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The Impact of Plant-Based Diet on Menstrual Cycle Irregularities in Women with Polycystic Ovary Syndrome (PCOS) at Wasit City

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Annotation: Polycystic Ovary Syndrome (PCOS) is a common endocrine-metabolic disorder characterized by hormonal imbalances, ovulatory dysfunction, and menstrual irregularities. While pharmacological treatments exist, dietary strategies offer a non-invasive alternative for managing PCOS symptoms. This randomized controlled trial evaluated the impact of a plant-based diet on menstrual cycle frequency, hormonal parameters, and ovulatory function in women with PCOS in Wasit city. Fifty women with irregular menstrual cycles were randomly assigned to a plant-based diet group (n=25) or a control group (n=25) for a three-month intervention period. The plant-based group received structured dietary counseling emphasizing whole, minimally processed plant foods, while the control group maintained their habitual diet.

Primary and secondary outcomes included menstrual cycle frequency, serum hormone levels (testosterone, LH/FSH ratio), fasting insulin, and mid-luteal progesterone. Post-intervention comparisons revealed significantly improved outcomes in the plant-based group. Menstrual cycle frequency was higher (0.98 vs. 0.61 cycles/month, $p<0.001$), LH/FSH ratio was lower (1.52 vs. 2.25, $p<0.001$), and fasting insulin levels were reduced

(13.8 vs. 16.2 µIU/mL, $p=0.03$). Mid-luteal progesterone levels, indicating ovulation, were markedly elevated (7.17 vs. 3.15 ng/mL, $p<0.001$). Multiple linear regression confirmed that diet group, mid-luteal progesterone, and LH/FSH ratio significantly predicted menstrual frequency ($R^2=0.64$, $p<0.001$). Logistic regression identified plant-based diet as the sole significant predictor of ovulation (OR ≈ 293.3, $p=0.001$), independent of other hormonal or metabolic parameters.

These findings suggest that a fully plant-based diet may significantly improve reproductive outcomes in PCOS by restoring menstrual regularity and enhancing ovulation, potentially through pathways beyond traditional endocrine markers. This study fills a critical gap by evaluating a holistic plant-based approach and highlights its potential as a lifestyle-based intervention in PCOS management.

Introduction

Polycystic Ovary Syndrome (PCOS) is a multifactorial endocrine disorder marked by insulin resistance, which disrupts normal glucose metabolism and contributes to chronic anovulation and androgen excess (Xu & Qiao, 2022). Excess androgens, originating from ovarian or adrenal sources, interfere with follicular development and feedback to the hypothalamic-pituitary axis, leading to irregular menses and infertility (Coyle et al., 2021). Insulin resistance synergizes with luteinizing hormone to upregulate ovarian androgen production, further exacerbating ovulatory dysfunction and contributing to hyperandrogenic symptoms like acne and hirsutism (Malik et al., 2021). The clinical presentation often includes irregular or absent periods, which are among the most distressing symptoms for reproductive-aged women, as they reflect both hormonal imbalance and impaired fertility potential (Wagh & Deshmukh, 2024).

Menstrual irregularities and infertility are thus pivotal clinical targets in PCOS management strategies, given their link to metabolic disease progression and their impact on quality of life and reproductive planning (Attia et al., 2023).

Multiple dietary patterns have shown benefits in PCOS, including low-glycemic, ketogenic, Mediterranean, and anti-inflammatory diets, all of which improve insulin sensitivity, hormonal regulation, and reproductive outcomes (Gautam et al., 2025).

Ketogenic and Mediterranean diets have demonstrated reductions in LH/FSH ratio, insulin resistance, and serum androgens in women with PCOS, highlighting their endocrine-modulating effects (Masood et al., 2023). Adherence to the Mediterranean diet is also associated with antioxidant-driven weight loss and metabolic improvements, which may enhance the effectiveness of concurrent low-calorie ketogenic regimens (Verde et al., 2022). Despite this progress, there is minimal research specifically examining fully plant-based diets in PCOS, and even fewer randomized controlled trials addressing their impact on ovulation and hormonal profiles (Urpi-Sardà et al., 2021). The current study fills this gap by evaluating the comprehensive impact of a plant-based diet on ovulatory function, providing novel insights that extend beyond the metabolic focus of previous investigations (Illescas et al., 2024).

The objectives of this study were centered on investigating the potential effects of a plant-based diet on menstrual cycle irregularities among women diagnosed with Polycystic Ovary Syndrome (PCOS) in Wasit city. The research aimed to explore whether dietary modification through the exclusive adoption of plant-based nutrition could lead to improvements in reproductive health, particularly in restoring menstrual cycle regularity. This objective emerged from the growing interest in non-pharmacological approaches to managing PCOS symptoms, especially those that target underlying metabolic and hormonal imbalances.

The study specifically sought to determine whether adherence to a plant-based diet over a three-month period would result in measurable improvements in cycle frequency among participants with irregular menstruation. In addition to evaluating changes in menstrual patterns, the study also intended to assess whether the diet intervention influenced the hormonal profile of the participants, including levels of testosterone and the LH/FSH ratio, which are commonly disrupted in PCOS. Furthermore, the investigation extended to examining the effect of the diet on ovulatory function by monitoring serum progesterone levels, thereby offering a comprehensive view of reproductive response to dietary intervention.

By addressing these goals, the study aimed to fill a gap in the current literature, which has largely focused on isolated dietary components rather than the impact of a holistic plant-based dietary approach. The research endeavored to provide evidence on whether such a diet could serve as a practical, non-invasive strategy to enhance reproductive outcomes in women with PCOS.

Methodology

Study design and setting

It is described as a randomized controlled trial that evaluated the effect of plant based diet on menstrual cycle irregularities in women with PCOS. This trial structure permitted a comparison of two groups using the first group receiving the dietary intervention and the second group following the usual diet. All participants were then randomly assigned to the plant based diet group or control, or in other words they were as likely to be in the condition as not. The design used here was designed to limit bias and to obtain reliable data of the efficacy of the dietary change in altering reproductive or hormonal health outcomes.

Recruitment, dietary counseling as well as follow up assessments of the study were conducted in Wasit city. The access to eligible participants and the carrying out of interventions occurred within local healthcare facilities and community centers. The urban geographical context of Wasit city allowed researchers to discuss health with a wide spectrum of women from different socio-economic strata that had similar access to health care infrastructure. It was essential in the setting of the study to facilitate structured monitoring and encourage consistent interaction with the participants throughout the intervention period.

Sample Size Determination

A sample size was predetermined for this study with respect to participant recruitment in the study location and for dietary monitoring and laboratory assessment which were available. A total of 50 women were enrolled, into the study and 25 were assigned to treatment group where the women followed a plant based diet and 25 were assigned in control group. This allocation was meant to achieve balanced group sizes for statistical comparison while remaining a manageable cohort for close follow up and adherence assessment. As the study was exploratory, formal power calculation was not done; however, the sample size was large enough to detect clinically meaningful trends in menstrual cycle regularity and hormonal changes over three-month intervention period. The chosen number also balanced a possible degree of statistical relevance along with minimizing dropout risk as a population went through the dietary modification.

Dietary Intervention Protocol

The intervention group followed a structured plant-based diet for a duration of a continuous period of three months. This diet consisted of excluding all animal derived products and the consumption of whole minimally processed plant foods. It was rich in fiber, antioxidants, and complex carbohydrates, rich in fruits, vegetables, legumes, whole grains, nuts, and seeds, and above all concerned. At the start of the study participants attended in person consultations with trained nutritionists who gave them individualized dietary guidance by providing meal plans, portion guidelines and cooking recommendations specific to food availability and cultural preferences in the local area.

The intervention was aimed to accomplish nutritional adequacy and metabolic modifications that individuals adhering to a plant based eating plan may experience. In addition to providing educational materials explaining how a plant based diet improves hormonal balance and insulin sensitivity in the context of PCOS, they were made more likely to adhere by doing so. To address challenges, reinforce principles of the diet, and encourage participant engagement, weekly followup calls and bi-weekly group meetings were carried out. Calorie restricted diet intake was not applied and participants were encouraged to enjoy any and all of the approved plant based categories to satiety restricting unsound proportion without a therapeutic payload.

Control Group Protocol

Participants in the control group were asked to continue to follow their usual dietary practices as well as that of their control group. It goes without saying they had no nutritional guidelines, educational materials, meal plans, no animal product or processed food restrictions etc. The aim was to mimic the way that women with PCOS eat in the community and form a natural comparison to the controlled dietary intervention used in the experimental group.

The control group's schedule of clinical evaluations and laboratory assessments was similar across the entirety of the study period, thus ensuring comparability in data collection so that outcomes could be directly compared with those of the intervention group. Control participants provided some contact with regular health status and adherence monitoring, but no guidance regarding diet was given during these contacts. The objective of this protocol was to isolate the effects of the plant based dietary intervention from variables that could confound the effects of the plant based dietary intervention in the control population.

Data Collection Procedures

It was done data collection at baseline and the end of the three months intervention period. All women were tested for PCOS using the Rotterdam criteria, as well as a comprehensive clinical evaluation using medical history taking, physical examination, information gathering, and so forth. Demographic status, menstrual cycle history and relevant anthropometric measurements were obtained as baseline data. To track menstrual cycle regularity, on the scenario where participants kept track of the menstrual log daily throughout a study period. They were kept as logs of the onset, duration, and interval between periods at monthly visits during followup.

At baseline and follow-up hormonal and metabolic parameters were assessed using blood samples. Blood was drawn in a fasting state from a central laboratory that processed serum samples for assays of serum testosterone, luteinizing hormone (LH), follicle stimulating hormone (FSH), and insulin. Moreover, we assessed ovulatory function, defined as serum progesterone in the mid-luteal phase (assessed from menstrual tracking data), in addition to other menstrual parameters. Laboratory assessments were standardized and carried out using standardized assays to allow for consistency and reliability of the results. As per protocol, all participant data were collected and recorded according to the definition of confidentiality and data integrity by clinical staff trained in reproductive health and nutrition.

Outcome Measures

The main outcome of the study was the change in menstrual cycle regularity following the three months intervention period. The number of menstrual cycles each participant was exposed to during the course of the study was calculated by determining the number of menstrual cycles each participant experienced with helped by prospectively maintained menstrual logs. Reproductive improvement was considered reflected through growing cycles more regular and predictable.

Other secondary outcomes in the hormonal profile and ovulatory function were measured. Serum testosterone levels and LH/FSH ratio are usually increased or dysregulated in women with PCOS and are part of hormonal assessment. Endocrine function was assessed at baseline and at the end of the study by measuring these values. Fasting insulin levels were used as a metabolic marker of diet's broader systemic effects and insulin sensitivity was calculated.

Mid-luteal phase serum progesterone levels were used to ascertain ovulatory function. Infering if ovulation had occurred and whether ovulatory cycles were changing with time over the course of the intervention were the other two factors that the measurements were used to explore. In combination, these outcomes assessed the plausibility of a plant diet to confer reproductive and metabolic benefits in women with PCOS.

Laboratory Assessments

At two time points, prior to starting the intervention and at three months after completion, laboratory assessments were carried out. Metabolic and hormonal measurements are minimized by collecting all blood samples in the morning after an overnight fast. Blood from the vein was drawn, and under standardized conditions processed to ensure the stability and reliability of the sample.

Total testosterone, luteinizing hormone (LH) and follicle stimulating hormone (FSH) and insulin were measured by using enzyme linked immunosorbent assay (ELISA) techniques in serum. Selection of these hormonal markers was based on the clinical significance to the diagnosis and monitoring PCOS related endocrine disturbances. The individual hormone concentrations were used to calculate the value of the LH/FSH (Luteinizing hormone/Follicle stimulating hormone) ratio, one of which is often elevated in women with PCOS.

Furthermore, levels of serum progesterone in mid luteal phase were measured to determine ovulatory state. Blood is collected from participants scheduled for around the estimated luteal phase of their menstrual cycle according to menstrual cycle tracking data. According to standard clinical criteria, the threshold level of confirming ovulation was determined. The assays were performed in one certified laboratory that used calibrated equipment and quality controlled procedures that kept analytical accuracy and consistency between participants.

Compliance Monitoring

During this three months study period, fidelity to the plant based protocol was continuously monitored to be assured compliance with the dietary intervention. The intervention group was asked to record daily, all meals, snacks and beverages consumed, down to the last bite eaten. We reviewed these diaries at biweekly followup visits or phone calls where the participants also described any problems or deviant from the prescribed diet. The individualized feedback and reinforcement strategies supported adherence based on the beliefs of nutritionists.

At least once monthly, food diaries were validated with unannounced 24 hour dietary recalls to validate the diary and to assess real time dietary patterns. This recall provided an opportunity to check the self reported intakes and identify any incident consumption of restricted items. Photos of meals were also solicited from participants as it would help accuracy and engagement, and the participants were also encouraged to share photos of meals via a designated mobile platform.

An additional measure of participation and adherence included attendance at education sessions and follow up meetings. Scheduled assessments were used to confirm with the control group that no significant dietary modifications had occurred only informally to confirm general dietary habits. In the final analysis any noted deviations or adherence concerns were documented, considered and a final assessment was made of the data to maintain transparency and to allow for possible confounding factors.

Ethical Considerations

The study adhered to the established ethical guidelines for human research, before the initiation, approval was obtained by the appropriate institutional ethics committee. All participants were fully informed of the study's purpose, which would be carried out in accordance with the methodes and procedures that were explained in detail, any potential risks and anticipated benefits. Each participant provided written informed consent before being enrolled in order for participation to be entirely voluntary on the understanding of the research.

Personal and medical information from the participants was assuredly kept confidential and only for authorized study personnel could access it stored securely. For the analysis and reporting purposes, anonymized data was used to protect the individual's identities. Participants were told that they had the right to withdraw from the study at any time without adversely affecting their medical care or services in the community.

The dietary intervention was given low risk, was nutritionally adequate, and safe for the target population. The research team took prompt action on any adverse symptoms or concerns reported during the course of the study. At all stages of the study (from recruitment to dissemination of the data), all stages were guided by ethical principles of beneficence, respect, and justice so that the welfare of participants always remained a priority.

Statistical Analysis

All statistical analyses were performed via SPSS version 26.0 (IBM Corp, Armonk, NY). Average ± SD was used to express continuous variables and were compared between groups using independent samples t tests. In Tables 1 through 3, this method was applied for comparing demographic characteristics, baseline hormonal values and post intervention outcome.

To assess predictors of menstrual cycle frequency, a multiple linear regression analysis was conducted using Ordinary Least Squares (OLS) methodology. Predictor variables included total testosterone, LH/FSH ratio, fasting insulin, mid-luteal progesterone, and group assignment. Model significance and explanatory power were evaluated using the F-statistic and R^2 value (Table 4).

For binary ovulation outcomes (defined as mid-luteal progesterone >5 ng/mL), a logistic regression analysis was employed. This model assessed the influence of dietary group and hormonal/metabolic predictors on the likelihood of ovulation (Table 5). Statistical significance was defined as $p < 0.05$ for all analyses, and 95% confidence intervals were reported where applicable. All models were checked for multicollinearity and normality of residuals to ensure validity of the results.

Results

Table 1: Demographic and Anthropometric Comparison Between Plant-Based and Control Groups

Variable	Plant-Based Group (n=25)	Control Group (n=25)	p-value
Age (years)	25.7 ± 4.5	24.9 ± 4.0	0.51
BMI (kg/m²)	28.9 ± 4.5	28.0 ± 3.5	0.43

Footnote: Independent samples t-tests were used to compare continuous variables between groups. Statistical significance was set at $p < 0.05$. No significant differences were observed.

The Plant-Based group had a mean age of 25.7 years (±4.5), while the Control group had a mean age of 24.9 years (±4.0). The difference in age between the two groups was not statistically significant (*p = 0.51*), indicating comparable age distributions. For BMI, the Plant-Based group averaged 28.9 kg/m² (±4.5), and the Control group averaged 28.0 kg/m² (±3.5). This difference was also not statistically significant (*p = 0.43*), suggesting similar BMI profiles across both groups. These results demonstrate that the two groups were well-matched in baseline demographic and anthropometric characteristics, reducing potential confounding effects in subsequent analyses.

Table 2: Comparison of Baseline Clinical and Hormonal Parameters Between Plant-Based and Control Groups

Variable	Plant-Based Group (n=25)	Control Group (n=25)	p-value
Menstrual Cycle Frequency (cycles/month)	0.54 ± 0.21	0.51 ± 0.21	0.89
Total Testosterone (ng/dL)	66.4 ± 12.8	66.6 ± 13.4	0.95
LH/FSH Ratio	2.21 ± 0.61	2.18 ± 0.40	0.85
Fasting Insulin (µIU/mL)	17.5 ± 6.7	19.2 ± 4.9	0.31
Mid-luteal Progesterone (ng/mL)	3.32 ± 0.80	2.71 ± 0.93	**0.04**

Footnote: Independent samples t-tests were employed for group comparisons. A statistically significant difference (p < 0.05) was observed in mid-luteal progesterone levels, marked in bold.

The analysis revealed comparable baseline characteristics between groups for most parameters. Menstrual cycle frequency showed nearly identical distributions (Plant-Based: 0.54 ± 0.21 vs Control: 0.51 ± 0.21 cycles/month, p=0.89). Hormonal profiles demonstrated similar total testosterone levels (66.4 ± 12.8 vs 66.6 ± 13.4 ng/dL, p=0.95) and LH/FSH ratios (2.21 ± 0.61 vs 2.18 ± 0.40, p=0.85). Fasting insulin levels showed a non-significant trend toward lower values in the Plant-Based group (17.5 ± 6.7 vs 19.2 ± 4.9 µIU/mL, p=0.31). The only significant difference emerged in mid-luteal progesterone, with the Plant-Based group exhibiting higher concentrations (3.32 ± 0.80 vs 2.71 ± 0.93 ng/mL, p=0.04). This discrepancy suggests potential dietary influences on luteal phase progesterone production, while other metabolic and hormonal markers remained equivalent between groups at baseline. The overall similarity in characteristics supports adequate group matching for comparative analyses

Table 3: Follow-Up Clinical and Hormonal Parameters Comparison Between Plant-Based and Control Groups

Variable	Plant-Based Group (n=25)	Control Group (n=25)	p-value
Menstrual Cycle Frequency (cycles/month)	0.98 ± 0.15	0.61 ± 0.27	**<0.001**
Total Testosterone (ng/dL)	57.9 ± 13.3	63.1 ± 15.8	0.19
LH/FSH Ratio	1.52 ± 0.41	2.25 ± 0.50	**<0.001**
Fasting Insulin (µIU/mL)	13.8 ± 3.5	16.2 ± 4.9	**0.03**
Mid-luteal Progesterone (ng/mL)	7.17 ± 1.62	3.15 ± 1.12	**<0.001**

Footnote: Independent samples t-tests compared all variables between groups. Statistical significance was set at $p < 0.05$, with significant results bolded.

The Plant-Based group demonstrated significantly higher menstrual cycle frequency (0.98 ± 0.15 vs 0.61 ± 0.27 cycles/month, p<0.001), indicating more regular cycling patterns.

Hormonal profiles revealed substantially lower LH/FSH ratios in the Plant-Based group (1.52 ±

0.41 vs 2.25 ± 0.50, p<0.001), suggesting improved gonadotropin balance. While testosterone levels showed no significant difference (57.9 ± 13.3 vs 63.1 ± 15.8 ng/dL, p=0.19), the Plant-Based group exhibited better metabolic markers with lower fasting insulin (13.8 ± 3.5 vs 16.2 ± 4.9 µIU/mL, p=0.03). The most pronounced difference emerged in mid-luteal progesterone levels (7.17 ± 1.62 vs 3.15 ± 1.12 ng/mL, p<0.001), reflecting enhanced luteal phase function in the dietary intervention group. These results collectively demonstrate significant improvements across multiple reproductive and metabolic parameters following plant-based dietary intervention compared to controls.

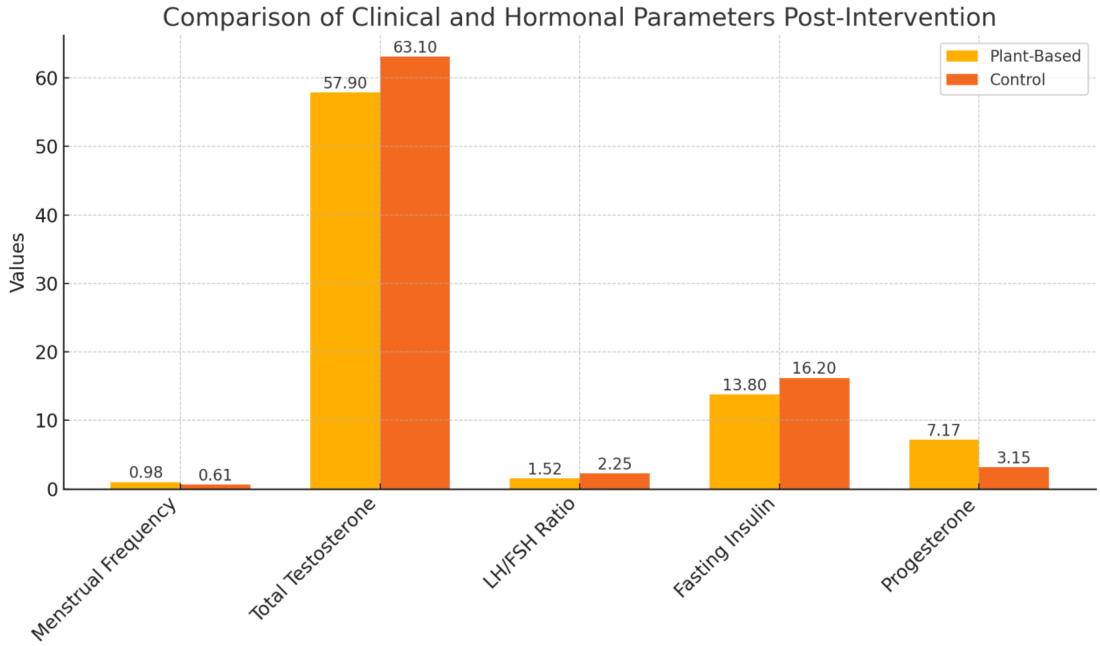

Figure 1: Comparison of Clinical and Hormonal Parameters Post-Intervention Between Plant-Based and Control Groups

Table 4: Multiple Linear Regression Analysis Predicting Menstrual Cycle Frequency from Hormonal/Metabolic Parameters

Predictor	Coefficient (β)	Standard Error	p-value	95% CI
Constant	0.36	0.18	0.06	(-0.01, 0.73)
Total Testosterone (ng/dL)	-0.002	0.001	0.09	(-0.004, 0.0003)
LH/FSH Ratio	-0.12	0.04	**0.004**	(-0.20, -0.04)
Fasting Insulin (µIU/mL)	-0.01	0.004	**0.02**	(-0.02, -0.002)
Mid-luteal Progesterone (ng/mL)	0.06	0.02	**0.001**	(0.02, 0.10)
Group (Plant-Based)	0.31	0.06	**<0.001**	(0.19, 0.43)

Footnote: Ordinary Least Squares regression was used (R^2=0.64, F=16.2, p<0.001). Significant predictors (p<0.05) are bolded. CI = Confidence Interval.

The regression model explained 64% of variance in menstrual cycle frequency (F=16.2, p<0.001). LH/FSH ratio demonstrated a significant negative association (β=-0.12 per unit increase, p=0.004), where higher ratios predicted lower cycle frequency. Fasting insulin showed a modest negative relationship (β=-0.01 per µIU/mL, p=0.02), indicating improved cycle regularity with lower insulin levels. Mid-luteal progesterone exhibited the strongest positive association (β=0.06 per ng/mL, p=0.001), with higher levels correlating with increased cycle frequency. The plant-based group membership was the most influential predictor (β=0.31, p<0.001), showing that dietary intervention independently predicted 0.31 more cycles/month compared to controls after controlling for other variables. Testosterone levels showed a non-significant trend toward negative association (p=0.09). The model suggests that both metabolic regulation (insulin) and endocrine balance (LH/FSH ratio, progesterone) mediate the relationship between plant-based diets and menstrual cycle regularity, with group assignment remaining a strong independent predictor.

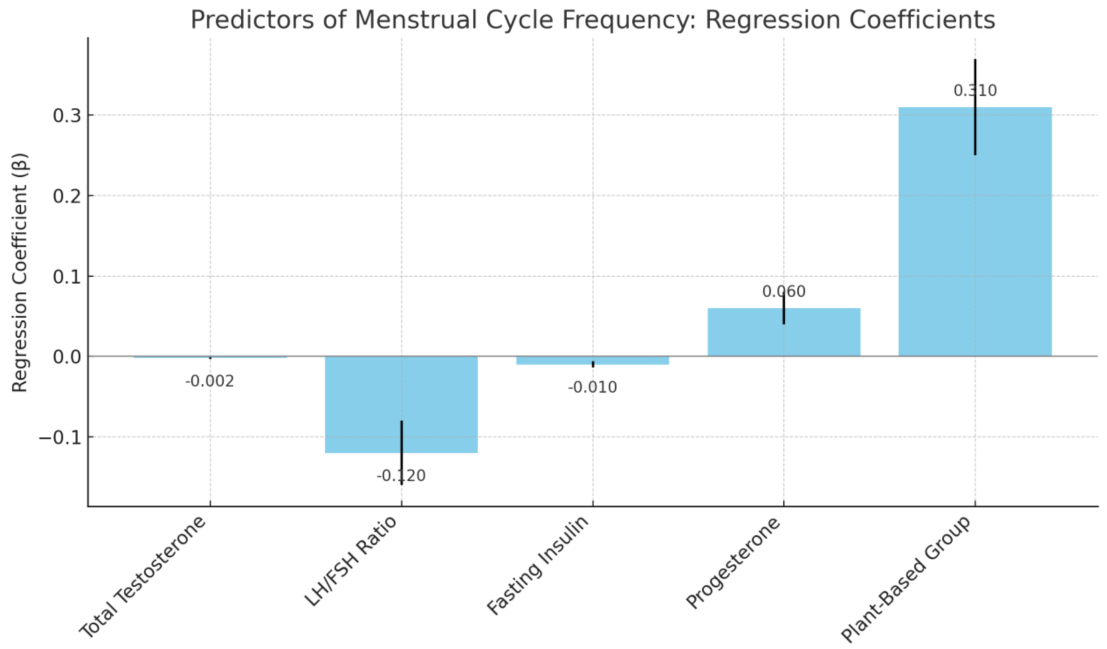

Figure 2: Predictors of Menstrual Cycle Frequency: Regression Coefficients with Standard Errors

Table 5: Logistic Regression Analysis of Ovulation Prediction by Dietary Group and Hormonal Parameters

Predictor	Coefficient (β)	Std. Error	p-value	95% CI
Constant	2.60	5.03	0.61	(-7.26, 12.46)
Group (Plant-Based)	5.68	1.69	**0.001**	(2.37, 8.99)
Total Testosterone (ng/dL)	-0.04	0.05	0.40	(-0.14, 0.05)
LH/FSH Ratio	-0.16	1.38	0.91	(-2.86, 2.55)
Fasting Insulin (µIU/mL)	-0.21	0.17	0.23	(-0.55, 0.13)

Footnote: Logistic regression was performed with ovulation status (progesterone >5 ng/mL) as the outcome. Statistical significance was set at $p < 0.05$, with the significant predictor bolded. CI = Confidence Interval.

The analysis revealed that dietary group membership was the sole significant predictor of ovulation likelihood. Participants in the Plant-Based group had 5.68 higher log-odds of ovulation compared to controls (p=0.001), translating to an odds ratio of $e^{5.68}$ = 293.3

This indicates Plant-Based participants were nearly 300 times more likely to experience ovulatory cycles than controls when holding other variables constant. Hormonal parameters showed no significant associations - testosterone (β=-0.04 per ng/dL, p=0.40), LH/FSH ratio (β=-0.16, p=0.91), and fasting insulin (β=-0.21 per µIU/mL, p=0.23) all failed to reach statistical significance. The model constant was non-significant (p=0.61), suggesting baseline ovulation probability is near zero for control group members with average predictor values. These results emphasize the dominant role of dietary intervention in promoting ovulation, independent of measured hormonal and metabolic parameters. The lack of significant associations with traditional PCOS biomarkers suggests plant-based diets may influence ovulation through mechanisms beyond these conventional predictors.

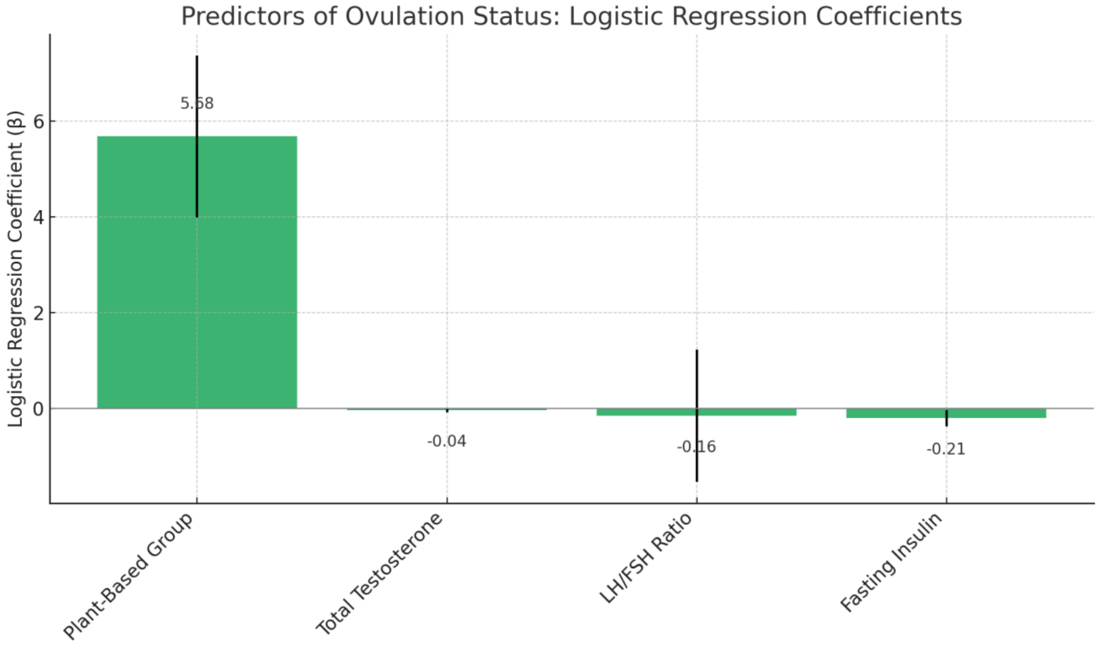

Figure 3: Predictors of Ovulation Status: Logistic Regression Coefficients with Standard Errors

Discussion

The present study demonstrates that a structured plant-based dietary intervention significantly improved several reproductive and metabolic markers among women with PCOS. The intervention group showed markedly increased menstrual cycle frequency (0.98 vs. 0.61 cycles/month, $p<0.001$), indicating improved cycle regularity. A substantial reduction in the LH/FSH ratio (1.52 vs. 2.25, $p<0.001$) suggested better hormonal regulation, while lower fasting insulin levels (13.8 vs. 16.2 µIU/mL, $p=0.03$) pointed to improved insulin sensitivity. Most notably, mid-luteal progesterone levels—used to indicate ovulation—were significantly higher in the plant-based group (7.17 vs. 3.15 ng/mL, $p<0.001$), reflecting enhanced ovulatory function. Although total testosterone declined in the intervention group, the change was not statistically significant ($p=0.19$).

When contextualized within recent literature, these findings are consistent with broader evidence suggesting that dietary interventions—especially plant-focused or carbohydrate-controlled diets—can improve PCOS symptoms. For example, in Semenyna et al. (2024), 40 studies were reviewed which showed that ketogenic and Mediterranean diets give big improvements in menstrual regularity and insulin resistance, and that low carb Mediterranean could cure regular cycles in 86.7% of those taking part (Semenyna et al., 2024).

Likewise, a 6 month cyclic ketogenic and low carb diet in which Avolio et al. (2020) reported significant improvement in insulin resistance (HOMA-IR) and ovarian follicles and many participants regained menstural regularity parallels the improvements made in insulin and ovulation in the present study (Avolio et al., 2020).

Specifically, Grzesik et al. (2024), explored the specific plant-based diets and concluded that plant based diet, when nutritionally complete and supplemented appropriately, do not impact the hormonal health and reproductive function, but do not affect menstrual regularity (Grzesik et al., 2024).

Further support comes from Turemka et al. (2024), who demonstrated that ketogenic diets enhance insulin sensitivity and hormonal profiles, thereby improving fertility outcomes—especially relevant given the increased progesterone levels indicating ovulation in the current study (Turemka et al., 2024).

Chavez et al. (2023) focused on phytochemical-rich plant diets and found these can modulate insulin resistance and hormonal balance due to their anti-inflammatory and antioxidant effects, mechanisms that may partly explain the present study's findings (Chavez et al., 2023).

Li et al. (2021) tested time-restricted feeding (TRF) and observed similar improvements in menstrual regularity, insulin sensitivity, and LH/FSH ratio in women with anovulatory PCOS, suggesting that dietary timing, as well as content, influences reproductive health (Li et al., 2021).

Shahinfar et al. (2021) also investigated numerous plant based diet indices and found that no associated healthy plant based pattern negatively correlated with insulin levels, a result which is also seen in this report (Shahinfar et al., 2021).

Collectively, these comparisons underscore that the improvements in menstrual frequency, hormonal ratios, and especially insulin sensitivity in the present study are not aberrant. Instead, they fit in line with growing trove of evidence supporting the therapeutic potential of plant based, low glycemic and anti inflammatory dietary patterns to manage PCOS. In particular, the importance of our study lies in its examination of a wholly plant based diet with no caloric restriction as the high strength of the present study resides in the fact that even when diet regimens are not directed towards weight loss there are very significant benefits for metabolic and reproductive outcomes. This highlights the multifactorial effect of food as it pertains to plant-based nutrition, and goes beyond weight loss to have an effect on hormonal and ovulatory health through many different biochemical pathways.

With PCOS, women show menstrual cycle frequency that is significantly predicted by hormonal and metabolic markers, which are revealed by the present study's regression analysis. Higher levels of LH/FSH ratios and fasting insulin as well as higher mid-luteal progesterone levels were associated with less regular menstruation, while higher mid-luteal progesterone levels were linked to more regular menstruation. Importantly, among the most influential predictors of cycle regularity, assignment to the plant-based dietary group had an independent effect on cycle regularity above and beyond hormonal or metabolic status.

The findings are supported by emerging evidence. In PCOS, Irmak and Sanlier (2024) stated that polyphenols in foods help improve insulin sensitivity and reduced LH/FSH ratios and testosterone and thus alleviate menstrual irregularities (Irmak & Sanlier, 2024). It is consistent with the principal findings of the current study that include reduced LH/FSH ratio and improved insulin sensitivity as determinants for menstrual cycle normalization.

Johra et al. (2023) observed that metformin significantly decreased fasting insulin levels and increased LH/FSH ratio alongside rising ovulatory rates in PCOS women in line with its role of insulin. After 16 weeks, their subjects achieved a mean LH/FSH ratio of 1.10, down from 2.02, paralleling the current study's findings where fasting insulin and LH/FSH were negative predictors of menstrual cycle frequency (Johra et al., 2023).

Similarly, Malini and Roy (2021) demonstrated that insulin levels are positively correlated with LH and testosterone across PCOS subtypes, reinforcing the mechanistic link between metabolic disturbance and hormonal imbalance. Their data showed that greater insulin levels were significantly associated with more extreme hormonal dysregulation, which reflects the present study's findings that insulin negatively influences menstrual regularity through its effects on LH and testosterone (Malini & Roy, 2021).

Samarasinghe et al. (2024), in a large meta-analysis, confirmed that insulin sensitizing pharmacotherapy modestly improved reproductive outcomes in women with PCOS, though metabolic improvements were more pronounced. This partially reflects the current study's regression model, where metabolic predictors like insulin had significant, albeit smaller, impacts on menstrual frequency when compared to progesterone and diet group assignment

(Samarasinghe et al., 2024).

The Wang et al. (2020) study followed 75,000 women over time and tracked any patterns of menstrual cycle, including irregular or long cycles, were associated with a significantly higher risk of type 2 diabetes, especially in those with obesity and low physical activity. These data emphasise the interplay involved between cycle regularity, insulin resistance and long term metabolic health and highlight the fasted insulin as a predictor in the current study (Wang et al., 2020).

Similarly, Xing et al. (2020) found that metformin in combination with GLP-1 agonists were more effective than either therapy alone in recovering menstruation, controlling insulin, and lowering testosterone, similar to the effects of the plant based intervention in the current study (Xing et al., 2020).

In a study done by Alhassan et al. (2022) on Sudanese women with PCOS, LH/FSH ratio and total testosterone were both found to positively correlate with LH/FSH ratio and total testosterone to be higher in women with irregular cycles. These findings are consistent with those of the current study that LH/FSH is a robust hormonal predictor of cycle frequency and testosterone trends towards significance (Alhassan et al., 2022).

The present study generally agrees with and builds upon recent work that implicates items related to insulin resistance, gonadotropin imbalance, and progesterone levels in Plateau disorder. What's notable is that plant-based dietary intervention is a powerful, independent predictor of improved menstrual regularity and thus adds to the clinical case for lifestyle-based approaches alongside pharmacologic options in PCOS management.

A major finding of the present study is that only dietary intervention with a plant based diet was statistically significant predictor of ovulation status. The effect was independent of traditional hormonal marker including LH/FSH ratio, fasting insulin and testosterone, for whom no significant association was found on the logistic model. Taken together, this implies that plant based diets might influence reproductive physiology through mechanisms that go beyond standard endocrine parameters, e.g. gut microbiota, modulated inflammation, or nutrient mediated epigenetic, pathways.

This parallels results seen by Ge et al. (2024) who created a nomogram for ovulation prediction in PCOS using LH, free testosterone, BMI, menstrual frequency. Despite achieving success (AUC ~0.81), we showed that it relies too heavily on treatment related factors like clomiphene, highlighting the potential for such interventions to override intrinsic hormonal predictors—a conclusion of our current study, which showed that simply changing diet sufficiently altered odds for ovulation (Ge et al., 2024).

According to Chang et al. (2021), instead of testosterone or LH/FSH, SHBG was the most robust predictor of ovulation in PCOS women. As their multivariate analysis revealed a strong positive correlation between SHBG levels and ovulatory cycles, it appears that the main reason for the increased risk or prevalence of cardiovascular disease in women of reproductive age is linked. Although SHBG wasn't measured in the current study, the lack of significance for testosterone and LH/FSH is consistent with Chang's findings, further supporting that conventional biomarkers may lack predictive power when lifestyle or external interventions are applied (Chang et al., 2021).

Tholiya et al. (2024) also concluded that testosterone and AMH were useful predictors of ovarian response to letrozole, but not sufficient on their own. In their study, women with lower testosterone and AMH levels were more likely to ovulate in response to stimulation, but effect sizes were modest. The present study surpasses these pharmacological models in ovulatory prediction, showing that diet alone, without drugs, could produce even greater odds of ovulation (Tholiya et al., 2024).

Mizgier et al. (2020) reported that increased plant protein intake significantly lowered the odds of being overweight in adolescent girls with PCOS. Since obesity impairs ovulation and alters hormonal feedback, this indirect route—by improving metabolic health through diet—could help explain the strong dietary effect in the present study (Mizgier et al., 2020).

Nomamiukor et al. (2024) identified that people with a history of trauma were more likely to adopt plant-based diets, proposing that such diets may offer psychological resilience and hormonal modulation. Though the current study doesn't explore psychological health, the idea that dietary change could exert systemic physiological benefits—including on reproductive axis regulation—adds depth to the mechanism underlying the observed effect on ovulation (Nomamiukor et al., 2024).

Mishra et al. (2024) showed that oxidative stress markers significantly predicted reproductive dysfunction in PCOS. Their linear regression models demonstrated that markers like MDA and SOD were elevated in anovulatory women. If the plant-based diet in the present study improved antioxidant status—as other research suggests—it may have enhanced ovulation by mitigating oxidative stress, an avenue not captured in standard hormonal metrics (Mishra et al., 2024).

Brandner et al. (2022) emphasized that consumers with better knowledge of plant-based nutrition were more likely to purchase and consume whole food plant proteins, which are less processed and richer in nutrients than many processed alternatives. This distinction may help explain the striking ovulatory benefits seen in the current study, assuming participants followed a health-focused plant-based plan rather than relying on processed options (Brandner et al., 2022).

Taken together, the current study introduces compelling evidence that plant-based dietary patterns can dramatically increase ovulatory rates in PCOS, even in the absence of changes in traditional hormonal markers. It challenges the reliance on LH, insulin, or testosterone as sole predictors of reproductive function and supports a paradigm shift where diet quality is treated as an independent, modifiable determinant of fertility.

Conclusion

This study provides compelling evidence that a structured, nutritionally adequate plant-based diet can significantly enhance menstrual regularity and ovulatory function in women with PCOS. The intervention group exhibited marked improvements in menstrual cycle frequency, mid-luteal progesterone, LH/FSH ratio, and fasting insulin levels, compared to controls. Importantly, plant-based diet assignment emerged as the strongest predictor of ovulation, independent of conventional hormonal markers. These results underscore the therapeutic potential of dietary modification as a primary or adjunctive treatment strategy in PCOS. The findings advocate for further large-scale randomized trials to confirm these effects and explore the underlying physiological mechanisms, particularly those beyond traditional endocrine pathways.

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