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Assessing Reproductive Hormones During Ovulation: Addressing Menstrual Issues And Gynecological Difficulties In Moradabad

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Introduction: Reproductive aging is characterized by variations in hormonal levels, which impact ovarian function and overall reproductive health. Monitoring these hormonal fluctuations, particularly during ovulation, provides valuable insights into reproductive health management. This study examines the influence of age on key reproductive hormones—estrogen, follicle-stimulating hormone (FSH), and luteinizing hormone (LH)—across different reproductive stages among women in Moradabad.
Objectives: To assess the impact of age on estrogen, FSH, and LH levels during the ovulatory phase in women at varying reproductive stages and to understand how these age-related hormonal changes might reflect reproductive aging and ovarian reserve.
Methods: A cross-sectional design is used, involving 73 female participants divided into three age groups: early reproductive (12–21 years, n = 39), mid-reproductive (22–31 years, n = 18), and late reproductive (32–41 years, n = 16). Blood samples were collected during the peri-ovulatory phase, and hormone levels were measured using enzyme-linked immunosorbent assays (ELISA). Statistical analysis, including one-way ANOVA, is performed to identify significant differences across age groups.
Results: Findings demonstrated significant differences in hormone levels across the three age groups ($p < 0.001$). Estrogen levels showed a marked decline with age, with the late reproductive group having 50% lower estrogen levels compared to the early reproductive group. Conversely, FSH and LH levels exhibited a progressive increase with age; the late reproductive group displayed FSH and LH levels up to 3.5 times higher than those in the early reproductive group.
Conclusions: These age-related hormonal fluctuations suggest a gradual decline in ovarian reserve and responsiveness, indicating a link to reproductive aging. The findings emphasize the importance of age-related monitoring of hormonal changes during ovulation to aid in reproductive health management and provide early intervention insights for different age groups.

Keywords: Reproductive Hormones, Menstrual Issues & Gynecological Difficulties, Ovulation

INTRODUCTION

The release of a practical reproductive cell from the ovary is referred to as ovulation. Between the time of menarche and menopause, ovulation normally happens once per month. A masterfully coordinated series of hormonal responses and anatomical changes, mostly involving the anterior pituitary, anterior hypothalamus, and ovaries, culminates in the release of a fertile, mature egg from the dominant follicle. Gonadotropin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), luteinizing hormone (LH), estrogen, and progesterone are the main participants in this system. Numerous other factors, such as growth factors, activin, and inhibin, contribute essential fine-tuning.(1)

Estrogen causes certain alterations in the reproductive system that set up the reproductive system for potential pregnancy before oocyte release. For instance, the cervical mucus becomes more copious and less viscous, the vagina's pH becomes less acidic, and the cervical area becomes more patulous as ovulation approaches. These changes all promote the movement of motile sperm toward the liberated oocyte. Furthermore, estrogen acts as the "growth factor" of the endometrium, assisting it in going from the proliferative to the secretory stages through the corpus luteum's post-ovulatory release of progesterone.

The uterus is ready for the potential fertilization of an egg through the secretions of progesterone, estrogen, and the corpus luteum. The ovarian follicle that collapses, the luteinization of the granulosa cells, and the ingrowth of capillaries and fibroblasts from the theca cell layer combine to produce the corpus luteum. When there is no pregnancy, ovulation determines the timing of the subsequent menstrual cycle because the corpus luteum only has a 14 ± 2-day lifespan before it is "rescued" by human chorionic gonadotropin (hCG) from the conceptus's trophoblast.(2)

When one considers how many steps are involved in the process of ovulation and how precisely many events must occur, one is left in awe of the system's inventiveness and a little taken aback that its breakdown, or anovulation, does not occur more frequently than is actually observed.

In women, hormone fluctuations are essential for controlling the menstrual cycle, fertility, and general reproductive health. Estrogen, FSH, and LH are important markers of ovarian function and reproductive status among the major hormones involved. Changes in reproductive health, such as the passage from the reproductive years to the perimenopause and menopause, might be indicated by variations in these hormone levels. (3–9) Clinicians can benefit greatly from knowing how age affects these hormones at various stages of the reproductive process, especially ovulation, as this knowledge can help forecast the longevity of reproductive systems and treat hormonal abnormalities associated with aging.(10–15)

Ovulation is a complex process that requires a delicate balance among endocrine, paracrine, and autocrine systems; any disturbances in this equilibrium can result in ovulatory dysfunction. Different age groups encounter distinct challenges related to ovulatory irregularities, amenorrhea, and infertility, complicating clinical assessments of stress, especially given the lack of objective markers. Providing personalized, one-to-one care is essential for accurately evaluating women's health, as stress can profoundly influence the menstrual cycle and overall reproductive health. The prevalence of stress among women presents significant health concerns that warrant further investigation. Consequently, more research is needed to better understand the relationship between age and ovulation, which will ultimately aid in the development of targeted interventions aimed at improving reproductive health outcomes. By addressing these factors, healthcare providers can enhance their ability to support women in managing the complexities of their reproductive health across various life stages.

Previous Research

Estrogen levels typically decline with advancing age, while follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels increase as a compensatory response to the body's reduced ovarian function. This hormonal shift is well-documented in the literature, yet studies specifically examining hormonal variations during ovulation across distinct reproductive age groups remain limited. Understanding these dynamics is crucial for assessing reproductive health and predicting potential issues related to fertility and menstruation.

Hormonal Dynamics During Ovulation

During ovulation, the hormonal interplay involves several key players:

Estrogen: Levels of estrogen gradually rise as it is produced by growing follicles in the ovaries. This increase plays a vital role in thickening the uterine lining and providing essential feedback to the hypothalamus and pituitary gland, facilitating the ovulatory process.(16–18)

Follicle-Stimulating Hormone (FSH): Secreted by the anterior pituitary gland, FSH stimulates the growth of ovarian

follicles. This hormone is essential for the development of the dominant follicle that is ultimately released during ovulation.(19–21)

Luteinizing Hormone (LH): A surge in LH levels, triggered by elevated estrogen concentrations, is crucial for initiating ovulation. This surge leads to the release of the mature oocyte and the formation of the corpus luteum, which subsequently secretes progesterone to prepare the uterus for potential implantation.(22)

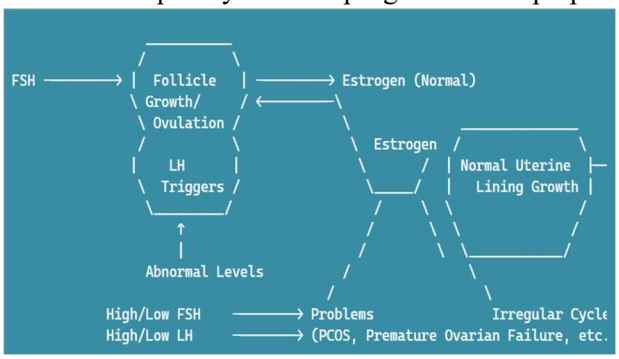

Figure 1. A. FSH (Follicle-Stimulating Hormone): Stimulates the growth and development of follicles in the ovary. B. Follicle: Contains an egg and produces estrogen. C. Estrogen: Prepares the uterine lining for a potential pregnancy. D.LH (Luteinizing Hormone): Triggers ovulation (the release of an egg from the ovary). E. Normal Uterine Lining Growth: The uterine lining thickens in preparation for a potential pregnancy. F. Hormonal imbalances and menstrual irregularities: Abnormal FSH and LH levels: If FSH or LH levels are too high or too low, it can disrupt the menstrual cycle. G. Problems: High/low FSH or LH levels can lead to various problems, including: PCOS (Polycystic Ovary Syndrome): Characterized by enlarged ovaries with multiple cysts. H. Premature Ovarian Failure: When the ovaries stop functioning before the age of 40. I. Irregular Cycle: Abnormal hormone levels can cause irregular menstrual cycles, including missed periods, heavy bleeding, or irregular bleeding.

Understanding these hormonal dynamics is essential for grasping the nuances of reproductive health. This study aims to analyze the variations in estrogen, FSH, and LH levels during ovulation among different reproductive age groups, with a specific focus on the population in Moradabad. By elucidating these hormonal patt erns, we may gain deeper insights into the factors influencing menstrual and reproductive health.

OBJECTIVES

- Assess Age-Related Changes in Estrogen, FSH, and LH Levels During Ovulation
  To measure estrogen, follicle-stimulating hormone (FSH), and luteinizing hormone (LH) levels across different reproductive age groups during the peri-ovulatory phase, identifying age-related hormonal variations.
- Examine the Relationship Between Hormonal Fluctuations and Reproductive Aging
  To explore how age-related changes in estrogen, FSH, and LH levels correlate with indicators of reproductive aging, such as decreased ovarian reserve and sensitivity.
- Highlight Clinical Implications of Hormonal Monitoring for Reproductive Health Management
  To underscore the importance of tracking these hormonal shifts during ovulation as a potential tool for early reproductive health interventions across different age groups.

METHODS

This cross-sectional study included 73 female participants, categorized into three reproductive age groups: early reproductive (12–21) age, n = 39, mid-reproductive (22–31) age, n = 18, and late reproductive (32–41) age, n = 16. Ovulation is calculated using an online ovulation calculator tool (https://www.calculator.net/ovulation-calculator.html), with the cycle data starting on 03/02/2023 and assuming a 28-day cycle.

Participants are recruited based on the following criteria:

❖ Inclusion criteria:
- Being in the ovulation phase (determined by cycle tracking and ovulation)

❖ Exclusion criteria:
- Pregnant women
- History of surgical menopause or hormone replacement therapy
- Smoking or alcohol use
- Presence of chronic or metabolic diseases
- Use of pharmacologic treatments, antioxidant supplementation, oral contraceptives, or intrauterine devices (IUDs)

Data Collection and Hormonal Assays

Venous blood samples are collected from all participants during the peri-ovulatory phase, confirmed through menstrual cycle tracking and ovulation prediction kits. Hormonal assays were performed to measure estrogen, FSH, and LH levels using enzyme-linked immunosorbent assay (ELISA) techniques. Additional demographic and reproductive health data, including age, menstrual history, are obtained using structured questionnaires.(23)

Statistical Analysis

Descriptive statistics, including mean and standard deviation, were calculated for age and hormone levels within each group. One-way ANOVA is conducted separately for each hormone to assess the effect of age on hormonal variations. Statistical significance is set at **$p < 0.05$** for all analyses, which are performed using SPSS software (version 25.0).

RESULTS

The hormonal levels during ovulation were compared across three reproductive age groups, revealing significant variations in estrogen, FSH, and LH levels. The data indicated that the early reproductive age group (12–21 years) had the highest mean estrogen levels at 197.27 pg/mL (± 30.18), compared to the mid-reproductive (22–31 years) and late reproductive (32–41 years) groups, which exhibited mean estrogen levels of 110.19 pg/mL (± 36.79) and 98.90 pg/mL (± 11.98), respectively. In contrast, FSH and LH levels displayed a progressive increase with age, with the early reproductive group showing mean FSH and LH levels of 15.03 mIU/mL (± 9.30) and 15.07 mIU/mL (± 9.17), while the mid-reproductive group had levels of 38.89 mIU/mL (± 4.36) and 36.67 mIU/mL (± 5.43), and the late reproductive group recorded levels of 52.81 mIU/mL (± 3.97) and 51.03 mIU/mL (± 4.05), respectively.

The analysis of variance (ANOVA) results highlighted statistically significant differences among the age groups for all hormones measured, with p-values less than 0.001 for estrogen, FSH, and LH. This suggests that age is a crucial factor influencing hormonal levels during ovulation, with younger women exhibiting higher estrogen levels and older women displaying elevated FSH and LH levels. Furthermore, the average number of days since the last menstrual period varied slightly across groups, indicating that menstrual cycle regularity may also play a role in hormonal dynamics. These findings underscore the importance of understanding how hormonal variations relate to age, providing valuable insights into reproductive health across different life stages.

DISCUSSION

The findings of this study underscore the significant impact of age on hormonal levels during ovulation, confirming established patterns observed in previous research. Specifically, estrogen levels are found to decline steadily with advancing age, correlating with the reduced ovarian reserve and diminished follicular activity typical in older age groups. This decline in estrogen production triggers a compensatory increase in follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels, reflecting decreased ovarian sensitivity and an altered hormonal feedback mechanism.

This hormonal variation is critical in understanding reproductive health, as it can influence various outcomes, including menstrual irregularities, infertility, and menopausal symptoms. Younger women, characterized by higher

estrogen levels and lower FSH and LH concentrations, generally exhibit a more robust ovarian reserve and greater reproductive potential. In contrast, older women tend to experience hormonal dysregulation, which may contribute to the challenges associated with reproductive aging.

Moreover, the review by Ghalia M Attia et al. (2023) highlights the broader implications of irregular menstruation on women's health, pointing to potential links with metabolic syndrome, heart disease, and infertility as a result of hormonal imbalances, particularly involving estrogen and progesterone. (24) These insights emphasize the importance of understanding hormonal dynamics across different reproductive age groups to aid clinicians in predicting reproductive lifespan and addressing hormonal imbalances effectively. Future research should explore the influence of lifestyle factors, stress, and environmental variables on these hormonal patterns, paving the way for comprehensive strategies aimed at improving women's reproductive health throughout their lifespan.

Clinical Implications

These results have significant implications for fertility assessments, hormonal therapies, and reproductive health management among women across various age groups. By monitoring hormonal changes during ovulation, clinicians can better predict reproductive status, enabling them to provide tailored advice for family planning and managing menopausal transitions. Understanding the distinct hormonal profiles associated with different reproductive age groups allows healthcare providers to identify potential issues earlier and implement appropriate interventions. For younger women experiencing hormonal imbalances, targeted strategies can enhance fertility and overall reproductive health. In contrast, for older women, awareness of rising FSH and LH levels may inform discussions about fertility preservation, menopause management, and the need for potential hormonal therapies. Ultimately, these findings underscore the necessity of personalized healthcare approaches that consider age-related hormonal dynamics to optimize reproductive health outcomes for women at every stage of life.

Conclusion

This study provides compelling evidence of significant age-related hormonal variations during ovulation, characterized by declining estrogen levels and increasing FSH and LH levels in older reproductive age groups. These findings enhance our understanding of the hormonal dynamics underlying reproductive aging, illustrating how hormonal changes may impact fertility and overall reproductive health. By emphasizing the importance of age as a critical determinant of hormonal health in women, this research underscores the necessity for tailored approaches in fertility assessments and reproductive health management. Such insights may guide clinicians in developing more effective strategies for addressing hormonal imbalances and improving health outcomes for women across different life stages.

REFRENCES

[1] Murray CM, Orr CJ. Chapter 12 - Hormonal Regulation of the Menstrual Cycle and Ovulation. In: Kovacs CS, Deal CL, editors. Maternal-Fetal and Neonatal Endocrinology [Internet]. Academic Press; 2020 [cited 2024 Nov 10]. p. 159–67. Available from: https://www.sciencedirect.com/science/article/pii/B978012814823500012X

[2] The Mechanism of Ovulation | GLOWM [Internet]. [cited 2024 Oct 12]. Available from: http://www.glowm.com/section-view/heading/The Mechanism of Ovulation/item/289

[3] Choi HR, Chang Y, Kim Y, Cho Y, Kwon MJ, Kang J, et al. Vasomotor and other menopause symptoms and the prevalence of ideal cardiovascular health metrics among premenopausal stage women. Menopause N Y N. 2023 Jul 1;30(7):750–7.

[4] Kim H, Jung JH, Han K, Lee DY, Fava M, Mischoulon D, et al. Ages at menarche and menopause, hormone therapy, and the risk of depression. Gen Hosp Psychiatry. 2023;83:35–42.

[5] Deora V, Kant R, Kumar N. Isoflavone Supplementation Alleviates Vascular Hardness in Women in the Perimenopausal to Postmenopausal Stages: A Systematic Study. J Chem Health Risks. 2023 Oct 23;13(4s):786–92.

[6] Deora V, Kant R, Kumar N. POST-VACCINATED COVID-19 OXIDATIVE STRESS IN MENOPAUSE FEMALES. Asian J Pharm Clin Res. 2023 Dec 7;10–2.
[7] MSD Manual Professional Edition [Internet]. [cited 2024 Jul 12]. Menopause - Gynecology and Obstetrics. Available from: https://www.msdmanuals.com/professional/gynecology-and-obstetrics/menopause/menopause
[8] Andrews RAF, John B, Lancastle D. Symptom monitoring improves physical and emotional outcomes during menopause: a randomized controlled trial. Menopause N Y N. 2023 Mar 1;30(3):267–74.
[9] Avis NE, Brockwell S, Colvin A. A universal menopausal syndrome? Am J Med. 2005 Dec 19;118 Suppl 12B:37–46.
[10] Schmalenberger KM, Tauseef HA, Barone JC, Owens SA, Lieberman L, Jarczok MN, et al. How to study the menstrual cycle: Practical tools and recommendations. Psychoneuroendocrinology. 2021 Jan 1;123:104895.
[11] Allshouse A, Pavlovic J, Santoro N. Menstrual cycle hormone changes associated with reproductive aging and how they may relate to symptoms. Obstet Gynecol Clin North Am. 2018 Oct 25;45(4):613.
[12] Critchley HOD, Babayev E, Bulun SE, Clark S, Garcia-Grau I, Gregersen PK, et al. Menstruation: science and society. Am J Obstet Gynecol. 2020 Nov 1;223(5):624–64.
[13] Reed BG, Carr BR. The Normal Menstrual Cycle and the Control of Ovulation. In: Feingold KR, Anawalt B, Blackman MR, Boyce A, Chrousos G, Corpas E, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000 [cited 2024 Oct 20]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK279054/
[14] T K, T Y, K Y, S M, T I. Associations of LH and FSH with reproductive hormones depending on each stage of the menopausal transition. BMC Womens Health [Internet]. 2023 May 25 [cited 2024 Oct 12];23(1). Available from: https://pubmed.ncbi.nlm.nih.gov/37231423/
[15] Kapper C, Oppelt P, Ganhör C, Gyunesh AA, Arbeithuber B, Stelzl P, et al. Minerals and the Menstrual Cycle: Impacts on Ovulation and Endometrial Health. Nutrients. 2024 Mar 29;16(7):1008.
[16] Garcia NM, Walker RS, Zoellner LA. Estrogen, progesterone, and the menstrual cycle: A systematic review of fear learning, intrusive memories, and PTSD. Clin Psychol Rev. 2018 Dec;66:80–96.
[17] Delgado BJ, Lopez-Ojeda W. Estrogen. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Oct 20]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK538260/
[18] Foster WB, Beach KF, Carson PF, Harris KC, Alonso BL, Costa LT, et al. Estradiol withdrawal following a hormone simulated pregnancy induces deficits in affective behaviors and increases ΔFosB in D1 and D2 neurons in the nucleus accumbens core in mice. Horm Behav. 2023 Mar 1;149:105312.
[19] Das N, Kumar TR. Molecular regulation of follicle-stimulating hormone synthesis, secretion and action. J Mol Endocrinol. 2018 Apr;60(3):R131–55.
[20] Pratama G, Wiweko B, Asmarinah, Widyahening IS, Andraini T, Bayuaji H, et al. Mechanism of elevated LH/FSH ratio in lean PCOS revisited: a path analysis. Sci Rep. 2024 Apr 8;14(1):8229.
[21] Orlowski M, Sarao MS. Physiology, Follicle Stimulating Hormone. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Oct 20]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK535442/
[22] Prediction of ovulation: new insight into an old challenge | Scientific Reports [Internet]. [cited 2024 Oct 12]. Available from: https://www.nature.com/articles/s41598-023-47241-2
[23] Deora V. AT THE ONSET ANDAT THE CESSATION, REPRODUCTIVE LIFE SPIN OF SYMPTOMS: INDUCED STRESS IN WOMEN. 2024;
[24] Attia GM, Alharbi OA, Aljohani RM. The Impact of Irregular Menstruation on Health: A Review of the Literature. Cureus. 15(11):e49146.
Table 1.: Assessing of Hormonal Levels During Ovulation Across Age Groups

Age Group	Mean Age	Estrogen (pg/mL)	FSH (mIU/mL)	LH (mIU/mL)	Days Since Last Menstrual Period
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
12-21	13.87	197.27 ± 30.18	15.03 ± 9.30	15.07 ± 9.17	12.62 ± 1.23
22-31	26.33	110.19 ± 36.79	38.89 ± 4.36	36.67 ± 5.43	14.33 ± 1.71
32-41	36.19	98.90 ± 11.98	52.81 ± 3.97	51.03 ± 4.05	13.50 ± 1.79

able 2.: ANOVA Results

Hormone	Between Groups Sum of Squares	Within Groups Sum of Squares	F-value	p-value
Estrogen	193126.38	579.12	757.92	< 0.001
FSH	21630.19	662.52	74.20	< 0.001
LH	19547.24	750.08	59.23	< 0.001

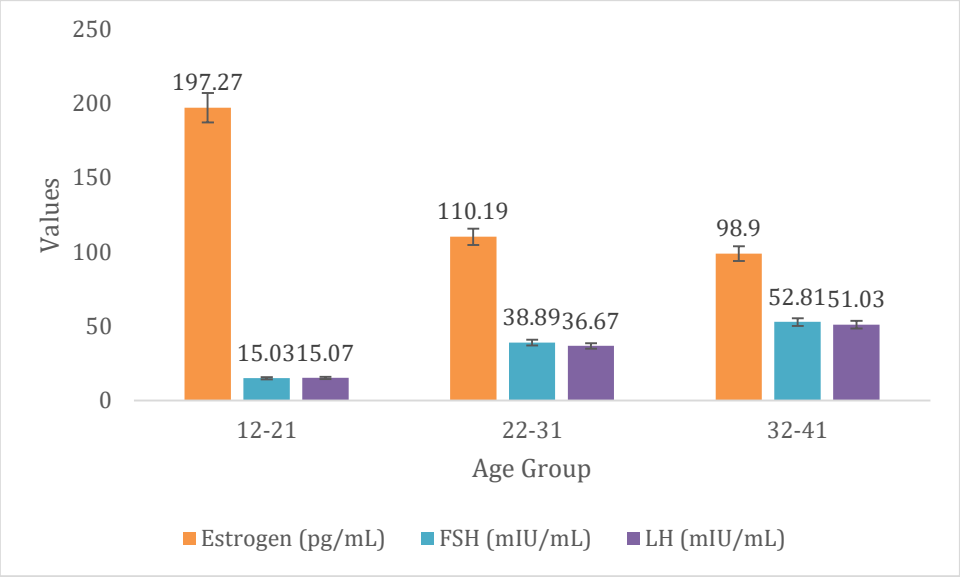

Figure 2. Age-Related Variations in Hormonal Levels During Ovulation. Estrogen (pg/mL): Significantly higher in the 12–21 age group compared to 22–31 and 32–41 ($p < 0.001$). FSH & LH (mIU/mL): Significantly increases with age across all groups ($p < 0.001$).

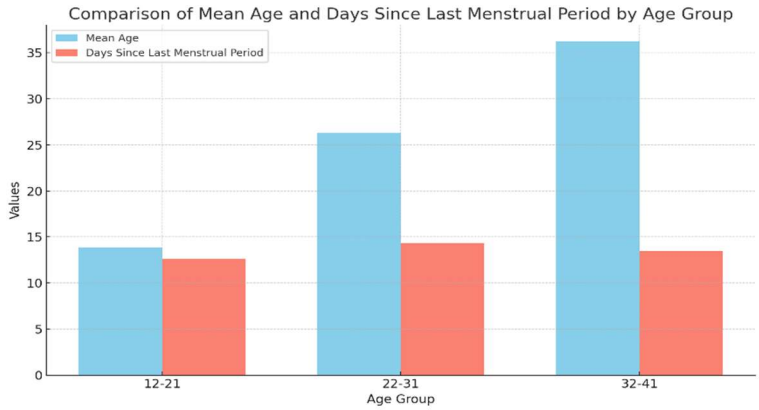

Figure 3. Mean Age and Days Since Last Menstrual Perio