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Studying the Correlation Between Serum Hormone Levels in Infertile Women and the Results of IVF and Various Causes of Infertility

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Abstract

Background: Infertility is defined as the inability to achieve a clinical pregnancy following 12 months of consistent, unprotected sexual activity. Both male and female factors, or both, may contribute to infertility. Infertility is most often caused by ovulatory dysfunction, such as inadequate ovarian reserve (POR) and polycystic ovaries (PCO).

Methods: A cross sectional study includes 37 participants. The samples of blood were collected at cycle day two and detected the hormonal levels by MINI VIDAS system.

Results: The result of present study showed that follicle-stimulating hormone (FSH) and luteinizing hormone (LH) in women with female and combined factors with significantly different higher from male and unexplained factors with (p=0.000, p=0.000). While, the level of estradiol (E2), anti-Mullerian hormone (AMH) and Estradiol hormone (E2) at day of human chorionic gonadotropin (HCG) injection in women with male and unexplained factors with significantly different higher from female and combined factors (*P=0.007, P=0.000, P=0.003*) respectively. While, progesterone in women, there was no significant different between cause of infertility groups with p=0.467. In addition, Total oocyte number, Fertilization rate, Embryo Grade l(GI), Embryo Grade ll (GII) and transferred embryo of women with unexplained and male factor were significantly different from female and combined factor cases with (*P=0.056, P=0.037, P=0.001, p=0.059 and p=0.057*) respectively. Regarding the correlation this hormone with pregnancy outcomes, there is no statistical significance.

Conclusion: Serum FSH and LH levels were significantly associated with female and combined factor cases, whereas E2 day2, AMH, and E2 HCG were significantly associated with unexplained and male factor cases. In terms of progesterone, there was no significant difference between the causes of infertility groups. Furthermore, the total number of oocytes, fertilization rate, embryo grade l (GI), embryo grade ll (GII), and transferred embryo were all significantly associated with unexplained and male factor cases. There is no statistical significance to the correlation between these hormones and pregnancy outcomes.

دراسة العلاقة بين مستويات الهرمونات في مصل الدم لدى النساء المصابات بالعقم ونتائج الإخصاب خارج الجسم (IVF) وأسباب العقم المختلفة

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الخلاصة

المقدمة

يُعرَّف العقم بأنه عدم القدرة على تحقيق حمل سريري بعد 12 شهرًا من النشاط الجنسي المنتظم غير المحمي. وقد تكون العوامل الذكرية أو الأنثوية أو كلاهما سببًا في العقم. وغالبًا ما يكون العقم ناتجًا عن خلل في الإباضة، مثل ضعف احتياطي المبيض (POR) أو متلازمة تكيس المبايض.(PCO)

العينات وطرق العمل

شملت الدراسة المقطعية 37 مشاركة. تم جمع عينات الدم في اليوم الثاني من الدورة الشهرية، وتم الكشف عن مستويات الهرمونات باستخدام نظام.MINI VIDAS

النتائج

أظهرت نتائج الدراسة أن هرموني التحفيز الجريبي (FSH) والهرمون اللوتيني (LH) لدى النساء اللواتي يعانين من أسباب أنثوية أو مشتركة للعقم كانا أعلى بشكل ملحوظ مقارنةً بمن لديهن أسباب ذكرية أو غير مفسرة (p=0.000لكلا الحالتين.(بينما كانت مستويات الإستراديول(E2) ، والهرمون المضاد لمولر(AMH) ، وهرمون الإستراديول في يوم حقن هرمون موجهة الغدد التناسلية المشيمية البشرية (HCG) أعلى بشكل ملحوظ في حالات العقم ذات الأسباب الذكرية وغير المفسرة مقارنة بالحالات ذات الأسباب الأنثوية أو المشتركة(P=0.007 ، P=0.000، P=0.003على التوالي.(أما بالنسبة لهرمون البروجستيرون، فلم يكن هناك فرق معنوي بين مجموعات أسباب العقم.(p=0.467) بالإضافة إلى ذلك، فإن العدد الكلي للبويضات، ونسبة التلقيح، وجودة الأجنة من الدرجة الأولى (GI) والدرجة الثانية(GII) ، وعدد الأجنة المنقولة كانت مرتبطة بشكل ملحوظ بحالات العقم غير المفسرة وذات الأسباب الذكرية مقارنة بالحالات الأنثوية أو المشتركة(P=0.056) ، P=0.037، P=0.001، p=0.059، p=0.057على التوالي.(أما فيما يتعلق بارتباط هذه الهرمونات بنتائج الحمل، فلم يكن هناك دلالة إحصائية.

الاستنتاج

ارتبطت مستويات هرموني FSH و LHفي الدم بشكل معنوي بحالات العقم ذات الأسباب الأنثوية أو المشتركة، بينما ارتبطت مستويات E2 في اليوم الثاني، وAMH، و E2في يوم حقن HCG بشكل معنوي بالحالات غير المفسرة أو ذات الأسباب الذكرية. لم يكن هناك فرق معنوي في مستويات البروجستيرون بين مجموعات أسباب العقم. كما أظهرت النتائج أن العدد الكلي للبويضات، ونسبة التلقيح، وجودة الأجنة GI) و(GII، وعدد الأجنة المنقولة كانت مرتبطة بشكل ملحوظ بالحالات غير المفسرة أو الذكرية. لم يُلاحظ وجود دلالة إحصائية لارتباط هذه الهرمونات بنتائج الحمل.

1. Introduction

Approximately 8–12% of couples worldwide experience infertility, with female factors accounting for over 50% of instances (Organization, 2023). Infertility rates are particularly high in Iraq, where they are caused by late marriages, consanguinity, and a lack of access to cutting-edge reproductive treatments (Al-Hilli et al., 2021). Male factor 30% and female factor 40% are the most frequent causes of infertility(El Adlani et al., 2021). The inability of a male spouse to conceive a child with a fertile female partner is known as male infertility(Shah et al., 2021). It is accounting for 40–50% of all infertility causes. Female infertility has many causes, ovulation disorders is one of this causes (Sala Uddin et al., 2018). Ovulation disorders frequently manifest as irregular periods (oligomenorrhea) or no periods at all (amenorrhea). Polycystic ovarian syndrome (PCOS) and primary ovarian insufficiency are the most common causes of female infertility, according to studies conducted globally(Deshpande and Gupta, 2019, Man et al., 2022). Ovulation, menstruation, embryo implantation, and pregnancy are among the primary events of female reproductive function that are linked to hormones and inflammatory systems. Pregnancy difficulties may be predisposed by hormonal abnormalities and a hyperinflammatory condition that disrupt the immune-endocrine cross-talk between the decidua and trophoblast, the endometrium, and the myometrium and cervix (Vannuccini et al., 2018). In reference to the intra-cytoplasmic sperm injection (ICSI), a mature egg is directly injected with a single healthy sperm. This kind of technology is known as assisted reproductive technology (ART)(Geng et al., 2020). In this study, Iraqi infertile and sub fertile women's serum levels of FSH, LH, E2, progesterone, and AMH will be correlated with fertility cases and ICSI results (live birth, clinical pregnancy). Our research could help develop tailored protocols to maximize the success of ART in this underprivileged area**.**

2. Patients and Methods

Based on the most prevalent causes of infertility, 37 patients were split up into four groups for this study. Islamic Fertility Center at Al-Kafeel Hospital in Karbala performed Intracytoplasmic Sperm Injection (ICSI). All patients were diagnosed by skilled gynecologists and embryologists after completing an antagonist program. The patients were between the ages of twenty and forty-one. On the second cycle day, five milliliters of the patients' blood were drawn into a gel tube, allowed to clot, and then centrifuged for five minutes at 3000 rpm to separate the serum. FSH, LH, prolactin, E2, AMH, E2 day of HCG injection, and B.HCG concentrations were measured using serum using the MINI VIDAS system.

3. Results

3.1. Demographics Characteristics According to the Reasons of Infertility

The patients were between the ages of 20 and 41. Women with male, female, and combination factors for infertility had mean ages of 29.6, 29.6, 32.4, and 31.6 years, respectively. The patient groups did not differ significantly (P = 0.131). In patients with unexplained infertility, the mean body max index (BMI) was 25.5, 27.5, 32.4, and 31.6 for male, female, and combination factor infertility, respectively. Regarding body max index, there was no significant difference between the patient groups (P=0.079). The mean values for the duration of infertility were 11.2, 10.2, 11, and 8.3 years for the male factor, female factor, and unexplained infertility, respectively. These differences were not statistically significant (P= 0.156). Regarding the infertility types, primary infertility had an unexplained infertility count of 3, whereas male, female, and combination causes had counts of 9, 4, and 6, respectively. Male,

female, and combination factor counts were 10, 1, and 2, respectively, but the unexplained infertility count for secondary infertility was 2. The types of infertility did not significantly differ among the patient groups (P = 0.121). as shown in Table1.

Table1: Lists Demographic Traits Categorized by the Cause for Infertility

Variables	Cause of infertility								P value
	Unexplained infertility (5)		Male factor (19)		Female factor (5)		Combined factor (8)		
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	
Age (year)	29.6	4.09	29.6	5	32.4	5.6	31.6	5.06	0.131
BMI (Kg/m^2)	25.5	4.49	27.50	5.33	31.3	4.36	31.6	4.24	0.079
Duration (year)	11.2	2.94	10.2	5.58	11	4.18	8.3	4.83	0.156
	Count	%	Count	%	Count	%	count	%	
Primary Infertility	3	13.6	9	40.9	4	18.2	6	27.3	0.121
Secondary Infertility	**2**	13.5	10	66.7	1	6.7	2	13.3	
ANOVA test (LSD test), chi-square test, SD: standard deviation, infertility pri.: primary infertility, infertility sec.: secondary infertility.									

3.2. The Levels of Hormones in The Groups Under Study

The mean serum level of follicle stimulating hormone (FSH) in unexplained infertility cases was 4.62 mlU/ml, 4.45 mlU/ml in males, 7.64 mlU/ml in females, and 7.24 mlU/ml in combined factors. However, the female and combined factors differed significantly from the unexplained and male factors (P = 0.000). Furthermore, the mean serum luteinizing hormone (LH) level in the unexplained infertility group was 3.28 mlU/ml, 3.29 mlU/ml in the male factor group, 8.16 mlU/ml in the female factor group, and 6.26 mlU/ml in the combination factor group. However, the female factor caused a significant difference from the unexplained, male, and combination factor groups (P=0.000). In contrast, the mean progesterone levels in unexplained infertility were 0.78 ng/ml, 1.3 ng/ml for males, 0.93 ng/ml for females, and 0.98 ng/ml for combination factors. Serum progesterone levels did not significantly differ across patient groups (P=0.467). The mean levels of the hormone estradiol (E2) on cycle day two were 48.8 pg/ml for unexplained infertility, 45.66 pg/ml for males, 32.30 pg/ml for females, and 33.61 pg/ml for combined factors. However, there was a significant difference (p=0.005) between the unexplained factor and the male, female, and combined factor groups. The mean levels of anti-Mullerian hormone (AMH) were 2.91 ng/ml in cases of unexplained infertility, 3.30 ng/ml in male factor groups, 0.53 ng/ml in female factor groups, and 0.85 ng/ml in combination factor groups. Male causes, however, were significantly different from female, unexplained, and combination factors (P=0.000). On the day of the HCG injection, the mean levels of the hormone estradiol (E2) were 2185.04 pg/ml for unexplained infertility, 2703.85 pg/ml for males, and 1053.81 pg/ml for females, while the combined levels were 1365.00 pg/ml. However, there was a significant difference (P = 0.003) between the male factor and the unexplained, female, and combined factor groups see Table2.

Table2: Hormonal Levels Related to Infertility Reasons

Variables	Cause of infertility								P value
	Unexplained infertility (5)		Male factor (19)		Female factor (5)		Combined factor (8)		
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	
FSH (mIU/ml)	4.62	0.80	4.45	1.29	7.64	0.75	7.24	2.00	**0.000**
LH (mIU/ml)	3.28	0.38	3.29	0.70	8.16	1.78	6.26	1.78	**0.000**
Progesteron (ng/ml)	0.78	0.19	1.3	1.98	0.93	0.27	0.98	0.35	0.467
E2 day 2 (pg/ml)	48.8	7.30	45.66	5.03	32.30	5.16	33.61	4.54	**0.005**
AMH (ng/ml)	2.91	0.97	3.30	0.64	0.53	0.20	0.85	0.40	**0.000**
E2 HCG (pg/ml)	2185.04	480.77	2703.85	389.97	1053.81	823.43	1365.00	475.25	**0.003**

Follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol hormone (E2) at day two of the cycle, anti-mullerian hormone (AMH), and human chorionic gonadotropin injection (HCG) are all examples of hormones. ANOVA (LSD) test.

3.3. Clinical Characteristics Associated with Infertility Etiology Include

Among the groups, there was no significant difference (P = 0.276) in the mean number of attempts at intracytoplasmic sperm injection (ICSI): 1.8 for unexplained infertility, 1.6 for male factor cases, 1.8 for female factor cases, and 1.5 for the combined factor group. The mean number of total oocytes was 13.40 for unexplained infertility, 13.94 for male factor cases, 10.20 for female factor cases, and 11.71 for the combined factor group. However, there was a significant difference between the male factor and unexplained infertility groups (P=0.056). The mean maturity rate was 88.46 in the group with unexplained infertility, 79.22 in cases with male factors, 70.86 in the group with female factors, and 80.71 in the group with combination factors. No significant difference was found (P=0.197). While, Fertilization rates were 86.7 in the group with unexplained infertility, 78.84 in cases with male factors, 70.66 in the group with female factors, and 64.24 in the group with combination factors. Nonetheless, unexplained factor there was a significant difference from the male, female, and combination factor groups (P=0.037). The mean embryo Grade I (GII) was 3.66 in the group with unexplained infertility, 3.57 in the group with male factors, 2.33 in the group with female factors, and 2.00 in the group with combination factors. However, there was a significant difference (P=0.001) between the male factor and the unexplained, female, and combined factor groups. Furthermore, the mean embryo Grade I (GII) was 3.66 in the group with unexplained infertility, 3.57 in the group with male factors, 2.33 in the group with female factors, and 2.00 in the group with combination factors. Nonetheless, unexplained and male factors there were a significant from the combined and female factor groups (P = 0.059). The mean of embryo Grade III (GIII) was approximately 3.00 in the group with unexplained infertility, 2.42 in cases

with male factors, 2.33 in the group with female factors, and 2.50 in the group with combination factors. However, there was no significant difference between the groups (P=0.488). Regarding transferred embryos, the mean was 3.20 in the group with unexplained infertility, 3.50 in cases with male factors, 2.40 in the group with female factors, and 2.83 in the group with combination factors. However, Male and unexplained factors differed significantly from the female and combined factor groups (p=0.057). The male factor infertility group had the highest conception rate, with 52.63% of the females achieving a successful pregnancy as indicated by a positive blood B HCG test. Conversely, the lowest conception rate (20%) occurred when a female factor contributed to infertility. as shown in Table3.

Table3: Mean of Clinical Traits Based on the Reasons for Infertility

Variables	Cause of infertility								P value
	Unexplained infertility (5)		Male factor (19)		Female factor (5)		Combined factor (8)		
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	
ICSI attempt	1.8	1.09	1.6	0.67	1.8	1.09	1.5	0.75	0.276
Total oocytes	13.40	6.87	13.94	5.86	10.20	7.85	11.71	4.99	0.056
Maturity rate	88.46	12.09	79.22	21.24	70.86	23.73	80.71	15.76	0.197
Fertilization rate	86.7	12.16	78.84	17.41	70.66	40.44	64.24	29.80	0.037
Embryo GI	3.66	2.88	4.07	2.01	1.66	0.57	2.00	0.81	0.001
Embryo GII	3.66	2.30	3.57	2.10	2.33	0.57	2.00	1.41	0.059
Embryo GIII	3.00	2.64	2.42	1.74	2.33	1.15	2.50	1.73	0.488
Transferred embryo	3.20	0.44	3.50	0.78	2.40	1.14	2.83	1.16	0.057
	Count	%	Count	%	Count	%	Count	%	
B HCG result -ve	3	60	9	47.37	4	80	6	75	0.121
B HCG result +ve	2	40	10	52.63	1	20	2	25	
ANOVA test (LSD test), chi-square test, GI: Grade I, B HCG: Beta-Human Chorionic Gonadotropins, and ICSI: Intracytoplasmic Sperm Injection									

3.4. Hormonal Analysis Using B HCG (Pregnancy Outcome)

The mean values of FSH, LH, Progesterone, E2 day 2, AMH, and E2 HCG in pregnant women were 4.86, 4.77, 0.90, 64.84, 3.45, and 2515.1, in that order. While, FSH, LH, Progesterone, E2 day 2, AMH, and E2 HCG mean levels in non-pregnant women were 7.39, 4.73, 0.75, 57.18, 5.39, and 2079, respectively. Table4 demonstrate that there was no significant difference among the B-HCG result groups (p=0.098, 0.488, 0.069, 0.295, 0.268, and 0.124).

Table4: Mean Variations in Hormonal Research Based on B HCG (Pregnancy Outcome)

Variables	B-HCG				P value
	Positive (pregnant)		Negation(pregnant)		
	Mean	SD	Mean	SD	
FSH (mIU/ml)	4.86	1.46	7.39	7.18	0.098
LH (mIU/ml)	4.77	1.75	4.73	2.27	0.488
Progesterone (ng/ml)	0.90	0.41	0.75	0.29	0.069
E2 day 2 (pg/ml)	64.84	25.29	57.18	26.84	0.295
AMH (ng/ml)	3.45	2.84	5.39	10.79	0.268
E2 HCG (pg/ml)	2515.1	986.1	2079	743.5	0.124

4. Discussion

The patients' ages ranged from 20 to 41 years, with the mean ages of women with unexplained infertility, male factor, female factor, and combined factor being 29.6, 29.6, 32.4, and 31.6 years, respectively. There were no significant differences between the patient groups in terms of age (P =0.131). This results were compatible with other research, such as the one completed by(Sarapik et al., 2012) who discovered that the mean age of the male and female factors was 32.6 and 34.8 years, respectively. A study by (Al-Musawy et al., 2018) whereby the mean age (27.7) revealed that there were no statistically significant variations in the age of the PCOS group between the patient and control groups. Although the research by (Bouet et al., 2020) in which the mean age was (36.68) and there was considerably lower in the control group compared with the POR group (p< 0.001). In addition, The mean of body max index (BMI) in patients with unexplained infertility, male factor, female and combined factor infertility (25.5, 27.5, 31.3 and 31.6 correspondingly). The BMIs of the various patient groups did not differ significantly (P=0.079). The current study's findings were connected to those of prior investigations, including the one conducted by (Spanou et al., 2018) whose BMI values were reported to be 23.4 for male factors and 23.6 for PCOS, respectively, with no significant correlation found (P > 0.05). Additionally, a study by (Mehta et al., 2013) The male factor's BMI mean was 23.97, although there were no noteworthy findings. The study by (Kudsy et al., 2016) where the PCOS group's BMI mean was 27.19, with no discernible change (P>0.05).The mean values for the duration of infertility were 11.2, 10.2, 11, and 8.3 years for the unexplained infertility, male factor, female factor, and combined factor infertility, respectively. These differences were not statistically significant (P= 0.156). It aligns with prior research, including that conducted by(Swadi et al., 2023) in which mean of infertility duration was (5) with no significant result. While in the study by (Vural et al., 2015) in which the mean of infertility duration was (7.6) with highly significantly association (P =0.01). Regarding the types of infertility, there was no significant differences about infertility types between patient groups with (P =0.121) in current study. Several studies such as the study by (Swadi et al., 2023). Their results showed no discernible difference between primary infertility (34), and subsequent infertility. regarding hormone levels in relation to the reasons of infertility in patient groups. Follicle stimulating hormone (FSH) was 4.62 mlU/ml in unexplained infertility and 4.45 mlU/ml in male factor cases, but it was 7.64 mlU/ml in females and 7.24 mlU/ml in combined factors. On the other hand, the unexplained and male factors were significantly different from the female and combined factors (P=0.000), which is in line with other research, including those conducted by(Sarapik et al., 2012) who reported the mean of FSH in male factor was (5.6), in PCOS group was (5.7), with no significant result, the levels of FSH was normal in these groups. The mean of follicle stimulating hormone (FSH) in female factor group was (7.64). Compared to male and unexplained causes, the female component was significantly different (P=0.000). (Rebar, 2007) demonstrated that the diagnosis of POR requires elevated FSH levels. The findings of the current study were in line with those of other investigations, including the study by (Barbakadze et al., 2015) who reported the FSH mean were 8.96 in the under-35-year-old group and 11.23 in the 35-40-year-old group. The relationship between age and FSH was positive, and the relayw25w2tionship between FSH level and age was highly significant (P<0.0001). The mean blood level of luteinizing hormone (LH) was 3.28 mlU/ml in unexplained factor group, 3.29 mlU/ml in the male factor group, 8.16 mlU/ml in the female factor group,

and 6.26 mlU/ml in combined factor group. However, the female factor group was significantly different from unexplained, male, and combination factor groups with(P=0.000).Other research by(Liu et al., 2019) who discovered that the LH mean was (3.2) and (3.8), respectively, with no statistically significant outcome (P = 0.20). The female factor group mean was greater than the male factor, which is in line with several research, including the one conducted by (Lisi et al., 2005) who discovered the endocrinological condition that is associated with hypersecretion of LH and ovulatory failure, which is linked to elevated LH levels. Also, the research by (Jain et al., 2022) revealed that mean of LH in PCO was (6.95). Additionally, the research by (Tsakos et al., 2014) It was discovered that ovarian stimulation may be accurately predicted by basal LH levels. However, a study conducted by (Liu et al., 2020) found that there was no significant difference in the mean LH levels between the control group (P=927) and those with inadequate ovarian reserve (P=5.64). In contrast, the mean progesterone levels in unexplained infertility was 0.78 ng/ml, 1.3 ng/ml in male factor, 0.93 ng/ml in female factor, and 0.98 ng/ml in combined factors. Serum progesterone levels did not significantly differ across patient groups (P=0.467). However, this study's findings differed from those of (Sahin et al., 2020) They discovered that the group with unexplained infertility had significantly lower serum progesterone levels than the fertile control group (p=0.02). Variations in sample size may be the cause of this discrepancy. The mean levels of the hormone estradiol (E2) at cycle day two were 48.8 pg/ml for unexplained infertility, 45.66 pg/ml for male factor, 32.30 pg/ml for female factor, and 33.61 pg/ml for combination factor. However, unexplained infertility differed significantly from the combined, male, and female factors groups (P=0.005). It aligns with prior research, including that conducted by(Zhang et al., 2019) They discovered that the mean levels of the hormone estradiol in PCOS cases were 51.97 and 53.8, respectively, with no discernible difference. Regarding female factor patients' levels of estradiol hormone (E2) on cycle day two, a number of investigations carried out by (Liu et al., 2020) and (Zhang et al., 2021) which showed that the mean levels of the hormone estradiol were 30.10 and 34.8, respectively. Anti-Mullerian hormone (AMH) mean levels in unexplained infertility were 2.91 ng/ml, 3.30 ng/ml in male factor group, 0.53 ng/ml in female factor group, and 0.85 ng/ml in combination factor group. Male causes, however, differed significantly from female, unexplained, and combination variables (P=0.000). It aligns with prior research, including that conducted by(Jain et al., 2022) They discovered that PCOS patients had an average AMH of 7.04. Another study carried out by (Liu et al., 2020) showed that the AMH mean for POR patients was 0.58 and the control was 2.56; there was a significant difference between the groups (P=0.001). Additionally, the research by (Zhang et al., 2021) The mean AMH in POR was shown to be (0.6) correlated with the age of the female; the advanced age group displayed lower AMH, and there was a significant difference between young and old POR patients. However, the research conducted by(Barbakadze et al., 2015) AMH was reported to be (2.5) in the group under 35 and (1.1) in the group between 35 and 40. Age-specific variations were better indicated by AMH values than by other variables. Estradiol hormone (E2) levels in unexplained infertility were around 2185.04 pg/ml on the day of HCG injection, 2703.85 pg/ml in males, 1053.81 pg/ml in females, and 1365.00 pg/ml in combined factors. The male factor, however, differed significantly from the female, unexplained, and combination factor groups (P=0.003). It resembles the research by(Kavrut et al., 2022) who disclosed that in POR instances, the mean E2 on HCG day was 684.66. According to the current study, the mean number of

intracytoplasmic sperm injection (ICSI) attempts was 1.8 in the group with unexplained infertility, 1.6 in cases with male factors, 1.8 in the group with female factors, and 1.5 in the group with combination factors. no significant variation between the groups (P=0.276). Females with unexplained infertility and male factors had mean total oocyte numbers of 13.40 and 13.94, respectively, whereas females with female or combined infertility had mean total egg counts of 10.20 and 11.71, respectively. The statistical significance of these differences was minor (p=0.056). A study carried out by (Swadi et al., 2023) They stated that the median number of oocytes in the male factor was 12, which was linked to excellent stimulation of FSH, AMH, and E2. Regarding the mean of maturity rate was 88.46 in the group with unexplained infertility, 79.22 in cases with male factors, 70.86 in the group with female factors, and 80.71 in the group with combination factors. However, no significant difference was found (P=0.197). This outcome contradicted a study of (Kamath et al., 2008) They discovered a strong correlation between PCOS etiology and maturity rate (P=0.006). Regarding the rate of fertilization, the current study's mean values for the unexplained, male, female, and combination factors were 86.7, 78.84, 70.66, and 64.24, respectively. The results of these differences were significant (p=0.037). This finding clarifies how the reason of infertility affects the rate of fertilization. Fertilization rates declined for women with female and mixed factors, whereas they increased for couples with unexplained infertility and male factors, according to the study. A study carried out by (Xu et al., 2022) According to their findings, ICSI greatly increases the rate of normal oocyte fertilization and the cycle's clinical pregnancy rate in male infertility. Additionally, it has a great safety profile and little effect on unfavorable pregnancy outcomes or obstetric and perinatal problems. In addition to the normal amor female side, which indicates good egg quality, the embryologist venally selects bept sperm for injection, demonstrating the ability of ICSI to overcome male factor causes. The mean embryo Gradel (GI) was 3.66 in the group with unexplained infertility, 4.07 in cases of male factors, 1.66 in the group with female factors, and 2.00 in the combined group. There was statistical significance (P=0.001) in these grades I differences. Furthermore, the mean embryo Grade I (GII) was 3.66 in the group with unexplained infertility, 3.57 in the group with male factors, 2.33 in the group with female factors, and 2.00 in the group with combination factors. However, there was a significant difference (P = 0.059) between the male and unexplained factor groups and the female and combined factor groups. The findings of the current study concurred with a study by (Sarapik et al., 2012) He stated that the male factor was (3.8), PCO was (2.9), and POR was (1.0) for high-quality embryos (embryo Grade I and ll). POR patients differed greatly from other patient populations (Sarapik et al., 2012). It would demonstrate the ability of a healthy oocyte source to fix a variety of sperm abnormalities in addition to the embryologist's selection of the most viable sperm. The mean of Embryo Grade III (Glll) was 3.00 in the group with unexplained infertility, 2.42 in the group with male factors, 2.33 in the group with female factors, and 2.50 in the group with combination factors. Nevertheless, there was no significant difference between the groups (P=0.488). This research runs counter to the study by (Lin et al., 2013) showed that poor embryo quality (Embryo Grade III) was associated with a decrease in AMH. The mean of transferred embryos was 3.20 in the group with unexplained infertility, 3.50 in instances with male factors, 2.40 in cases with female factors, and 2.83 in the group with combination factors. On the other hand, male and unexplained infertility factors differed significantly from female and combined factor causes (P=0.057). Regarding the female aspect in this study, fewer embryos are

acceptable for transfer because of the low quantity and poor quality of oocytes. This outcome is consistent with a study finding of (Opsahl et al., 2001) who showed the correlation between oocyte and embryo quality and quantity. Significant variations in follicle size may also be linked to disparities in follicular sensitivity to FSH and inadequate maturation. The quantity of viable oocytes and embryos may decline as a result of this event. The Beta-Human Chorionic Gonadotropins (B-HCG) test count, on the other hand. Following ICSI, the male factor infertility group had the highest pregnancy rate (52.63%). These findings suggest that whereas female factors have a poorer prognosis for ICSI outcomes, male factors have a good one. The idea that female variables are the most significant contributors to pregnancy following fertilization may help to explain these results. This outcome is in line with a study by (Ashrafi et al., 2013) who assessed the correlation between ICSI outcome and various infertility causes and reported varying ICSI success rates for various causes of infertility. Additionally, the mean levels of FSH, LH, progesterone, E2 day 2, AMH, and E2 HCG hormones in pregnant and non-pregnant women did not differ statistically significantly between the pregnancy result groups (p=0.098, p=0.488, P=0.069, P=0.295, P=0.268, and P=0.124), as indicated in table (3-6). This result is in line with numerous studies, including the study by (Bjercke et al., 2005, Bedaiwy et al., 2007, Al-Ghazali and Al-Jarrah, 2013) whose mentioned the same results of current study.

5. Conclusion

The current study concluded that there were significant differences in serum levels of FSH, LH, E2 D2, AMH, and E2 at HCG injection hormones between the various causes of infertility. Although there is a correlation between these hormones and the result of pregnancy, it is not statistically significant. To understand the role of these hormones in infertile women, more research with a larger sample size is required.

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