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Dietary Modifications as Therapy for Polycystic Ovarian Syndrome - A Review of Literature

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Abstract

Risk of chronic diseases such as hypertension, cardiovascular diseases, diabetes mellitus and cancer increase in women suffering from Polycystic Ovarian Syndrome (PCOS). For PCOS treatment, there are many approaches such as drug therapy, surgical therapy, traditional remedies, and acupuncture. However, lifestyle modifications with exercise and diet therapy remain one of the safest approaches. Nutritional management to reduce weight is one of the most fundamental and first-line approaches for PCOS treatment. A proper diet plan with essential dietary supplements is necessary for targeting the endocrine, reproductive and metabolic aspects of this syndrome. Given the prevalence of overweight and obesity with insulin resistance, a relatively low reduction in weight, we can aim to improve problems such as insulin resistance, high levels of androgens, reproductive system dysfunctions and fertility in these women. This article aims to put together and review the most crucial macro or micronutrients to be reduced or increased and possible supplementation of vitamins or components necessary for weight loss or maintenance of healthy eating habits required for management of PCOS. It criticizes methods made famous without any evidence of substantial research. Also, provides a background for further research and evidence required to prove whether doctors can recommend one diet over others. Gives an overview of the effects of diet therapy on reducing the risks of possible complications of PCOS.

Keywords: Dietary Modifications, Therapy, Polycystic Ovarian Syndrome

INTRODUCTION:

Polycystic Ovarian Syndrome (PCOS) affects one in every five women (4-18 % of reproductive age). It is characterized by amenorrhea or dysmenorrhea, hyperandrogenism, obesity, insulin resistance leading to subfertility or infertility occurring in women of reproductive age. Lifestyle modifications play a therapeutic role as the actual cause of this syndrome is unknown. Insulin resistance, metabolic and reproductive functions should be the focus for improvement, which can be possible through a low-calorie diet to achieve weight loss or maintain a healthy weight.[1] The article aims to answer whether dietary modifications are the safest and the most effective therapy available for PCOS women. Understanding better the effects of diet therapy on reducing the risks of possible complications of PCOS such as insulin resistance, CVDs.

Method:

A literature review based on PubMed published in the last five years (2013-2019) was carried out to evaluate the evidence regarding the optimum diet in terms of therapy and prevention in women with PCOS and the nutritional and metabolic equates. Around 53 articles have reviewed the outcomes were compared and analyzed. Studies concerning nutrition for women with PCOS in order of gestational health or improving fertility were excluded.

Why are diet changes important treatment options for PCOS?

A study on women in their reproductive age with PCOS done according to Rotterdam criteria concluded that mistakes women with PCOS make in their diets cause improper function of ovaries, leading to metabolic disorders.[2] Weight loss is important for PCOS management, most notably for improving insulin resistance and other metabolic disorders seen in this syndrome. Insulin resistance and compensatory hyperinsulinemia are due to obesity, which in turn increases adipogenesis and decreases lipolysis. Obesity also increases the sensitivity of thecal cells to Leutinizing Hormone and increases ovarian production of androgen. It also leads to an increase in inflammatory adipokines, which cause increased insulin resistance and adipogenesis.

Along with pharmacological therapy, lifestyle changes focused on diet modification and weight loss with exercise are central to therapy.[3] A study on obese and overweight women with PCOS showed that although weight reduction has equal efficacy with metformin in decreasing CRP level, it is noticeably more effective in improving insulin resistance in these women.[4]

Hence, changes in diet are crucial for weight loss, and also these changes bring about an overall betterment of other impaired pathways in this syndrome. Nutritional management holds a centre stage in PCOS. Healthy weight is essential for management, and that weight loss can facilitate management if patients are overweight or obese. This concept has been agreed upon universally, yet there is a lack of adequate study on specific diets such that one diet can be recommended over the other. The findings reported in a study by Jamillian et al. can be used as a reference for more extensive trials and may help clarify which types of nutrition could benefit this multisystem syndrome. The results of this study fortify the need to explore nutrition options for patients and for doctors to provide evidence-based nutritional advice. This article reinforces the idea of prescribing dietary advice with pharmacological and surgical treatments and the need for more time spent in the education of patients when compared to money spent on expensive interventions.[5] Another article gives further evidence that most studies show weight loss improves the symptoms of PCOS despite dietary composition and that weight loss should be targeted in all obese women with PCOS by reducing calorie intake with adequate nutritional intake and healthy food choices regardless of diet composition.[6] The relevance of the nutritional approach in PCOS patients is reinforced with studies that suggest there is a decrease in DNA damage and the impact of cardiometabolic risk factors with a low-calorie diet that induces weight loss in women with PCOS.[7] When a group receiving nutritional counselling and their energy intake reduced by at least 600 kcal/d was compared with another group that received an ambulatory exercise regimen from a physiotherapist over 16 weeks, a study showed that nutritional counselling with dieting is effective to improve metabolic disturbances in overweight women with PCOS.[8] Diets studied concerning PCOS treatment and their efficacy:

Amino acid extracts and antioxidants:

Research on women given a compound with amino acid extracts and antioxidants to study the effects of this dietary modification on insulin resistance concluded that it is necessary to modify the diet to offer alimentary support to avoid oxidative stress that causes the impairment of insulin signalling with subsequent insulin resistance.[9] Another study shows the effects of symbiotic pomegranate juice, which is a rich source of phytochemicals with high antioxidant activity enriched in a probiotic way, on PCOS. A study was performed on PCOS patients, and they concluded that SPJ is a kind of beverage that can improve insulin resistance, insulin, testosterone level, BMI, weight and waist circumference in these patients.[10] Other foods with high antioxidant content like raw red onion consumption can also be effective in lowering cholesterol in women with PCOS.[11]

Advanced Glycation End-products (AGE's):

When the impact of the dietary intervention of advanced glycation end product intake on the hormonal and metabolic profile in women with PCOS was investigated, changes in metabolic, hormonal and oxidative stress biomarkers are seen when modifications are made in their dietary AGE's. The findings in this study support that low AGE's dietary content can be recommended along with lifestyle changes for women with PCOS.[12]

Dietary Approaches to Stop Hypertension (DASH) Diet:

The DASH diet is usually rich in fruits, vegetables, whole grains, and low-fat dairy products and is low in saturated fats, cholesterol, and refined grains. Consumption of such a diet for eight weeks showed a noticeable fall in serum insulin, triglycerides and very-low-density lipoprotein cholesterol and a significant rise in total antioxidant capacity and glutathione levels.[13] A trial was done on women diagnosed with PCOS used the DASH diet consisted of 52% carbohydrates, 18% proteins, and 30% total fats. They conclude that the DASH diet in overweight and obese women with PCOS has beneficial effects on insulin resistance, serum CRP levels, and abdominal fat accumulation.[14]

Low starch/ low dairy Diet:

Carbohydrates from non-starchy vegetables and fruits cause lesser postprandial insulin secretion than carbohydrates from dairy and starch-based foods. A study was done to determine whether a low-starch/low-dairy diet can improve fasting and postprandial fat oxidation after a high saturated fat liquid meal (HSFLM) in overweight and obese women with PCOS, and they concluded that a low-starch/low-dairy diet increases fat oxidation in overweight and obese women with PCOS.[15]

Decanoic Acid is a dietary substitute:

Decanoic acid, naturally found in coconut and palm oil, is a nontoxic fatty acid that contains ten carbon molecules. Improvement in glucose sensitivity without weight gain in a diabetic mouse model with DA treatment. Advantages of decanoic acid treatment over antiandrogens and insulin sensitizers are evident as nontoxic, nonobese, and nonhormonal involvement.[16] Reversing the endocrine and metabolic abnormalities in the letrozole-induced PCOS rat model increases the possibility that PCOD diets including decanoic acid DA may be helpful in the treatment of both hyperandrogenism and insulin resistance.[17]

Ketogenic Diet (KD):

Diet high in fat, with adequate protein and low in carbs, a ketogenic diet can cause nutritional ketosis in the body. Initially, a ketogenic diet was known for its effects on epilepsy. This diet treated refractory epilepsy. KD use in other target populations has been increasingly discussed. KD is a common regime for weight loss nowadays. There have been literary indications for a clinical benefit of diabetes mellitus type 2 and polycystic ovarian syndrome (PCOS). Studies have shown that KD led to considerable weight loss and favoured effects on lipoprotein profile and insulin resistance.[18] KD is associated with significant weight loss and has shown beneficial effects on PCOS and cardiac ischemic preconditioning, improves oxygenation in patients with respiratory failure, and improves glycemic control in diabetics.[19] This diet yields a clinically important reduction in daylong insulin levels without adversely affecting lipid profile in obese, insulin-resistant women with PCOS. Treatment for PCOS can include this simple and safe dietary intervention.[20]

Vitamin D Supplement in diet:

Dietary supplementation of vitamin D has a beneficial effect on serum lipids in PCOS women. A randomized controlled trial found an increase in endometrial thickness in PCOS women who received vitamin D during intrauterine insemination cycles. Increased Vitamin D intake is related to decrease the risk of endometriosis and vitamin D treatment improved endometriosis in a rat model. Vitamin D also shows favourable effects in primary dysmenorrhea, uterine leiomyoma, and ovarian reserve in women who are in the late stage of their reproductive age.[21]

Why can a low-glycemic index diet be preferred?

There are clinically and biochemically evident differences in the phenotypes of women with PCOS. The role of proinflammatory and metabolic factors in the pathogenesis of the syndrome should be of focus. In women with a high level of androgens, the fundamental problem is an elevated insulin level but not an increase in glucose level. In women with a reference androgen level, the high level of glucose caused by a high GI diet triggers insulin levels.[22] Among all diets studied in light of PCOS; a low glycemic index diet has been studied the most. Low Glycemic Index (GI) has demonstrated improvements in insulin sensitivity in insulin-resistant populations. A study was done to research the effects of an isocaloric low GI diet on insulin sensitivity, independent of weight change, in women with PCOS, which was the first study to adopt an isocaloric low-GI diet in women with PCOS, and findings may add to the paucity of research in this field.[23] This fortifies the idea that weight loss might be essential for change insulin sensitivity. A study showed that a pulse-based diet containing lentils, split peas and chickpeas may be more effective than the therapeutic lifestyle changes (TLC) diet at improving cardio-metabolic disease risk factors in women with PCOS.[24] A study was done to assess the efficacy of a dietary intervention among women with PCOS in which they compared a vegan to a low-calorie (low-cal) diet. Results suggest that a vegan diet may effectively promote short-term weight loss in women with PCOS.[25] A study done in recent years suggests that the pathways for synthesis of proinflammatory mediators in women with PCOS are dormant, but these can be stimulated through diet reduction, especially a low GI diet.[26] A study also compared found that six meals had a more favourable effect on

post-OGTT insulin sensitivity in women with PCOS than isocaloric three meals.[27]

DISCUSSION:

PCOS is associated with numerous metabolic morbidities, especially insulin resistance, central obesity and various nutritional abnormalities like vitamin D deficit, mineral alterations. A systematic literature review done to evaluate evidence regarding the metabolic and nutritional correlates of PCOS and the optimum diet therapy for the treatment of these abnormalities suggests that given the detrimental effect of higher weight on these metabolic dysfunctions, a change in the lifestyle must be the cornerstone in the treatment of PCOS patients.[28] Half of the women with PCOS are overweight or obese, which is a severe phenotype. Weight loss is, therefore, the first-line treatment in overweight women with PCOS. A literature review on lifestyle modification with or without metformin in overweight women suggests that a 12-1500 kcal/day diet can be most useful in achieving weight loss. The type of diet is not necessarily correlated with the degree of weight loss.[29] A study done to review all evidence on low carbohydrate diet effects on overweight women with PCOS revealed that a diet low in carbohydrates might be preferable to a conventional diet in terms of increasing fertility, endocrine/metabolic parameters, weight reduction and satiety.[30] Another review of the literature was carried out to evaluate the influence of different food compositions on anthropometric, reproductive, metabolic, and psychological outcomes in PCOS. They summarized the benefits of different diets, thus reinforcing the idea that weight loss should be targeted in all overweight women with PCOS irrespective of dietary composition through calorie restriction in the context of appropriate nutritional intake and healthy dietary choices.[31] From all this above evidence, it is clear that 1) Overweight is a cause of insulin resistance in women with PCOS. 2) Weight loss in PCOS women is essential to counter many metabolic effects of PCOS, especially insulin sensitivity. 3) Lifestyle modifications, mainly dietary changes, are important treatment approaches for women with PCOS. Although most research seems to concur with each other, one main contradiction was in terms of a low caloric diet and its effects on testosterone levels. In one study, a low glycemic load (LGL) or a low-fat (LF) diet in obese and

overweight teenagers with PCOS had no meaningful effect on biochemical hyperandrogenism. [32] Another study was done to determine whether a modest reduction in dietary carbohydrate (CHO) content affects ß-cell responsiveness, lead to a decrease in serum testosterone concentration and insulin sensitivity in women with PCOS.[33] The main setback of adequate and reliable research in diet-based treatment for PCOS is due to the lack of adherence of subjects in the study to the diet. The rate of fallouts from the study is comparatively high. Some studies have significant effects on insulin resistance in other populations, but there is not enough evidence for its effects on PCOS patients, such as the Ketogenic diet. Although this diet has beneficial effects on diabetic patients and there is increasing awareness and liking towards it, research fails to provide enough proof for clinical application of this diet and its valid effects on the population with PCOS. Some research requires further studies, as in a test diet containing soy used as a resource for protein among subjects with PCOS significantly decreased BMI, glycemic control, total testosterone, triglycerides, and MDA.[34] Other such examples can be researched on intermittent fasting. Though there are studies on the effects of intermittent fasting on weight loss or insulin sensitivity, it remains unclear if intermittent fasting is an effective means of regulating homeostasis. Though the idea is becoming increasingly famous in a population in general, there is not enough evidence in the past five years to back it. Large-scale and long-term studies and trials are required for intermittent fasting to be recommended to prevent and treat this disease.[35] Questions in some research remained unanswered, as in the case of the effects of decanoic acid. Although advantages of decanoic acid treatment over antiandrogens and insulin sensitizers are evident in rat models, some questions need to be addressed before these studies can be applied to human patients like 1) does decanoic acid affect the growth and development of the fetuses in pregnancy; 2)what is the long-term effect of decanoic acid treatment; and 3) does decanoic acid have the same role in human PCOS patients as in the PCOS rat? Though a low glycemic index diet is most studied and researched in the light of reducing weight and insulin resistance in patients with PCOS, there are many different aspects of its effects that need to be explored, but a restricted period of dietary changes might not be long enough to yield evident results to study the all the pathways this suggests further need for research in

this area. Regarding vitamin and mineral deficiencies in the concerned patients, except for vitamin D, there are no further studies in the past five years to explore the benefits of reinstating these deficiencies and their therapeutic effect on patients with PCOS.

CONCLUSION:

Lifestyle modification through dietary changes and exercise remains a centre of management in overweight patients with PCOS. There is not enough proof in literature yet to suggest one diet over the other in terms of composition, but a low glycemic index diet seems to be the centre of interest and study for most researchers interested in this area. Almost all research published suggests that a change in diet irrespective of the constituents or a caloric deficit achieved through dietary modification, which leads to a reduction in weight or helps maintain a healthy weight, is essential for improving the metabolic morbidities of this syndrome which includes insulin resistance, hyperandrogenism, menstrual irregularities and fertility. Nutritional management can be a cost-effective and long-term solution for patients with PCOS struggling with weight and insulin resistance. To conclude, a balanced diet with reduced calories, sufficient antioxidants, low in carbohydrates, more in fibre, less trans fatty acids and maintaining any vitamin or mineral deficit at a normal such that it helps in reducing weight can be an overall practical nutritional approach in tackling the metabolic abnormalities of this phenotypically diverse syndrome.

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