A SYSTEMATIC REVIEW OF THE GREEN TEA EFFECTS ON ANTHROPOMETRIC PARAMETERS OF PCOS PATIENTS

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ABSTRACT

Introduction: Polycystic Ovarian Syndrome (PCOS) is a prevalent endocrine illness affecting reproductive-aged women that is characterized by irregular menstruation periods, infertility, hirsutism and obesity. Natural therapies, such as extract green tea supplementation, have recently received interest owing to their possible therapeutic properties. However, only a few studies linked green tea with PCOS patients. Hence, this study aimed to review the effects of green tea on anthropometric parameters of patients with polycystic ovarian syndrome (PCOS). **Method:** Articles were identified through PubMed, Science Direct, Scopus and Google Scholar electronic databases based on PCOS OR "polycystic ovar* syndrome" AND "green tea" OR "*Camelia Sinensis*" AND "anthropomet* parameters" OR "weight" OR "body mass index (BMI)" keywords and were included if they met the following criteria: in-vivo studies, female, studies of green tea, PCOS patient, English paper and article from year 2006 until 2023. The reviewing process was conducted according to the Preferred Reporting Items for Systematic and Meta-Analyses (PRISMA 2020) method. **Results:** A total of 34 relevant abstracts were screened and 5 full-text articles were reviewed. The findings found that green tea have a significant effect in reduction of weight, BMI, waist circumference and body fat percentage. The recommended daily dose is ranging from 500 mg to 540 mg while the working duration is 12 weeks. **Conclusions:** Green tea supplementation may have some potential advantages for weight loss and maintenance in those with polycystic ovarian syndrome (PCOS) depending on the amount and period of consumption. Nonetheless, more clinical studies are needed to corroborate these findings and identify the proper use of abstract green tea as an additional treatment for PCOS control.

KEYWORDS: Green tea effect, Anthropometric Parameters, PCOS

INTRODUCTION

Camellia Sinensis is a Theaceae plant that grows as an evergreen shrub and small tree. Green tea, a popular beverage, is made from its leaves and leaf buds (Ayyadurai & Deonikar, 2021). This plant may also be used to make tea, including black and oolong tea. Camellia Sinensis is widely farmed, accounting for about 3 million hectares of agricultural land in China. It is the world's second-most drank beverage and a good source of dietary flavonoids (Ayyadurai & Deonikar, 2021). Green tea powder is created by steaming, pan-frying, and drying the leaves. This powder is recognized for its advantages and flavour and is used in a variety of culinary preparations. Green tea is not only eaten as a beverage but it is also advertised as a nutritional supplement and weight reduction. It has significant health benefits due to its antioxidant, anticarcinogenic, and neuroprotective properties (Paiva et al., 2020). In recent years, there has been a rise in interest in green tea in Western nations, particularly among older citizens. Green tea has been shown to increase mood, attentiveness, and cognitive performance in studies. Its health advantages are mostly related to its powerful natural antioxidants (Huynh, 2016).

Polycystic ovarian syndrome (PCOS) is a condition in which the ovaries create an overabundance of androgens, which are male hormones found in modest levels in women. It is characterized by small cysts on the ovaries, although some women with the syndrome may not have cysts and others do. It is produced by increased testosterone synthesis from the ovaries and/or adrenal glands, which is affected by variables such as steroidogenesis changes and hyperinsulinemia (Witchel et al., 2019). PCOS is a prevalent endocrine illness in reproductive-aged women that affects 6-25% of women before menopause. Infertility, hirsutism, acne, hair loss, insulin intolerance, and obesity are all the symptoms. According to studies, PCOS patients are more likely than the general population to be overweight or obese, with an increasing proportion of obesity cases among PCOS patients (Mombaini et al., 2017).

Despite extensive research, limited studies were found on the effect of green tea with anthropometric parameters of PCOS patients. Therefore, this study aimed to review the effects of green tea on anthropometric parameters of patients with polycystic ovarian syndrome (PCOS).

METHODOLOGY

This systematic review applied the Preferred Reporting Items for Systematic and MetaAnalyses (PRISMA 2020) method which was conducted by using the PRISMA 2020 flow diagram (Page et al., 2021). Articles were identified through databases by determining the search phrases that are related to research questions. Several databases were used which included PubMed, Science Direct, Scopus and Google Scholar. Following the identification of articles using databases, the articles were screened by their title. Then, the abstract was reviewed by two independent reviewers for the remaining articles.

The key characteristics of the target population that the researchers employed to address their study topic are referred to as inclusion criteria. Inclusion criteria include factors related to geography, clinical settings, and demographics which were PCOS OR “polycystic ovar* syndrome” AND "green tea" OR "Camellia Sinensis" AND “anthropomet* parameters” OR “weight” OR “body mass index (BMI)”. The articles were recorded, exported, and screened using EndNote software to remove data duplication. Once the duplicates have been removed, the remaining full-articles were assessed for their eligibility which was determined by its full-text. After the screening process, full-text articles that did not meet the inclusion and exclusion criteria were excluded from the study. Finally, the remaining data after discarding the full-text articles that did not match the criteria were included in the systematic review.

All papers that meet the inclusion criteria in the systematic review were appraised rigorously by two critical appraisers. Based on the appraisal result, the finding can be used to guide the study's synthesis and analysis. The quality assessment includes studies that were being evaluated for bias risk in order to validate their quality. This evaluation was carried out by using the Joanna Briggs Institute (JBI) critical appraisal instrument (JBI 2020). Overall, the risk of bias was low in the four studies; randomized double-blind placebo-controlled trial and randomized placebo-controlled trial, randomized clinical trial and randomized double-blind clinical trial (Alghamdi, 2020; Carina et al., 2006; Farhadian et al., 2020; Mombaini et al., 2017; & Tehrani et al., 2017).

RESULTS

This search engine has come out with 34 total identified articles particularly Scopus (n=12), PubMed (n=15) and Cochrane (n=7). 9 studies were excluded because of duplication. Then, articles were screened based on the title and abstract, which results in removal of 10 articles due to irrelevant title and abstracts. The remaining 15 articles are selected to assess for the full text. Among the 15 studies, 10 articles were excluded due to exclusion criteria during abstract screening. A total of 4 articles are removed because it is a review article while two articles are excluded because it is an animal study. The review is focusing on anthropometric parameters hence, one article is excluded due to focusing on cardiometabolic function instead of anthropometric measurement. The data cannot be derived because of no access to the full article hence, 2 articles were excluded from this review. Finally, 5 remaining articles were included for the review with the published year range from 2006 until 2020. Figure 1 shows the flow diagram used for identifying, screening and including the articles to validate the findings in this review. Then, the findings from these articles were summarized in Table 1.

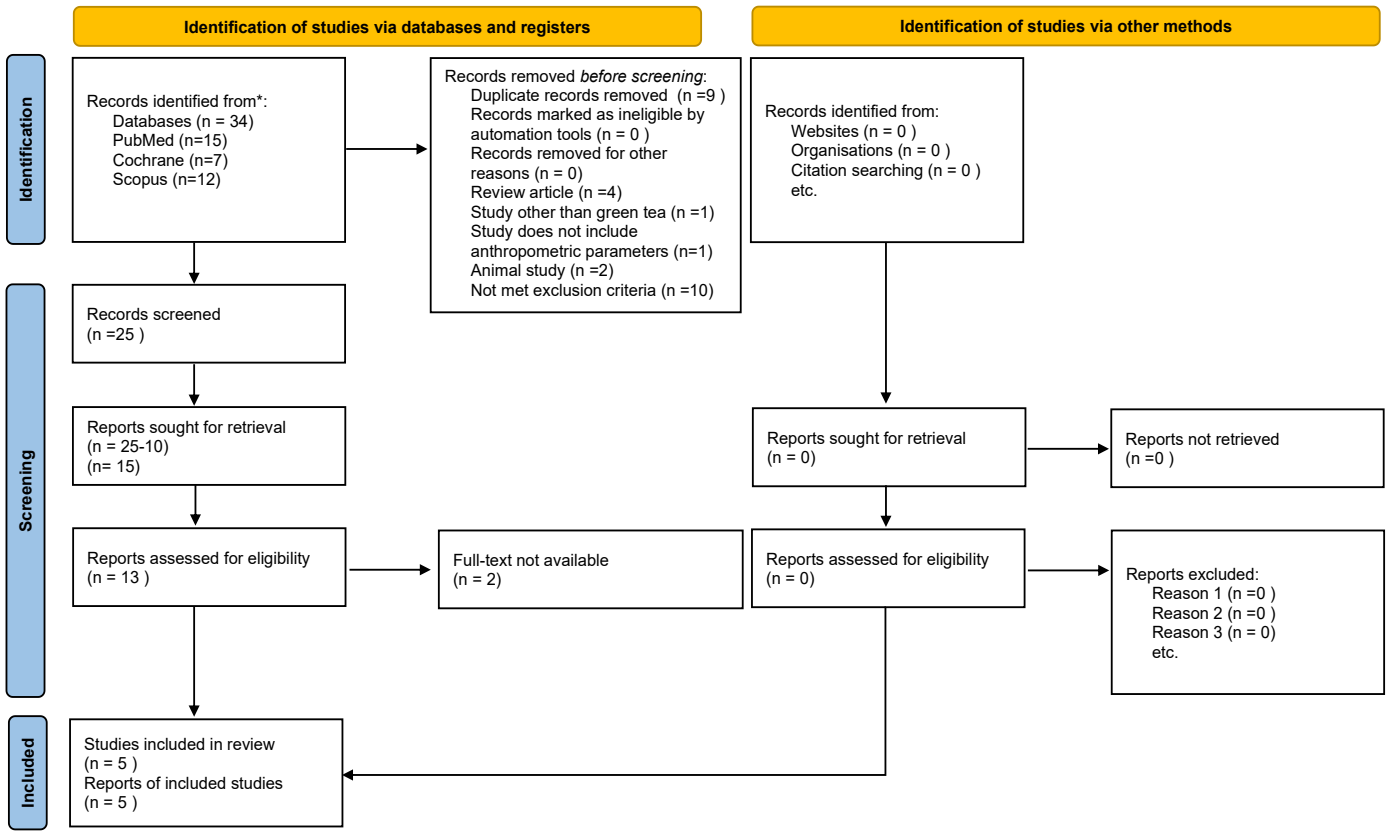

Figure 1: PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers.

Table 1: The dose, duration and effects of green tea supplementation on PCOS patients.

No	Author/year	Sample size/population	Study design	Research Findings		
				Duration of green tea supplementation	Dose of green tea supplementation	Effect of green tea intake on anthropometric parameters
1.	Mombaini E, Jafarirad S, Husain D, Haghighizadeh MH, Padfar P. (2017)	Fifty patients with PCOS, screened from a gynecology clinic. However, five subjects withdrew because of gastrointestinal complications and being pregnant. Hence, only forty-five patients completed the study (intervention group, green tea: n = 22, placebo group: n = 23)	Randomized double-blind placebo-controlled trial	45 days	Four tablets of green tea (Green Teadin, Dineh Co., Tehran, Iran) containing 500-mg green tea (C. sinensis L.) leaf powder.	Green tea supplement caused a significant reduction in weight, BMI, WC, and body fat percentage after the intervention period in the green tea group.
2.	Chan C.C., Koo M.W., Ng E.H., Tang O.S., Yeung W.S., Ho P.C. (2006)	Criteria for the subject: (1) age between 25 and 40 years (2) body mass index (BMI) 228 kg/M2 (3) diagnosis of PCOS Overall, thirty-four obese Chinese women with PCOS were involved in this study. They are eventually randomized into either the green	Randomized Placebo-Controlled Trial	3 months	2% Lung Chen tea freeze dried powder, which contained an equivalent of 540mg epigallocatechin gallate (EGCG) made into six capsules to be taken in three divided doses daily.	(1) Green tea consumption does not seem to exert a beneficial effect on glucose and lipid metabolism. (2) Green tea supplementation did not significantly reduce body weight in obese PCOS women.

		tea (n = 18) or placebo (n = 16) groups. However, two patients discontinued the treatment in the green tea group after 2 months because of emotional stress from family and work. Besides, another patient stopped the capsules consumption after the first week because she had no confidence in the capsules.				
3.	Tehrani H.G., Allahdadian M., Zarre F., Ranjbar H., Allahdadian F. (2017)	70 overweight and obese women aged between 20 and 40 years old and suffering from PCOS from a gynecological clinic of Isfahan city, Iran. They are divided into two groups. Experimental group is those who took green tea as Green Teadin tablet produced by DINEH IRAN; the group of pharmaceutical, hygienic & food industries. However, 5 patients were removed from the experimental group and control group respectively. Hence, only 30 patients were present in each group at the end of the study.	Randomized clinical trial	12 weeks	500 mg green tea capsules to be taken twice a day The green tea pills were produced by Dineh Industries of Iran (as Green Teadin) by grounding the green tea leaves and poured into capsules as green tea capsules.	Green tea consumption has positive effects on weight loss of women suffering from PCOS. It is reported that the ingredients of green tea can have a significant effect on weight loss, but additional mitigators such as caffeine intake and race can also play a role.

4.	Farhadian M., Barati S., M. Mahmoodi M., Barati Mosleh A., and Yavangui M. (2020)	45 women among 18–35 years of age with PCOS They are divided into 3 groups, (1) The green tea group was treated by green tea tablets. (2) The metformin group was treated by metformin tablets. (3) The control group received only placebo.	Randomized double-blind clinical trial	3 months	500mg of green tea tablets, three times a day.	The results showed that the average of all anthropometric indices such as weight, BMI, and waist and hip circumference was significantly reduced in the group receiving green tea as herbal medicine, and this reduction trend was statistically significant.
5.	Alghamdi, S.A. (2020)	85 PCOS women with obesity have been included and selected from Capital city of Kingdom of Saudi Arabia. The mean age of the PCOS women are 32.1±11.2 while the calculated BMI is 33.1± 8.6. For this study, 100% Saudi women were involved with 71.7% is known to be having family history of obesity.	Cross-sectional study	Daily	Not assigned.	Not assessed.

Based on 5 articles included in this review, the study design of 4 articles were randomized double-blind placebo-controlled trial, randomized placebo-controlled trial, randomized clinical trial and randomized double-blind clinical trial. All these study designs are classified as second level of evidence, whereas it can be considered as high-quality evidence. Only one study, which is a cross-sectional study, belongs to the fourth level of evidence.

In study by Mombaini et al. (2017), fifty patients with PCOS that have been screened from a gynecology clinic are chosen whose meet the criteria of PCOS patient. However, five subjects withdrew in the middle of research because of gastrointestinal complications and being pregnant resulting from consuming the green tea supplementation. Hence, only forty- five patients completed the study which consists of intervention group, green tea (n = 22), and placebo group (n = 23) (). Followed by a study by Chan et al. (2006), thirty-four obese Chinese women with PCOS were involved in this study. They are eventually randomized into either the green tea (n = 18) or placebo (n = 16) groups. The criteria that must be fulfilled where the participants must be 25 until 40 years old with body mass index 22.8 kg/m^2. Based on a study from Tehrani et al. (2017), seventy overweight and obese women aged between 20 and 40 years old who are suffering from PCOS from a gynecological clinic of Isfahan city, Iran were selected. They were divided into two groups, experimental group and control group. Experimental group is given green tea in the form of Green Teadin tablet produced by DINEH IRAN; the group of pharmaceutical, hygienic & food industries. However, before the study ended, 5 patients were removed from the experimental group and control group respectively. Hence, only 30 patients were present in each group at the end of the study. Another study includes forty-five women aged 18 to 35 years of age who suffer from PCOS (Farhadian et al., 2020). They were divided into 3 groups consisting of green tea group; treated by green tea tablets, metformin group; treated by metformin tablets, and control group; received placebo as treatment. Lastly, the study from Alghamdi, (2020), eighty-five PCOS women with obesity were included and selected from the Capital city of Kingdom of Saudi Arabia. The mean age of these PCOS women is 32.1±11.2 while the calculated BMI is 33.1± 8.6. For this study, 100% Saudi women were involved with 71.7% is known to behaving family history of obesity.

Moreover, a study from Mombaini et al., (2017) reports that their participants consume the green tea supplement within 45 days in order to complete the study. It shows a positive effect on the reduction of weight, BMI, waist circumferences and body fat percentage. On the other hand, three studies stated that the duration of green tea supplementation applied to their studies is 3 months or 12 weeks (Carina et al., 2006; Tehrani et al., 2017; & Farhadian et al., 2020). This timeline may allow for a better evaluation of the benefits of green tea on PCOS symptoms and general well-being. Overall, the range of green tea supplementation was 500 mg to 540 mg ((Mombaini et al., 2017; Carina et al., 2006; Tehrani et al., 2017; & Farhadian et al., 2020). There was no specific diet followed by any of the participants during the study. However, the study from Alghamdi et al., (2020) does not assign any doses of green tea in their study.

Based on a comprehensive analysis of the readings, all of the included studies are very likely to provide consistent outcomes. The findings imply that integrating green tea administration has the potential to help people with polycystic ovarian syndrome (PCOS). The results shows that the green tea group lost weight, BMI, waist circumference, and body fat following the intervention period.

DISCUSSION

Overall, green tea administration leads to weight reduction in people with polycystic ovarian syndrome (PCOS). There is a significant reduction in weight (Mombaini et al., 2017; Tehrani et al., 2017; & Farhadian et al., 2020), BMI (Mombaini et al., 2017; & Farhadian et al., 2020), waist circumferences (Mombaini et al., 2017; & Farhadian et al., 2020), and body fat percentage (Mombaini et al., 2017) following the intervention period in the green tea group. Green tea's weight reduction processes may be explained by its catechin polyphenol and caffeine content, which leads to sustained catecholamine activity and increased levels of norepinephrine. This will result in an increase in energy expenditure and fat oxidation, indirectly leading to reduction of body weight (Mombaini et al., 2017). However, Chan et al. (2006) reported that, no substantial improvement in glucose and lipid metabolism as well as no significant effects in body weight reduction among their subjects.

Findings show that determination of effective dose and working duration of green tea supplementation in PCOS patients involves careful evaluation of several criteria, including the precise aims of supplementation, individual patient characteristics, and the available research. According to Mombaini et al., (2017) Tehrani et al., (2017) & Farhadian et al., (2020) there is significant result in anthropometric parameters of PCOS patients prescribed with green tea supplementation with dosage of 500mg or 540mg green tea supplementation.

The dosage of green tea is crucial in prescribing it to patients. Findings from Dostal et al. (2015) found side effects associated with high doses of Green Tea Extract (GTE) capsules. In their study, 538 out of 1075 women were given GTE capsules containing 1315 mg ± 116 total catechins per day, with 843 ± 44 mg as EGCG. The results showed that participants with higher GTE doses experienced more side effects like nausea, indigestion, diarrhea, constipation, and vomiting compared to the placebo group. However, these symptoms cannot be solely attributed to green tea. This is evidenced by other studies from Nantz et al. (2009) and Widlansky et al. (2007) whereby even though lower doses of green tea were administered (300 mg of EGCG and 200 mg of GTE with >45% as EGCG), yet rash incidences were still reported. Thus, individual tolerance levels may vary, and even lower doses can have side effects

Study from Mombaini et al. (2017) discovered that a positive effect also can be obtained with a shorter length of green tea drinking. Participants in this trial who took green tea supplements at a comparable average dosage as in the previous studies showed substantial results after only 45 days of intervention. The best length of green tea intake for PCOS patients may differ based on individual responses and unique health circumstances. While some people may see considerable benefits in a very short period of time, others may take a longer period such as 3 months or 12 weeks of supplement administration to achieve apparent results.

The reviewed papers also have physical attributes that could be discussed. Majority of the studies were conducted in Iran, followed by Saudi Arabia and Hong Kong. Despite being a famous drink and food products, there is limited study available on the beneficial effect of green tea on PCOS patients. Hence, it is critical to carry out more study in depth to ensure that the unrevealed benefits of green tea among Malaysians are discovered.

CONCLUSION

In conclusion, this systematic review provides evidence on the potential significance of green tea in the context of weight management for PCOS. Green tea supplementation dose varies according to disease. A daily dosage of 500 mg to 540 mg is indicated for PCOS individuals. Furthermore, green tea consumption for 3 month or 12 weeks is recommended to see prominent changes in weight loss among PCOS patients. Based on this review, green tea may contain bioactive compounds such as catechins, flavonoids, and polyphenols, which have demonstrated anti-obesity properties and the ability to promote fat oxidation.

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