

# Mindfulness Meditation as a Treatment for the Symptoms of Polycystic Ovary Syndrome

Alice Van Derveer, Stacey Dutton  
Agnes Scott College

Polycystic ovary syndrome (PCOS) is a complex neuroendocrine disorder that affects approximately 7% of women of reproductive age. PCOS is characterized by any combination of the three major symptoms: chronic anovulation, hyperandrogenism, and polycystic ovaries. Currently, there is no cure for PCOS, and many of the prescribed treatments are pharmaceutical. The benefits of mindfulness meditation have been explored in other disorders like depression, diabetes, and coronary heart disease, but not with PCOS specifically. The hypothesis of this literature review is that a practice of mindfulness meditation may be beneficial for the depression, diabetes, hormonal irregularities, and metabolic syndrome associated with PCOS. After analyzing research studies on various aspects of PCOS and the potential benefits of mindfulness meditation in the individual symptoms, there seems to be a potential benefit to using mindfulness meditation to treat the symptoms of PCOS and help patients with this condition have a better quality of life.

**P**olycystic ovary syndrome (PCOS) is a complex neuroendocrine condition characterized by a combination of chronic anovulation, hyperandrogenism, and polycystic ovaries (Conway et al., 2014). In fact, PCOS is the most common cause of chronic anovulation and hyperandrogenism in young women, affecting approximately 7% of women of reproductive age (Christensen et al., 2013). The excess of androgen hormones seen in PCOS can result in can cause a multitude of problems, including irregular menses, severe acne, male pattern hair growth (hirsutism), alopecia, type 2 diabetes, and anovulatory infertility. Depression also seen frequently in patients with PCOS as the quality of life of the patient is often compromised due to the higher incidence of obesity, infertility, and hirsutism (Glintborg & Andersen, 2016).

Currently, PCOS does not have a cure. Rather, healthcare professionals and patients work together to alleviate the symptoms. Hormone treatment in the form of oral contraception is often sought out for hirsutism, irregular menses, and acne (Mccartney & Marshall, 2017). Other medical interventions like metformin and

clomiphene have shown success in treating hyperinsulinemia and ovulation, respectively, and weight loss has also been shown to alleviate some PCOS symptoms. However, non-medical alternatives have not been adequately explored to determine their effect on physical and psychological symptoms of PCOS. This review proposes that the practice of mindfulness meditation could help to alleviate symptoms associated with PCOS, particularly depression, obesity, and diabetes. These associated symptoms are common amongst women with PCOS, but they can also cause problems of their own that make life with PCOS more challenging.

## **Search Strategy**

This review analyzes studies identified on PubMed in three categories: 1) polycystic ovary syndrome, 2) the comorbid conditions associated with PCOS (depression, diabetes, obesity, metabolic syndrome, luteinizing hormone levels, gonadotropin-releasing hormone levels), and 3) the effects of mindfulness meditation for depression, diabetes, obesity, metabolic syndrome, luteinizing hormone levels, and gonadotropin-releasing hormone levels. The

search was limited to studies published between January 1988 and May 2017.

### **Polycystic Ovary Syndrome**

Along with ovarian dysfunction, in most cases, females with PCOS exhibit elevated luteinizing hormone/follicular-stimulating hormone ratios but normal levels of estradiol, a naturally-occurring estrogen hormone (Reckelhoff, 2007). Many females suffering from this condition are obese and express symptoms of metabolic syndrome, a cluster of conditions that increase one's risk of heart disease, stroke, and diabetes. PCOS is also associated with increased risk of infertility and type II diabetes.

According to "Guidelines Diagnosis and Treatment of Polycystic Ovary Syndrome: An Endocrine Society Clinical Practice Guideline," PCOS can be diagnosed in adults when two of the following criteria are met: androgen excess, ovulatory dysfunction, or polycystic ovaries (Legro et al., 2007). Upon diagnosis, medical management of the acute issues involved in PCOS involves treatment of the irregular menses, treatment for hirsutism, and management of infertility (Sheehan, 2008). Irregular menses is troubling because the fluctuation of the menstrual cycles can lead to significant pain and embarrassment. The most common treatment for this aspect of PCOS is oral contraceptives, which are formulated to normalize menstrual cycles. The menstrual cycle can be normalized by improving insulin sensitivity, as insulin resistance is another common symptom of PCOS. The next step is treating the hirsutism. Hirsutism severity varies from patient to patient, and the choice between biochemical and mechanical methods of hair removal is often dependent on the severity of the hair growth. Biochemical treatments include decreasing the testosterone production using oral contraceptives and decreasing testosterone action using anti-androgens. Lifestyle changes, weight loss, and metformin can act

to both decrease testosterone production and testosterone action. Mechanical methods of treating hirsutism include plucking, shaving, laser hair removal, and vaniqa cream, a prescription cream used to reduce unwanted facial hair (Table 1). The acute issue associated with PCOS is infertility, as PCOS accounts for 75% of anovulatory infertility and the first trimester miscarriage rate is as high as 30-50% in women with PCOS who actually do get pregnant (Homburg et al., 1988). One of the primary treatments for infertility is clomiphene citrate, but obesity often interferes with the effectiveness of the drug in ways that scientists are unsure of (Sheehan, 2008). Research suggests that weight loss of <5% of initial body weight can aid in a female's ability to achieve pregnancy, and treatments with metformin and thiazolidinedione have also been linked to increased fertility in PCOS patients, but more research is needed on the mechanisms that lead to this increase and the potential side effects of these medications.

A study by the Matsuzaki lab suggests that hypothalamic kisspeptin expression is a key regulator of gonadotropin-releasing hormone (GnRH) and luteinizing hormone (LH), a hormone that acts in the hypothalamic-pituitary-gonadal axis of the endocrine system (Matsuzaki et al., 2016). Kisspeptin, and its receptor GPR54, have been previously identified to be essential factors for GnRH secretion and the onset of puberty, but they also play a key role in ovulation and fertility regulation through GnRH neuron activation. Researchers have hypothesized that sex hormones consistently inhibit GnRH/LH secretion by a negative feedback mechanism at the KNDy neuron. In humans, the menstrual cycle is longer than that of rodents and the LH pulse frequency is the shortest in the mid and late follicular phase when the estrogen level is high. The strength of the estrogen negative feedback on the gonadotropin secretion appears to be

short-lived while the tone of the negative feedback to the hypothalamus is weaker in the late follicular phase than in the early follicular phase. Women with PCOS show frequent pulsatile LH secretion even if they do not have developing or mature follicles, as not all patients with PCOS have cysts on their ovaries. Women with PCOS also have constant estrogen feedback from antral follicles that would stimulate the hypothalamus, and that stimulation is like that of the late follicular phase in normal cyclic women. This suggests that constant estrogen activity in PCOS just like that in the late follicular phase seemed to decrease the negative feedback tone and resulted in frequent excitation of the KNDy neuron and frequent pulsatile GnRH/LH secretion.

The symptoms of PCOS could be both the result of and the cause of malfunctions in the nervous system. One of the major ways that this is seen is through the incidence of psychiatric disorders in patients with PCOS. A study of 5431 patients with PCOS revealed that 7.13% of patients developed some form of psychiatric disorder during the follow-up to the experiment compared to 2.93% of their non-PCOS counterparts (Hung et al., 2014). The most common of these disorders was depression, followed by anxiety and sleep disorder. PCOS is implicated in the nervous system with regard to cognitive functioning as well. A study by the Rees lab revealed that females with PCOS expressed a degraded cognitive performance compared to controls who did not have PCOS (Rees et al, 2016). An analysis of MRI scans also revealed that there were differences in the white matter microstructure between PCOS and control groups. Areas of decreased axial diffusivity (a measure of diffusion taken along the principle axis of diffusion) in the PCOS patients were found throughout the mean white matter skeleton. Finally, tissue volume fraction was increased in the rostral body of the corpus callosum and in parts of the

anterior white matter in patients with PCOS. This data suggests that PCOS may be linked to a decrease in cognitive performance and microstructural alterations within the brain.

Another impact of PCOS is the prevalence of mood disorders and anxiety. Several recent studies have found correlations between depression, anxiety, and PCOS. One study analyzed women with PCOS compared to healthy women to determine if there was a difference in depression symptoms and body dissatisfaction between the two groups (Pastore et al., 2011). They determined that depression symptoms were common across all three BMI categories (lean, overweight, and obese) in the PCOS cohort, and there was increased depression severity that was strongly correlated with increased body dissatisfaction in the PCOS population. "Weight concern" was a particularly major subscale of body dissatisfaction for women with PCOS. A second study analyzed the levels of anxiety, depression, self-esteem, social anxiety, and quality of life among women who suffer from PCOS, and they compared 86 women with PCOS to 47 women who did not have PCOS (Açmaz et al., 2013). They discovered that the depression scores in the group of women with PCOS who were also infertile were significantly higher than the fertile group. The anxiety scores of the group that had a BMI that was considered "obese" were higher than the other BMI groups studied. These results suggest that PCOS and the associated weight gain may be negatively impacting patients' mood and anxiety levels, which could result in depression.

### **Current Treatments for Polycystic Ovary Syndrome**

Because the mechanisms behind the development of PCOS are unclear to researchers, it is often necessary to treat the symptoms of the syndrome rather than treating the syndrome itself. In fact, a

syndrome is defined as: “a group of signs and symptoms that occur together and characterize a particular abnormality or condition.” Often, treating PCOS involves treating the individual symptoms of the condition without actually treating its root cause. As previously stated, PCOS is treated by treating the three major symptoms of the condition: irregular menses, hirsutism, and infertility. Many of the common treatments are pharmaceutical in nature such as oral contraceptives, metformin, and clomiphene. However, the primary non-pharmaceutical suggestions are lifestyle changes, such as adjusting diet and exercise levels, and weight loss.

Metformin works similarly to other drugs: using a signal transduction pathway involving networks within the body that are interwoven to create a cascade effect. Researchers constructed a study to analyze metformin’s mechanism of action, beginning with collecting information on known drug-related genes that work upstream of metformin and genes that work downstream of metformin (Sun et al., 2015). These researchers generated specific signaling pathway network (SPNetwork) and a Drug-specific Signaling Pathway Network (DSPATHNet) to identify specific targets for metformin determined that the MYC gene, which plays a role in cell cycle progression and apoptosis may be the center of the pathway that metformin acts on. Metformin exerts anti-diabetes effects using mitochondrial complex I inhibition, which increases AMP/ATP ratio and activates AMP-activated protein kinases (AMPKs). It has also been suggested that metformin may play a role in reducing ATP availability and that AMPK may exert an effect on the body’s metabolism of metformin by improving lipid metabolism and mitochondrial function in the liver (Rena et al., 2013).

### **Mindfulness Meditation as a Potential Treatment for PCOS**

One non-pharmaceutical treatment that may prove effective in treating the symptoms of PCOS is mindfulness meditation. Mindfulness meditation has been used in various cultures and religions around the world for generations and has been used to treat mental and physical health conditions (Tang & Leve, 2016). As discussed in “A translational neuroscience perspective on mindfulness meditation as a prevention strategy,” mindfulness meditation likely impacts three aspects of human self-awareness: enhanced attention control, improved emotion regulation, and altered self-awareness. Tang and Leve created a hypothetical framework of what parts of the central nervous system mindfulness meditation impacts and how it may impact these areas, as well as how using mindfulness meditation may trigger a cascade effect to promote general health and well-being as well as treat specific symptoms of specific disorders. They suggest that “mindfulness meditation may be associated with observable changes at the behavioral level on specific mental processes, including attention control, emotion regulation, and self-awareness.” Their research led them to understand that mindfulness meditation alters the anterior cingulate cortex (ACC), the prefrontal cortex (PFC), the striatum associated with attention control, limbic areas, the insula, the posterior cingulate cortex (PCC), and the precuneus as it relates to self-awareness. These areas of the brain are responsible for the attention control, emotional regulation, and self-awareness, and many of the brain systems are intertwined to interact with each other so that changes to one system often correspond to changes in another system.

Mindfulness meditation has previously been shown to be beneficial in the treatment of mood disorders like depression. One

randomized trial conducted between October 2014 and December 2015 analyzed the benefits of a yoga-based mindfulness intervention on patients with depression who did not respond well to antidepressants (Sharma et al., 2017). Patients who received the yoga treatment experienced significant improvements in their depressive and anxious symptoms compared to the control group, and these patients had a high likelihood of being able to complete their treatment regimen.

A recent study was conducted to determine the effects of mindfulness meditation on diabetes mellitus and coronary heart disease (CHD) (Keyworth et al., 2014). This is important because PCOS can result in diabetes. The researchers wanted to determine if a six-week regimen of meditation was an acceptable intervention for people with either of these conditions, as well as whether a six-week regimen reduces worry and thought suppression in people with diabetes and CHD. The researchers gave qualitative data suggesting that meditation and mindfulness skills were acceptable interventions for people with long-term conditions such as diabetes mellitus and CHD. It is important to note that the participants of the study cited the feasibility of integrating mindfulness techniques into daily life. This is vital because treatments that cannot easily be implemented into the patients' daily lives will most likely be less effective because patients will be less likely to follow the treatment or will stop using it altogether.

A study published in 2013 analyzed the effects of a holistic yoga program on endocrine parameters in adolescents with PCOS (Nidhi et al., 2013). This study looked at ninety adolescent girls, aged 15-18, who met the criteria for PCOS, and the girls were divided into two groups. One group engaged in a holistic yoga practice for twelve weeks, while the second group engaged in physical

exercise for twelve weeks. As mentioned early, PCOS has been shown to lead to increased GnRH/LH levels, and the aim of this study was to determine if LH levels were impacted by using mindfulness meditation and yoga compared to regular exercise. After twelve weeks, study participants who used the mindfulness meditation and yoga program had reduced levels of LH compared to the exercise group, as well as improved menstrual frequency. These results show that mindfulness meditation as a part of a holistic yoga practice may be beneficial in treating the increased LH levels and irregular menstruation as seen in PCOS patients.

Finally, a study was conducted to determine the effects of restorative yoga and stretching on metabolic syndrome (Kanaya et al., 2015). This study looked at 171 participants aged 21 to 65 that met metabolic syndrome (a large waist circumference and two of the following conditions: fasting glucose  $\geq 100$  mg/dl, triglycerides  $\geq 150$  mg/dl, HDL-cholesterol  $< 50$  mg/dl for women or  $< 40$  mg/dl for men, and blood pressure  $\geq 130/\geq 80$  or the use of anti-hypertensive medication). The participants also had to have an underactive lifestyle ( $< 150$  minutes/week of moderate intensity activity) and had to agree to not using any other weight loss treatments during the duration of the study. At the baseline examination, the researchers analyzed the participants fasting plasma glucose, total cholesterol, triglycerides, HDL-cholesterol, weight, height, waist circumference, blood pressure, BMI, and visceral fat. They re-measured these values at 6- and 12-months of follow-up. Restorative yoga acted as the experimental condition and active stretching acted as the control condition, and the researchers found that yoga was associated with significant reductions in fasting glucose after one year. While the effects of the mindfulness activity of yoga need to be tested further, it is apparent that there may be a

significant connection between mind-body therapy and improving metabolic syndrome.

### **Conclusion**

For many medical conditions, the first line of defense is pharmaceutical treatments. While pharmaceutical treatments serve a vital purpose, there are certain homeopathic and natural remedies that can have the same effect as taking medications. In the case of polycystic ovary syndrome, there is not yet a treatment that fights the condition at its core; current treatments only target the symptoms related to the disease. Some of these symptoms include diabetes, obesity, and psychiatric disorders. It is possible that replacing or reducing treatments for these conditions and replacing them with mindfulness meditation could alleviate these symptoms and limit the number of pharmaceutical medications the patient is

taking (Figure 1). Further research is required to determine what other benefits mindfulness strategies have on disease prevention and progression, but utilizing non-drug treatments could help the patient's symptoms as well as help the patient financially and with overall well-being. It will also be important to determine what levels of mindfulness exercises are the most beneficial for this particular condition, as anything from ten minutes a day to an hour a day may be necessary to see the full benefits of the treatment. Finally, mindfulness meditation is certainly not a cure for the overall condition of PCOS, but rather a way to potentially lessen the severity of the symptoms for those suffering from the condition. The effects of mindfulness meditation on the overall condition of PCOS have yet to be studied.

Symptom	Pharmaceutical Treatment	Non-pharmaceutical Treatment
Irregular menses	Oral contraceptives Metformin Anti-androgens	Lifestyle changes Weight loss
Hirsutism	Oral contraceptives Vaniqa cream Metformin Laser-hair removal	Plucking Shaving
Infertility	Clomiphene citrate Metformin Thiazolidinedione	Lifestyle changes Weight loss

Table 1. Common methods of treatment of major symptoms of polycystic ovary syndrome (PCOS) Source: Sheehan, 2008

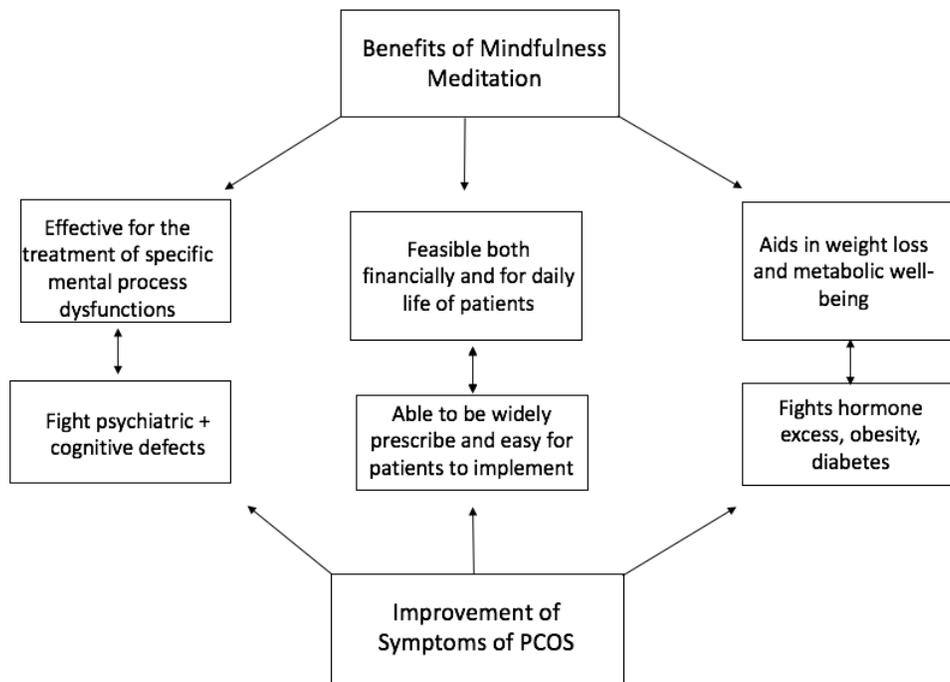


Figure 1. Potential benefits of using mindfulness meditation to treat PCOS

### Resources

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