



The Analysis Study Effect of Intermittent Fasting on Female Reproductive Hormones and Menstrual Cycle: A Comprehensive Systematic Review

¹ Tuswandi Ahmad Waly, ¹ Bayu Setyo Nugroho

¹ Waled Regional General Hospital, Cirebon Regency, West Java, Indonesia

Email : wandiwaly@gmail.com

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ABSTRACT

Background: Intermittent fasting (IF) has surged in popularity as a dietary approach for weight management and metabolic health, yet its effects on female reproductive hormones and menstrual cycle regulation remain an area of growing scientific inquiry. This systematic review aims to evaluate the influence of IF on female reproductive hormones and menstrual cycle. **Methods:** The study followed PRISMA 2020 guidelines, reviewing English-language publications from 2015 to 2025. Editorials, duplicate reviews from the same journal, and papers lacking a DOI were excluded. The literature search was conducted using PubMed, SagePub, SpringerLink, and Google Scholar. **Result:** A total of 2,172 articles were initially identified through online databases (PubMed, SagePub, SpringerLink, and Google Scholar). After three rounds of screening, eight relevant studies were selected for full-text analysis. **Conclusion:** IF presents both potential benefits and risks for female reproductive health. While it may aid in weight loss, improve insulin sensitivity, and reduce inflammation, concerns remain about its effects on hormonal circadian rhythms and reproductive function. Individualized approaches that consider metabolic status, hormonal health, and lifestyle factors are essential for optimizing the benefits of IF while minimizing potential adverse effects on female reproductive hormones and menstrual cycles.

Keywords: intermittent fasting, female reproductive hormones, menstrual cycle

INTRODUCTION

Intermittent fasting (IF) has surged in popularity as a dietary approach for weight management and metabolic health, yet its effects on female reproductive hormones and menstrual cycle regulation remain an area of growing scientific inquiry. While the metabolic benefits of IF, such as improved insulin sensitivity, reduced oxidative stress, and cardiovascular health, are well documented, concerns have been raised regarding its impact on hormonal balance and reproductive function in women. Unlike male physiology, which appears more resilient to fasting-induced hormonal fluctuations, the female endocrine system is intricately linked to energy availability, making it particularly susceptible to dietary modifications.^{1,2}

Emerging data suggest that the timing and duration of fasting periods may play a pivotal role in determining IF's impact on female reproductive health. Studies indicate that time-restricted eating (TRE), one of the most common forms of IF, may lead to reductions in androgen markers such as testosterone and the free androgen index (FAI) while increasing levels of sex hormone-binding globulin (SHBG).^{3,4} These changes have been particularly noted in premenopausal women with obesity and polycystic ovary syndrome (PCOS), suggesting that IF could hold promise as a non-pharmacological strategy for managing hyperandrogenic conditions. However, the extent to which these hormonal shifts translate into clinical benefits for fertility and menstrual cycle regularity remains unclear.^{5,6}

One of the most debated aspects of IF in women is its potential impact on menstrual cycle regularity. Anecdotal reports and some observational studies suggest that prolonged or extreme fasting regimens could contribute to menstrual irregularities, likely due to disruptions in the hypothalamic-pituitary-gonadal (HPG) axis.^{7,8} Caloric restriction and fasting-related stressors have been shown to suppress gonadotropin-releasing hormone (GnRH) pulsatility, which in turn may lead to reduced LH and FSH secretion, impairing ovulation and menstrual function. However, current human trials provide inconsistent findings, with some studies demonstrating no significant impact on menstrual cycles, while others suggest

potential risks when fasting durations extend beyond physiologically tolerable limits.^{9,10}

Beyond reproductive hormones, IF has also been explored in relation to broader aspects of women's health, including its influence on the gut microbiome, circadian rhythm alignment, and inflammatory markers. Evidence suggests that fasting may enhance gut microbiota composition, which in turn could influence estrogen metabolism and systemic inflammation—factors known to play crucial roles in reproductive health. Additionally, the synchronization of meal timing with circadian rhythms, particularly through early TRE (eating within a morning-to-afternoon window), has been proposed as a strategy to mitigate potential adverse hormonal effects.^{11,12}

Despite the growing interest in IF's effects on female reproductive health, significant gaps remain in the literature. Most studies to date have been conducted in small cohorts, often lacking long-term follow-up data to assess sustained impacts on menstrual health and fertility. Furthermore, studies frequently overlook key variables such as menstrual cycle phase at the time of data collection, which can significantly influence hormonal readings. Additionally, the applicability of findings from overweight or PCOS populations to lean, healthy women remains uncertain, highlighting the need for more diverse study populations.^{13,14}

This systematic review aims to evaluate the influence of IF on female reproductive hormones, with a particular focus on estrogen, progesterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and androgens, alongside its implications for menstrual cycle regularity and fertility.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate the influence of IF on female reproductive hormones based on literatures of the last decade. The review aimed to provide insights to improve patient treatment strategies, with an emphasis on the significance of key findings in the reviewed studies. Inclusion criteria for the study included: 1) Papers published in English, and 2) Papers published between 2014 and 2024. Exclusion criteria were: 1) Editorials, 2) Papers without a DOI, 3) Previously published review articles, and 4) Duplicate entries in journals.

Search Strategy

The keywords used for this research are intermittent fasting, female reproductive hormones, menstrual cycle. The Boolean MeSH keywords inputted on databases for this research are: *((("intermittent fasting"[MeSH Terms] OR ("intermittent"[All Fields] AND "fasting"[All Fields]) OR "intermittent fasting"[All Fields]) AND ((("femal"[All Fields] OR "female"[MeSH Terms] OR "female"[All Fields] OR "females"[All Fields] OR "female s"[All Fields] OR "femals"[All Fields]) AND ("reproduction"[MeSH Terms] OR "reproduction"[All Fields] OR "reproductions"[All Fields] OR "reproductive"[All Fields] OR "reproductively"[All Fields] OR "reproductives"[All Fields] OR "reproductivity"[All Fields]) AND ("hormon"[All Fields] OR "hormonal"[All Fields] OR "hormonally"[All Fields] OR "hormonals"[All Fields] OR "hormone s"[All Fields] OR "hormones"[Pharmacological Action] OR "hormones"[MeSH Terms] OR "hormones"[All Fields] OR "hormone"[All Fields] OR "hormons"[All Fields])) AND ("menstrual cycle"[MeSH Terms] OR ("menstrual"[All Fields] AND "cycle"[All Fields]) OR "menstrual cycle"[All Fields])) AND (y_10[Filter])).*

Data retrieval

Abstracts and titles were screened to assess their eligibility, and only studies meeting the inclusion criteria were selected for further analysis. Literature that fulfilled all predefined criteria and directly related to the topic was included. Studies that did not meet these criteria were excluded. Data such as titles, authors,

publication dates, study locations, methodologies, and study parameters were thoroughly examined during the review.

Quality Assessment and Data Synthesis

Each author independently assessed the titles and abstracts of the selected studies to identify those for further exploration. Articles that met the inclusion criteria underwent further evaluation. Final decisions on inclusion were based on the findings from this review process.

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	<i>("intermittent fasting"[MeSH Terms] OR ("intermittent"[All Fields] AND "fasting"[All Fields]) OR "intermittent fasting"[All Fields]) AND ("femal"[All Fields] OR "female"[MeSH Terms] OR "female"[All Fields] OR "females"[All Fields] OR "female s"[All Fields] OR "femals"[All Fields]) AND ("reproduction"[MeSH Terms] OR "reproduction"[All Fields] OR "reproductions"[All Fields] OR "reproductive"[All Fields] OR "reproductively"[All Fields] OR "reproductives"[All Fields] OR "reproductivity"[All Fields]) AND ("hormon"[All Fields] OR "hormonal"[All Fields] OR "hormonally"[All Fields] OR "hormonals"[All Fields] OR "hormone s"[All Fields] OR "hormones"[Pharmacological Action] OR "hormones"[MeSH Terms] OR "hormones"[All Fields] OR "hormone"[All Fields] OR "hormons"[All Fields])) AND ("menstrual cycle"[MeSH Terms] OR ("menstrual"[All Fields] AND "cycle"[All Fields]) OR "menstrual cycle"[All Fields])) AND (y 10[Filter])</i>	466
Springer Link	((intermittent fasting) AND (female reproductive hormones)) AND (menstrual cycle)	402
Sagepub	((intermittent fasting) AND (female reproductive hormones)) AND (menstrual cycle)	500
Google Scholar	((intermittent fasting) AND (female reproductive hormones)) AND (menstrual cycle)	804

Table 2. JBI *Critical appraisal of Study*

Parameters	Li (2021)	Kim (2021)	Matt son (2017)	Str att on (2020)	Mor o (2020)	Mo ro (2016)	Mo ro (2021)	Al- R a wi (2020)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No.	No.	No.	No.	No.	No.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the outcomes of participants included in any comparisons measured in the same way?	No.	No.	No.	No.	No.	No.	No.	No.
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

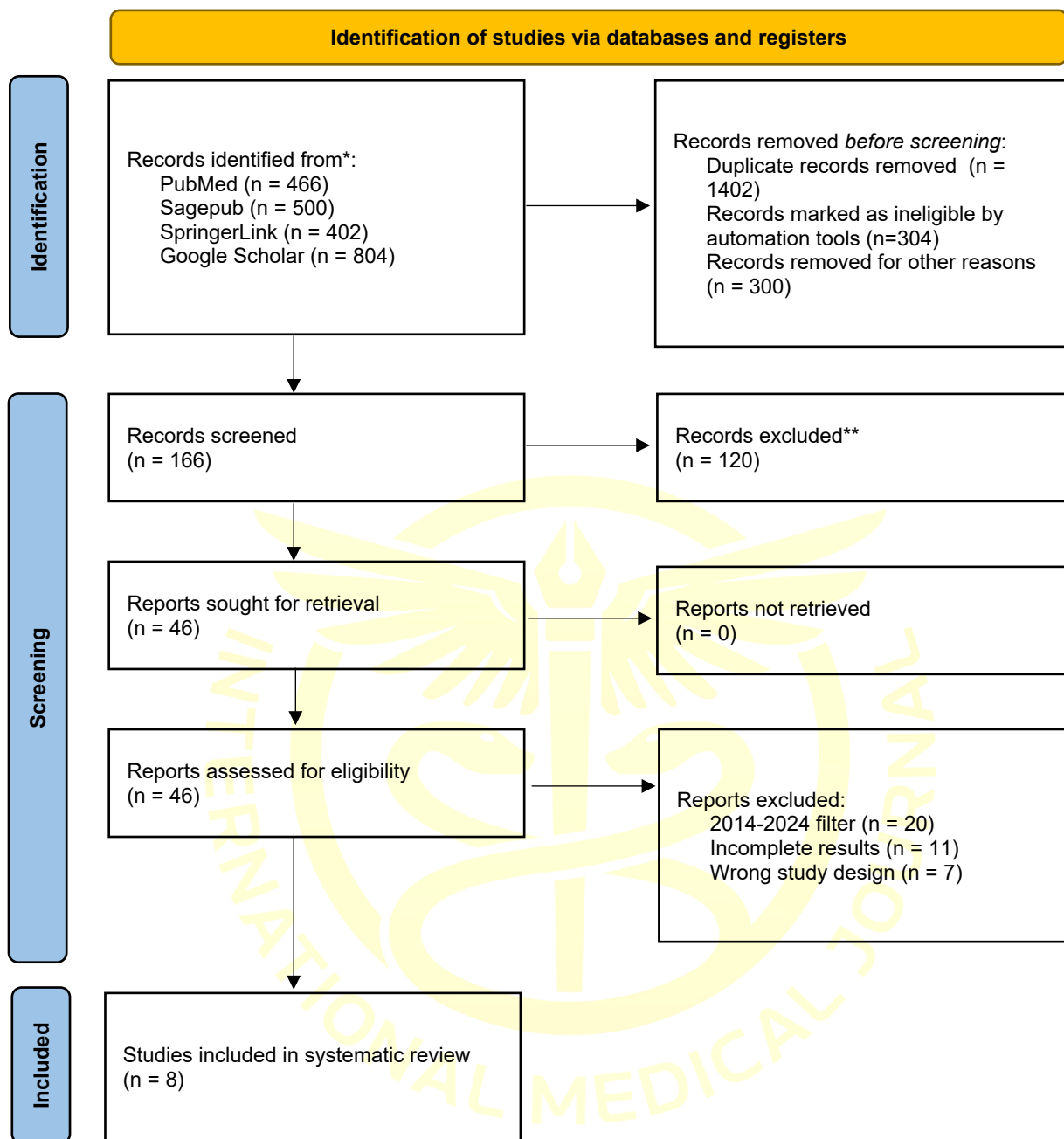


Figure 1. Article search flowchart

RESULT

The initial number of articles retrieved from online databases (PubMed, SagePub, SpringerLink, and Google Scholar) is 2,172 articles. After conducting three levels of screening, eight articles that directly relate to the current systematic review have been chosen for further assessment through full-text reading and analysis. Table 3 presents the selected literature included in this analysis.

Table 3. The literature included in this study

No.	Author	Origin	Method	Sample	Result
1.	Li, et al. ¹⁵ (2021)	China	Retrospective study	18	Time-restricted feeding (TRF) led to significant reductions in body weight, BMI, body fat measures, and markers of insulin resistance, inflammation, and liver function. Additionally, 73.3% of participants experienced improved menstrual cycle regularity. TRF may be beneficial for anovulatory PCOS by promoting weight loss, improving menstruation, reducing hyperandrogenemia, and enhancing metabolic health.
2.	Kim, et al. ¹⁶ (2021)	Korea	Retrospective study	-	Intermittent fasting offers metabolic benefits, including improved blood glucose levels, cardiac and brain function, and weight loss. However, concerns exist regarding muscle loss, ketosis, electrolyte imbalance, and its impact on hormonal circadian rhythms. Given its potential to alter hormone levels and secretion patterns, careful

					consideration is needed to balance its benefits and risks based on individual health conditions.
3.	Mattson, et al. ¹⁷ (2017)	USA	Retrospective study	-	Intermittent fasting (IF) involves extended periods of little or no energy intake, while periodic fasting (PF) includes fasting or fasting-mimicking diets lasting up to 21 days. In animal models, IF and PF improve health and counteract age-related diseases such as diabetes, cardiovascular disease, cancer, and neurological disorders. Human studies show that IF, PF, and time-restricted feeding (TRF) aid weight loss and improve insulin resistance and cardiovascular risk factors. These benefits stem from cellular stress response pathways that enhance mitochondrial health, DNA repair, autophagy, and stem cell regeneration. Further clinical trials are needed to confirm IF's efficacy in disease prevention and management.
4.	Stratton, et al. ¹⁸ (2020)	USA	Retrospective study	26	A study assessed body composition, muscle characteristics, energy expenditure, performance, blood biomarkers, and psychometric parameters. Significant reductions were observed in body mass, fat mass, body fat

					percentage, testosterone, adiponectin, and resting energy expenditure, while strength and muscle size improved. Plasma cortisol increased only in the non-dieting (ND) group. Fat-free mass was maintained in both groups. Findings suggest that time-restricted feeding (TRF) does not provide additional fat loss benefits beyond caloric restriction during a 4-week hypocaloric diet.
5.	Moro, et al. ¹⁹ (2020)	Italy	Retrospective study	16	Time-restricted eating (TRE) with an 8-hour feeding window led to a 2% reduction in body weight and a 1.1% decrease in fat mass percentage without affecting fat-free mass. While overall performance remained unchanged, peak power output relative to body weight improved. TRE also resulted in significant reductions in free testosterone, IGF-1, and the neutrophil-to-lymphocyte ratio, suggesting potential anti-inflammatory and immune-protective effects. These findings indicate that TRE may be a useful dietary strategy for endurance athletes to enhance body composition and support immune health.
6.	Moro, et al. ²⁰ (2016)	Italy	Retrospective study	34	Time-restricted feeding (TRF) over 8 weeks led to

					a significant reduction in fat mass while maintaining fat-free mass, muscle area, and strength. TRF also decreased testosterone, IGF-1, and triiodothyronine while increasing adiponectin and reducing leptin. No significant changes were observed in cholesterol levels, thyroid-stimulating hormone, or resting energy expenditure, though respiratory ratio decreased. These findings suggest that TRF combined with resistance training may enhance fat loss and improve health-related biomarkers while preserving muscle mass in resistance-trained males.
7.	Moro, et al. ²¹ (2021)	Italy	Retrospective study	20	After 12 months of time-restricted eating (TRE), participants showed significant reductions in body mass, fat mass, IGF-1, and testosterone compared to the non-dieting (ND) group. TRE also improved inflammatory markers, insulin sensitivity, and lipid profiles. Additionally, TRE participants spontaneously reduced their daily energy intake, while the ND group maintained their calorie consumption. No adverse events were reported. These findings suggest that long-term TRE combined

					with resistance training is a safe and effective strategy for improving metabolic and cardiovascular health.
8.	Al-Rawi, et al. ²² (2020)	UAE	Retrospective study	57	During Ramadan, diurnal intermittent fasting (DIF) led to significant decreases in serum ghrelin, melatonin, and leptin levels, while salivary cortisol remained unchanged. Male sex and anthropometric factors had the greatest influence on these hormonal changes. Further research is needed to explore DIF's effects on circadian rhythms in overweight and obese individuals.

DISCUSSION

The impact of intermittent fasting (IF) on female reproductive hormones and menstrual cycle regulation remains an area of growing interest. The reviewed studies suggest that IF, particularly time-restricted feeding (TRF), may provide metabolic and reproductive benefits, especially for individuals with conditions such as polycystic ovary syndrome (PCOS). Li et al. (2021) demonstrated that TRF significantly improved menstrual cycle regularity in 73.3% of participants while reducing body weight, body fat percentage, and insulin resistance. These findings indicate that IF could serve as a non-pharmacological intervention for women with anovulatory PCOS by promoting hormonal balance and metabolic health.¹⁵

Despite these potential benefits, concerns remain regarding the effects of IF on hormonal circadian rhythms. Kim et al. (2021) highlighted that while IF improves glucose metabolism and cardiovascular health, it may also disrupt hormone secretion patterns, leading to concerns about muscle loss, ketosis, and electrolyte imbalances. Since reproductive hormones such as estrogen and progesterone are highly sensitive to energy availability and metabolic stress, any disruption in hormonal rhythms could have implications for menstrual cycle regularity and fertility.¹⁶

In animal and human studies, IF has shown promising effects on metabolic and physiological health. Mattson et al. (2017) described how IF activates cellular stress response pathways that enhance mitochondrial function, DNA repair, and autophagy. These cellular mechanisms are crucial for maintaining overall health and may also influence reproductive hormones by improving insulin sensitivity and reducing inflammation, both of which play critical roles in ovarian function. However, the extent to which these benefits translate into long-term reproductive health improvements in women remains uncertain.¹⁷

The influence of IF on body composition and hormonal markers has been examined in multiple studies. Stratton et al. (2020) found that TRF led to reductions in body mass and fat percentage while maintaining fat-free mass and muscle strength. However, significant reductions in testosterone and adiponectin were also noted, which may have implications for female reproductive health, given that androgens play a role in ovarian function and estrogen production. This highlights the need to consider potential hormonal trade-offs when adopting IF as a dietary strategy.¹⁸

Further research on TRE suggests potential benefits for immune health and inflammation reduction. Moro et al. (2020) reported that an 8-hour feeding window resulted in significant weight loss and reductions in free testosterone, IGF-1, and the neutrophil-to-lymphocyte ratio, suggesting an anti-inflammatory effect. Inflammation is a key factor in reproductive disorders such as PCOS and endometriosis, and reducing systemic inflammation through dietary interventions could support menstrual health and ovulatory function. However, further research

is required to determine whether these benefits extend to women without metabolic disorders.¹⁹

Long-term IF interventions have yielded mixed results concerning hormonal balance. Moro et al. (2016) found that TRF over eight weeks reduced fat mass while maintaining muscle strength, but it also led to decreased testosterone, IGF-1, and triiodothyronine. While these changes may indicate metabolic benefits, the reductions in key anabolic hormones raise concerns about the potential impact on ovarian function and fertility.²⁰ Similarly, Moro et al. (2021) observed that a 12-month TRE program led to reductions in testosterone and IGF-1, along with improved lipid profiles and insulin sensitivity, reinforcing the complex interplay between fasting, metabolism, and hormonal health.²¹

Additionally, fasting protocols such as diurnal intermittent fasting (DIF) during Ramadan have been studied for their effects on hormonal rhythms. Al-Rawi et al. (2020) found that DIF led to significant reductions in ghrelin, melatonin, and leptin levels, while cortisol remained unchanged. Given the role of these hormones in regulating hunger, metabolism, and reproductive function, any disruptions could impact menstrual cycle regularity. These findings suggest that meal timing and fasting duration are crucial factors influencing hormonal balance and should be tailored to individual needs.²²

Although the current evidence highlights several potential benefits of IF for female reproductive health, it also underscores the importance of individual variability. Women with PCOS or insulin resistance may experience significant improvements in metabolic and hormonal markers, while those with regular cycles or high physical activity levels may be more vulnerable to hormonal disturbances. The variability in study outcomes suggests that factors such as fasting duration, caloric intake, and baseline metabolic health must be considered when evaluating IF's effects on reproductive hormones.²³

Future research should focus on large-scale, well-controlled trials to better understand the long-term effects of IF on female reproductive health. Key areas of investigation should include the impact of different fasting regimens on menstrual cycle regularity, ovulatory function, and fertility outcomes. Additionally, studies

should assess how IF interacts with other lifestyle factors such as physical activity, stress, and sleep, which can further influence hormonal balance.¹⁶

CONCLUSION

IF presents both potential benefits and risks for female reproductive health. While it may aid in weight loss, improve insulin sensitivity, and reduce inflammation, concerns remain about its effects on hormonal circadian rhythms and reproductive function. Individualized approaches that consider metabolic status, hormonal health, and lifestyle factors are essential for optimizing the benefits of IF while minimizing potential adverse effects on female reproductive hormones and menstrual cycles.

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