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EVALUATION OF FOLLICLE-STIMULATING HORMONE VERSUS ANTI-MÜLLERIAN HORMONE IN POLYCYSTIC OVARY SYNDROME: CLINICAL IMPLICATION

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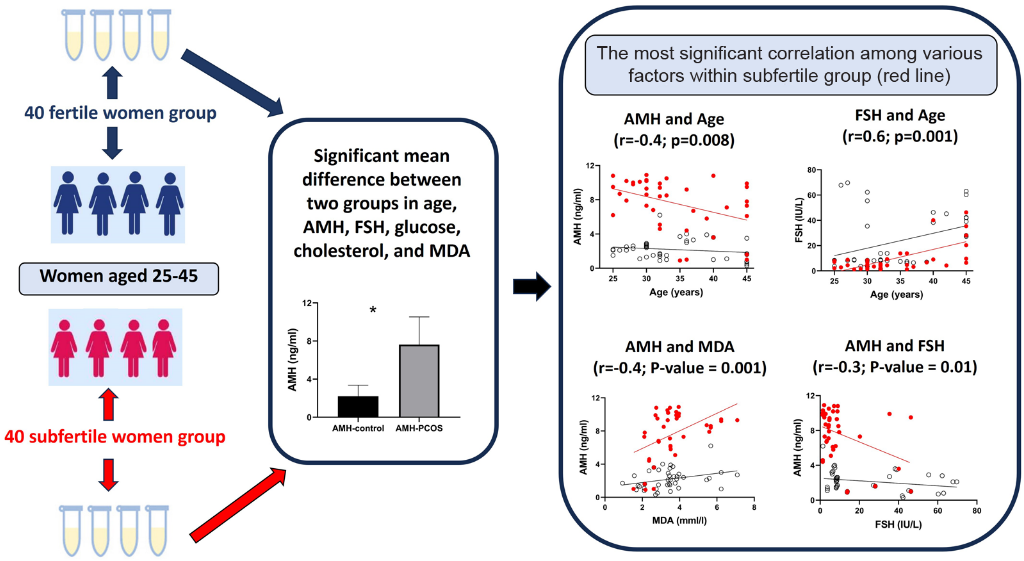
Background. Polycystic Ovary Syndrome (PCOS) is a hormonal disorder affecting women of reproductive age. Alarmingly, there is a significant diagnostic gap, with about 75 % of women in hospital settings unknowingly having PCOS due to inconsistent diagnostic criteria. The manifestations of PCOS are multifaceted, along with hyperandrogenism, which results in excessive male hormones, hirsutism, and irregular menstrual cycles, frequently culminating in infertility and profound mental fitness challenges. The role of oxidative stress cannot be understated; it detrimentally influences the reproductive lifespan and inflicts damage that exacerbates infertility issues.

Materials and Methods. The research was conducted on 80 women between the ages of 25–45 years who were divided into PCOS and control groups. Women's blood samples were obtained from the Nineveh Health Directorate Oncology and Nuclear Medicine Hospital, Iraq. The levels of AMH and FSH were measured through the ELISA kits. In addition, biochemical parameters such as glucose, total cholesterol, malondialdehyde (MDA), and glutathione (GSH) were quantified in both control and PCOS women. Relationships between these variables were explored using unpaired *t*-tests, Pearson's correlation coefficient, and multiple of regression analysis.

Results and Discussion. FSH levels were positively correlated with age while AMH was related to age inversely, suggesting that aging decreases ovarian reserve in PCOS women. Furthermore, a significant increase in mean serum Malondialdehyde (MDA) was observed for the women with PCOS group compared to healthy controls, aligning with a significant association among AMH and MDA. Remarkably, no statistically significant correlation between FSH and AMH was found relating glucose, and total cholesterol (TC) in the PCOS group. Therefore, the monitoring of these indicators could enhance the clinical care of PCOS.

Conclusion. This study reveals age-associated adjustments in ovarian reserve in PCOS. Moreover, the increase in MDA levels revealed the increased oxidative stress that characterized the condition's complexity.

Graphical abstract



Keywords: polycystic ovary syndrome, follicle stimulating hormone, anti-Müllerian hormone, body mass index, malondialdehyde

INTRODUCTİON

A hormonal disorder affects 5–15 % of premenopausal women known as PCOS or polycystic ovarian syndrome (Cunha & Póvoa, 2021). The prevalence of undiagnosed PCOS presents a worrying picture; studies suggest that approximately 75 % of female patients who attend hospitals may be suffering from undiagnosed polycystic ovary syndrome. This may be as a result of a host of factors including lack of awareness and knowledge about PCOS compounded by its complexity of diagnosis which is rather variable based on different diagnostic criteria (Dybciak *et al.,* 2022; Simon *et al.,* 2023). PCOS is accompanied by prominent symptoms including hyperandrogenism and hirsutism besides the menstrual irregularities (Idicula-Thomas *et al.,* 2020). PCOS presents various phenotypes including the classic PCOS characterized by hyperandrogenism, oligo-ovulation and polycystic ovary. Another phenotype includes PCOS with hyperandrogenism, ovulation irregularity but normal ovary. Additionally, there is a normo-androgenic PCOS with ovulatory dysfunction, polycystic ovary, but normal androgen levels. It can also be further classified according to body mass index (BMI) into lean PCOS (normal or low BMI) and obese PCOSs (overweight or obese) (Barry *et al.,* 2014; Azziz *et al.,* 2009). In addition to affecting the physiological conditions, it is also associated with mentally health issues, casting shadows of depression, anxiety, and psychosexual dysfunction (Teede *et al.,* 2010).

The commonly employed biomarkers to evaluate the status of the ovarian reserve include arbitrary follicle count, FSH, and AMH levels. These markers have a critical role to play in fertility assessment for women and are useful in diagnosing PCOS, thus allowing for more specific routes for the treatment of infertility (Tal & Seifer, 2017). For these, AMH stands out as an especially useful marker that is secreted by granulosa cells of ovarian Antral follicles, starting in the second half of fetal life from about twenty-third week's development and up to adulthood. The utility of AMH as an ovarian reserve indicator is underscored by its inverse relationship with age – its production diminishes as age advances (Broer *et al.,* 2014; Shrikhande *et al.,* 2020). This characteristic makes it a valuable tool in evaluating the ovarian reserve, offering clinicians a dynamic parameter to assess reproductive potential. One notable advantage of AMH lies in its relative stability throughout the menstrual cycle in normo-ovulatory women. Unlike some hormonal markers that fluctuate during specific phases, AMH maintains consistency. Consequently, there is no discernible advantage to assessing AMH during the menstrual cycle. This stability enhances the practicality and reliability of AMH as a marker for ovarian reserve assessment (Aljarad *et al.,* 2019).

Currently, oxidative stress appears to influence the reproductive life span of both men and women. High levels of oxidative stress result in pathological changes in the reproductive system, which causes infertility. The body contains an antioxidant defense system that minimizes reactive oxygen species (ROS) effect in the human's basics agents of defense against reactive oxygen species. The enzyme-based antioxidants include superoxide dismutase, catalase, glutathione peroxidase, thioredoxin, while non-enzyme based ones include ascorbate, tocopherol, catechin, curcumin and carotenoids. However, once ROS levels go beyond a definite level, it causes oxidative stress to the cell's DNA, proteins, lipids, and carbohydrates which may result in injury (Jena *et al.,* 2023). The delicate equilibrium between ROS and their corresponding antioxidant counterparts intricately governs the finely tuned process of ovulatory function, overseeing the cyclic release of mature follicles (ova) essential for conception (Chen *et al.,* 2008). The presence of antioxidants emerges as a crucial element in safeguarding developing follicles, fostering a homeostatic redox environment, and creating conditions conducive to the optimal health of eggs (Agarwal *et al.,* 2005). Previous findings illuminate a strong correlation among females grappling with PCOS and heightened levels of oxidative stress markers, intricately linked with insulin resistance, hyperandrogenism, and inflammation (Hamza *et al.,* 2016; Murri *et al.,* 2013; Papalou *et al.,* 2016). However, the specifics of this relationship between PCOS and oxidative stress are still indistinct, as there exist several opinions in the scientific literature. A certain number of studies hypothesized that oxidative stress could be a trigger for PCOS development, but others argue that PCOS acts as a catalyst by creating oxidative stress as a result of the intricate interactions between metabolic and hormonal abnormalities (Agarwal *et al.,* 2012).

The aim of the present work is to reveal putative changes in the ovarian reserve, and to investigate the relationship between such endocrine biomarkers as FSH and AMH, age, and oxidative stress markers. The study endeavors to provide valuable diagnostic information for optimizing reproductive outcomes, enhance medical diagnostics, and contribute recommendations for maintaining optimal hormone levels within a healthy range.

MATERIALS AND METHODS

Study subjects. 80 women aged between 25 and 45 were randomly assimilated into two groups. One group comprised 40 participants diagnosed with PCOS, and the other was the control group. Bivariate correlations of biochemical tests in PCOS women and the control group are shown in **Table 1**. polycystic ovary syndrome prognosis was made in keeping with the Rotterdam Criteria (Rotterdam, 2004). Patient statistics, encompassing age, weight, height, and family records, were carefully collected to understand their association with PCOS.

Demographic details. Demographic details were obtained, including calculations for age and body mass index (BMI). The BMI was defined as being ≤25 to represent normal weight and ≥25 to signify being overweight or obese.

Blood collection and ethical approval. Women's blood samples were obtained from the Nineveh Health Directorate Oncology and Nuclear Medicine Hospitals, Iraq. Every female participant involved in the research study granted their informed consent. The collection process involved using biochemistry blood tubes to ensure appropriate preservation and handling from January 2022 to April. Serums were separated through centrifugation at 3,000 revolutions per minute for 10 min and stored at a temperature of -20 °C until use.

Biochemical parameters. ELISA kits from Ansh (Germany) and Human (Germany) were used to conduct the Enzyme-Linked Immunosorbent Assay for AMH and FSH (Freund *et al.*, 1986). The assays were performed according to the manufacturer's recommendations for increased accuracy and a standardized protocol. In addition, ready-made assay (kits) from the company, BIOLABS were used to assess glucose and total cholesterol (TC) levels based on enzymatic methods. Regarding malondialdehyde (MDA) levels, a TBA modified reaction was used (Botsoglou *et al.,* 1994). The level assessment of GSH used Ellman's reagent/ DTNB (Cao *et al.,* 2020).

Statistical analysis. The statistical analysis for this study was conducted using IBM SPSS Statistics 22 software. Graph Pad Prism v8.0 was also employed for graphical representation of the data. For group comparisons, the Bland–Altman method was utilized, a statistical technique particularly effective in assessing agreement between two quantitative measurements. Multiple regression analysis and Pearson's correlation coefficient have been used to explore the relationships among the variables. A comparison of variables with a normal distribution was performed by *t*-test, difference mean value and standard deviation (SD) were calculated. The significance level was set at $P < 0.05$.

RESULTS AND DISCUSSION

Comparison of biochemical measurements between women with PCOS and healthy control. Bland–Altman plot was used to determine the agreement for various variables, including age, body mass index (BMI), AMH, FSH, glucose, TC, MDA, and GSH between PCOS women and the control group (Bland & Altman, 1995). The results indicated a moderate degree of agreement on the Bland-Altman plots for these measurements, as illustrated in **Figure 1**.

The data analysis showed a significant mean age difference among the control group and PCOS women group (p-value = 0.05, t = -1.97). However, the study did not identify a statistically considerable mean distinction in BMI (**Fig. 2**; **Table 1**).

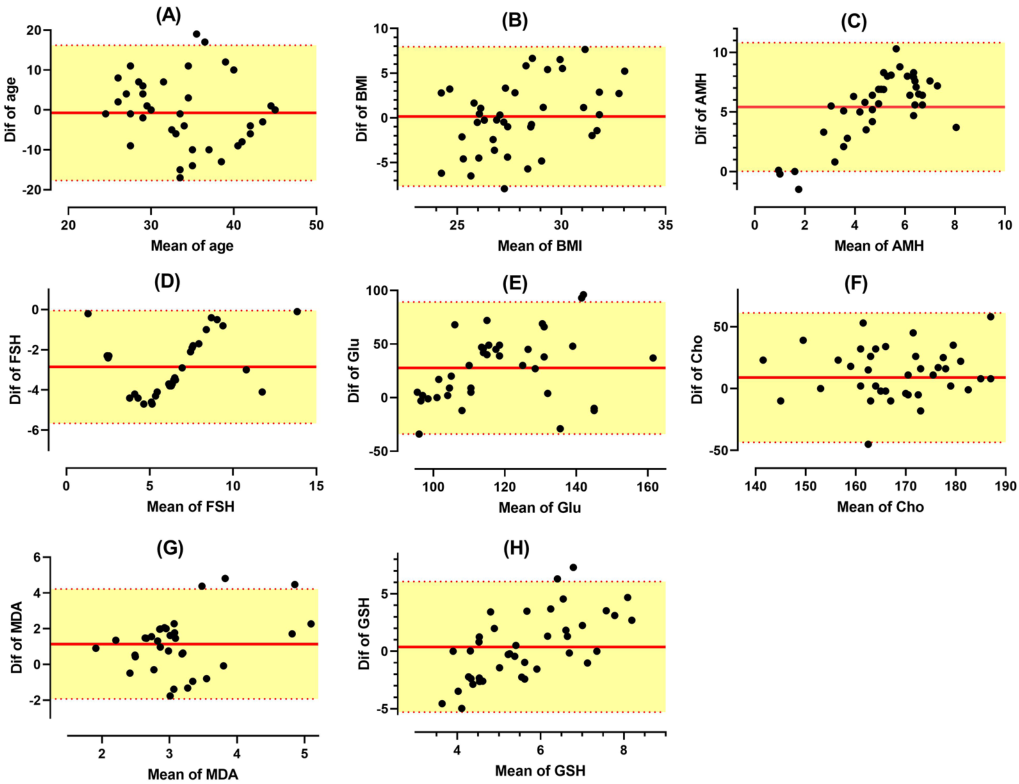


Fig. 1. A comparative analysis of various variables examined, including A. Age, B. BMI, C. AMH, D. FSH, E. glucose, F. TC, G. MDA, and H. GSH. The red line signifies the mean difference, while the red dotted lines indicate the 95 % confidence limits. If the values closely approach the red line, it indicates the absence of a statistically significant variance. If the points are scattered evenly with no clear pattern, it suggests good agreement. If there are points that lie outside the limits of red dotted lines, it indicates that there is no agreement between the tests

In exploring antioxidants and oxidative stress levels, the study considered two variables: MDA and serum GSH. The levels of MDA have been notably higher in PCOS women compared to the control group (*p*-value = 0.005, t = 3.01) (**Fig. 2**; **Table 1**). This observation aligns with findings from other studies reinforcing MDA as an indicator of chronic oxidative states prevalent in PCOS group (Desai *et al.,* 2014; Sabuncu *et al.,* 2001). The increased amount of MDA in serum indicates that the process of peroxidation fats is increased as well as the degree of tissue damage in patients with PCOS. Notably, even in non-obese PCOS patients the MDA levels were elevated in comparison with the control group (Desai *et al.,* 2014; Yilmaz *et al.,* 2016). On the other hand, there was no significant difference observed in serum GSH levels between the test and control groups. These results parallel those of a previous study conducted by Enechukwu *et al*. 2019. In addition, there was a significant difference in TC between PCOS patients and the control group (*p*-value = 0.03, t = 2.14). This finding is consistent with previous published studies (Enechukwu *et al.,* 2019; Macut *et al.,* 2013; Manikkumar *et al.,* 2013). Moreover, serum glucose levels were also significantly higher in PCOS patients compared with controls (*p*-value = 0.001, t = 5.40).

Table 1. **Bivariate correlation of biochemical measurements in PCOS women and control group**

Parameters	Test group (n = 40)	Control group (n = 40)	Mean difference	*T*-test	*p*-value
Age	34.02±6.71	34.75±7.91	-0.73	-1.97	0.05
BMI (kg/m^2)	28.16±3.70	27.97±2.43	0.19	0.28	0.78
AMH (IU/mL)	7.62±2.91	2.20±1.16	5.42	10.65	0.001
FSH (IU/mL)	4.91±3.08	7.77±2.6	-2.85	-11.46	0.001
Glucose	131.05±26.47	103.37±19.09	27.68	5.40	0.001
TC	174.67±15.33	165.77±22.44	8.90	2.14	0.03
MDA mmol/L	3.70±1.21	2.56±0.86	1.14	3.01	0.005
GSH mmol/L	5.82±2.45	5.44±1.16	0.38	0.97	0.33
Vitamin D ng/mL	13.87±0.55	15.27±2.30	-1.40	-1.55	0.218

Note: Data are shown as mean±SD. The negative value means that the values of the control are higher than the values of the patient. FSH; follicle stimulating hormone, AMH; anti-Müllerian hormone, and TC; total cholesterol

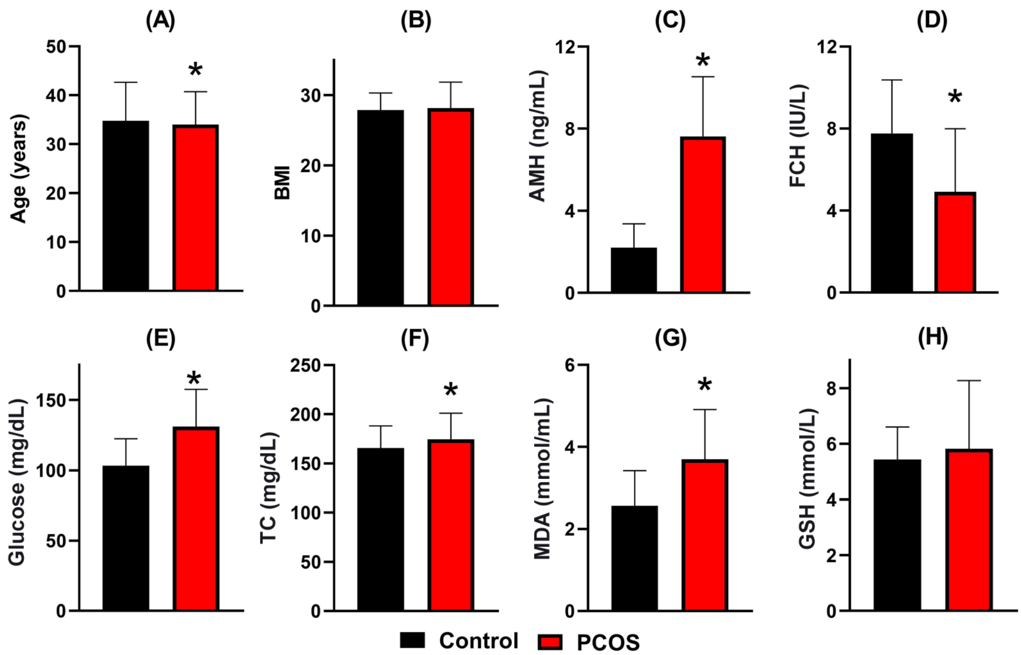


Fig. 2. Comparison of the mean levels of various variables examined, including A. Age, B. BMI, C. AMH, D. FSH, E. glucose, F. TC, G. MDA, and H. GSH. between control (black column) and PCOS groups (red column). *; Significant difference between groups (P<0.05)

AMH levels were substantially higher in the PCOS group (7.62±2.91) than in the normal group (2.20±1.16) (*p*-value = 0.001), mirroring findings from prior research (Kohzadi *et al.,* 2020; Köninger *et al.,* 2014; Matsuzaki *et al.,* 2017; Sahmay *et al.,* 2013;

Woo *et al.,* 2012). An upswing in androgens in the PCOS cohort is identified as a driving force behind heightened AMH production. This may play a role in diminishing the sensitivity of developing follicles to FSH. The increased AMH levels in PCOS provide credence to the PCOS-ovarian dysfunctions perception of a reduced ovarian reserve, even among PCOS subjects with apparently regular menstrual cycles, unraveling the intricate facets of subfertility in this population. Intriguingly, FSH levels are significantly lower in the PCOS group (4.91±3.08) in comparison with the control group (7.77±2.6) (**Fig. 2**; **Table 1**). The burgeoning count of small follicles, coupled with the AMH secreted from them dampen follicular sensitivity to FSH, ultimately resulting in a reduction in its efficacy in individuals struggling with PCOS (Hamza *et al.,* 2016).

Correlations of AMH and FSH levels with biochemical variables. Different correlations of AMH with medical and biochemical traits were observed in ladies with PCOS in comparison to the control group, suggesting a potential contribution to PCOS pathogenesis. Within the PCOS group, a statistically significant positive correlation emerged between FSH and age (*p*-value=0.001), contrasting with the control group where no significant correlation was observed (**Fig. 3**; **Table 2**). The findings of a previous study revealed a significant correlation among age and FSH solely in the normal group, emphasizing the nuanced nature of age-related hormonal dynamics (Kohzadi *et al.,* 2020). Moreover, the present study revealed a decline in AMH mean with aging in the PCOS group, supported by correlation coefficients (-0.41) and *p*-values (0.008). This aligns with previous research (MacNaughton *et al.,* 1992), attributing the decline to diminishing follicles and ovarian reserves approaching menopause. In contrast, a feeble and statistically insignificant correlation was observed in the fertile group between AMH and age. These findings underscore the complexity of AMH associations in diverse populations, emphasizing the necessity for continued research to unravel the intricate mechanisms influencing PCOS pathogenesis and age-related hormonal dynamics.

This research also did not observe a significantly large disparity of AMH, FSH, and BMI among the two groups: PCOS and control (**Table 2**). In contrast, another previous study reported a negative correlation between BMI and AMH levels (Oldfield *et al.,* 2021). This dissimilarity can be related to the various demographic composition of female participants in this study, encompassing different ages and situations together with perimenopausal, postmenopausal, fertility, infertility, and PCOS. Remarkably, the outcomes of this study conform with the earlier studies (Gupta *et al.,* 2019; Okunola *et al.,* 2017; Sahmay *et al.,* 2018). On the other hand, the study conducted by L. G. Nardo *et al.* (2009) offered another view where AMH rises with increased exercise and does not bear relation to BMI. In light of these findings, it still remains unclear whether BMI can be used to measure the serum AMH levels in contexts (Bahadur *et al.,* 2021; Kloos *et al.,* 2022). Therefore, it is recommended to conduct further investigations with larger sample sizes to explore the relationship and mechanism between BMI and serum AMH to have a clearer point of view.

In the context of the study findings, elevated TC levels observed in the PCOS women, compared to the normal group, do not exhibit a considerable correlation with AMH and FSH (**Table 2**). This implies that these specific factors might not directly contribute to the onset or severity of PCOS within the examined population. Intriguingly, there was a noteworthy correlation between FSH and TC in fertile women, indicating a potential connection between cholesterol (is a steroid hormone precursor) and FSH, especially pronounced in those with regular menstrual cycles. In contrast, the lack of a strong correlation in PCOS women hints at a disrupted hormonal milieu or distinct mechanisms influencing cholesterol metabolism in this population. Nevertheless, these findings diverge from a study by C. Serviente *et al*. (2019) which points to a positive association between higher FSH in postmenopausal women and elevated levels of both TC and Low-Density Lipoprotein (LDL). Additionally, this study unveils a non-significant association between TC and AMH in both control and PCOS women, contradicting a previous study that showed a negative correlation. This incongruence suggests the potential influence of lipid profile changes on AMH ranges in ladies with diminished ovarian features (Junet *et al.,* 2020). Additionally, the data divulges no statistically significant correlation between FSH or AMH and glucose in both fertile and PCOS groups (**Table 2**). This contrasts with previous studies linking FSH or AMH concentration to insulin resistance, prediabetes, and diabetes in postmenopausal women or those with circulating androgens in PCOS with normal or impaired fasting glucose (Nardo *et al.,* 2009; Stefanska *et al.,* 2019; Wang *et al.,* 2016).

Table 2. **Correlation between anti-Müllerian hormone (AMH), follicle stimulating hormone (FSH), body mass index (BMI), age, total cholesterol (TC), glucose, Malondialdehyde (MDA), and glutathione (GSH), in PCOS and healthy women**

Variable		Control group (n = 40)		Test group (n = 40)	
		FSH	AMH	FSH	AMH
Age	Pearson correlation	-0.012	0.29	-0.41**	0.65**
	p-value	0.43	0.06	0.008	0.001
BMI	Pearson correlation	-0.02	-0.80	0.06	-0.28
	p-value	0.88	0.62	0.72	0.08
TC	Pearson correlation	-0.29	0.59**	0.01	-0.1
	p-value	0.07	0.001	0.96	0.52
Glucose	Pearson correlation	-0.14	0.26	0.25	0.09
	p-value	0.4	0.11	0.13	0.59
MDA	Pearson correlation	0.28	0.09	0.46**	-0.40**
	p-value	0.08	0.56	0.001	0.01
GSH	Pearson correlation	0.23	0.07	-0.2	0.09
	p-value	0.14	0.65	0.22	0.56
AMH	Pearson correlation	1	-0.26	1	-0.38*
	p-value	-	0.09	-	0.01
FSH	Pearson correlation	-0.26	1	-0.38*	1
	p-value	0.09	-	0.01	-

The data showed that there were significant differences in the interaction of AMH FSH and MDA in PCOS and control groups. Moreover, a significant positive correlation was noted between AMH and MDA based on Pearson correlation = 0.46 and *p*-value = 0.001 in PCOS women (**Fig. 3**; **Table 2**). This aligns with prior research, suggesting a link between elevated risks of PCOS and the integral role of free radicals within the female reproductive tract (Agarwal *et al.,* 2005). Furthermore, MDA levels are implicated in heightened lipid peroxidation products, correlating with a spectrum of chronic sicknesses (Adibhatla & Hatcher, 2010). Numerous studies highlight increased oxidative stress levels in PCOS patients, as well as those with obesity, insulin resistance, cardiovascular disorders, and cancers (Cheng & He, 2022; Fatima *et al.,* 2019; Zuo *et al.,* 2016). Conversely, in fertile women, no statistically significant differences manifest between AMH or FSH and MDA. This absence of statistical discord suggests a distinct biochemical equilibrium in the fertile domain, untethered from the intricate dynamics observed in their subfertile counterparts. Furthermore, the data indicates a lack of significant differences between AMH and glutathione (GSH) in both PCOS and control groups (**Table 2**). However, this finding contradicted research from 1996, which observed that there is a positive association between decreased concentrations of GSH in RBC and hormonal disarray (Sheng-Huang *et al.,* 2015). The impact of GSH seemed to hinge on the relative frailty of producing free radicals and the subsequent buffering role of antioxidants.

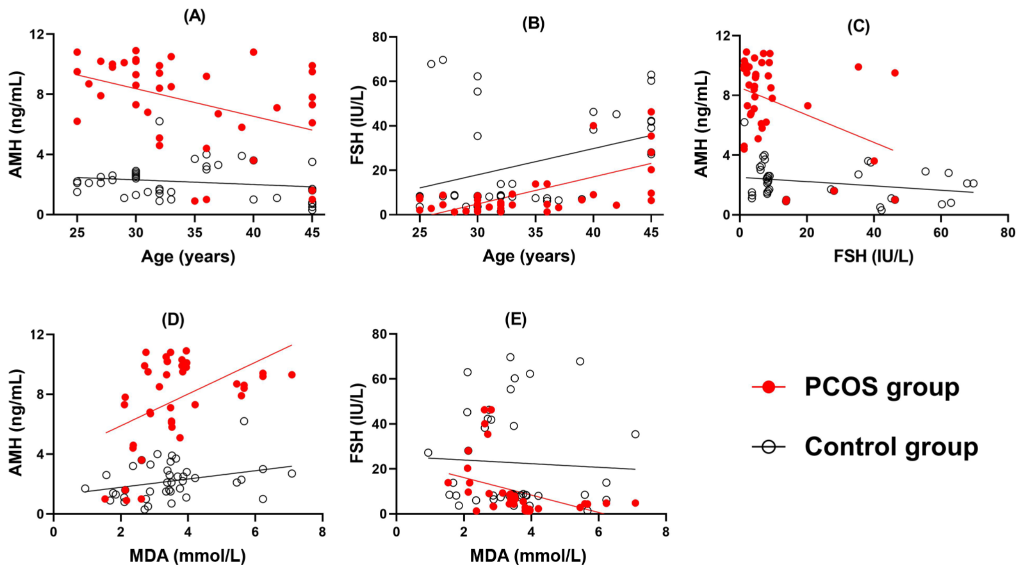


Fig. 3. The most significant correlations among various factors within both control group (depicted by the black line) and PCOS group (illustrated by the red line). The distinctive correlations include (A) AMH and age, (B) FSH and age, (C) AMH and FSH, (D) AMH and MDA, and (E) FSH and MDA

After the levels of FSH and AMH had been compared, the data revealed a negative correlation within the PCOS group (Pearson correlation = -0.38, *p*-value = 0.01) (**Fig. 3**; **Table 2**). This finding aligned with prior research (Lie Fong *et al.,* 2012; Okunola *et al.,* 2017; Singer *et al.,* 2009). The negative correlation indicated that an increasing concentration of basal serum FSH, along with a decreasing random AMH, correlates with the decline in ovarian reserve, constantly connected to aging. Conversely, the analysis found no statistical difference between FSH and AMH in healthy women. This absence of correlation in the fertile group implies a more complex or nuanced relationship between these two hormonal markers in women with normal fertility.

Previous studies have posited a direct impact of vitamin D on AMH synthesis. Notably, individuals with higher vitamin D concentrations may potentially sustain their ovarian reserve for extended periods. Additionally, other investigations suggested that vitamin D plays a role of a positive modulator in the synthesis of AMH (Muscogiuri *et al.,* 2017; Revelli *et al.,* 2009). To further explore this relationship, vitamin D levels were assessed in seven specific samples, deemed most impactful based on the correlations observed among AMH, FSH, and MDA. Notably, data in **Table 1** revealed no statistically differences in terms of vitamin D content between the PCOS and the control groups. This study aligns with prior findings that indicated no statistically significant distinctions in vitamin D levels between these two groups (Kim *et al.,* 2014; Moini *et al.,* 2015; Rahsepar *et al.* 2017). Although these findings do not demonstrate a specific correlation between vitamin D levels and PCOS, they highlight an interaction among vitamin D and AMH synthesis emphasizing the multifaceted nature of factors that impact the ovarian reserve. To fully understand the complex relationships between vitamin D, AMH, and reproductive health, more investigation is necessary.

CONCLUSION

The study concludes with significant findings that contribute to understanding the ovarian reserve dynamics and the impact of oxidative stress in PCOS. The identified correlations between FSH, AMH, and age within the PCOS group provide valuable insights into the complexities of the ovarian reserve dynamics associated with advancing age. Moreover, the study found that PCOS patients had significantly higher mean serum MDA levels than controls, indicating enhanced oxidative stress. The non-significant difference in serum GSH levels between the test and control groups emphasizes the imbalance in antioxidants. The notable link between AMH and MDA suggests a potential connection between the risks of PCOS and the role of free radicals in the female reproductive tract.

THE LIMITATIONS OF THE STUDY

The study involved only 80 female participants, and was conducted at a single medical center; therefore, the generalizations of the findings may not be achievable. Furthermore, diverse potential confounding factors, such as diet, lifestyle, drugs, and genetic versions, were not thoroughly managed or accounted for, potentially impacting the outcomes. Thus, the results of the study should be further supported and expanded in the subsequent research involving a bigger sample of more diverse participants.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interest: the author declares that the study was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

Animal rights: this article does not include animal studies.

Human rights: all studies were conducted in accordance with the Declaration of Helsinki guidelines. Women's blood samples were obtained from the Nineveh Health Directorate Oncology and Nuclear Medicine Hospitals, Iraq. The permission for this study was approved by the Ethics Committee on 10/01/2022, under reference No 124.

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АНАЛІЗ ФОЛІКУЛОСТИМУЛЮВАЛЬНОГО ПОРІВНЯНО З АНТИМЮЛЛЕРОВИМ ГОРМОНОМ ЗА СИНДРОМУ ПОЛІКІСТОЗНИХ ЯЄЧНИКІВ: КЛІНІЧНЕ ЗНАЧЕННЯ

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Вступ. Синдром полікістозних яєчників (СПКЯ) — це гормональний розлад, який вражає жінок репродуктивного віку. Викликає занепокоєння значна діагностична прогалина: близько 75 % жінок у лікарнях мають діагноз СПКЯ через суперечливі діагностичні критерії. Прояви СПКЯ є багатогранними, разом із гіперандрогенією, яка призводить до надмірного вироблення чоловічих гормонів, гірсутизму й нерегулярних менструальних циклів, що часто тягне за собою безпліддя та серйозні проблеми із психічною працездатністю. Роль окисного стресу не можна недооцінювати; це згубно впливає на репродуктивну тривалість життя і посилює проблеми безпліддя.

Матеріали та методи. Дослідження проводили серед 80 жінок віком від 25 до 45 років, які були розподілені на групи СПКЯ та контрольні групи. Зразки крові жінок було отримано з відділу охорони здоров'я Ніневії, Онкологічної лікарні та лікарні ядерної медицини в Іраку. Рівні фолікулостимулювального (ФСГ) і антимюллерового гормонів (АМГ) було виміряно за допомогою наборів ELISA. Крім того, біохімічні показники, такі як рівень глюкози, загальний холестерин, малондіальдегід (МДА) і глутатіон (GSH), було виміряно в обох групах. Взаємозв'язок між змінними було досліджено за допомогою непарного *t*-тесту, коефіцієнта кореляції Пірсона та множинного регресійного аналізу.

Результати й обговорення. Рівні ФСГ позитивно корелювали з віком, тоді як АМГ був пов'язаний з віком обернено, що свідчить про те, що старіння зменшує резерв яєчників у жінок із СПКЯ. Крім того, у групі СПКЯ спостерігали значне збільшення середнього рівня малонового діальдегіду (МДА) порівняно з контрольною групою, що узгоджується зі суттєвим зв'язком між рівнем АМГ та МДА. Примітно, що не виявлено статистично значущої кореляції між ФСГ і АМГ щодо рівня глюкози та загального холестерину (ЗХ) у групі СПКЯ. Отже, моніторинг цих показників може покращити клінічне лікування СПКЯ.

Висновок. Це дослідження виявляє вікові зміни в оваріальному резерві за СПКЯ. Крім того, підвищений оксидативний стрес, що вказує на збільшення рівнів МДА, підкреслює складність цього стану.

Ключові слова: синдром полікістозних яєчників, фолікулостимулювальний гормон, антимюллерівський гормон, індекс маси тіла, малоновий діальдегід

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