Jinekoloji - Obstetrik ve Neonatoloji Tıp Dergisi
The Journal of Gynecology-Obstetrics and Neonatology

ÖZGÜN ARAŞTIRMA / ORIGINAL ARTICLE

DOI: 10.38136/jgon.1550129

Basal LH/FSH ratio and basal estradiol level in relation to oocyte and embryo quality in cases with polycystic ovary syndrome

Polikistik over sendromlu olgularda bazal LH/FSH oranı ve bazal estradiol seviyesinin oosit ve embriyo kalitesiyle ilişkisi

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ABSTRACT

Aim: Our aim is to investigate the effect of the basal luteinizing hormone/follicle stimulating hormone ratio and basal estradiol levels on in vitro fertilization outcomes in patients with polycystic ovary syndrome.

Materials and Methods: Cases with polycystic ovary syndrome between the ages of 18-35 were involved in the study. The characteristic features of the cases, laboratory values, total stimulation duration and dose, endometrium thickness and dominant follicle number on the ovulation trigger day, maturity and number of oocytes, quality and number of embryos, number of transferred embryos, implantation rate and clinical pregnancy rates were recorded from the hospital registry system and files. SPSS version 26.0 is used for analyzing the data.

Results: The average number of oocytes obtained from all cases was 15, MII oocyte rate was 85%, embryo number was 8 and high quality embryo rate was 66%. Oocyte and embryo number were higher in group 2 (p=0,04 ve p<0,01). No notable correlation was detected between basal estradiol levels and MII oocyte rates (r=-0.1, p=0.06). No notable correlation was detected between basal estradiol levels and good quality embryo rate (r=0.03, p=0.6).

Conclusion: In conclusion, the number of oocytes and embryos was higher in polycystic ovary syndrome cases with a basal luteinizing hormone/follicle stimulating hormone ratio ≥ 1.5. However, basal luteinizing hormone /follicle stimulating hormone ratio and basal estradiol level were not related to oocyte and embryo quality.

Keywords: Oocyte maturation, embryo quality, in vitro fertilization

ÖZ

Amaç: Amacımız, polikistik over sendromlu olgularda, bazal lüteinize edici hormon/folikül stimüle edici hormon oranı ve bazal estradiol düzeyinin, in vitro fertilizasyon sonuçları üzerine etkisinin araştırılmasıdır.

Gereçler ve Yöntem: 18-35 yaş arası, polikistik over sendromlu olgular çalışmaya dahil edilmiştir. Olguların karakteristik özellikleri, laboratuvar değerleri, total stimülasyon süresi ve dozu, ovulasyon tetikleme günü endometrium kalınlığı ve dominant folikül sayısı, elde edilen oosit maturite ve sayısı, embriyo kalite ve sayısı, transfer edilen embriyo sayısı, implantasyon oranı ve klinik gebelik oranları hastane kayıt sistemi ve dosyalarından elde edilerek kaydedilmiştir. Elde edilen veriler SPSS 26.0 versiyonu ile analiz edilmiştir.

Bulgular: Tüm olgulardan elde edilen ortalama oosit sayısı 15, MII oosit oranı %85, embriyo sayısı 8 ve iyi kalite embriyo oranı %66 olarak saptanmıştır. Oosit ve embriyo sayısının grup 2'de daha yüksek olduğu saptanmıştır (p=0,04 ve p<0,01). Bazal estradiol düzeyleri ve MII oosit oranları arasında anlamlı korelasyon saptanmamıştır (r=-0,1, p=0,06). Bazal estradiol düzeyleri ve iyi kalite embriyo oranı arasında anlamlı korelasyon saptanmamıştır (r=0,03, p=0,6).

Sonuç: Bazal lüteinize edici hormon/folikül stimüle edici hormon oranı ≥ 1,5 olan polikistik over sendromlu olgularda, oosit ve embriyo sayısının daha yüksek olduğu saptanmıştır. Bazal lüteinize edici hormon/folikül stimüle edici hormon oranı ve bazal estradiol seviyesinin oosit ve embriyo kalitesi ile ilişkili olmadığı saptanmıştır.

Anahtar Kelimeler: Oosit matürasyonu, embriyo kalitesi, in vitro fertilizasyon

Cite as: Akdöner A, Yavuz O, Mankan KA, Balcı U, Kovalı Sezer M, Doğan SS, et al. Basal LH/FSH ratio and basal estradiol level in relation to oocyte and embryo quality in cases with polycystic ovary syndrome. Jinekoloji-Obstetrik ve Neonatoloji Tıp Dergisi 2025;22(2):234–240.

Geliş/Received: 14.09.2024 • **Kabul/Accepted:** 14.04.2025

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Çevrimiçi Erişim/Available online at: https://dergipark.org.tr/tr/pub/jgon

INTRODUCTION

Polycystic ovary syndrome (PCOS), which is one of the most widespread hormonal conditions, affects 5-10% of reproductive age women (1). The serum luteinizing hormone (LH) level and the ratio of LH to follicle stimulating hormone (FSH) are higher in women with PCOS. The LH/FSH ratio may be increased in 35-90% of patients due to the raise in the frequency and amplitude of LH pulses (1-3). Some studies have indicated that an early-onset LH peak during antagonist cycles influences the quality of oocytes and embryos, as well as clinical pregnancy outcomes. On the other hand, it has been shown that the abnormal increase during the LH peak does not affect clinical results (4-7). Therefore, there are controversial results regarding the effect of basal LH level and LH/FSH ratio on fertility (8).

In a study evaluating factors related to ovarian hyperstimulation syndrome (OHSS), it was shown that basal estradiol (E2) levels are related to the severity of OHSS and that the number of oocytes obtained in these severe OHSS cases, is higher than in other cases, but the quality of oocytes is lower (9). In addition, there are conflicting results regarding whether basal E2 levels are negatively or not associated with oocyte number and maturation. Additionally, some studies have shown that low serum basal E2 levels are associated with low clinical pregnancy rates (10-13). Therefore, there is no clear data regarding the relationship of basal E2 level with in vitro fertilization (IVF) results.

As a result, there is no sufficient data regarding the effect of LH/FSH ratio and basal E2 level on IVF results in cases with polycystic ovary syndrome. Therefore, our aim is to investigate the relationship of basal LH/FSH ratio and basal E2 level with clinical pregnancy outcomes and the embryo and oocyte number and quality in patients with PCOS who received IVF/intracytoplasmic sperm injection (ICSI) treatment with an antagonist protocol.

MATERIALS AND METHODS

Our study was carried out at Dokuz Eylül University, Department of Gynecology and Obstetrics, In Vitro Fertilization Center, between March 2024 and July 2024, after obtaining ethics committee permission with decision number 2024/07-11. Our study followed the guidelines established by the 2008 Declaration of Helsinki. Cases between the ages of 18 and 35, who had infertility due to PCOS only or due to PCOS and tubal factor, and who received IVF/ICSI treatment with an antagonist protocol and whose treatment and follow-up were performed in our center, were involved in the study. And cases over 35 years of age and with additional causes of infertility were not involved in the study. Before any treatments were administered, we received informed consent forms from all patients treated in our clinic. Age, body mass index (BMI), Ferriman Gallwey score (FGS) cause of infertility, primary/secondary infertility, basal FSH, basal LH, basal E2, basal LH/FSH ratio, thyroid stimulating hormone (TSH), prolactin (PRL), IVF cycle protocol, total recombinant FSH (rFSH) dosage, total stimulation time (days), endometrium thickness on the ovulation trigger day, number of dominant follicles on the ovulation trigger day, number and maturity of oocytes (number and rate of mature oocytes, immature oocytes, germinal vesicle (GV) oocytes, degenerated oocytes), quality and number of embryos (quality I and II), number of transferred embryos, fertilization, cleavage, implantation, and clinical pregnancy rates were recorded from the hospital registry system and files.

The cases were first divided into two groups according to the LH/FSH ratio and these groups were compared in terms of oocyte maturity and number, embryo quality and number, and clinical pregnancy rates. The LH/FSH ratio threshold value was accepted as “1.5” based on previous studies (8,14,15). Then, the cases with fresh embryo transfer were divided into two groups according to whether there was a clinical pregnancy or not, and basal E2 levels were compared between the groups. Finally, correlation analysis was performed between the mature oocyte rate, high quality embryo rate and basal E2 level.

Human menopausal gonadotropin (HMG) and/or recombinant FSH was started on the 2nd-4th day of the cycle to the cases included in the study and who did not have any obstacle to start controlled ovarian stimulation (COS) and were planned to have a fresh or frozen cycle. Gonadotropin doses were administered in the range of 150-300 units with individualized protocols. The patients were called for intermittent check-ups and dose adjustments were made. When a follicle measuring 12-14 mm was formed in the TV-USG follow-ups, gonadotropin releasing hormone (GnRH) antagonist was given until ovulation was triggered in order to prevent the LH peak. GnRH agonist and/or recombinant human chorionic gonadotropin (rec-hCG) was used to trigger ovulation. Oocyte pick-up (OPU) was performed under TV-USG guidance 34-36 hours after ovulation triggering. The oocytes were examined mechanically and chemically and then evaluated morphologically with an inverted microscope (Olympus IX70, Olympus, Vienna, Austria). Oocytes were determined according to their nuclear maturation; mature, metaphase II (MII) oocytes, immature, metaphase I (MI) oocytes, germinal vesicle (GV) oocytes and degenerating oocytes. Then, IVF/ICSI procedure was applied to the oocytes with the sperm which obtained from the patients’ partners (16).

Fertilization was determined by observing two separate pronuclei under the microscope 16–18 hours after the IVF/ICSI procedure.

Cleavage was assessed 24 hours after fertilization. Embryo evaluation was performed approximately 48–72 hours after IVF/ICSI. Embryo quality; It was calculated using modified Veeck criteria based on morphological features, including cell number, symmetry, shape of blastomeres, size of cytoplasmic fragmentations in the perivitelline space, and cleavage rate (16). Grade 1 embryo (top quality embryo); blastomeres are round and equal in size, 0% fragmentation, grade 2 embryo; blastomeres are round and equal in size, 0–25% fragmentation, grade 3 embryo; blastomeres unequal in size and 25–50% fragmentation, grade 4 embryo; blastomeres were defined as equal or unequal size and >50% fragmentation rate (17-19).

Then, to the cases planned as fresh cycles, a maximum of two embryos were transferred on the 2nd, 3rd or 5th day, depending on the quality and number of embryos, and implantation and clinical pregnancy rates were evaluated. Cases found to be β-HCG positive after transfer were considered implantation positive. Cases in which a fetus with heartbeat was observed in intrauterin cavity during ultrasound control were evaluated as clinical pregnancy positive. In cases planned as frozen cycles, embryos were cryopreserved.

Data analysis was performed using SPSS version 26.0 (IBM Inc., Chicago, IL, USA). Mann-Whitney U test is used for analyzing the not normally distributed parameters. Categorical data were assessed using the Chi-square test and Fisher's exact test. Qualitative data are expressed as numbers and percentages (%). Quantitative data of all cases are stated as median (minimum-maximum). Spearman correlation analysis was performed for correlation analysis between variables. Kolmogorov-Smirnov test is used for evaluation of normal distribution of the data. Results were assessed using a 95% confidence interval (CI). $p<0.05$ was considered significant.

RESULTS

Among our cases, 90 cases (75%) with an LH/FSH ratio of <1.5 (Group 1) were detected, while 30 cases (25%) with an LH/FSH ratio of ≥1.5 (Group 2) were detected. While the median age of all our cases was 30 (20-35), the median age of group 1 was 30 and group 2 was 29. The age difference was significant ($p = 0.02$). While 119 (99.2%) of our cases were primary infertile, one (0.8%) was secondary infertile. In terms of BMI, FGS, basal FSH, basal, E2, TSH and PRL values, no notable difference was detected. However, there was a significant difference between the basal LH values and basal LH/FSH ratios ($p<0.0001$ and $p<0.0001$), (Table 1).

The average number of oocytes obtained from all cases was 15, the MII oocyte rate was 85%, the embryo number was 8 and the good quality embryo rate was 66%. When the groups were evaluated in relation to oocyte and embryo number, it was found that the oocyte and embryo number were significantly higher in group 2 cases than in group 1 cases (n=17 vs n=13, n=10.5 vs n=7) ($p=0.04$ and $p<0.01$). No notable difference was detected in relation to the embryo quality, MII oocyte rate, immature oocyte rate, GV oocyte rate, degenerated oocyte rate, fertilization and cleavage rates. While no notable difference was found in endometrial thickness and total FSH dosage, total stimulation duration (11 days vs 10 days) and total dominant follicle number (18 vs 13.5) were significantly higher in group 2 cases ($p=0.03$ and $p=0.01$), (Table 2).

Among our cases, there are 51 cases in which fresh embryo transfer was performed. These cases were splited into groups in accordance with LH/FSH ratios (Group 1-LH/FSH <1.5–Group 2-LH/FSH ≥1.5). The groups were compared in relation to oocyte and embryo number and quality, number of transferred embryos, implantation

Table 1. Characteristic Features of the Cases and Laboratory Findings

	All Cases (n=120, 100%) Median (Min.-Max.)	Group I (LH/FSH <1,5) (n=90, 75%)	Group II (LH/FSH ≥1,5) (n=30, 25%)	p
Age	30 (20-35)	30 (21-35)	29 (20-35)	0.02
BMI (Kg/m²)	26 (18-45)	25.7 (18-45)	26.6 (18-37)	0.3
FGS	7 (3-29)	7 (3-29)	8 (3-25)	0.8
Basal FSH	6.3 (2-12.2)	6.4 (3.1-12.2)	6.1 (2-8)	0.2
Basal LH	6.1 (1.7-53)	4,7 (1,7-17,4)	12.4 (3.9-53)	<0.0001
Basal E2	52 (20-628)	53 (20-628)	46.5 (20.7-102)	0.09
Basal LH/FSH Ratio	0.9 (0.2-7.4)	0.7 (0.2-1.4)	1.9 (1.5-7.4)	<0.0001
TSH	1.7 (0.1-5.7)	1.7 (0.1-5.7)	1.8 (0.6-5.2)	0.3
PRL	12.6 (2.5-141)	12.8 (2.5-35.3)	10.6 (3.7-141)	0.5

Table 2. Evaluation of All Cases in Terms of Oocyte Number and Maturation, Embryo Number and Quality, Fertilization Rate, Cleavage Rate, Total Recombinant FSH Dosage, Total Stimulation Duration, Endometrial Thickness, Total Dominant Follicle Number and Other Hormone Levels According to Basal LH/FSH Ratios

	All Cases (n=120, 100%) Median (Min.-Max.)	Group I (LH/FSH <1,5) (n=90, 75%)	Group II (LH/FSH ≥1,5) (n=30, 25%)	P
Oocyte number	15 (2-44)	13 (3-44)	17 (2-34)	0.04
MII Oocyte Rate	85% (33.3%-100%)	83.3% (33.3%-100%)	87.8% (64.2%-100%)	0.2
Immature Oocyte Rate	0% (0%-67%)	0% (0%-67%)	0% (0%-33%)	0.09
GV Oocyte Rate	5% (0%-43%)	5.5% (0%-43%)	4.5% (0%-36%)	0.5
Degenerate Oocyte Rate	0% (0%-30%)	0% (0%-30%)	0% (0%-22%)	0.9
Fertilization Rate	75% (10 %-100 %)	72.1% (10%-100%)	77% (41%-100%)	0.2
Cleavage Rate	100% (59 %-100 %)	100% (60%-100%)	100% (59%-100%)	0.5
Embryo number	8 (1-24)	7 (1-24)	10.5 (2-17)	<0.01
Good Quality Embryo Rate	66% (0 %-100 %)	66% (0%-100%)	66% (18%-100%)	0.4
Total recombinant FSH dosage (units)	1856.25 (300-5475)	1818.75 (600-5475)	1912.50 (300-4875)	0.7
Total stimulation duration (days)	11 (3-18)	10 (4-16)	11 (3-18)	0.03
Endometrial thickness (mm)	11 (4.9-16)	11 (4.9-16)	11.1 (7.2-14)	0.9
Total dominant follicle number	15 (4-35)	13.5 (4-34)	18 (4-35)	0.01

Table 3. Evaluation of Fresh Embryo Transfer Cases in Terms of Oocyte Number and Maturation, Embryo Number and Quality, Number of Transferred Embryos, Implantation Rates and Clinical Pregnancy Rates according to Basal LH/FSH Ratios

	All Cases (n=51, 100%)	Group I (LH/FSH <1,5) (n:41, 80.4%)	Group II (LH/FSH ≥1,5) (n=10, 19.6%)	p
Oocyte number	12 (3-23)	11 (3-23)	15.5 (3-19)	0.1
MII Oocyte Rate	87.5% (33.3%-100%)	83.3% (33.3%-100%)	92.3% (66.6%-100%)	0.08
Embryo number	7 (1-15)	6 (1-15)	9.5 (2-13)	0.02
Good Quality Embryo Rate	66% (0%-100%)	66% (0%-100%)	64.5% (31%-82%)	0.5
Transferred Embryo Number	1 (1-2)	1 (1-2)	1 (1-2)	0.4
Implantation Rate	23 (45.1%)	20 (48.8%)	3 (30%)	0.2
Clinical Pregnancy Rate	21 (41.2%)	18 (43.9%)	3 (30%)	0.4

and clinical pregnancy rate. While no notable difference was found in terms of oocyte number, MII oocyte rates and good quality embryo rates, the embryo number was significantly higher in group 2 (9.5 vs. 6, p = 0.02). No significant difference was found in relation to the number of embryos transferred, implantation rate and clinical pregnancy rate (Table 3).

The cases who underwent fresh embryo transfer were splited into two groups in accordance with clinical pregnancy status and compared in terms of basal FSH, LH, E2 and basal LH/FSH ratios. No significant difference was detected (Table 4).

Correlation analysis was performed to evaluate the relationship between MII oocyte rates and good quality embryo rates with basal hormone values (FSH, LH, E2), TSH, PRL, total rFSH dose, stimulation duration and dominant follicle numbers. No notable correlation was found between basal FSH, basal LH, basal E2, PRL, TSH values with MII oocyte rates and good quality embryo rates. When total rFSH dosage, total stimulation time, and good quality embryo and MII oocyte rates were evaluated, no significant correlation was detected. While there was no significant relationship between the total dominant follicle number and the MII oocyte rate, a significant negative correlation was found

Table 4. Comparison of Basal FSH, LH, E2 Levels and Basal LH/FSH Ratios in Cases with Fresh Embryo Transfer, According to Clinical Pregnancy Status

	All Cases (n=51, 100%)	Clinical Pregnancy + (n=21, 41.2%)	Clinical Pregnancy - (n=30, 58.8%)	p
Basal FSH	6.6 (2-12.2)	6.8 (3.6-12.2)	6.6 (2-12)	0.8
Basal LH	6.1 (1.7-53)	5.5 (2.3-53)	6.3 (1.7-25)	0.4
Basal E2	55 (20-628)	54 (25-628)	56 (20-154)	0.9
Basal LH/FSH Ratio	0.9 (0.2-7.4)	0.8 (0.3-7.4)	0.9 (0.2-3.6)	0.4

Table 5. Comparison of the Relationship Between Mature Oocyte Ratio and Embryo Quality and Basal Hormone Levels, Total FSH Dosage, Total Stimulation Duration and Total Dominant Follicle Number in All Cases

	MII Oocyte Rate (r-coefficient, p value)	Good Quality Embryo Rate (r-coefficient, p value)
Basal FSH	0.03, 0.7	0.03, 0.6
Basal LH	0.1, 0.05	0.1, 0.2
Basal E2	-0.1, 0.06	0.03, 0.6
TSH	-0.02, 0.7	-0.01, 0.8
PRL	0.04, 0.6	-0.01, 0.8
Total recombinant FSH dosage (units)	0.06, 0.5	0.03, 0.7
Total stimulation duration (days)	0.003, 0.9	0.004, 0.9
Total dominant follicle number	0.07, 0.3	-0.2, 0.01

between the total dominant follicle number and the good quality embryo rate (r =-0.2, p = 0.01), (Table 5).

DISCUSSION

According to the results of our study, when all cases were evaluated, the oocyte (p=0.04) and embryo number (p<0.01) were significantly higher in cases with basal LH/FSH ratio ≥1.5. However, when the groups were evaluated in terms of embryo quality, oocyte maturation, degenerated oocyte, immature oocyte and GV oocyte rate, fertilization rate, and cleavage rate, no significant difference was found. Furthermore, an evaluation of cases involving fresh embryo transfers revealed no significant differences in implantation and clinical prenancy rates. In line with the results, we can say that there is a positive relationship between high basal LH/FSH ratio and the oocyte and embryo number, but this relationship does not have a significant effect on IVF results. When the literature was evaluated, similar to our findings, Ganor-Paz et al. found in their study that a high basal LH/FSH ratio (>1.5) did not negatively affect pregnancy outcomes (15). In another study, it was found that high basal LH and high basal LH/FSH ratio did not have negative effects on embryological data, pregnancy outcomes and clinical characteristics (20). In the research of Singh et al., no notable relationship was observed between the basal LH/FSH ratio and the number of oocytes, embryo formation and clinical pregnancy rates (8). However, another study showed that high basal LH level was associated with lower success rates (21). As a difference, in our study, the oocyte and embryo number in the group with high basal LH/FSH ratio were significantly higher. However, no notable difference was detected in relation to oocyte maturation, high quality embryo rate and clinical pregnancy rates. While in Singh et al.'s research, fertilization rates were higher in groups with low basal LH/FSH ratio and low basal LH, we found no significant difference in relation to fertilization and cleavage rates (8). Considering that anti-mullerian hormone (AMH) is highly correlated with the basal LH/FSH ratio (22), it can be said that the reason why we obtained a higher number of oocytes in the group with a higher basal LH/FSH ratio is that the ovarian reserve in these cases is higher. The negative correlation between the total dominant follicle number and good quality embryo rates can be explained in a similar way. Although a higher number of follicles and oocytes are obtained in cases with high reserve, it can be thought that the rate of high quality embryos decreases due to the increase in the severity of PCOS. However,

there are contradictory data on this subject in the publications (8, 15, 20, 21). Similarly, it was thought that the fact that the cases in the second group consisted of younger women may be due to the fact that these women preferred to seek medical treatment earlier due to more severe symptoms. However, as a limitation of our study, this parameter could not be evaluated due to insufficient data in terms of AMH values of our cases. Also, in our study, unlike the literature, we found that the total stimulation duration is longer in group 2 cases (8, 20). This situation can similarly be explained by the fact that PCOS becomes more resistant to treatment as its severity increases (23).

During each menstrual cycle, the ratio changes between LH and FSH result in varying concentrations of androgens, estrogens and progesterone. The basal LH/FSH ratio shows that the maturation of the dominant follicle continues under the influence of FSH after the selection of the dominant follicle. On the other hand, in women with PCOS who are infertile, elevated amplitude and frequency of GnRH secretion result in heightened amplitude and frequency of LH secretion. Increased LH levels trigger raised androgen secretion from ovarian follicular theca cells. At the same time, FSH stimulates the conversion of excess androgen to estrogen in granulosa cells (24,25). Insufficient aromatization of androgens produced at increased levels by high LH causes low FSH levels and inadequate ovarian E2 levels in women with PCOS. Therefore, it can be said that high basal LH/FSH rates are associated with more deterioration in follicular development (8,26). It is hypothesized that this situation may be attributed as one of the reasons for the absence of a similar effect on quality of embryo and pregnancy outcomes despite the observed higher numbers of oocytes and embryos in the group characterized by a elevated basal LH/FSH ratio in our research. This suggests oocyte number alone is not sufficient for pregnancy success and pathologies at the follicular level are also effective in IVF success in PCOS cases.

In another study, an inverse relationship was found between LH levels on the day the antagonist was started and embryo quality, while no significant correlation was found in the correlation analysis between basal LH levels and LH levels on the day of the antagonist (27). In our study, consistent with this study, we did not detect a significant relation between basal LH levels and good quality embryo rates. It is thought that elevated basal LH levels may have a negative effect on the oocyte by causing a high androgenic environment (28). However, according to our study, no significant correlation was detected between basal LH levels and mature oocyte rates.

In a study evaluating the effect of estrogen on oocytes, it was shown that adding 17β estradiol to the medium in in vitro maturation (IVM) cycles increased fertilization and cleavage rates in oocytes. It can be said that estrogen affects the quality of mature oocytes, fertilization potential and early postfertilization development (29). As a difference, in our research, we found no correlation between basal E2 levels and mature oocyte rates. Upon literature review, alongside studies supporting our findings which asserting no significant relationship between basal E2 levels and oocyte maturation, there are also publications indicates a negative correlation between the oocyte number obtained in ART cycles and elevated basal E2 levels (10-12). Additionally, contrary to studies in the literature showing that elevated basal E2 negatively affects pregnancy rates, we found no notable difference in basal E2 levels between cases with and without clinical pregnancy (11,13). In order to clarify these contradictions regarding the relationship of basal E2 level with pregnancy outcomes and its effect on the oocyte, more specific studies on the effect of E2 at the follicular level need to be planned.

The strength of our study is that it aims to investigate the relationship between basal LH/FSH ratio and oocyte maturation and embryo quality in a specific patient group. There are not many studies in the literature evaluating the effect of the basal LH/FSH ratio on oocytes and embryos, and no definitive results have been obtained on this subject. In this respect, our study makes an important contribution to the literature. In addition, recently in our clinic, the number of fresh embryo transfer cases has decreased due to the preference of total cryopreservation in PCOS cases in order to decrease the risk of OHSS. Therefore, in our study, clinical pregnancy outcomes were evaluated with fewer cases. Studies with larger samples will be able to provide more precise data.

CONCLUSION

In conclusion, in our study, it was found that the oocyte and embryo number was higher in PCOS cases with a basal LH/FSH ratio ≥ 1.5. Yet, no significant effect was detected on oocyte maturation, embryo quality and clinical pregnancy outcomes. Similarly, there was no correlation between basal E2 level and mature oocyte rate and embryo quality. Based on these results, we can say that high basal LH/FSH ratio or high basal serum E2 level does not have a negative effect on IVF results. Nevertheless, it is believed that additional studies with larger sample sizes are still required.

Author Contributions

Conception and design: Aslı Akdöner; *Acquisition of data:* Kadir Alper Mankan, Umay Balci, Aslı Akdöner, Müge Kovalı Sezer, Sultan Seda Doğan; *Drafting the manuscript:* Aslı Akdöner, Onur Yavuz; *Statistical analysis:* Onur Yavuz, Aslı Akdöner; *Critical revision of the manuscript and supervision:* Murat Celiloğlu, Recep Emre Okyay, Mehmet Güney, Ömer Erbil Doğan, Erkan Çağlıyan

Conflict of Interest
The authors declare that there is no conflict of interest.

Financial Disclosure
The research received no funding

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