Effects of Anti-Inflammatory Diet Approaches on Metabolic, Reproductive, and Inflammatory Health in Women: A Review

by

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ABSTRACT

Background: Hormonal imbalances, infertility, and chronic inflammation are increasingly common among women of reproductive age and are often linked through diet and inflammation. While medications are common treatments, many women seek diet strategies for hormone health.

Objective: To evaluate the effects of anti-inflammatory diet interventions on metabolic, inflammatory, and fertility-related outcomes in women with hormone imbalances.

Methods: A systematic search of PubMed identified clinical trials and intervention studies involving women aged 18–50. Studies had to include anti-inflammatory based diets that report outcomes related to metabolic, fertility or inflammatory markers. Nine studies met inclusion criteria and were categorized by outcome: metabolic, inflammatory, or reproductive.

Results: Of the nine studies (six RCTs, three observational), diets like Mediterranean, DASH, and whole-food plant-based were assessed. Most showed improvements in insulin, glucose, HOMA-IR, and inflammatory markers. Two studies reported increased pregnancy and IVF success rates.

Conclusions: Anti-inflammatory diets may support hormone balance and metabolic health, though larger, more diverse studies are needed.

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INTRODUCTION

The burden of hormonal imbalances, inflammatory conditions, and infertility is steadily increasing in women, especially those of reproductive age. These conditions can reveal

themselves in a multitude of ways, the most common being polycystic ovary syndrome (PCOS), insulin resistance, thyroid disorders, poor glucose control, dysregulated menstrual cycles, infertility, and dysregulated reproductive hormones (Nichols, 2021). New research provides evidence that this could be caused by systemic inflammation and poor dietary habits, which play a critical role in the development or progression of these conditions (Mizgier, 2024). Many women facing these health concerns are seeking nutritional strategies and lifestyle changes, in addition to or instead of pharmaceutical interventions.

Despite growing interest, further investigation is needed to connect the effects of anti-inflammatory or whole-food-based dietary approaches on specific physiological markers of health in women, particularly those related to metabolism, inflammation, and fertility. It's hypothesized that such dietary patterns can enhanced metabolic regulation, improve reproductive hormone balance, and reduce systemic inflammation in women with hormonal imbalances or related conditions, leading to measurable improvements in insulin sensitivity, fertility, and inflammation.

BACKROUND

Hormone imbalances such as PCOS, insulin resistance, thyroid disorders, and infertility are commonly treated with medications and medical procedures. Oral contraceptives regulate menstrual cycles and reduce excess androgens in PCOS, while metformin improves insulin sensitivity (Teede, 2018) For infertility, ovulation-inducing drugs like clomiphene citrate and letrozole stimulate ovulation (Nichols, 2024) Advanced non-pharmacologic options include assisted reproductive technologies (IUI (intrauterine insemination), IVF (in vitro fertilization)) that support conception when medications are insufficient (Nichols, 2024) These treatments often complement lifestyle changes for optimal results.

Prevalence and Incidence:

Polycystic Ovary Syndrome (PCOS) affects 8–13% of reproductive-age women worldwide, but up to 70% of cases may go undiagnosed due to symptom variability and limited awareness (Teede et al., 2018). It is especially prevalent among women aged 15–45 and rising in regions such as North America, Europe, and Asia. Hypothyroidism, particularly the autoimmune form (Hashimoto's), impacts around 5% of the U.S. population, with subclinical cases affecting up to 15%, especially in women over age 60 (Hollowell et al., 2002). Women are 5–8 times more likely than men to develop thyroid conditions. Infertility affects roughly 11% of U.S. women, with 30–40% of cases linked to ovulatory disorders such as PCOS and thyroid dysfunction (CDC, 2022). These statistics highlight the widespread burden of hormone-related conditions and the need for sustainable management strategies.

Current Treatments:

Current treatments for PCOS include metformin to improve insulin sensitivity, ovulation-inducing medications like clomiphene and letrozole, and hormonal contraceptives to regulate

cycles and reduce androgens (Teede, 2018; Moran , 2022). Hypothyroidism is typically managed with daily levothyroxine to restore thyroid hormone levels (Hollowell, 2002). Infertility treatments may involve ovulation medications (ranging from $100–$3,000 per cycle) or IVF, which can cost $15,000–$25,000 per cycle (CDC, 2022). While often effective, these treatments do not address underlying inflammation or metabolic dysfunction, making dietary and lifestyle interventions an appealing complementary approach.

New research suggests there is a connection between chronic inflammation and hormonal imbalance. Specifically, chronic inflammation can disrupt hormone balance by interfering with homeostasis and regulation of the adrenal cortex, which is influenced by glucagon and thyroid hormones, both of which have anti-inflammatory effects and play roles in the body's stress response (Garcia-Leme & Farsky, 1993). These disruptions can lead to conditions such as hypothyroidism, PCOS, and insulin resistance. (Garcia-Leme & Farsky, 1993.)

Diet and lifestyle changes play a vital role in managing hormone imbalances by targeting chronic inflammation, which is a factor disrupting hormone regulation. Chronic inflammation can impair the adrenal cortex, reducing its ability to produce key hormones like cortisol that regulate stress and metabolism. This disruption can worsen conditions such as PCOS, insulin resistance, and thyroid dysfunction. (Nichols, 2024) Diets high in processed foods, saturated fats, and added sugars promote inflammation, whereas anti-inflammatory diets rich in whole vegetables, fruits, whole grains, legumes, healthy fats like omega-3s, and antioxidants help reduce inflammatory markers and oxidative stress. (Moran, L. J., Hutchison, S. K., Norman, R. J., & Teede, H. J. (2022). These dietary patterns support healthier adrenal function and improve hormonal balance. When combined with lifestyle interventions such as stress reduction techniques, regular physical activity, and adequate sleep, these changes strengthen the body's natural ability to regulate hormones and promote overall endocrine health. (Tortoriello, 2024).

Anti-inflammatory diet patterns are characterized by high intakes of vegetables, fruits, whole grains, legumes, nuts, seeds, and healthy fats, such as omega-3 and omega-6 fatty acids, and low intakes of saturated fats, red meats, and ultra-processed foods. These diets are typically high in fiber, antioxidants, vitamins, minerals, phytochemicals, and omega-3 fatty acids, all of which have been shown to regulate endocrine conditions and modulate inflammatory responses (Brdar, 2021). As a result, an anti-inflammatory diet pattern or lifestyle change has been shown to improve hormone regulation and is recommended for better hormone control, increased fertility changes, and reduced inflammation (Nichols, 2021). Much of the research on anti-inflammatory diets has focused on women with PCOS. However, there is a need for more evidence regarding their effects on wider populations of women experiencing hormone dysregulation and inflammatory imbalances unrelated to PCOS. (Tortoriello, 2024)

In contrast, a typical Western diet, commonly consumed in the United States, is characterized by frequent overeating (or high intakes of high-calorie foods) high intakes of saturated fats and ultra-processed foods, and limited consumption of whole, nutrient-dense foods (Malesza et al., 2021). This eating pattern is associated with dysregulated hormones, weight gain, and an increased risk of chronic disease. This eating pattern often leads to metabolic issues like insulin

resistance, poor cholesterol levels, and inflammation by damaging gut health and allowing harmful substances to enter the body. (Malesza et al., 2021).

OBJECTIVES

The objective of this systematic review is to evaluate the effects of anti-inflammatory and whole-food-based dietary interventions on the markers of metabolic, inflammatory, and reproductive health in women. This review focuses on women aged 18-50 with or without existing hormone dysregulation.

Specifically, metabolic health will be assessed by examining the impact of anti-inflammatory dietary interventions on metabolic markers, including fasting insulin, fasting glucose, Homeostatic Model Assessment of Insulin Resistance (HOMA-IR), and overall insulin sensitivity.

Inflammatory health will be evaluated by analyzing changes in markers such as C-reactive protein (CRP), interleukins (e.g., IL-6), tumor necrosis factor-alpha (TNF-α), and other relevant pro- or anti-inflammatory cytokines.

Finally, reproductive and fertility health will be reviewed by assessing the effects of dietary patterns on reproductive hormone-related outcomes such as clinical pregnancy rates, live birth rates, and menstrual regularity.

This review aims to clarify current evidence, identify practical implications, and provide suggestions to improve clinical nutrition practice through nutrition-based interventions for hormone dysregulation and inflammation in women.

METHODS

This systematic review was conducted to assess the effects of qnti-inflammatory diet patterns on hormonal regulation in women. Eligible studies were determined by previously defined criteria set by clinically relevant PICO framework (population, intervention, comparison, outcome) framework. The main population of interest was pre-menopausal women, aged 18-50, with or without hormone-related conditions. These included conditions such as PCOS, hypothyroidism, infertility, and elevated parathyroid hormone (PTH) levels. Studies that involved nonpregnant, nonlactating, postmenopausal women, males (apart from two studies noted below), or individuals with other unrelated endocrine disorders (e.g., Cushing's syndrome, Addison's disease) were excluded.

The interventions evaluated included anti-inflammatory which emphasized non-processed, nutrient dense foods. The studies included the Mediterranean diet, the DASH (dietary approaches to stop hypertension) diet, low glycemic index diets, whole-grain-based diets, and plant-forward diets. Excluded studies were those that focused on calorie restriction, supplementation without a dietary component, and high-fat or ketogenic diets that were not inherently anti-inflammatory.

Comparisons included a traditional Western diet, or other dietary patterns not identified as anti-inflammatory.

A structured literature review was conducted using the PubMed database. Search terms included ("anti-inflammatory diet" OR "whole food diet" OR "Mediterranean diet" OR "plant-based diet") AND ("women" OR "female") AND ("hormones" OR "insulin resistance" OR "androgens" OR "progesterone" OR "thyroid hormones" OR "T3" OR "T4" OR "PTH") AND ("clinical trial" OR "RCT" OR "intervention study"). The search was completed during May 2025. This search was not registered in any database such as PROSPERO, and no formal protocol was prepared before.

Studies were included if they reported at least one measure of biological data, specifically regarding metabolic, hormonal, inflammatory, or reproductive health. Such outcomes included insulin sensitivity or resistance (e.g., HOMA-IR, fasting insulin and glucose), thyroid hormones (T3, T4), PTH, or inflammatory markers (e.g., CRP, antibodies, cytokines). Additional data was also collected, including characteristics of the population (e.g., age, gender, diagnosis), specific dietary components, the duration of the intervention, and the sample size that was included in the study. Funding sources were not extracted as data. Unclear or missing information in the text was verified by the full text documents (if available) or from data tables.

One investigator conducted the screening and review process. Initially, titles were screened to identify potentially relevant studies. Full-text screening followed for all studies that met the inclusion criteria, with an emphasis on identifying significant and relevant outcomes related to metabolic, inflammatory, and reproductive health.

Although the focus of this review was on women, two studies that included males were purposefully selected to illustrate the wider implications of anti-inflammatory dietary patterns across both sexes, even though male-specific data were not analyzed in detail. Their inclusion strengthens the evidence base showing general hormonal and metabolic benefits of anti-inflammatory diets.

Studies were grouped according to their primary outcomes, resulting in three main categories: (1) metabolic markers (e.g., HOMA-IR, fasting insulin, and glucose), (2) inflammatory markers (e.g., CRP, IL-1 and IL-6, TNF-α), and (3) fertility-related markers (e.g., rates of clinical pregnancy, rates of spontaneous pregnancy, and menstrual cyclicity). Results were summarized both broadly and in detail, with particular attention given to statistically significant changes in relevant metabolic, inflammatory, and reproductive outcomes. Where appropriate, study data were organized into summary tables to aid in comparison across studies.

Risk of bias for each study was evaluated based on the study type/design (randomized or nonrandomized), sample size, use of control groups, attrition rates (i.e., the number of participants enrolled and the number of participants who completed each study), and the transparency and consistency of the outcome measurements. Studies were then labeled as having a low, moderate, or high risk of bias according to the guidelines above.

A qualitative synthesis was used to summarize and interpret findings across studies. No meta-analysis or statistical modeling was performed. Reporting biases were assessed by comparing

each study's reported outcomes to its stated aims and objectives. The quality or certainty of the evidence was further evaluated by examining sample sizes, consistency of findings, and relevance to the target population.

RESULTS

The literature search for this systematic review was conducted using PubMed and initially yielded over 1,000 articles. After removing duplicate entries, titles and abstracts were screened for relevance. Based on predefined inclusion criteria, seven studies were selected for full review and inclusion in the synthesis. These studies were chosen for their relevance to the central focus areas of this review: metabolic markers, inflammatory markers, and fertility or reproductive markers. Each study was categorized according to its primary and most significant reported outcomes. Some studies contributed data to more than one outcome category because they measured multiple relevant biomarkers.

Several articles were excluded during the title and abstract screening phase. Exclusions were primarily due to missing information or the absence of relevant biological marker measurements in the results. Specifically, studies that focused solely on BMI or weight management without assessing endocrine, inflammatory, or reproductive biomarkers were excluded. Additionally, studies were omitted if the dietary intervention did not align with an anti-inflammatory dietary pattern. For example, those emphasizing ketogenic, low-carbohydrate, or high-fat diets were excluded.

The selected studies were conducted and published between 2015 and 2024, with a combined sample size of approximately 700 participants. All studies included female participants ranging from the ages of 18-50 and two studies included both men and women. The studies varied in their design: six were randomized controlled trials (RCTs), two were prospective intervention trials, and one was a large observational study. Intervention durations ranged from eight to twelve weeks in these studies. The dietary interventions included Mediterranean, DASH, low-glycemic index, and other whole food-based or anti-inflammatory patterns that included a balanced diet of unprocessed foods with balanced macronutrients. Conditions that were studied included PCOS, infertility, and obesity.

When assessing the qualities of these studies, the risk of bias was evaluated across five main categories: study design, sample size, control groups, attrition rates (i.e., the proportion of participants who completed the study versus those who dropped out), and the reporting of outcomes. Based on these categories, three studies, which were Campbell et al. (2024), Asemi & Esmaillzadeh (2015), and Karayiannis et al. (2018), were considered to have a low risk of bias. Three others, including studies by Salama et al. (2015), Mizgier et al. (2024), and Roager et al. (2019), were rated as having a moderate risk of bias. One study by Brdar et al. (2021) was rated as high risk due to its observational design and reliance on self-reported dietary intake data, which introduced potential bias depending on participants' responses and method of measurement recording.

The certainty and risk of bias were also assessed across each outcome category. For the metabolic markers, the evidence was considered moderate to high certainty due to consistent findings across multiple well-designed RCTs. Evidence related to inflammatory markers was

considered moderately certain because of the limited number of studies and some variability in outcome reporting. Reproductive and fertility-related outcomes were supported by moderate certainty, with both studies demonstrating statistically and clinically relevant improvements in reproductive function, although more research is needed in this area of study.

Metabolic Markers

The reviewed studies provide evidence that anti-inflammatory diets positively influence metabolic markers. Salama et al. (2015) demonstrated that a 12-week anti-inflammatory dietary intervention resulted in approximately 7% weight loss, along with improvements in blood glucose control and lipid profiles (FBG decreased by 5.15%, (HOMA) showed a decrease of 27.50%, and There was an 8.9% reduction in total cholesterol, an 18.02% decline in triglycerides, and 10.6% reduction in LDL cholesterol). Building on this, several studies reported enhanced insulin sensitivity and related metabolic improvements. Campbell et al. (2024) reported that participants following a whole-food, plant-based diet for eight weeks experienced significant reductions in metabolic indicators. Specifically, compared to the group consuming a usual diet, fasting insulin levels decreased by 5.6 μIU/mL ($p = 0.003$), HOMA-IR dropped by 1.5 units ($p = 0.004$), fasting glucose decreased by 6.2 mg/dL ($p = 0.02$), and triglycerides decreased by 30.4 mg/dL ($p = 0.008$), indicating improved insulin sensitivity, insulin resistance and lipid metabolism. Similarly, Asemi and Esmaillzadeh (2015) showed that participants following the DASH diet for eight weeks had significantly reduced serum insulin levels (−1.88 μIU/mL) compared to an increase in the control group (+2.89 μIU/mL, $p = 0.03$). HOMA-IR also declined in the DASH group by −0.45, versus a rise of +0.80 in controls ($p = 0.01$). Finally, a pilot study of adolescent girls with PCOS by Mizgier et al. (2024) found that those in the overweight or obese group who adhered to an anti-inflammatory diet demonstrated reductions in fasting insulin and HOMA-IR (fasting insulin ($p = 0.01$) and HOMA-IR ($p = 0.02$), as well as improvements in antioxidant capacity.

Fewer studies addressed thyroid-specific outcomes, but findings suggest potential dietary influence on thyroid hormone regulation, as there was less disruption of thyroid markers (TSH, T3 and T4). Brdar et al. (2021), using data from a large observational cohort, found that increased intake of fruits and vegetables was associated with elevated levels of FT3, (free triiodothyronine) whereas higher saturated fat intake was linked to lower FT4 (free thyroxine) levels. These findings indicate that dietary quality may influence thyroid hormone levels, further supporting the role of anti-inflammatory diets in broader endocrine and metabolic health.

Inflammatory Markers

Evidence also supports the beneficial impact of anti-inflammatory dietary patterns on inflammatory biomarkers. Studies have shown positive changes in markers such as CRP, IL-6, IL-1, and TNF-α, all of which reflect levels of inflammation in the body. Mizgier et al. (2024) demonstrated that both normal and overweight participants with PCOS experienced reductions in IL-1, IL-6, and TNF-α (IL-1 (0.007), IL-6 ($p = 0.008$), TNF-α ($p = 0.01$) following an anti-inflammatory diet (AIDiet (anti inflammatory)) intervention. Another study by Roager et al. (2019) found that participants consuming a whole grain-rich diet experienced reductions in systemic low-grade inflammation, as evidenced by statistically significant decreases in CRP ($p=0.003$). Finally, Asemi and Esmaillzadeh (2015) reported a decline in high-sensitivity CRP

(hs-CRP) of −763.29 ng/mL in participants following the DASH diet compared to an increase of +665.95 ng/mL in the control group ($p = 0.009$). These findings further highlight the anti-inflammatory potential of high-quality, nutrient-dense dietary patterns.

Reproductive and Fertility Markers

Two studies assessed the impact of anti-inflammatory or dietary patterns on reproductive and fertility-related outcomes. First, Salama et al. (2015) reported that 63% of participants regained menstrual cyclicity and 12% achieved spontaneous pregnancy within 12 weeks of initiating an anti-inflammatory dietary regimen, suggesting that diet can enhance reproductive health and fertility. Additionally, Karayiannis et al. (2018) showed that in women undergoing in vitro fertilization (IVF), those with the highest adherence to a Mediterranean diet had greater odds of having a clinical pregnancy compared to those with the lower adherence to the diet. The adjusted relative risk was 2.52 (95% CI: 1.14–5.58, $p = 0.02$), indicating that the high-adherence group was more than twice as likely to have a clinical pregnancy than the low-adherence group. These findings highlight the potential of dietary interventions to support reproductive health in both natural and assisted fertility contexts.

Summary

Collectively, these findings reinforce the anti-inflammatory potential of nutrient-dense, high-quality dietary patterns and their relevance in managing chronic, inflammation-related conditions. Among the five studies focused on metabolic markers, participants following anti-inflammatory diets experienced improvements in insulin sensitivity, fasting glucose, and/or lipid parameters, with most outcomes showing statistically significant differences compared to controls (Campbell (2024); Mizgier (2024); Brdar (2021); Salama (2015); Asemi and Esmaillzadeh (2015)). The three studies focused on inflammatory markers reported reductions in pro-inflammatory cytokines, such as IL-1, IL-6, and TNF-α, and CRP, suggesting a systemic anti-inflammatory effect (Mizgier (2024); Roager et al. (2019); Asemi and Esmaillzadeh (2015)). Finally, both studies assessing reproductive outcomes showed improved menstrual regulation or clinical pregnancy outcomes (Karayiannis (2018); Salama (2015)).

In summary, the studies included in this review demonstrate that anti-inflammatory dietary patterns offer measurable beneficial for metabolic, inflammatory, and reproductive health in women. The findings support the role of targeted nutrition strategies in managing hormone-related conditions and enhancing the overall well-being in women.

DISCUSSION

The findings presented in this review suggest that anti-inflammatory diet patterns may present as a helpful strategy to improve metabolic health, reduce inflammation, and improve reproductive outcomes in women of reproductive age. Dietary interventions, such as the Mediterranean diet, DASH diet, and other plant-forward and lower-processed eating patterns, consistently showed improvements in insulin sensitivity, reductions in inflammatory markers, and, in some cases, improvements in fertility outcomes, including clinical pregnancy.

Elevated fasting insulin, glucose, and HOMA-IR values are clinical indicators of impaired insulin sensitivity and metabolic dysfunction. While these markers are features of metabolic

syndrome, they are also frequently observed in women with PCOS and other hormone-related conditions. For example, persistent hyperinsulinemia contributes to excess androgen production in PCOS, disrupts ovulatory cycles and affects fertility (Mizgier, 2024). Moreover, insulin resistance is associated with increased risk of type 2 diabetes and cardiovascular disease, highlighting the broader health implications of metabolic dysregulation. Dietary patterns that improve insulin sensitivity, lower fasting glucose and insulin levels, and support more stable hormone regulation can help restore reproductive function while simultaneously reducing overall chronic disease risk (Nichols, 2024).

The findings of this review complement the growing body of research and literature supporting the impact of diet quality not only on overall health, but specifically on endocrine and reproductive health. For instance, Campbell et al. (2024) found that a whole-food-based diet significantly reduced fasting insulin, glucose, HOMA-IR, and triglycerides in women with breast cancer, suggesting a powerful metabolic impact of minimally processed, plant-rich eating. Women undergoing cancer treatment often face metabolic disruptions due to inflammation, hormonal shifts, and side effects from medications that impair appetite, nutrient absorption, and micronutrient status. An anti-inflammatory diet can help stabilize blood sugar, reduce inflammation, and support antioxidant defenses, potentially improving treatment tolerance and overall nutritional health. These benefits extend beyond PCOS, highlighting the broader role of anti-inflammatory dietary strategies in supporting hormone-related conditions like cancer survivorship (Campbell, 2024). An anti-inflammatory diet pattern could also benefit this specific population in other ways, such as maintaining antioxidant levels and decreasing inflammation. It can be difficult for these participants to maintain weight, as well as adequate vitamin and mineral balance.

It has been seen that elevated inflammatory markers, such as CRP, IL-6, and TNF-α, indicate the presence of chronic low-grade inflammation, which has been associated with endocrine disorders such as PCOS, insulin resistance, and infertility. Inflammatory cytokines interfere with hypothalamic-pituitary-ovarian axis regulation, impair follicular development, and may contribute to poor endometrial receptivity, all of which are factors that reduce the likelihood of successful conception (Lonardo et al. 2024). Dietary patterns that lower inflammatory markers create an improved inflammatory environment that supports hormone balance. By restoring inflammatory balance, these interventions may help reestablish endocrine and reproductive homeostasis, ultimately supporting both metabolic function and fertility.

Asemi and Esmaillzadeh (2015) showed that women with PCOS who followed the DASH diet experienced significant reductions in insulin and HOMA-IR, as well as high-sensitivity C-reactive protein (hs-CRP) compared to increases in these markers in the control group. Reductions in inflammatory marker were also shown in studies by Mizgier et al. (2024) and Roager et al. (2019), who reported meaningful improvements in IL-1, IL-6, TNF-α, and CRP concentrations in response to anti-inflammatory diets.

These outcomes support the idea that nutrition plays a direct and clinically relevant role in modulating inflammation and metabolic function, which can in turn affect fertility outcomes by increasing chances of clinical pregnancy and menstrual cycle regulation. Chronic inflammation and insulin resistance are not isolated conditions. Rather, they create a physiological

environment that disrupts hormone signaling, ovulation, and other reproductive processes. As such, they represent intervention points for nutrition therapy.

When looking at fertility, clinical markers such as clinical pregnancy rates show insight into reproductive health and responsiveness to diet interventions. Improved outcomes in these markers suggest improved hormonal regulation and higher chance of conception.

Reproductive markers, while assessed in fewer studies than metabolic markers, also showed supporting outcomes. Karayiannis et al. (2018) found that women undergoing IVF who had the highest adherence to a Mediterranean-style diet were more likely to achieve clinical pregnancy, with a relative risk of 2.52 (95% CI: 1.14–5.58). Salama et al. (2015) similarly reported that 63% of participants experienced regained menstrual cyclicity and 12% conceived spontaneously within a 12-week intervention. These findings support the growing idea that hormone-related infertility may, in part, be nutritionally changeable, especially in populations where inflammation or insulin resistance are contributing factors to infertility or difficulty conceiving.

Several limitations of the evidence and studies should be included. First, many of the studies were randomized controlled trials, but a few relied on observational or self-reported data, particularly in dietary intake, which introduces the risk of variables such as recall bias. Also, sample sizes in several studies were small and may limit generalizability to the overall population. This introduces a new avenue for future research, specifically with the need for more clinical trials in women and more research regarding hormone regulation, specific to menstrual cycle phase.

Another limitation of the evidence is the overrepresentation of participants with PCOS. While PCOS is a common and relevant condition in this area of research, fewer studies specifically targeted women with other hormonal disorders such as hypothyroidism or elevated PTH, despite these also being conditions of interest. This represents a gap in the literature and suggests a need for more diverse representation of hormonal imbalances, or even generally healthy women in the future to better understand the expanse of these dietary effects.

In all, the evidence presented in this review supports the hypothesis that anti-inflammatory and whole-food-based dietary patterns may play an important role in improving hormonal health in women. While more large-scale, long-term trials are needed to build on this foundation, especially in populations beyond PCOS, the findings provide a legitimate argument for the importance of nutrition-focused strategies in holistic approaches to hormone-related health concerns and fertility.

Implementing anti-inflammatory dietary patterns in clinical practice offers dietitians a powerful tool to support women with hormone-related imbalances and diseases. These diets, rich in fruits, vegetables, whole grains, nuts, seeds, and healthy fats, help meet or exceed Recommended Dietary Allowances (RDAs) for essential nutrients such as fiber, vitamins (e.g., A, C, D, E), minerals (e.g., magnesium, zinc), and omega-3 fatty acids—all crucial for regulating inflammation and hormone synthesis. Dietitians can individualize meal plans that emphasize these nutrient-dense foods while minimizing processed and pro-inflammatory items. Through education, counseling, and ongoing support, dietitians guide clients in adopting sustainable

eating habits that reduce systemic inflammation, improve insulin sensitivity, and promote hormonal balance. In fertility centers, integrating dietary interventions as part of a multidisciplinary approach may enhance reproductive outcomes by optimizing the hormonal environment and reducing inflammation that can impair ovulation and implantation. By incorporating anti-inflammatory diets into care plans, dietitians play a key role in complementing medical treatments and improving endocrine and reproductive health outcomes.

CONCLUSION

This review highlights and emphasizes the growing body of evidence and research that supports the role of anti-inflammatory and whole-food-based dietary patterns in improving key hormonal, metabolic, and inflammatory health markers in women of reproductive age. Across many populations, including women with PCOS, insulin resistance, and infertility, dietary approaches were consistently associated with improvements in the outcomes measured, such as improved insulin sensitivity, reduced inflammation, and improved reproductive hormone balance.

Future research should explore the relationship between diet, inflammation, and hormonal changes across the menstrual cycle. Hormone levels fluctuate throughout the cycle, influencing metabolism, mood, and inflammation, yet many studies treat hormonal health as static. Stratifying outcomes by menstrual phase would offer more accurate insights into how dietary interventions affect hormonal balance. Incorporating advanced tools like the DUTCH (Dried Urine Test for Comprehensive Hormones) test could further enhance research by providing detailed data on hormone metabolites, cortisol levels, and adrenal function. This detail could inform more personalized, cycle-specific nutrition strategies to manage symptoms and support reproductive health.

While the findings are promising, they also point to important areas for further research. The dominance of studies focused on PCOS shows a gap in the literature for other hormone-related conditions, such as hypothyroidism and elevated PTH. Also, the low number of large-scale, long-term trials shows the need for stronger and standardized research.

The evidence and studies synthesized in this review shows valuable insight for clinicians, dietitians, and women seeking non-pharmacologic strategies to support hormonal health. Integrating and following anti-inflammatory dietary patterns into personalized nutrition care plans may serve as a safe and sustainable approach to managing endocrine and reproductive health.

OTHER INFORMATION

Funding support: This research received no external funding.

Competing interests: The authors declare no competing interests.

Availability of data, code and other materials: No analytic code or statistical models were used in this review. Data collection and synthesis were performed manually by the primary reviewer. Template data collection forms and summary tables of extracted study data are

available upon reasonable request from the corresponding author. The full texts of the included studies are publicly available through PubMed or corresponding journal websites. No additional materials, such as software code or proprietary data, were used in this review.

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Table 1: Metabolic Markers

Author	Study Design	Population	Intervention	Comparison	Outcomes	Key Findings
Campbell et al. (2024)	RCT	66 women with breast cancer	8 week Whole-food, plant-based diet	Usual diet	Weight, fasting glucose, insulin, HOMA-IR, lipids, inflammatory and hormonal biomarkers	Fasting Insulin: ↓ -5.6 μIU/mL (p = 0.003) HOMA-IR (Insulin Resistance): ↓ -1.5 units (p = 0.004) Fasting Glucose: ↓ -6.2 mg/dL (p = 0.02) Triglycerides: ↓ -30.4 mg/dL (p = 0.008)
Mizgier et al. (2024)	RCT	32 adolescent girls with PCOS, normal (N) weight and obese (Ov/Ob) weight groups	12 week AIDiet	Both groups underwent intervention	Diet quality (KIDMED index), total antioxidant capacity (TAC), fasting insulin, HOMA-IR, inflammatory markers (IL-1, IL-6, TNF-α), and hormonal marker (androstenedione)	Ov/Ob group: ↓ Fasting insulin levels ↓ HOMA-IR index ↓ Total antioxidant capacity (TAC)
Brdar et al. (2021)	Cross sectional observa	2580 adults, men and women	Food frequency questionnaire (FFQ) on total energy,	Baseline	Serum concentrations of TSH, FT3, and FT4.	Fruit and vegetable intake: ↑ FT3 levels

	tion study		macronutrients, and specific food groups (fruits, vegetables, whole grains, meat, dairy, fats, etc.). 58 food items were assessed		Associations between food group/nutrient intake and thyroid hormone levels.	Saturated Fat intake: ↓ FT4 levels
Salama et al. (2015)	Prospective interventional study	100 nonpregnant, overweight, and obese adult females with PCOS	12 week Anti-inflammatory diet and physical activity	Baseline	Body composition (body fat percent, visceral fat area) Hormonal profiles Menstrual cyclicity Blood pressure Glucose homeostasis Lipid profiles Inflammatory markers: C-reactive protein (CRP) and serum amyloid A (SAA)	↓ weight loss (~7%) ↑ body composition ↑ glucose homeostasis ↑ lipid profiles ↓ inflammatory markers (CRP and SAA)
Asemi and Esmaillzadeh (2015)	RCT	48 overweight/obese women with PCOS	8 week DASH Diet: 52% carbohydrates, 18% proteins, 30% total	8 week Control Diet: Matched the DASH diet in macronutrie	Serum insulin levels Homeostasis model assessment of insulin	↓ insulin levels and HOMA-IR in the DASH diet group compared to

			fats; rich in fruits, vegetables, whole grains, and low-fat dairy; low in saturated fats, cholesterol, refined grains, and sweets; sodium content <2,400 mg/day	nt composition but lacked the specific dietary pattern.	resistance (HOMA-IR) Serum high-sensitivity C-reactive protein (hs-CRP) levels Waist and hip circumferences	the control group.

Table 2: Inflammatory Markers

Author	Study Design	Population	Intervention	Comparison	Outcomes	Key Findings
Mizgier et al. (2024)	RCT	32 adolescent girls with PCOS, normal (N) weight and obese (Ov/Ob) weight groups	12 week AIDiet	Both groups underwent intervention	Diet quality (KIDMED index), total antioxidant capacity (TAC), fasting insulin, HOMA-IR, inflammatory markers (IL-1, IL-6, TNF-α), and hormonal marker (androstenedione)	In both groups: ↓ Total antioxidant capacity (TAC) ↓ Interleukin-1 (IL-1) ↓ Interleukin-6 (IL-6) ↓ Tumor Necrosis Factor-alpha (TNF-α)
Roager et al. (2019)	RCT	80 healthy adults (40 men and 40 women)	8 week Whole grain-rich diet (50–60% of energy from whole grains)	8 week Refined grain diet (50–60% of energy from refined grains)	Body weight Systemic low-grade inflammation markers (e.g., C-reactive protein)	↓ body weight ↓ systemic low-grade inflammation markers (CRP)
Asemi and Esmaillzadeh (2015)	RCT	48 overweight/obese women with PCOS	8 week DASH Diet: 52% carbohydrates, 18% proteins, 30% total fats; rich in fruits, vegetables,	8 week Control Diet: Matched the DASH diet in macronutrient composition but lacked	Serum insulin levels Homeostasis model assessment of insulin resistance	↓ hs-CRP in DASH group

			whole grains, and low-fat dairy; low in saturated fats, cholesterol, refined grains, and sweets; sodium content <2,400 mg/day	the specific dietary pattern.	(HOMA-IR) Serum high-sensitivity C-reactive protein (hs-CRP) levels Waist and hip circumferences	

Table 3: Reproductive and Fertility Markers

Author	Study Design	Population	Intervention	Comparison	Outcomes	Key Findings
Karayiannis et al. (2018)	Prospective cohort study	244 non-obese women undergoing IVF treatment	Adherence to the Mediterranean diet	Women with lower adherence to the Mediterranean diet	IVF success rate (clinical pregnancy rate) Embryo quality, implantation rate, and live birth rate	↑ adherence to the Mediterranean diet = ↑ clinical pregnancy rate.
Salama et al. (2015)	Prospective interventional study	75 nonpregnant, overweight, and obese adult females with PCOS	12 week Anti-inflammatory hypocaloric diet with physical activity	Baseline	Body composition (body fat percent, visceral fat area) Hormonal profiles Menstrual cyclicity Blood pressure Glucose homeostasis Lipid profiles Inflammatory markers: C-reactive protein (CRP) and serum	63% regained menstrual cyclicity 12% achieved spontaneous pregnancy within 12 weeks

					amyloid A (SAA)	