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A REVIEW OF DIETARY MANAGEMENT IN POLYCYSTIC OVARY SYNDROME WITH EMPHASIS ON MENTAL HEALTH, STRESS AND CORTISOL REGULATION

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ABSTRACT

Polycystic ovary syndrome (PCOS) has become one of the most commonly occuring endocrine problems that *affect women all across the globe. It affects more than just the reproductive system or the way the body handles sugar. This problem is now seen as a condition that affects metabolism and mental health adversely. It is shaped via hormone fluctuations, ongoing mild inflammation and the way the lifestyle. This review looks at the ways that PCOS operates inside the body, stating its pathophysiological causes, affect of stress hormones, role of diet in the management, and integration of psychological well-being and nutrition. The correlation of PCOS with hyperandrogenism, insulin resistance (IR), hyper-secretion of LH, hypothalamic inflammation, chronic psychological and physiological stress has been proposed as well. Other than that, the most significant dietary patterns, proper selection of nutrients, adequate dietary adjustments etc. that are crucial for the management of this syndrome, have also been covered. The impact of Mediterranean diet, Ketogenic diet, low GI diet, and DASH diet has been proven to improve the symptoms of PCOS drastically. The symptoms and condition of PCOS may worsen if there is an increase in stress hormones and also because of poor lifestyle habits. PCOS patients are three times more likely to face anxiety and depression, than non-PCOS individuals. Oxidative stress (OS) very negatively impacts metabolism and hormone production, as outlined. The progress and consequences of PCOS can greatly be impacted by Integrating nutrition with psychological well-being for its management. By synthesizing the mechanistic links between stress physiology, dietary intake, and PCOS pathophysiology, this paper articulates the case for integrated nutritional and psychological strategies in the long-term management of the syndrome.*

Keywords: *Polycystic ovary syndrome (PCOS), Psychological stress, Oxidative stress, Dietary pattern, Nutritional management*

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common endocrine condition that impacts women of reproductive age, affecting about 8–13% of women worldwide (Stener et al., 2024). It is a polygenetic disorder with reproductive, metabolic, and psychological abnormalities, such as hyperandrogenism, ovulatory dysfunction, insulin resistance, obesity, and cardiometabolic risk (Wang

et al., 2023; Aversa et al., 2020). However, in addition to reproduction, PCOS carries a significant long-term metabolic burden and impact on quality of life. Hyperandrogenism and compensatory hyperinsulinemia may feed back to each other, causing further androgen production and lowered levels of sex hormone binding globulin in the liver, leading to ongoing metabolic and endocrine abnormalities (Houston & Templeman, 2025). Ovarian function, appetite regulation, energy homeostasis, and insulin signaling were further affected by chronic low-grade inflammation, which can worsen metabolic and reproductive abnormalities, as elevated inflammatory mediators involved in their progression (Saadati et al., 2025). In addition to its endocrine and metabolic symptoms, psychological stress is another key factor in PCOS that's gaining attention. Women with PCOS are more likely to experience anxiety and depressive symptoms, emotional distress and impaired quality of life compared to women without the syndrome (Deng et al., 2024). Stress psychological disturbances can be produced by factors such as infertility, irregular menstruation, obesity, hirsutism, acne and dissatisfaction with body image, and psychological stress can also have an impact on the regulation of hormones. This interaction seems to be mediated by the hypothalamic–pituitary–adrenal (HPA) axis. Hyperactivity of the HPA axis has been reported in women with PCOS because of the elevated hair cortisol levels, which signify more cumulative exposure to glucocorticoids (Huchegowda & Rajendra, 2026). Cortisol is especially important as chronic activation of the stress response can affect several pathways that are related to PCOS, including metabolic, inflammatory, and reproductive pathways. Weight management and treatment of metabolic abnormalities are crucial areas of treatment for PCOS which is still heavily reliant on dietary management. A low-glycemic-index diet combined with consumption of dietary fiber, unsaturated fatty acids, sufficient protein and micronutrient-rich food may enhance insulin sensitivity and metabolic health (Nurkolis et al., 2025). The Mediterranean diet has seen benefits on body composition, inflammation, hyperandrogenism and insulin resistance, and other personalized diet plans such as ketogenic diets have shown promise in metabolic benefits (Masood et al., 2023). Recent studies also show a link between diet, gut microbiota, inflammation and metabolic dysfunction in PCOS. Although there is growing evidence for nutritional and psychological interventions, these two aspects are treated separately. There is a strong link between dietary patterns, metabolic dysfunction, stress physiology, cortisol regulation and psychological well-being in PCOS which needs to be explored more in depth in the context of holistic PCOS care. Thus, it is important to have a holistic perspective of nutritional and psychological aspects to form individual plans for treatment and management of the metabolic and psychosocial load of PCOS.

Pathophysiology of Polycystic Ovary Syndrome

Polycystic ovary syndrome (PCOS) is the most common endocrinologic condition in women of reproductive age, prevalence of which is estimated between 8 and 13% all over the world (Hoeger et al., 2021). PCOS is a reproductive, metabolic, and psychological dysfunction and often is associated with hyperandrogenism and insulin resistance (Soni & Prabhakar., 2022). The pathogenetic mechanism involves impairments of neuroendocrine function that result in a decreased pituitary gonadotropin secretion, leading to a hormonal imbalance, ovulatory dysfunction and an increased production of ovarian androgens, (Cela et al., 2025). Hyperandrogenism is a cardinal diagnostic criterion of PCOS, and almost 75% of clinically recognised women with PCOS present with signs of hyperandrogenism such as hirsutism, refractory acne and androgenic alopecia due to dysregulation of the HPO axis (Su et al., 2025). Supraphysiological levels of androgens at the cellular level lead to endoplasmic reticulum (ER) stress and apoptosis in granulosa cells, which directly reduces the integrity of the follicles (Jin et al., 2020). Hyperandrogenism in PCOS is due to dysregulation of HPO axis and the resultant hypersecretion of LH and hyperinsulinism, with weak negative feedback of cortisol on HPA resulting in hypersecretion of ACTH and, consequently, overproduction of adrenal androgens (Fahs et al., 2023). Androgen excess, at the systemic metabolic level, can be characterized by dyslipidaemia, glucose intolerance, insulin

resistance, and increase in the risk of metabolic syndrome and cardiovascular disease and type 2 diabetes mellitus (Gonzalez et al., 2022). Although insulin resistance (IR) itself is not a diagnostic criterion, it is a critical component of the pathophysiological features of PCOS. IR is potentiated by androgen excess in synchrony with the compensatory hyperinsulinemia, which in turn recirculates the androgen secretion and decreases synthesis of hepatic sex hormone binding globulin (SHBG), increasing levels of free testosterone in the circulation and creating a self-confirming cycle of increased androgens and hyperinsulinemia (Harada, 2022). IR in PCOS is a systemic issue related with the signaling via insulin in the skeletal muscle, adipose tissue and liver (Zhao et al., 2023). The systematic review of hyperinsulinaemic-euglycaemic clamp studies including 1224 women with PCOS and 741 control women showed that women with PCOS had a significant decrease in insulin sensitivity (mean effect size: −27%; 99% CI: −21 to −33) (Dong & Rees., 2023). Diabetes mellitus, which is characterized by impaired glucose tolerance and gestational diabetes mellitus, along with cardiovascular risks, are clinical manifestations of IR that are present in 30–80% of women with PCOS (Cela et al., 2024). This environment is further complicated by vitamin D deficiency, which negatively affects insulin receptor expression and calcium-dependent glucose metabolism, and also dysregulates steroidogenic enzyme activity, and increases androgenic load (Morgante et al., 2022).

One of the main neuroendocrine abnormalities seen in PCOS is the increased frequency of GnRH pulses with a tendency to have a negative effect on FSH production, but a positive effect on LH production. This LH:FSH ratio, typically 1-2 in a healthy woman, often rises to 2-3 in PCOS which stimulates the production of excessive ovarian androgen(s), thereby disrupting the process of follicular maturation, and maintaining PCOS as a chronic condition of anovulation (Bai et al., 2024; Cela et al., 2024). The anti-Müllerian hormone (AMH) is a glycoprotein belonging to the members of the TGF-β superfamily, and is very much elevated in PCOS when compared with healthy controls, and has also been directly reported to have positive correlation with follicular excess, although its level of heterogeneity amongst studies is substantial, and it has not been adopted as a diagnostic criterion on its own, in large part given its utility is limited by the substantial inter-study heterogeneity preventing such use (Fahs et al., 2023).

There is a new development that inflammation of the hypothalamus may act as a mechanism linking metabolic and neuroendocrine aberrations of PCOS. Moreover, compared to acute inflammation, a state where hypothalamus function is preserved, the chronic low-grade inflammation is known to disturbs hypothalamic signaling, thereby disturbing the mechanisms of appetite regulation, energy homeostasis, as well as the secretion of reproductive hormones; at the same time inflammatory mediators attenuate the insulin signaling pathways and worsen metabolic complications (Barlampa et al. 2021). Pro-inflammatory cytokine levels of IL-6, IL-18, and TNF-α are consistently raised in PCOS and the resulting imbalance in inflammatory cytokines causes ovarian dysfunction, disrupted steroidogenesis, and impaired ovarian folliculogenesis (Su et al., 2025).

Role of Stress Hormones and Psychological Stress in PCOS

Under-appreciated, but mechanistically relevant, chronic psychological and physiological stress is a contributor to the pathophysiology of PCOS. PCOS women have measurable HPA axis hyperactivation that has been demonstrated by significant elevation in hair cortisol concentrations, a validated biomarker of cumulative glucocorticoid exposure; PCOS women had a hair cortisol concentration of 130 pg/mg, which was significantly higher than in controls (63 pg/mg hair; $p < 0.001$). (Gonzalez et al., 2022) To build on these endocrinological findings, a case-control study of 100 PCOS women and 150 controls found significantly elevated serum cortisol ($p = 0.001$) and DHEA ($p = 0.01$) levels in PCOS women, supporting hyperactivity of the HPA axis as a consistent biological finding in PCOS (Benjamin et al., 2023). Primary stress markers like cortisol and DHEA, indicate the systemic effects of oxidative, inflammatory, metabolic and emotional stress – all heightened in PCOS (Benjamin et al., 2023). The oxidative status in particular has been closely linked

to the pathogenesis of obesity, IR, and endothelial dysfunction in PCOS which in turn increases the risk of cardiovascular disease (CVD) (Almhmoud et al., 2024). Differential rates of body dissatisfaction and lowered health-related quality of life further maintain psychological distress, continuing a bidirectional feedback loop to maintain HPA activation (Marschalek et al., 2023).

It is evident that psychiatric comorbidities are more common in women with PCOS and that these comorbidities may worsen endocrine abnormalities, creating a vicious cycle (Hu et al., 2024). Yin et al. (2021) conducted a thorough review of 46 studies, involving 30,989 participants — 9,265 of whom were women with PCOS and 25,638 who did not — and found higher levels of depressive symptoms, anxiety, reduced quality of life, sexual dysfunction and emotional distress in women with PCOS. Hyperandrogenism, insulin resistance and chronic anovulation are known mechanistically associated hormonal-metabolic sequelae of PCOS that are associated with mood dysregulation, with addition to this, experiencing distress around experiencing infertility is a well established precipitant for anxiety and depression (Ismail & Ismail, 2024). This psychoneuroendocrine relationship highlights the need for a holistic interdisciplinary approach to the treatment of PCOS, not only to deal with the metabolic endocrinologic aspects of the syndrome but also to cater to its psychological component.

Dietary Components and Nutritional Strategies

The International Evidence-based Guideline for the Assessment and Management of PCOS say that lifestyle changes, such as dietary ones, are provided as the first line of treatment to control PCOS metabolic problems (Teede et al., 2018). In these patients, low calorie diet plan design should work on certain parameters: Weight loss and/or maintenance of correct weight will suffice; minimal or no increased intake of simple sugars and refined carbohydrates; increased consumption of foods with a lower glycemic index (GI); reduction in saturated and trans fatty acids and checking food deficiencies such as vitamin D, chromium and omega3. Because overweight and obesity are so common, and insulin resistance in particular is such a prevalent issue, a comparatively small amount of body weight reduction (around 5%) can have a beneficial impact them. Many of these women suffer from insulin resistance, high levels of androgens, reproductive system imbalances, and decreased fertility (Faghfoori et al., 2017). The dietary recommendations should be tailored to each individual's needs, according to weight, level of physical activity and energy needs (Cannarella et al., 2025).

Dietary adjustments are a fundamental part for the treatment for PCOS, but several diets are recommended that require special attention. Like the Mediterranean diet or keto diet, eating patterns influence metabolic health and could have certain health benefits (Nandagopal et al., 2026). In many staple plant-based foods, Carbohydrates are the most important energy source. In 2022, WHO determined carbohydrates as a key determinant of diet quality (Zhang et al., 2025). The glycemic load can be lowered through either decreased intake of carbohydrates or through using low GI food. Low GI diets include low crude carbohydrates: whole grains, seeds, nuts, legumes, fruits and vegetables (Deswal et al., 2020). A meta-analysis conducted by Saadati et al. has shown that a Low Glycemic diet (LGD) can play an effective role in decreasing the physical and biochemical symptoms of PCOS (Saadati et al., 2021). An increased dietary fiber intake seems to have comprehensive benefit on glucose metabolism in women with PCOS. Plant-based foods not only are a good source of fiber, which is important for blood sugar control, but they also contain natural compounds like polyphenols that help reduce elevated blood glucose levels, with an added bonus of promoting insulin response. Low-fat sources of protein – such as seafood, lean poultry and plant-based proteins – should be included (Han et al., 2023). Recent studies have shown that a diet rich in protein can be helpful against PCOS to some degree. Thus, the pattern of high protein content in a well-balanced diet favors metabolic progress and healthy fat loss in PCOS patients (Muhammed Seed et al., 2025). Adequate quantity and quality of fatty acids is important for fertility (Jurczewska and Szostak-Wegierek, 2022).

Omega-3 Polyunsaturated fatty acids (PUFAs), especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), lowers triglyceride levels, making an improvement in inflammation

and insulin resistance (IR) in women with PCOS. Besides this, diet intervention providing dietary bioactives, like flavonoids, polyphenols and n-3 PUFAs with anti-inflammatory activity and reducing metabolic derangements is also crucial in managing PCOS (Albardan et al., 2024). Seeds, nuts, fatty fishes like sardines, tuna etc. are good sources. The gut microbiota has been associated with metabolic alterations that have been noted in PCOS. Dysfunction of gut microbiota has been associated with PCOS symptoms like hyperandrogenism, insulin resistance etc. There is some promising research regarding the use of probiotics and its beneficial effects on metabolic and hormonal variables in PCOS patients (Senthilkumar and Arumugam, 2025). The main purpose of the use of probiotics or synbiotic preparations (combination of probiotics and prebiotics) in dietary therapy of PCOS is now to correct the disturbances in the intestinal microbiome (Chudzicka-Strugala et al., 2022).

Individuals with metabolic disorders showed improvement when the foods have anti-inflammatory antioxidants that reduce the amount of fat tissue and increase the balance between gut bacteria (Vaziri Esfarjani et al., 2025). Anti-inflammatory foods such as berries, leafy greens, fatty types of salmon, and extra-virgin olive oil helps to reduce the symptoms of inflammation, such as fatigue. They are also excellent sources of potassium, calcium, iron and magnesium as well as vitamins C, K, E and B which are essential for PCOS treatment. Vitamins B2, B3, B5 and B6 help improve the functioning of the thyroid, fertility, and potassium is essential for the formation of Follicle Stimulating Hormone (Jagati and Thaimei, 2024). A Mendelian randomization study reveals a direct correlation between levels of vitamin A, D, E, K and B12 in the blood and reduced risk of PCOS. These vitamins have been found to impact insulin resistance, abnormal lipid profile, and extra weight gain, which are main mechanisms which play a role in the development of PCOS (Shen et al., 2023). Biochemical studies have revealed that women with PCOS have lower zinc and selenium levels, contributing to the worsening of PCOS symptoms (Günalan et al., 2018).

Folate levels (B9) are also mostly decreased, and folic acid alone or in combination with other B vitamins can optimize insulin levels. The reduced vitamin B12 level observed in PCOS and insulin resistant women suggest that this vitamin may play a role in the pathogenesis of increased insulin, decreased insulin sensitivity and increased homocysteine levels (Abass and Hussein, 2025). Based on its prognosis, Vitamin D has been proven to have therapeutic usage in PCOS (Table 1). The effect of vitamin D in PCOS, metabolic and reproductive dysfunctions may be mediated via its overall effect on insulin resistance (Mohan et al., 2023).

Table 1. Dietary components and nutritional strategies relevant to the management of PCOS

Dietary component/strategy	Major sources or examples	Potential relevance to PCOS management	Key evidence
Low-glycemic-index carbohydrates	Whole grains, legumes, vegetables, fruits, seeds and nuts	May improve glycemic control and reduce clinical and biochemical manifestations associated with PCOS	Deswal et al. (2020); Saadati et al. (2021)
Dietary fibre	Whole grains, legumes, fruits and vegetables	Supports glucose regulation and may contribute to improved metabolic health	Saadati et al. (2021)
Protein	Seafood, lean poultry and plant-based protein	Adequate protein intake may support metabolic health and healthy weight management	Han et al. (2023); Muhammed Saeed et al. (2025)
Omega-3 fatty acids	Fatty fish, seeds and nuts; EPA and DHA	May improve triglyceride concentrations, inflammation and insulin resistance	Albardan et al. (2024)

Antioxidant-rich foods	Berries, leafy vegetables, extra-virgin olive oil and other plant foods	May counter oxidative and inflammatory processes associated with metabolic dysfunction	Vaziri Esfarjani et al. (2025); Jagati & Thaimei (2024)
Vitamin D	Dietary sources and supplementation where appropriate	May contribute to improved insulin sensitivity and reproductive/metabolic function in women with PCOS	Mohan et al. (2023); Akre et al. (2022)
Folate and vitamin B12	Green leafy vegetables, fortified foods and animal-derived foods	May be relevant to insulin metabolism and homocysteine regulation	Abass & Hussein (2025)
Zinc and selenium	Meat, seafood, eggs, nuts and other nutrient-dense foods	Lower concentrations have been reported in women with PCOS and may contribute to metabolic dysfunction	Günalan et al. (2018)
Probiotics and synbiotics	Fermented foods and probiotic/synbiotic preparations	May help modulate gut microbiota and potentially improve metabolic and hormonal parameters	Chudzicka-Strugała et al. (2022); Senthilkumar & Arumugam (2025)
Reduction of refined and ultra-processed foods	Limiting refined carbohydrates, excessive saturated/trans fats and ultra-processed foods	May support weight control and reduce metabolic burden	Faghfoori et al. (2017); Alomran et al. (2023)

Dietary Patterns in the Management of PCOS

One of the most important nutritional interventions in women with PCOS is Mediterranean diet (MD); it has shown to decrease body weight and have an anti-inflammatory effect. Previous evidence is suggestive that MD reduces inflammation, high androgen levels and IR in PCOS patients (Barrea et al., 2019). The Mediterranean diet was added to the international recommendations on healthy dietary patterns because of its consistent use of unsaturated fat, antioxidants, carbohydrates with low GI, fiber, vitamins and suitable levels of animal-derived protein (Jagati and Thaimei, 2024). Other than that, A brief four-week low-calorie ketogenic diet (LCKD) was shown to increase several health markers in overweight and obese women diagnosed with PCOS, including better blood sugar regulation, hormone balance, and better body composition outcomes (Seven Avuk and Bas, 2025). Ketogenic diet (KD) is characterized by a high fat and low carbohydrate intake, more specifically 1672 kcal/day with 71.1% fats, 4.8% carbohydrates, and 24.1% proteins. These promote weight loss and metabolic improvement via ketosis (Muhammed Saeed et al., 2025). Findings of the study conducted by Paoli et al. are suggestive of the use of KD as a potential therapeutic support for PCOS along with a shift to more balanced eating habits exclusively focusing on the quantity of carbohydrate (Paoli et al., 2020). Another dietary pattern that has gained popularity due to its distinguished results is the DASH diet (Dietary Approaches to Stop Hypertension). DASH diet is a low sodium diet to balance high blood pressure. It consists of 1600 kcal/day with 50-55% carbohydrates, 15-20% protein, 20-30% fats and less than 2.4 g/day sodium intake (Muhammed Saeed et al., 2025).

Thus, the link between what women eat and likelihood of acquiring PCOS is unquestionable. The majority of the studies reviewed found that women with PCOS typically eat similarly, with higher intakes of the harmful foods (refined carbohydrate, animal-based protein, fat and ultra-

processed foods). It also shows that some of the micronutrients are of significance in the prevalence of PCOS in women, specifically Vitamin D and folate (B9). Research also indicates the role of a person's genes and their environment play in developing PCOS (Alomran et al., 2023). Over-consumption of caffeine and alcohol can worsen the symptoms. Thus, balancing the diet is very essential (Figure 1).

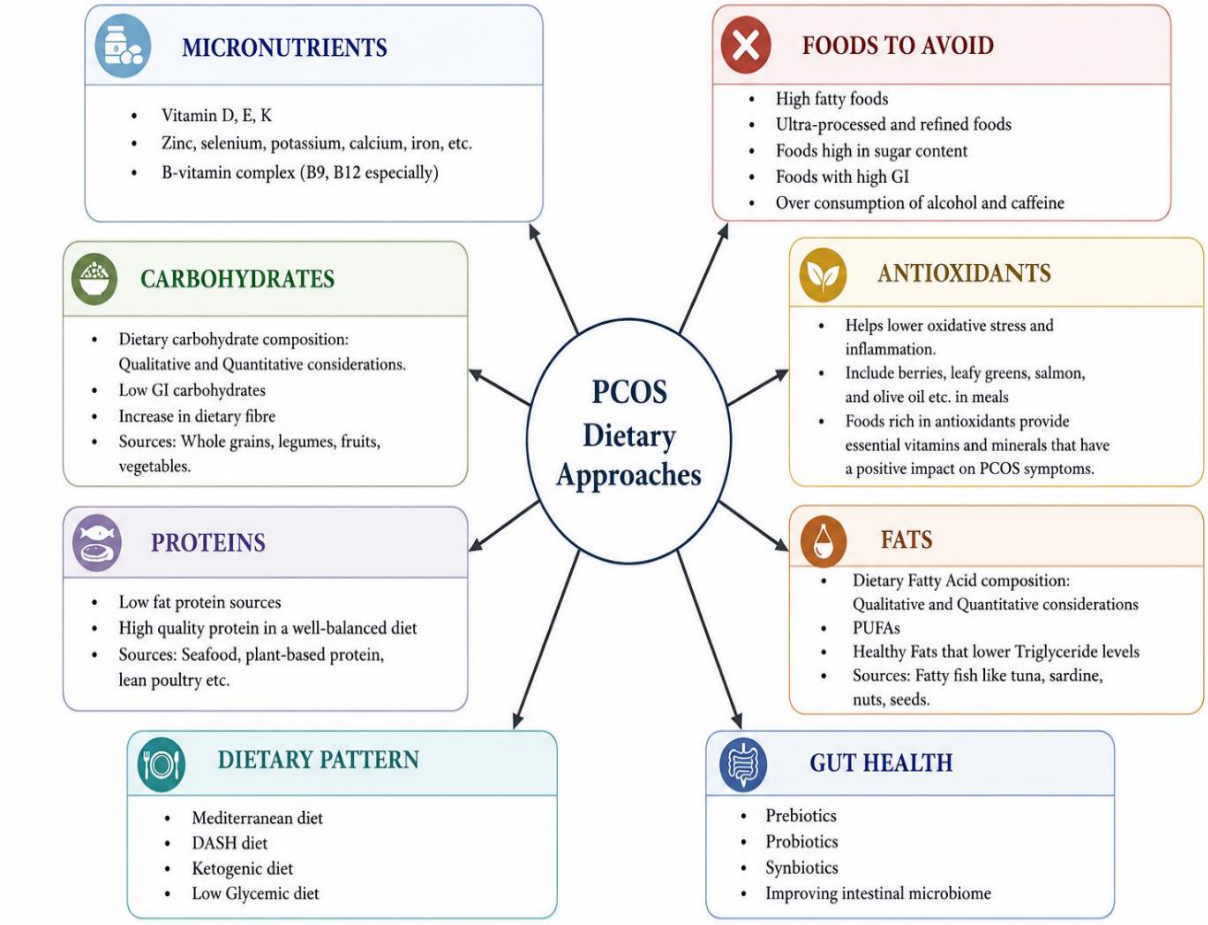

Figure 1. Overview of dietary approaches for the management of Polycystic Ovary Syndrome (PCOS).

Mental Health and Cellular Stress in PCOS

PCOS sufferers may experience distress and a wo rse quality of life due to common PCOS sympto ms include hirsutism, acne, infertility, menstrual dysfunction, obesity, and the possibility of long-term problems (Khan et al., 2025). PCOS prevalence varies from 2.2% to 26.7% globally, depending on the diagnostic criteria used (Dybciak et al., 2023). Patients with PCOS are three times as likely than non-PCOS individuals to experience anxiety and depression. The prevalence of anxiety and depression in PCOS patients is not well studied (Zehravi et al., 2021). Anxiety, sadness, and eating disorders, the three most prevalent mental health conditions associated with PCOS will cost the US population alone more than $4 billion in direct medical expenses in 2021 (Yadav et al., 2023). Research indicates that women with PCOS are more likely to experience neuropsychiatric conditions such obsessive-compulsive disorder, depression, anxiety disorders, and bipolar disorder. According to the American Psychiatric Association, major depressive disorder is defined as a depressive episode with at least five symptoms, such as a

markedly diminished interest or pleasure or at least a depressed mood, that occurs most of the day, almost every day, for at least two weeks, and causes clinically significant distress (Stańczyk et al., 2026).

PCOS has a complicated etiology that is impacted by numerous variables. There is growing evidence that abnormal follicular growth and decreased fertility in PCOS patients are largely caused by oxidative stress and energy metabolic abnormalities in granulosa cells (GCs). People with PCOS often exhibit mitochondrial dysfunction, elevated oxidative stress, and disturbed glucose metabolism, all of which contribute to poor oocyte quality (Yan et al., 2024). In women with PCOS, oxidative stress (OS) and alterations in metabolism and hormones have been linked to altered levels of heavy metals and critical elements. Blood levels of antimonium (Sb), cadmium (Cd), lead (Pb), mercury (Hg), arsenic (As), tellurium (Te), thallium (Tl), osmium (Os), and zinc (Zn) were elevated in PCOS women, whereas blood levels of copper (Cu) were inconsistent. Markers of OS and chronic inflammation were shown to be significantly correlated with critical elements (Se, Zn, Cr, Ca, Mg, and Cu) and heavy metals (Sb, Cd, Pb, Hg, As, Te, and Tl). In PCOS, metabolic and hormonal traits were linked to heavy metals (Sb, Cd, Pb, and Hg) and important elements (Zn, Cr, Se, Ca, Mg, and Cu) (Srnovršnik et al., 2023). The accumulation of unfolded or misfolded proteins in the ER because of an imbalance between the ER's capacity to fold proteins and the demand for protein folding is known as ER stress. Numerous signal transduction cascades that are set off by ER stress result in the unfolded protein response (UPR), which regulates several cellular functions. Gonadotropins and intraovarian local variables make up the ovarian follicular microenvironment, which is a key regulator of this dynamic process (Koike et al., 2023).

Stress Hormones and Cortisol Regulation

One important stress marker that can be utilized to evaluate the role of stress in the pathophysiology of this illness is cortisol. Numerous factors, including circadian rhythm, emotion, pain, stress, and anxiety, have been found to affect an increase in HPA axis activity (Benjamin et al., 2021). The activation of the glucocorticoid receptor (GR) during stress has led to extensive research on the hypothalamic-pituitary-adrenal (HPA) axis (Anderson, 2024). Decreased levels of monoamine neurotransmitters and changes in the HPA axis are associated with the pathophysiology of depression. In addition, PCOS risk factors such as obesity, IR, hyperandrogenemia, inflammation, and infertility are thought to contribute to the development of depression. The symptoms of neuroendocrine problems in PCOS are made worse by the interaction between the diseases of the HPA and HPG axes. These two axes are regulated by neurotransmitters like GABA, dopamine, beta-endorphin, and norepinephrine (Li et al., 2025). Cortisol is the preferred hormone for assessing the HPA axis, it is important to consider that its pulsatile production and circadian rhythm cause circulating concentrations to vary greatly (Gonzalez et al., 2022). It has been observed that cortisol, the main stress hormone released when the hypothalamus-pituitary-adrenal (HPA) axis is activated, affects human reproductive function through immunosuppression (Karunyam et al., 2023). The proposed interactions among psychological stress, HPA-axis activation, cortisol dysregulation, metabolic disturbances, and reproductive dysfunction in PCOS are summarized in Figure 2.

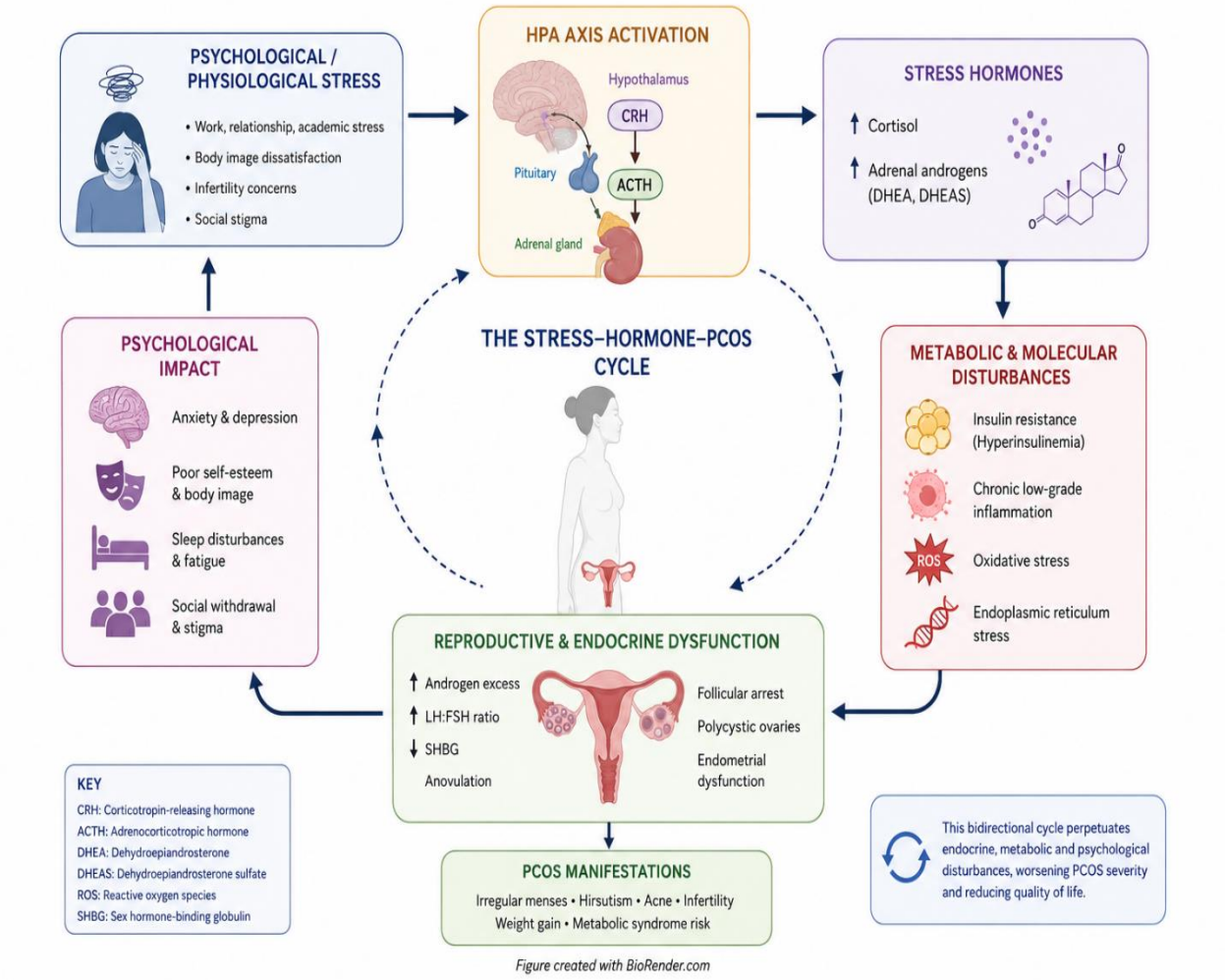

Figure 2. Interplay between psychological stress, HPA-axis dysregulation, and PCOS pathophysiology.

In addition to mental costs like stress and social isolation brought on by the syndrome's symptoms and societal stigma, women with PCOS are more likely to experience anxiety, despair, and eating disorders. These problems are made worse by psychosocial obstacles like poor body image and trouble interacting with others (Khan et al., 2025). Patients' quality of life may be adversely affected by changes in sleep quality, mood issues, and body image. Studies on brain imaging revealed functional changes linked to deficits in verbal and episodic memory, executive function, attention, and visuospatial working memory (Pinto et al., 2024). Primary ovarian abnormalities, endocrine changes, and metabolic modifiers like anti-Mullerian hormone, insulin resistance, and chronic inflammation are all part of the pathophysiology of PCOS (Rushinaidu et al., 2023). This comprehensive analysis focuses on dietary approaches, pharmaceuticals, and herbal remedies that are particularly effective in treating PCOS. The best strategies to address insulin resistance, obesity, and irregular ovulation include Mediterranean, low-glycemic index, and ketogenic diets that are tailored to everyone, according to research (Muhammed Saeed et al., 2025). Maintaining a suitable nutritional status, eating a nutritious diet, and exercising frequently can all help to lessen PCOS symptoms. The primary objectives of dietary treatments are insulin regulation and weight control (Krishnan et al., 2025).

Nutritional and Lifestyle Strategies for Comprehensive PCOS Management

The most prevalent endocrine and metabolic condition affecting women of reproductive age globally is polycystic ovarian syndrome, or PCOS. It presents with menstrual irregularities, metabolic dysfunction, and biochemical changes such as hyperandrogenism, polycystic ovaries, hyperleptinemia, insulin resistance, and increased cardiometabolic risk, which are often compounded by obesity and visceral fat (Di Lorenzo et al., 2023). The fundamental pathologic aspect of PCOS is metabolic stress. Critical metabolic stress affects all of the body's organs and tissues, including the liver (increased hepatic gluconeogenesis), the pancreas (hyperinsulinemia and insulin resistance), adipose tissue (dyslipidaemia), the ovaries (abnormal ovulation), and the adrenal glands (excess androgen) (Almhmoud et al., 2024).

45-90% of women of reproductive age suffer from vitamin D deficiency or insufficiency. PCOS women receiving ovarian stimulation for infertility, vitamin D deficiency was linked to a significant decrease in pregnancy rate, ovulation rate and the likelihood of a live birth (Akre et al., 2022). Vitamin D plays a very important role in the signaling of anti–Mullerian hormone and helps in the production of many hormones such as progesterone, LH, and FSH. The serum (OH) D level was found much lower in women with PCOS than in normal women (Tripathi et al., 2020). Obese individuals typically exhibit more severe clinical manifestations of PCOS as compared to their lean counterparts. Nonetheless, a number of key pathophysiological mechanisms (hyperandrogenemia, IR, oxidative stress, chronic inflammation) are shared by both (Barrea et al., 2021). Hirsutism is estimated to affect around 53% of patients with PCOS, therefore it should be a clear target in treatment. Acne is another visible symptom with profound psychological effects. (Karampela and Druce, 2026). Fertility uncertainty can exacerbate emotional anguish, further taxing mental health. Thorough care for mental health and self-esteem must be provided in addition to treating physical symptoms. Psychoeducation, therapy, and support groups specifically designed for women with PCOS can be extremely helpful in enabling them to deal with the emotional difficulties brought on by the condition, building resilience and cultivating a good feeling of wellbeing and self-worth (Pal and Mahapatra, 2024). In addition to obesity and infertility, clinical symptoms such hirsutism, acne, alopecia, and seborrhoea can cause a great deal of mental discomfort (Bahadori et al., 2022). There is conflicting evidence that PCOS patients are more likely to develop schizophrenia or bipolar disorder (Simon et al., 2023).

PCOS commonly develops in high-risk girls, particularly those with obesity, early pubarche, or those born to mothers with PCOS. Dietary intervention has become a fundamental component of PCOS management, targeting the metabolic and hormonal disturbances that define the disorder. Different dietary patterns such as ketogenic, low-carbohydrate, Mediterranean, and low-glycemic index diets. The Mediterranean diet has been given a great reputation worldwide because of its anti-inflammatory qualities. This dietary approach has significantly shown a reduction in insulin resistance, an improvement in menstrual regularity, and an increase in fertility among women with PCOS. Supplementation with inositol, omega-3 fatty acids, vitamin D, and resveratrol has been shown to improve insulin sensitivity and hormonal balance in affected individuals (Muhammad saeed et al., 2025). The most frequently reported depressed symptoms in women with PCOS are fatigue and sleep difficulties, which may also be signs of depression. To prevent disease-related complications, lessen the severity of a condition and control symptoms, self-management is a continual process of self-directed behaviour modification that is recognised to enhance one's personal emotional, behavioural, and medical management (Ee et al., 2021).

Psychological and Behavioral Interventions

Cognitive behavioral therapy (CBT) is recommended as the primary treatment for depression and may be used alongside antidepressant medication when clinically appropriate (Jiskoot et al., 2020). Mindfulness programs have grown in use and are now featured

in trials to alleviate stress and support psychological well-being in multiple medical populations (Cowan et al., 2023). Dialectical behaviour therapy (DBT) is also involved in supportive psychological counselling (Bai et al., 2024). Acupuncture therapy is effective in reducing PCOS symptoms of depression and the mechanism may be connected to the control of androgen and serum β-endorphin levels and is frequently used to treat sadness (Xing et al., 2025). Research highlights that women with PCOS often rely on maladaptive coping strategies, including increased avoidance and emotional suppression (Srivastava and Sarraf, 2024). The issue of reducing weight is exacerbated by both eating disorders and body image disturbance, underscoring the significance of regular screening for both conditions and the application of therapies such cognitive behavioural therapy (Hoeger et al., 2021). Realistic lifestyle goals may be attained by setting SMART (Specific Measurable, Achievable, Realistic, and Timely) goals and monitoring one's progress (Mohamed et al., 2025). Moreover related mind-body techniques including breathing exercises, meditation, and relaxation training can help a lot (Nandagopal et al., 2026). To increase the efficacy of traditional treatment and manage the condition of women with PCOS holistically a behavioural or educational model is presented. Understanding PCOS and available treatments, behavioural interventions (diet, exercise, sleep), stress management (cognitive therapy, relaxation techniques), managing physical changes, goal-setting, progress monitoring, positive reinforcement are the best ways (Gautam et al., 2025). The principal nutritional, psychological, behavioral, and lifestyle interventions discussed in this review and their potential targets in PCOS management are summarized in Table 2.

Table 2. Integrated nutritional, psychological and lifestyle approaches for comprehensive PCOS management

Intervention/domain	Principal target	Potential benefits in PCOS	Supporting evidence
Mediterranean diet	Insulin resistance, inflammation, body weight and androgen excess	May improve metabolic profile, reduce inflammation and support reproductive health	Barrea et al. (2019); Jagati & Thaimei (2024)
Low-glycemic-index diet	Glycemic regulation and insulin resistance	May improve reproductive, clinical and biochemical manifestations of PCOS	Saadati et al. (2021)
Ketogenic/low-calorie ketogenic diet	Body composition, glucose metabolism and hormonal disturbances	May promote weight loss and improve selected metabolic and hormonal outcomes	Paoli et al. (2020); Seven Avuk & Baş (2025)
DASH dietary pattern	Cardiometabolic health and blood pressure	Provides a structured dietary pattern emphasizing balanced macronutrient intake and reduced sodium	Muhammed Saeed et al. (2025)
Physical activity and lifestyle modification	Weight management and metabolic health	Supports weight control and overall management of PCOS-related metabolic abnormalities	Ee et al. (2021); Gautam et al. (2025)
Cognitive behavioral therapy (CBT)	Depression, anxiety, body image and maladaptive behaviors	May improve psychological well-being and support sustainable lifestyle change	Jiskoot et al. (2020); Hoeger et al. (2021)
Mindfulness and relaxation techniques	Psychological stress and emotional well-being	May reduce perceived stress and support psychological well-being	Cowan et al. (2023);

			Nandagopal et al. (2026)
SMART goal setting and self-monitoring	Adherence and behavioral change	Provides structured, measurable and achievable lifestyle targets	Mohamed et al. (2025)
Psychoeducation and support groups	Self-esteem, coping and psychological distress	May improve resilience, self-worth and coping with PCOS-related symptoms	Pal & Mahapatra (2024)
Stress-management interventions	HPA-axis activity and psychological stress	May help address the interaction between psychological stress and PCOS-related endocrine dysfunction	Benjamin et al. (2021); Gonzalez et al. (2022)
Integrated nutritional and psychological care	Metabolic and psychological burden simultaneously	Addresses the interconnected nutritional, endocrine and psychological dimensions of PCOS	Gautam et al. (2025); Nandagopal et al. (2026)

Conclusion

Polycystic ovary syndrome is not simply a reproductive/metabolic syndrome but a multi-system syndrome, in which hormonal dysfunction, insulin resistance, chronic low-grade inflammation and hyperactivity of the HPA axis interrelate in a bi-directional relationship with psychological stress. The evidence reviewed here revealed that hyperandrogenism, insulin resistance, and elevated cortisol do not occur independently, but rather, each worsens the other, and these are not simply downstream effects of the accompanying anxiety, depression and body image disturbance. Dietary management continues to be the bedrock of first line intervention and all Mediterranean, low-glycemic index and ketogenic diets, sufficient protein intake and omega-3 intake, micronutrient correction (especially vitamin D, folate, vitamin B12) and gut microbiota modulation have been shown to have measurable effects on insulin sensitivity, androgen levels and inflammatory markers. But nutritional therapy is only one aspect of the disorder. Because of the well established psychoneuroendocrine connection between stress hormones and the severity of PCOS, dietary counseling can be expected to have a lasting effect only in combination with psychological support (CBT, mindfulness, structured self-management including SMART goal setting). Thus, moving towards integrated care models, including individualized nutritional therapy, with regular assessment and management of mental health comorbidities is the future direction of development for PCOS management. This approach acknowledges that the two are connected—improving metabolic markers and improving quality of life—and that it is more accurate to say that the gut, the ovaries and the mind are all mechanistically connected with PCOS.

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