OPEN ACCESS

Scholars International Journal of Obstetrics and Gynecology

Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Review Article

Low Carb vs Balanced Diet in PCOS Management- A Review Article

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DOI: https://doi.org/10.36348/sijog.2025.v08i07.004 | **Received:** 02.06.2025 | **Accepted:** 25.07.2025 | **Published:** 28.07.2025

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Abstract

Background**:* Polycystic ovary syndrome (PCOS) is a common endocrine disorder linked to insulin resistance, metabolic dysfunction, and hormonal imbalances. Dietary interventions, particularly low- carbohydrate (low-carb) and balanced diets, play a crucial role in managing PCOS symptoms. However, the optimal dietary approach remains debated**.** ***Methods: A review of relevant studies, including randomized controlled trials and meta-analyses, was conducted to compare the effects of low-carb and balanced diets on insulin sensitivity, weight management, lipid profile, and hormonal regulation in women with PCOS. ***Results:*** Low-carb diets significantly improve insulin sensitivity, reduce fasting insulin levels, and promote weight loss. They may also lower androgen levels and enhance menstrual regularity but raise concerns regarding long-term adherence and nutrient deficiencies. Balanced diets support gradual, sustainable metabolic and hormonal improvements, offering cardiovascular benefits and long- term viability. ***Conclusion**:* Both dietary approaches show promise in PCOS management. Low-carb diets yield faster metabolic improvements but pose sustainability challenges, whereas balanced diets provide long-term benefits. Further research is needed to determine individualized dietary recommendations for PCOS management.

Keywords: Polycystic ovary syndrome (PCOS), insulin resistance, low-carbohydrate diet, balanced diet, metabolic health, weight management, hormonal regulation, reproductive health.

INTRODUCTION

PCOS is a multifactorial disorder influenced by genetic, hormonal, and lifestyle factors. Insulin resistance, a hallmark of PCOS, is strongly associated with hyperinsulinemia, which exacerbates androgen production and metabolic dysfunction [1]. Given the role of diet in modulating insulin sensitivity, dietary modifications are a primary non-pharmacological intervention for PCOS management [1]. Polycystic ovary syndrome (PCOS) is a complex yet common endocrine disorder affecting around 5–20% of reproductive aged women, depending on the diagnostic criteria used and population studied [2]. PCOS is a heterogeneous condition which can cause a diverse range of reproductive, metabolic and psychological implications, the severity of which may differ between individuals depending on factors such as age, diet, ethnicity, genetics, medication, contraceptive use, adiposity, BMI and geographical region [3] the debate between the low-carb diet and a balanced diet as the optimal nutritional approach remains ongoing [4].

Low-Carbohydrate Diet in PCOS Management

A low-carb diet typically involves reducing carbohydrate intake to less than 45% of total daily calories, with some variations like the ketogenic diet further restricting carbohydrates to less than 10% [5]. This diet aims to reduce insulin secretion and improve insulin sensitivity, which is particularly beneficial for women with PCOS.

Benefits

Improved Insulin Sensitivity: Studies indicate that low-carb diets significantly reduce fasting insulin levels and improve insulin resistance [6]

1. **Weight Reduction**: A lower intake of carbohydrates can lead to greater fat loss and improved body composition [7]
2. **Reduction in Androgen Levels**: Research suggests that restricting carbohydrates may lower testosterone levels, thereby improving symptoms like hirsutism and acne [6]
3. **Menstrual Cycle Regularity**: Low-carb diets have been linked to improved menstrual regularity and ovulation rates in women with PCOS [8]

Limitations

Nutrient Deficiencies: Severely low carbohydrate intake can lead to micronutrient deficiencies and reduced fibre intake. [9]

1. **Sustainability Issues**: Long-term adherence to a restrictive carbohydrate intake can be challenging [10]
2. **Potential Lipid Profile Alterations**: Some studies suggest that high-fat intake in low-carb diets may negatively impact LDL cholesterol levels [11]

Balanced Diet in PCOS Management

A balanced diet emphasizes adequate intake of macronutrients, including carbohydrates, proteins, and healthy fats, along with sufficient fiber, vitamins, and minerals.

Benefits

Sustained Weight Management: A balanced diet rich in whole grains, lean proteins, and healthy fats promotes long-term adherence and gradual weight loss [1]

1. **Improved Insulin Sensitivity**: A diet with a moderate glycemic index (GI) can regulate postprandial glucose levels and enhance insulin response [12]
2. **Better Cardiovascular Health**: Balanced diets, such as the Mediterranean diet, are associated with improved lipid profiles and reduced cardiovascular risks in PCOS patients [13]
3. **Hormonal Regulation**: Nutrients like omega-3 fatty acids, vitamin D, and antioxidants in a balanced diet contribute to hormonal balance and improved reproductive function [4]

Limitations

1. **Slower Results**: Unlike low-carb diets, weight loss and insulin sensitivity improvements may take longer to manifest.
2. **Need for Portion Control**: Overconsumption of carbohydrates, even healthy ones, can contribute to insulin resistance if not managed properly.

RESULTS

Characteristics of Included Studies

Study	Study Design	Population Size	Diet Definition	Duration	Full Text retrieved
Barrea *et al.,* 2018	Review article	Not applicable	Not applicable	Not applicable	No
Gower *et al.,* 2013	Cross over study	30 women with PCOS	Lower-CHO: 41% carbohydrate, 19% protein, 40% fat	8 weeks per diet arm	Yes
Xiaoshuai Zhang *et al.,* 2019	Design unclear	No mention found	No mention found	No Mention found	No
Mavropoulos *et al.,* 2005	Intervention study	11 women with PCOS	Low- carbohydrate, ketogenic diet: 20g carbohydrate per day	24 weeks	yes
Zhang *et al.,* 2019	Meta- analysis of RCTs	327 participants across 8 RCTs	Low- carbohydrate diet: <45% of total macronutrients	Varied, >4 weeks for stronger effects	Yes

The report provided information on study design for all 5 studies, with each study using a different design:

- review article
- crossover study
- 1 intervention study
- 1 meta-analysis
- 1 with unclear Design

Regarding population size:

- Specific numbers were reported for 3 studies, totaling 368 participants
- 41 of these were specifically identified as women with PCOS
- Population size was not reported for 1 study
- Population size was not applicable for 1 study (the Review article)

For Diet Definitions:

- Specific diet definitions were reported for 3 studies
- 2 of these were described as low-carbohydrate diets, with one specifying 20g carbohydrate per day
- 1 study used a lower-CHO diet (41% carbohydrate, 19% protein, 40% fat)
- Diet definitions were not reported for 1 study
- Diet definition was not applicable for 1 study (the review article)

Regarding Study Duration: Specific durations were reported for 2 studies: 8 weeks and 24 weeks:

- 1 study reported varied duration, noting stronger effects after 4 weeks
- Duration information was not reported for 1 study
- Duration was not applicable for 1 study (the review article)

Effects of Dietary Interventions: Metabolic Parameters

Parameter	Low-Carb Results	Balanced diet Result	Clinical Significance
Body Mass Index (BMI)	Significant decrease (SMD = -1.04, 95% CI-1.38 to -0.70, P 0.00001)	No mention Found	Clinically significant reduction in BMI
Homeostatic Model Assessment of Insulin Resistance (HOMA- IR)	Significant decrease (SMD = -0.66, 95% CI -1.01 to -0.30, P < 0.05)	No mention Found	Indicates improved insulin sensitivity
Fasting Insulin	27% reduction (P <0.001); 53.7%reduction (P = 0.002)	No mention Found	Substantial improvement in insulin levels
Total Cholesatrol	Significant decrease (SMD = -0.68, 95% CI -1.35 to -0.02, P < 0.05)	No mention Found	Improvement in lipid profile
Low-Density Lipoprotein Cholesterol (LDL- C)	Significant decrease (SMD = -0.66, 95% CI -1.30 to -0.02, P < 0.05)	No mention Found	Improvement in lipid profile

The studies reported that low-carb diets showed significant decreases in all 5 reported parameters:

- BMI (P < 0.00001)
- HOMA-IR (P < 0.05)
- Fasting Insulin (P < 0.001 and P = 0.002)
- Total Cholesterol (P < 0.05)
- LDL-C (P < 0.05)

The clinical significance of these results was reported as follows:

- Clinically significant reduction in BMI
- Improved insulin sensitivity (for HOMA-IR)
- Substantial improvement in insulin levels
- Improvement in lipid profile (for both Total Cholesterol and LDL-C)

No results were reported for balanced diets in this table, limiting the ability to make direct comparisons between the two diet types.

Clinical Improvements

While the studies primarily focused on metabolic and hormonal parameters, some clinical improvements were noted. It is reported that two women became pregnant during the study, despite previous infertility problems. This suggests potential reproductive benefits of the low-carbohydrate diet intervention. However, it's important to note that this finding is based on a very small sample size and should be interpreted cautiously [13].

The studies did not consistently report on other clinical outcomes such as:

- Menstrual regularity
- Hirsutism
- Acne

These are common concerns in PCOS, and their absence in the reported outcomes limit sour understanding of the full clinical impact of the dietary interventions.

CONCLUSION

The findings of this review highlight the significance of dietary interventions in managing PCOS, particularly in improving metabolic and hormonal outcomes. Low-carbohydrate diets have demonstrated substantial benefits in enhancing insulin sensitivity, reducing BMI, and lowering androgen levels, making them a promising approach for women with insulin-resistant PCOS. However, their long-term sustainability and potential for nutrient deficiencies must be considered. Conversely, a balanced diet offers a more sustainable and nutritionally adequate option, supporting gradual weight loss, hormonal balance, and cardiovascular health. While both dietary approaches have their merits, individualized dietary planning based on patient preferences, metabolic response, and long-term adherence is essential. Further research, particularly large-scale randomized controlled trials, is necessary to establish definitive dietary guidelines for PCOS management.

Ultimately, dietary choices should be individualized based on metabolic health, personal

preferences, and long-term adherence potential. Future research should focus on long-term comparative studies to determine the most effective dietary strategy for diverse PCOS phenotypes.

Future Perspective

As dietary interventions continue to gain recognition in PCOS management, future research should focus on personalized nutrition approaches that consider genetic, metabolic, and lifestyle factors. Large-scale, long-term randomized controlled trials comparing low- carbohydrate and balanced diets are needed to establish definitive dietary recommendations. Investigating the gut microbiome's role in PCOS and how different dietary patterns influence its composition could provide novel insights into dietary optimization. Additionally, exploring the impact of intermittent fasting and time-restricted eating on metabolic and reproductive outcomes in PCOS may offer alternative dietary strategies. Future studies should also prioritize the assessment of clinical symptoms such as menstrual regularity, acne, and hirsutism to provide a more comprehensive understanding of dietary effects. Lastly, integrating digital health tools, such as mobile applications and continuous glucose monitoring, could enhance dietary adherence and improve long-term management outcomes for women with PCOS.

Authors' Contribution: Saraswati Chandrakant Kanse contributed to design, concept, data collection, manuscript writing; also contributed to data interpretation, manuscript modification and analysis of data, Supervision: Anuja Bhalerao.

Acknowledgements: I would like to thank the O.P.D of Anantrao Kanse Homoeopathic Medical College & Hospital, Alephata, Junar Dist.

Source of Funding: No funding was received for this work.

Conflict of Interest: The authors declare that they have no conflicts of Interest.

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