

## Review Article

Mehrukh Zehravi, Mudasir Maqbool\*, Irfat Ara

# Healthy Lifestyle and Dietary Approaches to Treating Polycystic Ovary Syndrome: A Review

<https://doi.org/10.1515/openhe-2022-0008>

received February 02, 2022; accepted April 15, 2022

**Abstract:** PCOS (Polycystic Ovary Syndrome) is an endocrine condition that affects women of reproductive age: it can have catastrophic consequences, as it is accompanied by anovulation, androgen excess, infertility, insulin resistance, depression, and amenorrhea. Women who have a hereditary tendency are more likely to be affected. Other environmental variables such as a sedentary lifestyle, bad eating habits, inactivity, and obesity have frequently been implicated in the development of this illness. Each year, more women are diagnosed with PCOS as a result of an increasingly unhealthy lifestyle. When PCOS is detected early and treated correctly, the accompanying reproductive, metabolic, and cardiovascular problems can be effectively managed or predicted. PCOS is becoming a growing source of worry, as it primarily affects women of reproductive age. PCOS is also prevalent in many teenage girls during puberty. Despite being one of the most frequent reproductive health issues among women, doctors face a tremendous obstacle in providing appropriate medical therapy. PCOS is known to cause anxiety and despair, particularly when exacerbated by excessive facial hair growth, obesity, and infertility, anxiety and despair. Thus, PCOS can have a negative effect on an individual's quality of life if it is not treated promptly. The best first-line treatment for PCOS is a lifestyle intervention that includes a healthy diet with caloric restriction, exercise to aid in weight loss and to avoid future weight gain, and support for behaviour modification. Future studies should focus on the gaps in our understanding of PCOS. Patients will receive the best care if those physicians are followed. To date, there has been no effective treatment for PCOS, and

most patients receive only symptomatic treatment with hormones and insulin sensitizers, which leads to long-term medication dependency.

**Keywords:** Health, Lifestyle, Diet, PCOS

## 1 Introduction

Women with PCOS experience irregular menstrual cycles, insulin resistance, and ovulatory dysfunction, as well as other symptoms of endocrine system imbalance. As a result, the hypothalamus, pituitary, ovaries, adrenal glands, and peripheral fat tissue are all affected. About 70 percent of women of childbearing age suffer from the illness, which affects 12 to 21 percent of women of reproductive age. It is widely acknowledged PCOS can be suspected if the patient displays two of the following three symptoms: oligo/anovulation, hyperandrogenism and polycystic ovaries on ultrasound.

PCOS is more common in women with a genetic predisposition, but environmental factors including obesity and sedentary behavior; a diet high in unhealthy fats can also hasten its onset [1-5]. Obesity or overweight affects 50% of PCOS patients. Insulin resistance has been found in many women with PCOS even if they are not overweight. Also, 40% to 50% of women with PCOS and 80% of women with PCOS who are obese have insulin resistance and hyperinsulinemia, respectively. The pituitary gland releases excess luteinizing hormone (LH) in women with PCOS, associating the condition with an increased risk of diabetes, obesity, hypertension, and cardiovascular disease, as well as impaired glucose tolerance and dyslipidemia. In the past, oral contraceptives and anti-androgens were the major therapeutic techniques used to treat PCOS. Insulin sensitizers, metformin, and thiazolidines are among the most recent examples of pharmacotherapy. Acupuncture and statins are two new types of therapeutic tools on the horizon [5-11]. Although obesity and glucose intolerance are prevalent in PCOS, they are not necessarily present.

\*Corresponding author: **Mudasir Maqbool**, Department of Pharmaceutical Sciences, University Of Kashmir, Srinagar, Jammu and Kashmir, India, 190006. Email: bhatmudasir 92@gmail.com

**Mehrukh Zehravi**, Department of Clinical Pharmacy Girls Section, Prince Sattam Bin Abdul Aziz University Alkharj, Saudia Arabia  
**Irfat Ara**, Regional Research Institute of Unani Medicine, Srinagar, Jammu and Kashmir, India

Changes in lifestyle, such as increased physical activity and a healthier diet, can aid in the management of this illness. Weight management is the first line of defense against PCOS, as obesity and insulin resistance are associated with it. However, there is no consensus on the appropriate food composition [12, 13].

## 2 Methodology

Using PubMed, MEDLINE, Google Scholar, and the Cochrane Library databases, we conducted a complete literature review by electronic searches under the headings and keywords PCOS, management, newer treatment choices, recent advancements, cosmetic interventions, and herbal treatment. The review included both pre-clinical and clinical trials, and the articles that provided diverse treatment alternatives were utilized as the primary source of study, with the removal of papers that did not offer treatment and management strategies.

## 3 Impact of Healthy lifestyle

Many women with polycystic ovary syndrome (PCOS) benefit from making lifestyle changes, such as exercising more and eating more healthfully. Lifestyle change is the first line of treatment for persons who have been diagnosed with PCOS. Patients who had previously been diagnosed with PCOS may notice a significant improvement in symptoms and a reduction in the risk of complications. Maintaining a healthy lifestyle is especially beneficial for those who are under medical supervision. Being aware of the importance of adopting a healthy lifestyle from an early age would reduce both the disease's incidence and its long-term effects [14, 15]. Management of overweight and obese women with PCOS requires a nutritious diet, increased activity, and behavioral methods that focus on a healthy lifestyle [16]. Having polycystic ovarian syndrome (PCOS) can have a devastating effect on a woman's life. PCOS severity and related effects are influenced by a variety of factors, including dietary habits, daily activities, and co-existing medical problems [16-18].

PCOS complications can best be managed by changing the way the patient lives and by being aware of eating the right foods. Many studies are being done to see how different food groups can help people with PCOS manage their weight. In a study by Huber-Buchholz et al, the authors found that reducing central fat and improving insulin sensitivity by lifestyle changes leads to normal ovulation

in women with PCOS, even though there is no significant weight loss brought on by these changes. Reducing the amount of midbody fat is more effective for increasing fertility than losing weight all at once. The more fat around the belly, the more insulin resistance and hyperandrogenism, hence a greater chance of developing PCOS. A reduction in abdominal fat can help those already experiencing PCOS to have regular ovulation and deal with other issues. Yet another study found that women with PCOS who made lifestyle changes alone didn't need to take metformin to improve their ovulation, but they did [19-22]. Central fat, androgens, hair growth, the menstrual cycle, and insulin sensitivity all improve when people live a healthy lifestyle and eat a healthy diet. Even if a patient loses just 5% to 10% of their body weight, their ovarian volume and number of microfollicles per ovary go down. The mechanism behind losing weight affecting the size of the ovaries has yet to be ascertained. Microfollicles and ovarian stroma have been suggested as the reason, but this isn't certain. The more ovarian stroma, the more androstenedione is made. Thus, the volume and number of microfollicles in the ovaries will decrease, which will lead to less androstenedione and less facial hair growth [23-25]. A variety of lifestyle interventions can significantly reduce the complications of PCOS. Obesity can be managed with exercise therapy and a calorie-restricted diet. Importantly, excess weight can have a negative impact on metabolic and reproductive health: female fertility decreases significantly as BMI rises above 30 kg/m<sup>2</sup>. Body weight loss of 5% can help to regulate the menstrual cycle, improve fertility, lower testosterone and insulin levels, and reduce acne and hirsutism [26]. Therefore, the first-line treatment for infertility and metabolic problems in women with PCOS is a change in lifestyle. With medical nutrition therapy (MNT), the symptoms of PCOS may be alleviated: it helps alleviate symptoms and avoids complications. The condition will be improved if sweets and carbohydrates are reduced, weight is managed, and exercise is a regular part of lifestyle [27]. BMI can be lowered and insulin sensitivity improved by following a nutritious diet, restricting calories, and engaging in some form of physical activity. PCOS symptoms such as irregular menstrual cycles, ovulation, and lower diabetes risk in high-risk individuals can all be improved with even a minor (5%) weight loss, as can overall mental health and well-being as well as a reduction in diabetes risk [28]. According to the 2013 Endocrine Society clinical practice guidelines, PCOS patients who are overweight or obese should consider using exercise therapy as a treatment option. People who engage in regular physical activity are more likely to lose weight, lower their risk of cardi-

ovascular disease, and avoid developing type 2 diabetes, according to those guidelines [26, 28].

## 4 Impact of dietary modifications on PCOS

Women with PCOS should now consider meal substitution as a short-term dietary solution. In recent studies, macronutrient intake has been recommended as a dietary component for those with PCOS. It's recommended that fat intake should be limited to 30% of total calories, that high GI (glycemic index) carbohydrate consumption be avoided, and calories be distributed throughout the day in numerous meals with modest intake from snacks and beverages. Weight loss, free testosterone, LH/FSH ratio, and fasting insulin were all significantly decreased in women with obesity and PCOS who ate a low-carbohydrate ketogenic diet (LCKD) [17, 28]. New research on fasting for PCOS has gained attention. It has been found that fasting can improve the metabolic and hormonal dysfunctions associated with PCOS in a recent study by Chiofalo et al [29]. Metabolism and reproductive health are addressed by MNT in PCOS patients through the use of a personalized diet that addresses insulin resistance and metabolic and reproductive functions. Also, addressing weight loss needs and the nutrient composition of the diet affects insulin sensitivity regardless of weight loss. An energy-restricted diet that promotes weight loss of 5%–15% while also reducing androgen levels as well as other problems with the female reproductive system, can help women who are suffering from obesity-related health issues like insulin resistance [30, 31]. Insulin sensitivity is influenced both by the nature of the food and its ability to induce weight reduction. Glycemic load plays a significant impact in the lowering of postprandial glucose levels and subsequent hyperinsulinemia, as does the quality and quantity of carbs in the meal. Increased insulin sensitivity has been linked to a diet high in complex carbs and low in fiber, especially from unprocessed foods. Swelling of the stomach, digestion and absorption of nutrients like glucose, and greater satiety have all been linked to dietary fiber levels. Phytochemicals, such as polyphenols, found in plant-based foods, not only reduce hyperglycemia and enhance insulin sensitivity, but they also provide dietary fiber, which aids in glycemic control [32, 33]. Furthermore, the presence of causal protective substances such as inositol(s) explains the protective effect of high-fiber diets on the onset of metabolic illness. Although myo-inositol (MI) has been shown to have various beneficial health effects,

including anti-diabetic ones, it has gained a lot of attention in practical applications as supplements because of its numerous beneficial health effects. A 40:1 MI:DCI ratio was shown to be an effective treatment for IR in women with PCOS because inositol isomers show actions that mimic those of insulin. This treatment was found to be safe and effective. It has been demonstrated that high-fiber diets influence the composition, diversity, and richness of gut microorganisms. Numerous studies have explored the link between PCOS and gut microbiota abnormalities, suggesting that intestinal wall permeability in PCOS patients is affected by gut microbiota in the development of IR and menstrual disorders [34, 35]. Gut microbes create short-chain fatty acids, acetate, propionate, and butyrate, all of which maintain the intestinal barrier and reduce the risk of chronic sub-clinical inflammation when consumed with a low-carbohydrate, high-fiber diet. Firmicutes are the primary producers of butyrate, which appears to be protective against the onset of insulin resistance and obesity, in contrast to a diet high in simple sugars and refined complex carbohydrates, which promotes inflammation, insulin resistance, and the production of androgens and dysbiotic bacteria [36].

## 5 Impact of Low Glycemic Index diet

The glycemic index (GI) of a carbohydrate-containing diet is a measure of how quickly blood glucose levels rise in the body following its consumption. Foods with a high glycemic index, such as potatoes, white bread, and short grain rice, are those that are rapidly digested, absorbed, or converted to glucose. Those foods cause a sudden increase in blood glucose levels. When high GI foods are consumed, the insulin concentration rapidly increases. Following the transfer of glucose from meals to cells, there is a quick drop in glucose levels, making the person feel hungry and causes overeating. Low GI foods, on the other hand, such as soy products, beans, fruit, milk, pasta, grainy bread, and lentils, delay the rate of digestion and absorption following consumption. The gastrointestinal tract's nutrition receptors are stimulated for a longer period of time, which results in a longer feedback to the brain's satiety center [37, 38]. Satiety and fat oxidation, rather than carbohydrate oxidation, are the primary benefits of low glycemic index (GI) diets in weight management. In two studies, one diet had a low GI, while the other had a moderate to high GI, and researchers examined the macronutrient and fiber contents of the two diets. More women (95%) who fed a low GI diet showed improved menstrual cyclicity than

women (63%) who maintained a healthy but conventional diet [39, 40]. The voluntary intake of energy following the consumption of a low-GI meal was 81% lower than that following the consumption of a high-GI meal in another study done on 12 obese teenagers, suggesting that the consumption of low-GI food provides significant satiety. The post-absorptive plasma glucose, the levels of serum fatty acids, and the rise of plasma epinephrine were all lower in the high-GI meal group than the low-GI meal group [22, 40].

## 6 Impact of Omega-3 fatty acids

It has been found that omega-3 fatty acids can help with some of the problems that happen to women who have PCOS. These foods have many good qualities, such as being anti-inflammatory, antithrombotic, antiarrhythmic, and antiatherogenic. The omega-3 fatty acids may also help to reduce hirsutism, body mass index (BMI), LH, testosterone, insulin, and sex hormone-binding globulin (SHBG) levels in women with PCOS. This may also help to regulate the menstrual cycles and improve the lipid level. Fish oil is the main source of omega-3 fatty acids that people consume; chia, flax, and perilla seeds are the main sources of omega-3 fatty acids that come from plants. These foods also help fight cardiovascular diseases, cancer, neurological, and hormonal disorders, as well as the positive effects of their antioxidant functions that is good for the heart and body. Supplements of omega-3 can also help [41].

## 7 Impact of Inositols

Inositol is made up of six carbon atoms, each of which is linked by a hydroxyl group to another carbon; it can be made into 9 different stereoisomers. When it comes to PCOS and its treatment, Myo-inositol (MI) and D-chiro Inositol (DCI) are two of the most important compounds. Different tissues have a different ratio of MI to DCI. The DCI level in tissues that store glucose, like the liver and muscle fat, is higher than that in tissues that metabolize a high quantity of glucose, like the brain and heart. In persons with type 2 diabetes who are insulin resistant, the activity of the enzyme epimerase is lower, which means that the levels of DCI in their tissues drop. DCI and MI provide the ovary with glucose and send messages about follicle-stimulating hormone (FSH). MI helps the ovary get glucose and send messages about FSH [42]. The epimerase

enzyme, which is insulin-dependent, converts MI to DCI. The ovaries are not insulin resistant, and the epimerase enzyme is not insulin resistant. In PCOS, it is thought that because epimerase is more active, there is more DCI and less MI. This imbalance in the ratio may lead to hirsutism because of the rise in androgen levels. FSH signaling problems can affect the quality of oocytes because oocyte quality is linked to glucose intake [42]. In fact, the ratio of MI to DCI in the oocyte has been seen to go down to 0.2:1 in women with PCOS from 100:1 in normal women. The pharmacological agent inositols can be used to treat PCOS mixed with DCI and MI in a ratio of 40:1. In this case, the hormone imbalances were fixed more quickly than with MI alone. Because MI improves the ovulatory function and DCI reduces the peripheral hyperinsulinemia, this is good for women who are overweight and have PCOS, because both help them [3, 43]. In women with PCOS, MI as an insulin-sensitizer has been found to be a good option because it helps to restore metabolic profiles and ovulation in patients who are infertile. It has been found to be safe to eat after a much research. Mild inositol is MI, and MI is the most common form of it found in food. When it isn't bound with other compounds, it can be found as phosphoinositides or phytic acid in its free state. Much MI is found in fruits and in vegetables like peas and beans. Oats and bran are also good sources. Nuts like almonds, walnuts, and Brazil nuts are rich in phytic acid, which means they should be ingested with caution. Lemons and citrus fruits also contain MI. Eating whole grains provide a main source of dietary phytate. However, the bioavailability of MI can be decreased because it is through damage that occurs during the heat in processing [3, 43, 44].

## 8 Conclusion

Making healthy lifestyle choices, getting enough exercise, and eating the right foods can help women with PCOS. There isn't a perfect diet for women who have PCOS because it hasn't been discovered as yet. A low GI diet has been shown to be more effective than a diet with the same fiber and nutritional value. These findings need to be proven through more research in the future to be 100% certain. Food that has a good quantity of MI and omega-3 fatty acids can also help with PCOS problems. Weight loss leads to less androgen production, more sex hormone-binding globulin (SHBG), and better insulin sensitivity, which in turn lead to better menstrual cycles and more fertility in women with PCOS. Work needs to be done to resolve the best diet for women with PCOS, because it

has been recognized as a serious problem for women globally.

## Acknowledgments

Authors would like to thank all the authors whose work has been reviewed while preparing this manuscript.

## Funding information

The authors state no funding involved.

## Conflict of interest

The authors state no conflict of interest.

## Ethical approval

The conducted research is not related to either human or animal use.

## Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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