition. The change in terminology from PCOS to PMOS reflects the multisystem nature of this syndrome and emphasizes the importance of the metabolic, hormonal, reproductive, cardiovascular, dermatological, and psychological aspects of the disease.

Lifestyle changes remain a fundamental component of PMOS management. Current evidence indicates that both dietary interventions and regular physical activity can improve insulin sensitivity, body composition, lipid profile, cardiometabolic risk, menstrual cycle regularity,

ovulatory function, and selected hormonal parameters. Nutritional strategies, such as a low-glycemic-index diet, the Mediterranean diet, and an anti-inflammatory diet, may support metabolic and hormonal control, although no single dietary model can be considered universally optimal for all patients.

Physical activity should also be considered an important component of nonpharmacological treatment. Aerobic exercise, resistance training, and high-intensity interval training can improve metabolic parameters, particularly insulin resistance, BMI, waist circumference, and cardiorespiratory fitness. However, the available evidence does not point to a single, universally superior form of exercise; therefore, recommendations should be tailored to the patient's health status, preferences, and ability to adhere to the recommendations over the long term.

The most beneficial approach appears to be long-term, individualized lifestyle management tailored to the patient's metabolic profile, clinical symptoms, reproductive goals, psychological burden, preferences, and ability to sustain changes over the long term. Interventions should not focus exclusively on weight loss, as improvements in metabolic health can occur even without significant changes in body weight. Therefore, the quality, sustainability, and individualization of lifestyle changes are of key importance.

Regular monitoring of metabolic health is crucial for women with PMOS. Assessing glucose metabolism, lipid profile, blood pressure, body composition, and waist circumference can help identify patients at increased risk for type 2 diabetes, metabolic syndrome, MASLD, and cardiovascular disease. Early prevention and long-term follow-up should therefore be incorporated into routine clinical care.

Management for PMOS should also take into account quality of life and mental health. Symptoms such as hirsutism, acne, menstrual irregularities, fertility issues, weight-related stigma, and metabolic complications can negatively affect mental well-being and adherence to treatment recommendations. For this reason, effective care should include not only medical interventions and lifestyle changes, but also patient education, emotional support, and the avoidance of stigmatizing communication.

Overall, effective management of PMOS requires a multidisciplinary, patient-centered approach that includes gynecological, endocrinological, nutritional, metabolic, exercise-related, and psychological support. Future research should focus on standardized, long-term studies evaluating combined lifestyle interventions, phenotype-specific responses, adherence to recommendations, and patient-centered outcomes. Such evidence can help develop more precise and individualized treatment strategies for women affected by PMOS.

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