CODEN (USA)-IJPRUR, e-ISSN: 2348-6465

Review article

A Review of Alternatives for the Treatment of Polycystic Ovarian Syndrome [PCOS]

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ARTICLE INFO:
Received: 1 Apr 2023
Accepted: 18 Apr 2023
Published: 30 Apr 2023

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ABSTRACT:

Importance: Polycystic ovary syndrome (PCOS) is a common hormonal disorder that affects women of reproductive age. Conventional drugs used to treat PCOS have their own adverse effects. Understanding the benefits and limitations of alternative treatments may expand the options available for women with PCOS, improving their quality of life and reproductive outcomes. Objective: The objective of this review article is to evaluate the efficacy and safety of alternative treatments for PCOS, including altered gut microbe treatment, micro RNA therapy, acupuncture, traditional folk medicine, and statins.Evidence review: A comprehensive review of the literature and databases was conducted to identify studies on alternative treatments for PCOS. Studies were included if they were clinical trials or observational studies that evaluated the effectiveness and safety of alternative treatments for PCOS. Data on the study design, intervention, and outcomes were extracted and analyzed. Findings: The review of alternative treatments revealed that altered gut microbe treatment and micro RNA therapy have shown promising results in improving insulin resistance, reducing androgen levels, and regulating menstrual cycles in PCOS patients. Acupuncture has been shown to be effective in reducing hyperandrogenism, improving menstrual dysfunction, and reducing BMI in PCOS patients. Traditional folk medicine, including herbal remedies and weight loss programs, has also shown some benefits in improving PCOS symptoms. However, more research is needed to evaluate the safety and effectiveness of these treatments. Statins have been shown to be effective in reducing LDL cholesterol levels in PCOS patients, but their long-term safety in this population is still being evaluated. Conclusion and relevance: Alternative treatments for PCOS, mentioned in the article show promise in improving PCOS symptoms. However, further research is needed to validate these treatments and evaluate their safety and efficacy in the long-term. These alternative treatments may provide additional options for PCOS patients who are unable to tolerate or have unsatisfactory results with conventional treatments.

Keywords: Polycystic ovarian syndrome, pathophysiology, Diagnostic criteria, Alternative treatment, PCOS management.

1. INTRODUCTION

One of the most prevalent endocrine illnesses, polycystic ovarian syndrome (PCOS) is characterised by abnormal menstrual periods, hyperandrogenism, and polycystic ovaries (PCO) [1, 2]. It is one of the most frequent reasons why women of reproductive age experience ovulatory infertility. According to the diagnostic criteria employed, the prevalence of PCOS in adolescents varies between 9.1 and 36% worldwide (between 4 and 21%) [3,4,5,6,7]. The majority of women with PCOS have several components of the metabolic syndrome, including insulin resistance and hyperinsulinemia. In young, fertile women, hyperandrogenism—the primary symptom of PCOS—can have negative effects on their physical and physiological health [8]. A common clinical symptom of PCOS is obesity, which affects 50% of women [9]. The beginning of oligomenorrhea and hyperandrogenism frequently follows weight gain in women, indicating that obesity may have a pathogenetic role in the development of PCOS [10].

Hyperandrogenism and/or persistent anovulation are two symptoms of PCOS that have a clinical appearance. Symptoms of hyperandrogenism include hirsutism, acne, and/or male pattern baldness. Infertility, amenorrhea, or oligomenorrhea are possible symptoms of chronic anovulation. However, 20% of PCOS individuals may experience regular menstrual periods [11,12]. Several comorbidities, including type 2 diabetes, cardiovascular disease (CVD), obesity, dyslipidemia, hypertension, and glucose intolerance are all associated with an elevated risk of PCOS [13].

2. ETIOLOGY

PCOS is a diverse syndrome, and its precise cause is still unknown. Because it is a heterogenic illness, a variety of

circumstances contribute to its emergence. According to certain theories, both compensatory hyperinsulinemia and insulin resistance play a crucial role in the development of PCOS and are more prevalent in lean and overweight women [14].

A multifactorial illness, PCOS. The pathogenesis of the illness has been linked to a number of vulnerable genes. These genes play distinct roles in androgenic pathways and degrees of steroidogenesis. According to twin studies, heritability is approximately 70%. The expression of these genes as well as the onset and course of the disease are both significantly influenced by the environment. [15,16,17]

According to two well-known theories, PCOS characteristics are expressed in people who have a genetic predisposition when they are subjected to specific environmental conditions. The most prevalent environmental factors are insulin resistance and obesity. Fetalandrogen exposure is another theory that has been put out. [18]

3. EPIDEMIOLOGY AND RISK FACTORS

According to prevalence estimates, PCOS is a frequent endocrinopathy that affects 4%–8% of women of reproductive age, according to the NIH/NICHD criteria [19-23]. The prevalence of PCOS has recently been shown to vary depending on the diagnostic criteria utilised, according to multiple studies (see Table 2) [24-27]. The prevalence estimates produced using the Rotterdam criteria are two to three times higher than those found using the NIH/NICHD criteria, according to these studies time and time again.

PCOS risk is increased by a family history of the condition. PCOS is thought to be a heritable illness based on the clustering of instances in families [28, 29]. One sign of hereditary factors is a high frequency of PCOS or its symptoms among first-degree relatives [30, 31]. In comparison to dizygotic twins, monozygotic twins have also been found to have higher concordance 32. But the inheritance mode is still a mystery. The variability of PCOS phenotypes, the challenge of categorising males, postmenopausal women, and prepubertal girls into phenotypes, and the challenge of acquiring sufficient sample sizes to allow for acceptable statistical power are all problems that impede development in this area [33]. Chromosomes 2p16.3, 2p21, and 9q33.3 have been the sites of loci discovered in a genome-wide association analysis of Han Chinese individuals [34]. Some of these findings, including the chromosome 2p21 THADA and chromosome 9p33.3 DENND1A susceptibility loci, were confirmed in European cohorts. Given that the genes for susceptibility to PCOS are similar, it is likely that the condition was prevalent before humans left Africa [35].

Several disorders are linked to an increased prevalence of PCOS. Following a healthy lifestyle has been shown to reduce body weight, abdominal fat, testosterone, improve insulin sensitivity, and reduce hirsutism in women with PCOS. A history of weight gain frequently precedes the emergence of the clinical features of PCOS, 36 and hirsutism is often associated with PCOS. 28.3% of the 37 obese women who were referred for weight-loss help had PCOS. [38]. The prevalence of PCOS did not, however, differ significantly in an unselected sample based on obesity class. 39 The prevalence rates of PCOS were 8.2%, 9.8%, 9.9%, 5.2%, 12.4%, and 11.5% among women who were underweight, normal weight, overweight, mildly obese, moderately obese, and severely obese. The authors came to the conclusion that obesity may somewhat raise the risk of PCOS.

Women with epilepsy have been found to have a higher prevalence of reproductive diseases, such as PCOS [40]. Bilo et al 46 discovered PCOS in 13 of 50 women (26%) with epilepsy using NIH diagnostic criteria. The finding that epilepsy, independently of antiepileptic medications, increased the incidence of PCOS is supported by the fact that five (31%) of the 16 patients who were not being treated for epilepsy at presentation had PCOS. When given to women with epilepsy, the antiepileptic drug valproic acid, which is commonly used to treat epilepsy, bipolar disorder, and migraines, is linked to symptoms of polycystic ovary syndrome.

Menstrual irregularities, polycystic ovarian morphology, and increased serum testosterone are some of these characteristics [41,42]. Body mass index, fasting serum insulin, and testosterone levels decreased in epileptic women when lamotrigine was used instead of valproic acid [43]. Therefore, while analysing the literature that investigates the connection between epilepsy, bipolar disorder, and PCOS, the confounding effects of medication must be taken into account.

An elevated prevalence of PCOS has been linked to type 1, type 2, and gestational diabetes. Using the NIH/NICHD criteria, Escobar-Morreale et al. tested 85 Caucasian women with type 1 diabetes mellitus for PCOS [44]. In 16 of these women (18.8%), PCOS was found. Codner et al then used the ESHRE/ASRM criteria to screen 38 age- and BMI-matched controls and 42 women with type 1 diabetes mellitus for PCOS [45]. The prevalence of PCOS was 40.5% in the group with type 1 diabetes and 2.6% in the control group, resulting in a relative risk of PCOS in the type 1 diabetes group of 15.4 (95% confidence interval [CI] 2.2-110.2; P0.0001). PCO are particularly prevalent in type 2 diabetes, occuring in 82% of females [46]. Using the NIH/NICHD criteria, the prevalence of PCOS in type 2 diabetes has been calculated to be 26.7% [47]. A PCOS diagnosis was confirmed in 15 of 94 women (16%) who had gestational diabetes and in six of 94 (6.4%) who did not (P=0.03) [48].

There are a number of variables that have been linked to a higher risk of PCOS in children [49]. Low birth weight, congenital virilization, and high birth weight in girls born to obese moms are all prenatal risk factors. Premature pubarche, atypical central precocious puberty, obesity

syndromes, acanthosis nigricans, and metabolic syndrome are risk factors that become apparent later in childhood. Adolescents with chronically irregular menstrual cycles and these risk factors should be suspected of having PCOS [50].

4. PATHOPHYSIOLOGY

There is no other condition that can account for the oligo-anovulation and hyperandrogenic state of PCOS. It is an exclusionary diagnosis. But the majority of hyperandrogenic appearances are explained by it.

The majority of PCOS causes are brought on by functional ovarian hyperandrogenism (FOH). Typical functional ovarian hyperandrogenism, which is defined by dysregulated androgen production and an excess of 17-hydroxyprogesterone (17-OHP) in response to gonadotropin stimulation, is present in two-thirds of PCOS presentations. Although the 17-OHP overreaction in the remaining PCOS with atypical FOH is not present, testosterone increase can identify it when adrenal androgen production is suppressed. A related isolated functional adrenal hyperandrogenism affects about 3% of PCOS patients. The remaining PCOS cases are often moderate. The majority of these individuals are obese, which medical professionals believe explains why they have atypical PCOS. These patients do not exhibit any signs of steroid secretory abnormalities. The clinical value of specific testing for the FOH subgroup is still poor [51].

Functional hyperandrogenism of the ovaries Hyperandrogenism, oligo anovulation, and polycystic ovaries are the three main symptoms of PCOS. A combination of heritable and environmental variables contribute to functional ovarian hyperandrogenism, which is multifactorial in nature. Excess insulin, which is known to sensitise the ovary to luteinizing hormone (LH) by impeding the process of homologous desensitisation to LH in the normal ovulation cycle, as well as an inherent imbalance among intraovarian regulatory systems, are the two main contributors to this dysregulation. Most steroidogenic enzymes and proteins involved in androgen production are overexpressed in PCOS theca cells, which suggests a significant anomaly at the level and activity of steroidogenic enzymes, including P450c17, which has been extensively identified. Overproduction of androgen and insulin is the main cause of early luteinization in granulosa cells.

The early recruitment of primordial follicles into the growth pool is facilitated by androgen excess. At the same time, it starts an early luteinization process, which hinders the choice of the dominant follicle. This causes the gross anatomical alterations and characteristic PCOS histopathologic symptoms that make up PCOM. Even when LH is elevated, PCOS is not caused by it. Although LH excess is prevalent and required for the development of gonadal steroidogenic enzymes and the release of sex hormones, it is less likely to be the main factor for ovarian androgen excess due to theca cell desensitisation.

Atypical levels of insulin-resistant hyperinsulinism, which operate on theca cells to increase steroidogenesis, prematurely luteinize granulosa cells, and induce fat formation, are present in around half of patients with functional ovarian hyperandrogenism. LH excess is triggered by hyperandrogenemia, which then affects the cycle that supports the luteinized granulosa as well as theca.

A relative increase in LH vs FSH production and secretion may result from ovarian hormonal dysregulation altering the pulsatile gonadotropin-releasing hormone (GnRH) release. The relative decline in FSH inhibits appropriate stimulation of aromatase activity within the granulosa cells, limiting androgen conversion to the powerful oestrogen estradiol. LH promotes ovarian androgen synthesis. This develops into a noncyclic hormonal pattern that is self-sustaining.

In the peripheral, increased serum androgens are converted to oestrogens, primarily estrone. Estrogen production will be increased in obese PCOS individuals because conversion takes place largely in the stromal cells of adipose tissue. In contrast to the normal oscillations in feedback seen in the presence of a developing follicle and rapidly fluctuating estradiol levels, this conversion leads to persistent feedback at the hypothalamus and pituitary gland. Endometrial hyperplasia may result from the endometrium being stimulated by oestrogen without resistance [52,53,54].

5. DIAGNOSIS

The International PCOS Network's updated diagnostic recommendations support the use of the "Rotterdam criteria" in adults and the presence of both hyperandrogenism and oligo-anovulation in teenagers. [55] Between 60% to 80% of PCOS patients determined by the Rotterdam criteria have hyperandrogenism. Sex hormone-binding globulin, total serum testosterone, and free androgen index should be used in conjunction with "biochemical hyperandrogenism" assessment to identify PCOS as long as there is no accessible, sensitive, repeatable, and validated testosterone assay. [56]

Two of the following three criteria must be satisfied in order to diagnose polycystic ovarian syndrome (PCOS): excess androgen, ovulatory failure, or polycystic ovaries (PCO) however, conditions that mimic PCOS's clinical characteristics are not included.[57]They include non-classical congenital adrenal hyperplasia, hyperprolactinemia, and thyroid illness in all women (primarily 21-hydroxylase deficiency by serum 17-hydroxyprogesterone [17-OHP]) [57].

Table 1: Diagnostic criteria for evaluation of PCOS

Category	Specific anomaly	Suggested test
Androgen level	Clinical hyperandrogenism	Hirsutism androgenic alopecia, or abundant terminal hair that has a masculine pattern are all examples of clinical hyperandrogenism.
	Biochemical hyperandrogenism	An increased total, bioavailable, or free serum T level is often a component of biochemical hyperandrogenism, which is defined as an increase in serum androgen levels. The Task Force advises familiarity with local tests because it is challenging to determine an absolute level that is indicative of PCOS or other causes of hyperandrogenism due to variability in T levels and the poor uniformity of assays [58].
Menstrual cycle history	Oligo-or anovulation	Anovulation can cause frequent bleeding every 21 days or infrequent bleeding every 35 days. Occasionally, despite dropping at a normal interval, bleeding may be anovulatory (25–35 d). If bleeding intervals appear to suggest regular ovulation, a midluteal progesterone test may aid in the diagnosis.
Appearance of the ovary	Ultrasound imaging of ovarian size and morphology	The existence of 12 or more follicles that are 2 to 9 mm in diameter and/or an increased ovarian volume of at least 10 mL (without a cyst or dominant follicle) in either ovary are considered to be signs of PCO morphology [59].

Serum androgens are not required for the diagnosis if clinical hyperandrogenism is present without virilization. Similar to this, an ovarian ultrasound is not required when a patient exhibits symptoms of hyperandrogenism and ovulatory malfunction.[57]

6. EMERGING THERAPIES OF PCOS

6.1. Statins

Statins are one of the more recent medication choices that have been included in PCOS treatment methods. They are helpful in treating PCOS because they decrease sex steroid production, improve dyslipidemia, and decrease ovarian androgen production by preventing thecal cells from producing androgen [60,61]. Statins have been demonstrated to decrease the growth of human thecainterstitial cells in in vitro investigations on these cells, both in normal and PCOS ovaries, regardless of the presence of leukocytes or the availability of cholesterol [62]. The mevalonate pathway is thought to be crucial to thecainterstitial cells' ability to function, and statins' modulation of this route may be beneficial for PCOS's ovarian and cardiovascular systems. Statins may be used as a medical treatment for dyslipidemia, elevated oxidative stress, and hyperandrogenism in PCOS [63]. Long-term treatment of statins was demonstrated in RCTs to improve the clinical and biochemical abnormalities with one ovulation dysfunction in PCOS-affected women [64]. Despite the fact that statin medication has been found to reduce chronic inflammation and improve lipid profiles, using it makes PCOS patients' insulin sensitivity worse. A study by Johana et al. revealed that atorvastatin therapy reduces insulin sensitivity in PCOS-afflicted women, and the study further advised that statin therapy should only be started in accordance with generally established criteria and a personal risk assessment of CVS, not just PCOS [65].

6.2. Altered gut microbiome treatment in PCOS

Several research conducted over the past few years have linked PCOS to alterations in the gut flora. Between healthy people and PCOS patients, there is a noticeable variation in the composition of the gut microbiota [66,67]. Studies have shown that women with PCOS specifically have higher levels of hazardous bacteria (Escherichia and Shigella) and lower levels of good bacteria (Lactobacilli and Bifidobacteria) [66,68,69]. Alterations in the levels of tauroursodeoxycholic acid and glycodeoxycholic acid have also been linked to changes in interleukin-22 (IL-22) [70]. Probiotics (living microorganisms), prebiotics (sources of food for good gut bacteria), symbiotics, and more recent therapies such faecal microbiota transplantation and exogenous IL-22 injection are among the treatment possibilities for the altered gut microbiome that causes PCOS [71].

The metabolic profile in PCOS has been demonstrated to benefit from probiotic administration [72,73]. When compared to placebo, PCOS patients showed a substantial decrease in weight, BMI, plasma glucose, and serum insulin levels [72,74]. Prebiotics have demonstrated some favourable health effects through changing the microbiota of the host. Prebiotic use was associated with reductions in fasting plasma glucose, total cholesterol, and a significant rise in HDL cholesterol levels [75,76]. Consuming probiotics has been shown to reduce hyperandrogenism and menstrual abnormalities in PCOS-affected women [77].

A new treatment option for PCOS called fecal microbiota transplantation (FMT) includes providing the recipient's intestinal tract with bacteria from healthy donors' stool.

Receivers of this therapy can be treated for disease and their gut microbiome's composition is altered [78]. FMT lowers blood testosterone levels, raises oestrogen levels, and helps to maintain a regular menstrual cycle, according to an in vivo research [79].

Similar to this, it has been demonstrated that intestinal immune factor IL22 exogenously administered is efficient in treating PCOS-induced mouse models [80]. With the treatment of IL-22, a reduction in hyperandrogenism, improvement in ovary shape, and IR have all been documented. But to far, no clinical trial has documented the use of FMT plus exogenous IL-22 for the treatment of PCOS.

6.3. Traditional/folk medicine in PCOS

The focus has recently switched to traditional and herbal therapy due to its advantageous effects on PCOS. There are numerous natural treatments for PCOS that have been tried, such as cinnamon [81], flaxseeds [82], chestberry [83], liquorice [84], and berberine [85]. The therapy of PCOS with flavonoids, flavanones, and other polyphenolic substances such resveratrol, quercetin, and naringenin has been proposed [86]. Cinnamon (Cinnamomum verum) supplementation was reported to lower levels of anti-Mullerian hormone, fasting insulin, and insulin resistance in PCOS-afflicted women [87]. Flaxseed (Linum usitatissimum), another product made from plants, is a good source of lignin, a type of phytoestrogen [88]. A PCOS rat model's ovarian and endocrine profiles were improved by flaxseed and spearmint in an in vivo investigation [89]. Many pre-clinical and clinical studies have demonstrated that chasteberry (Vitex agnus-castus) reduces prolactin levels, enhances menstrual regularity, and treats infertility [90]. In addition to reducing cyclic adenosine monophosphate (cAMP) and prolactin secretion, it contains a number of substances that bind to dopamine type 2 (DA-2) receptors in the brain [91]. Researchers from Italy have discovered that Liquorice (Glycyrrhiza glabra) root can assist PCOS-affected women lower their serum testosterone levels [92].

Liquorice can also be utilised as an adjuvant therapy for hirsutism since it contains the active ingredient glycyrrhizin [93]. The primary active component of Rhizoma coptidis, berberine, has demonstrated beneficial effects on PCOS-related insulin resistance [94]. Berberine was more effective than metformin at reducing IR and dyslipidemia. When compared to Metformin, PCOS patients also had a decrease in androgen levels and the LH/FSH ratio [95]. Nicker Bean, a medicinal shrub (Caesalpinia bonducella), is currently in the news for its positive PCOS treatment outcomes. With the regularisation of the normal hormonal milieu in the PCOS state, its seed extracts have demonstrated anti-androgenic, hypoglycemic, and anti-inflammatory effects [96]. The aforementioned evidence, which mostly come from in vivo and small clinical trials, suggest that herbal medication may be somewhat beneficial for PCOS-affected women.

However, a better study design, more clinical relevance, and patient data should be added to the existing literature to improve it. Before any firm conclusions on the role of herbal treatment on PCOS can be reached, studies should examine the active components of herbal medicines rather than extract as a whole.

6.4. Acupuncture

Using needles to sensory stimulate the somatic afferent nerves that innervate the skin and muscles, acupuncture is a traditional medical practise [97]. Acupuncture has grown in acceptance across the globe in the fields of reproduction and endocrinology [98]. Acupuncture has been recommended as a helpful treatment for anovulatory dysfunction, IR, and hyperandrogenism in PCOS in a number of clinical and pre-clinical studies [99]. Acupuncture has been shown in Chinese studies to modulate the hypothalamic-pituitaryovarian axis, which suggests that it may be useful for enhancing the hormonal and metabolic profile in hyperandrogenism [97]. Electroacupuncture (5 week treatment) increased glucose tolerance and lowered adipose tissue androgens in an RCT of 17 overweight/obese PCOS patients [100].

Electroacupuncture has been shown to be more effective at improving insulin sensitivity than exercise in an in-vivo study using rats with a PCOS model [101]. A recent study has demonstrated that acupuncture reduces blood levels of androgen and b-endorphin, therefore reducing anxiety and depression in PCOS [102]. To provide more solid evidence for the treatment of PCOS, more rigorous clinical and preclinical trials with high-quality systematic research should be done.

6.5. microRNA therapy

MicroRNAs (miRNAs) may have therapeutic benefits in the treatment of numerous diseases, including issues connected to obesity, according to growing research. Non-coding RNAs called miRNAs, which have a length of about 22 nucleotides and post-transcriptionally affect gene expression, are altered in PCOS compared to healthy controls.[103]They cause mRNA cleavage, translational repression, and mRNA degradation when they attach to the target messenger RNA (mRNA). Adipose tissues release miRNAs, which function as both endocrine and paracrine messengers between different target organs [104]. Additionally, miRNAs are connected to the development of adipocytes and may therefore serve as potential biomarkers for disorders like obesity.

Several clinical trials are currently being conducted to determine the potential therapeutic effects of targeting miRNAs in obesity and its related metabolic disorders (such as T2DM, non-alcoholic fatty liver disease, and non-alcoholic steatohepatitis), which may also be advantageous for PCOS sufferers [105].

It should be emphasised that due to their teratogenic effects, all of these substances should be avoided during pregnancy and lactation. According to available data, metformin is safe, does not raise the risk of congenital defects, and is generally well tolerated during pregnancy. It is important to note that, aside from metformin, the use of all other pharmaceutical

drugs should be restricted to women without a desire for pregnancy and those utilising effective means of contraception because women with PCOS are typically young and of reproductive age. It should be mentioned that these medications are not approved for usage in PCOS-affected adolescent patients. Currently, the first-line treatment for women with PCOS should concentrate on lifestyle changes, such as dietary adjustments and increased physical activity, along with any extra pharmaceutical medicines that may be necessary.

6.6. Weight loss medications; Orlistat

A lipase inhibitor called orlistat reduces the absorption of dietary fat by preventing the breakdown of triglycerides in the pancreas and stomach. Orlistat is a weight-loss drug that has been demonstrated to be beneficial, while some have questioned its efficacy. In a study comparing the effects of orlistat vs. metformin treatment on biochemical and hormonal variables in women with PCOS, orlistat treatment resulted in statistically significant reductions in body weight and blood levels. Levels of androgen are higher than those of metformin [106]. Moreover, orlistat reduced IR indicators, testosterone, and total cholesterol. Orlistat also decreases blood pressure, and because it helps people lose weight, it may help people in this high-risk category prevent type 2 diabetes. The recommended dosage of 120 mg of orlistat three times a day with meals has been associated with increased lipodystrophy, diarrhoea, stomach pain, and gas. Moreover, it might result in a lack of fat-soluble vitamins. Orlistat may be useful in the management of obesity, although there is debate over how well it manages the metabolic component of PCOS.

Visceral adiposity Index (VAI) levels were higher in overweight and/or obese PCOS patients as compared to peer controls and non-obesity PCOS patients, and they were associated with a number of metabolic and inflammatory parameters [107].

6.7. Sibutramine

Sibutramine, an appetite suppressant, is used in combination with lifestyle modifications to treat obesity. It inhibits the reuptake of monoamines. It blocks the absorption of dopamine, norepinephrine, and other neurotransmitters including serotonin [108].

6.8. Rimonabant

Anorexia and obesity are treated with the cannabinoid 1 (CB1) receptor blocker rimonabant. In obese PCOS patients without nonalcoholic fatty liver disease (NAFLD), rimonabant decreased body weight and alanine aminotransferase (ALT) [109].

7. CONCLUSION

Due to the complicated etiology and confusing pathophysiology, understanding PCOS as a disease becomes difficult. The typical dermatological and reproductive symptoms of PCOS are merely the outward manifestation of a more intricate system. Nevertheless, there are several new promising treatments for PCOS which are currently under study, as the alteration in the gut microbiome of PCOS patients helps in maintaining a regular menstrual cycle, Acupuncture reduces anxiety and depression in PCOS-affected women, microRNA therapy may be advantageous in lowering obesity in PCOS patients, active components of several herbal medicines are found to have anti-androgenic, hypoglycemic, and anti-inflammatory effects.

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ACKNOWLEDGEMENT: None

CONFLICT OF INTEREST: The authors declare no conflict of interest, financial or otherwise.

SOURCE OF FUNDING: None.

AVAILABILITY OF DATA AND MATERIALS: Not applicable.

CONSENT FOR PUBLICATION: Not applicable.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE: Not applicable