

The Intervention Effects of Common Dietary Patterns on Polycystic Ovary Syndrome

Yezhen Wu*

School of Food Science and Engineering, Ningbo University, Ningbo 315211, China

**Corresponding author: Yezhen Wu.*

Abstract

The intervention effects of common dietary patterns on poly-cystic ovary syndrome (PCOS) are a common endocrine and metabolic disease in women of reproductive age with symptoms such as insulin resistance (IR), hyperandrogenemia, infertility, and so on. In recent years, the incidence rate of PCOS has been rising steadily. The exact causes of leading to the disease are still unknown, but it is presumed that it is associated with dietary patterns. However, dietary intervention as a first-line non-drug intervention strategy plays an important role in improving PCOS symptoms. Thus, from dietary aspects, the paper systematically investigated the research progress, clinical application, and limitations from the three core dietary patterns—the Mediterranean diet, ketogenic diet, and low-carbohydrate diet in the intervention of PCOS, which provided a reference for the formulation of individualized clinical nutritional interventions.

Keywords

PCOS, ketogenic diet, low-carbohydrate diet, Mediterranean diet

1. Introduction

Poly-cystic ovary syndrome (PCOS) is an endocrine disorder in women, which is one of the main reasons causing female infertility due to ovulatory dysfunction. The incidence rate of PCOS is 10%-13% in the globe [1]. The patients are mostly women of reproductive age. Clinical features present with prolonged menstrual cycles, abnormal menstrual flow, persistent failure of ovulation, and some hyperandrogenic symptoms [2]. Currently, the cause of PCOS is still unknown. But some existing researches show risk factors include genetics and environment. Dietary habit is one of the most important environmental factors. Study shows excessive dietary intakes of calories, fat, and cholesterol for a long time lead to triglyceride accumulation and excessive lipolysis, which will lead to problems such as IR, steatosis, metabolic disorder, and impaired fertility.

For the treatment strategies of PCOS, they are mainly based on lifestyle intervention and pharmacotherapy. *2023 International Evidence-Based Guidelines for the Assessment and Management of Polycystic Ovary Syndrome* suggests lifestyle intervention should be implemented first. Lifestyle intervention includes dietary intervention, sports intervention, etc. Dietary intervention is taken as the main approach, supplemented by sports intervention. At present, dietary intervention is an important clinical means of treating

PCOS. Common dietary patterns include Mediterranean diet (MD), the ketogenic diet (KD), and the low-carbohydrate diet (LCD), mainly composed of low sugar, low fat, and high fiber. However, at the present stage, few papers systematically state that different dietary patterns have effects on the intervention of PCOS. Therefore, in the paper, related research on the intervention for PCOS from MD, KD, and LCD will be organized and summarized. It will analyze the differences, advantages, and disadvantages of different dietary types, as well as the limitations of all kinds of dietary patterns, which will provide scientific evidence for patients with PCOS in dietary intervention.

2. MD

2.1 Overview of the MD

Traditional MD, originating from olive-growing regions in the Mediterranean Basin, is a plant-based dietary pattern. It stresses a high intake of fruits, vegetables, beans, nuts, grains, and olive oil, moderate intake of seafood and dairy products, and low intake of red meat, processed meat, and butter [3,4]. Its carbohydrate content is about 40%~50%. Protein accounts for about 15%~20%. Fat is about 30%~40%. The food taken in is rich in a variety of functional ingredients, including vitamins, minerals, carotenoids, unsaturated fatty acids, and phenolic compounds with antioxidant and anti-inflammatory properties [5]. Among them, omega-3 unsaturated fatty acids will prevent AA from being pro-inflammatory eicosanoids by a substrate competition mechanism. They can also be alternative substrates, generating less active 5-series leukotrienes, 3-series prostaglandins, and thromboxanes. In addition, E-series resolvins from EPA and D-series resolvins from DHA have strong anti-inflammatory effects. They can block excessive inflammatory reactions to promote the resolution of inflammation by accelerating the removal of apoptotic cells and cellular debris from inflamed tissues. Omega-3 fatty acids will exert anti-inflammatory effects according to the mechanisms described above [6].

2.2 MD's Applications for Treating PCOS

Based on current research, MD provides feasible nutritional strategies for PCOS through its unique nutritional components. People can take in 25-35g EVOO, 25-30g dietary fiber per day, and consume deep-sea fish 2 to 3 times per week to supplement Omega-3 fatty acids. In a study about MD's influences on the life quality of PCOS patients, 64 patients were randomly divided into an MD group and a conventional diet group. Through a 12-week intervention, the changes in comparing the scores of PCOSQ before and after intervention between the two groups of patients showed some symptoms, such as acne and infertility. In the conventional diet, the scores of acne rose from 3.11 ± 1.36 to 3.19 ± 1.33 , and the scores of infertility rose from 2.25 ± 1.18 to 2.98 ± 1.24 . In MD, the scores of acne improved from 3.47 ± 1.59 to 4.77 ± 1.05 , and the scores of infertility improved from 2.27 ± 2.10 to 4.44 ± 1.65 [7]. Compared with a conventional diet, MD's scores were significantly increased, so MD improved the symptoms of patients' acne and infertility. In clinical practice, MD is more suitable for patients with IR and obesity, which is the first-line nutritional intervention regimen for PCOS.

2.3 The Disadvantages of the Current MD

Many limitations and application challenges still exist in MD. First of all, currently, there is no standard to define MD around the globe. Various dietary assessment scoring systems have distinct differences in food components, determination of intake levels, and alcohol treatment. In practical application aspects, conventional MD highly depends on olive oil, fish, local seasonal fruits, and vegetables. Instead, in some non-MD regions, raw materials are difficult to obtain, and their prices are quite high. So it is hard to achieve localized replication. In addition, the MD pattern has high requirements for food ingredients, cooking, and processing, disconnected from the modern fast-paced lifestyle, with poor long-term compliance. What's more, a conventional dietary pattern containing moderate red-wine intake is related to the rising risk of breast cancer, GI cancer, and other cancers. So it is not suitable for special populations such as pregnant women, people with abnormal liver and renal function, and so on. Additionally, olive oil and nuts are rich in high-fat, so the intake amounts should be strictly controlled. If unnoticed, people will consume excess calories. It will be a potential health risk for the weight loss population and individuals with metabolic abnormalities [8].

3. KD

3.1 Overview of the KD

KD is a dietary pattern with high fat, moderate protein, and low carbohydrate. The ketogenesis can be generated by simulating a state of the body [9]. The energy ratio from carbohydrates is extremely low, only 5%. The energy from fat is 75%. The energy from protein is 20%. The amount of carbohydrates taken in should be controlled to 50g every day. In classic KD, the ratio of fat, protein, and carbohydrate is 4:1.

KD takes fat as an energy source by limiting daily intake of carbohydrates, causing the level of blood glucose to decline. If the glucose in the body is not enough, the energy can be gained by breaking down fat. It will cause the liver to release ketone bodies, which include acetoacetate, β -hydroxybutyrate, and acetone. They don't rely on protein to transport in the body but are transported in the IMM and blood, which plays an important role in the organism [10]. To induce ketosis, in KD, minimal carbohydrates, moderate protein, and high fat are needed to be ingested [11].

3.2 KD's Application in Treating PCOS

The research took 75 patients with PCOS from Beijing Shijitan Hospital as participants, who started and stuck to KD from 1 to 12 months in 2023. The average age is 30.59 ± 7.84 . The patients started to accept KD under the guidance of professionally trained OB and nutritionists. After 3-6 months' intervention, body mass declines from $8450 \pm 12.85\text{kg}$ to $70.75 \pm 10.91\text{kg}$. Body Fat Percentage (BFP) declines from $41.87 \pm 5.25\%$ to $36.60 \pm 4.58\%$. VFA declines from $167.87 \pm 39.63\text{cm}^2$ to $122.78 \pm 36.94\text{cm}^2$. BMI declines from $31.71 \pm 5.29\text{kg}/\text{cm}^2$ to $26.65 \pm 4.35\text{kg}/\text{cm}^2$. Menstrual disorders also decline from 56% to 16% [12]. After the intervention, although all the indicators decreased significantly, the long-term efficacy and safety remain to be tested. Clinically, KD is usually used for PCOS patients who are obese, have severe IR, and poor responses to conventional dietary interventions.

3.3 Current Limitations of KD

1 KD imposes excessively strict restrictions. Taking in amounts of fat but little carbohydrates and insufficient protein intake will cause hair loss. Once not following KD, the body will no longer be in a catabolic ketogenic state. The side effects of KD are easy to accept. They include hypothermia, headache, nausea, fatigue, diarrhea and vomiting. Besides PCOS, if the patient may suffer from Type 1 diabetes mellitus, eating disorders, recent stroke or heart attack, kidney and liver failure, severe emotional disorders, and so on, KD should not be adopted. Studies show if a patient adheres to KD for a long time, they may develop complications such as osteoporosis, constipation, kidney stones, vitamin deficiencies or dyslipidemia [1]. Therefore, KD must be consumed for a short time under doctors' supervision, generally about 12 weeks

4. LCD

4.1 Overview of LCDs

3LCD is a diet limiting intake of carbohydrates, which restricts the consumption of food in carbohydrates such as sugar, wheat-based foods and rice, and rice, and in the meantime supplements foods with high fat and protein, such as meat, eggs, dairy products and nuts. The core definition of LCD is the intake of carbohydrate lowering to 130g, or the proportion of energy derived from carbohydrates lowering to 26%. LCD patterns can promote energy ratio of fat and protein by reducing the intake of refined sugars, grains, tubers and high-sugar fruits. Meanwhile, an appropriate intake of non-starchy vegetables, high-quality fats as well as lean meat, eggs and seafood is also recommended. At the physiological mechanism level, LCD can reduce the level of insulin secretion. Insulin acts as key regulatory hormones of fat storage, whose reduced secretion can inhibit fat synthesis and promote fat breakdown, making the body's energy supply shifted from glycolysis to fat oxidation. It provides energy source for the body's energy supply [1].

4.2 Application of Low-carbohydrate Diet in the Treatment of PCOS

Based on a 12-week randomized controlled clinical trial, LCD shows a positive supportive role in comprehensively treating PCOS patients. The research made carbohydrate energy percentage controlled below 40% and focused on the intake of high-quality protein and unsaturated fatty acids. 80 PCOS patients from the 907th Hospital of the JLSF from 2023.1 to 2023.12 were randomly selected as research subjects. They were randomly divided into two groups. The first group was a conventional dietary intervention. The second was the intervention of LCD. After 12-week intervention, E2, LH and T from the second group was respectively 1.16 ± 0.27 pg/mL, 7.82 ± 1.61 mU/mL, 1.41 ± 2.18 ng/L, while the first group was 1.27 ± 0.22 pg/mL, 10.17 ± 2.35 mU/mL, 14.12 ± 2.37 ng/L. Before intervention, there was no distinct difference ($p > 0.05$) in E2, LH, T from both groups. The average level of E2, LHT evidently declined after intervention compared with previous intervention [15]. To sum up, LCD has indirectly regulated the function of the HPO axis through improving glucose-lipid metabolism and insulin sensitivity. So LCD can provide effective assistive effects for PCOS patients' clinical treatment.

5. Discussion

Currently, according to the research from dietary intervention of PCOS, MD, KD and LCD all can have positive effects on patient's metabolism and reproduction by improving IR to decrease androgen levels and body weight. But there exists differences in their intervention effect, safety and long-term applicability. By strictly limiting CHO, through high-fat function KD can achieve rapid weight loss in a short time, significantly improve IR and lower hyperandrogen levels, which will make obese patients with PCOS rapidly restore metabolic function and ovulation. Given safety, KD is not be used in the long run. LCD adopts moderate limitations to the intake of CHO. When improving IR, its compliance is higher with fewer adverse reactions. So it is a balanced regimen suitable for long-term adherence for most patients. MD is characterized by rich UFA, dietary fiber and anti-inflammatory components, whose effect of weight loss is relatively mild. But its benefit is evident in alleviating chronic inflammation and maintaining regular menstrual cycles. MD is more suitable for long-term basic dietary regimen, which also is first-line intervention regimen of PCOS. In general, KD is suitable for short-term intensive intervention. LCD is applicable to daily-balanced diet. MD is more suitable for long-term health maintenance. In the clinical application, personalized choice should be made by the patient's real situation.

6. Conclusion

PCOS seriously affected the patient's life quality and health, so dietary intervention is a vital way to treat PCOS. MD can effectively improve PCOS patients' acne, menstrual disorders, and infertility symptoms by improving IR and anti-inflammation. Its safety is high, but treatment compliance is influenced by regional differences. KD can help lose weight quickly and improve insulin sensitivity, but there exists controversy in its long-term safety and potential effects on sex hormones. LCD is to improve body metabolism by limiting the intake of carbohydrates, but its long-term adherence is poor. Its effect is greatly affected by the limitation of carbohydrates. The three dietary patterns have their advantages and disadvantages. At present, there is no optimal single dietary pattern suitable for all PCOS patients. There are three ideas for prospects. First of all, future dietary patterns are required to further research. Long-term efficacy and safety of various dietary patterns should be clarified to formulate a personalized and sustainable dietary plan by combining the PCOS patient's lifestyle, metabolic characteristics, and cultural background. In addition, multiple dietary patterns can be integrated to break the limitations of a single dietary pattern. At the same time, the advantages of personal dietary patterns can be combined to enhance the clinical interventions in PCOS patients. Finally, people should transform the concept of dietary intervention from avoiding the restriction of single nutrients to focusing on overall dietary quality. A more scientific and healthier dietary intervention will be achieved for PCOS patients by adding high-quality nutritional components.

References

- [1] Yang Xu, Wang Yan, Cao Hongmei, & Tang Lei. (2025). Effects of Different Types of Dietary Interventions on Polycystic Ovary Syndrome. *Journal of Practical Hospital Clinical Practice*, 22(1), 181-185. <http://dx.chinadoi.cn/10.3969/j.issn.1672-6170.2025.01.040>. (Chinese)
- [2] Dong, J., & Rees, D. A. (2023). Polycystic ovary syndrome: pathophysiology and therapeutic opportunities. *BMJ Medicine*, 2(1), e000548. <https://doi.org/10.1136/bmjmed-2023-000548>
- [3] Teede, H. J., Tay, C. T., Laven, J., Dokras, A., Moran, L. J., Piltonen, T. T., Costello, M. F., Boivin, J., Redman, L. M., Boyle, J. A., Norman, R. J., Mousa, A., Joham, A. E., & International PCOS Network (2023). Recommendations from the 2023 International Evidence-based Guideline for the Assessment and Management of Polycystic Ovary Syndrome. *Human reproduction (Oxford, England)*, 38(9), 1655–1679. <https://doi.org/10.1093/humrep/dead156>
- [4] Scannell, N., Villani, A., Moran, L., Mantzioris, E., & Cowan, S. (2025). A Pilot Study on Ad Libitum Mediterranean Diet Intervention for Women with PCOS: A Mixed-Methods Exploration of Acceptability, Adherence, and Participant Lived Experience. *Nutrients*, 17(7), 1105. <https://doi.org/10.3390/nu17071105>
- [5] Scannell, N., Villani, A., Moran, L., & Mantzioris, E. (2025). The potential role of the Mediterranean diet for the treatment and management of polycystic ovary syndrome: a review of the pathophysiological mechanisms and clinical evidence. *Proceedings of the Nutrition Society*, 84(2), 176–187. doi:10.1017/S0029665124007584
- [6] Çıtar Dazıroğlu, M. E., & Acar Tek, N. (2023). The Effect on Inflammation of Adherence to the Mediterranean Diet in Polycystic Ovary Syndrome. *Current Nutrition Reports*, 12(1), 191–202. <https://doi.org/10.1007/s13668-023-00451-6>
- [7] Xu Li, Liu Honghui, Chen Ruobing, Li Zhenyu, Song Xiaoyan & Wang Yunying. (2018). Effects of Mediterranean Dietary Pattern Combined with Brisk Walking on Quality of Life in Patients with Obese Polycystic Ovary Syndrome. *Modern Medicine and Health*, 34(21), 3305-3309.
- [8] Martínez-González, M. A., Gea, A., & Ruiz-Canela, M. (2019). The Mediterranean Diet and Cardiovascular Health. *Circulation research*, 124(5), 779–798. <https://doi.org/10.1161/CIRCRESAHA.118.313348>
- [9] Li Dingming, Yang Shunzhi, Li Jinyao, Sun Lu, Yang Ying, Feng Yancheng... & Liu Feixiang. Research Progress on Ketogenic Diet as an Adjunct Treatment for Schizophrenia. *Chinese Journal of Comparative Medicine*, 1-8. (Chinese)
- [10] Shi Yi. (2023). Study on the Effects and Mechanisms of Ketogenic Diet Intervention on Insulin Resistance and Chronic Inflammation in PCOS (Doctoral Dissertation, Soochow University). Doctoral <https://doi.org/10.27351/d.cnki.gszhu.2023.005156>. (Chinese)
- [11] Fleigle, D., Brumitt, J., McCarthy, E., Adelman, T., & Asbell, C. (2025). Polycystic Ovary Syndrome and the Effects of a Ketogenic Diet: A Scoping Review. *Nutrients*, 17(17), 2893. <https://doi.org/10.3390/nu17172893>
- [12] Xie Mengxiao, Li Jian, Bai Wenpei & Jiang Bo. (2025). Study on the adverse reactions of ketogenic diet in treating polycystic ovary syndrome. *Journal of Practical Clinical Medicine*,
- [13] Teicholz, N., Croft, S. M., Cuaranta, I., Cucuzzella, M., Glandt, M., Griauszde, D. H., Jerome-Zapadka, K., Kalayjian, T., Murphy, K., Nelson, M., Shanahan, C., Nishida, J. L., Oh, R. C., Parrella, N., Saner, E. M., Sethi, S., Volek, J. S., Williden, M., & Wolver, S. (2025). Myths and Facts Regarding Low-Carbohydrate Diets. *Nutrients*, 17(6), 1047. <https://doi.org/10.3390/nu17061047>
- [14] Shen Hongyun, Qin Haitao & Zhang Wenbing. (2025). Effects of low-carbohydrate dietary guidance on endocrine metabolism in overweight/obese patients with polycystic ovary syndrome. *China Science and Technology Papers Online Quality Papers*, 18(01), 197-200. (Chinese)

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

Open Access

This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

