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Fertilization and Embryogenesis Success Rates in Patients with Polycystic Ovary Syndrome Undergoing In Vitro Fertilization

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Abstract

Introduction: Infertility is a global health concern that affects individuals physically, emotionally, and socially. In women, ovulation dysfunction is a leading cause, most commonly related to Polycystic Ovary Syndrome (PCOS).

Objective: This study aimed to assess fertilization and embryogenesis success rates in women with PCOS undergoing in vitro fertilization at the Morula IVF Clinic Jakarta between January and December 2024. **Method:** A descriptive study was conducted involving 66 patients who met the inclusion criteria. Data were obtained from medical records, including age, body mass index, antral follicle count, hormonal levels, and fertilization and embryo development outcomes at the cleavage and blastocyst stages. **Result and Discussion:** Most patients were under 35 years, with normal body mass index and hormone profiles. Fertilization success reached 100 percent for mature oocytes and 75 percent for those showing two pronuclei. Embryogenesis showed good quality in most cleavage and blastocyst stage embryos, while some demonstrated poor development, reflecting variations in embryo growth. **Conclusion:** Continuous monitoring of embryo morphology is essential to optimize embryo transfer decisions and improve in vitro fertilization success among women with Polycystic Ovary Syndrome.

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Introduction

The presence of children in a family holds deep spiritual, psychological, and social meaning. For most couples, having children symbolizes happiness, stability, and fulfillment. However, several factors, including health conditions, economic readiness, and psychological or physical preparedness, can prevent couples from achieving this goal. According to the World Health Organization (WHO, 2023), infertility is defined as the inability of a couple to conceive after 12 months of regular, unprotected sexual intercourse. It is a global health condition that affects physical, emotional, and social well-being, with an estimated 42 to 180 million individuals—about one in six adults, or 17.5% of the global adult population—experiencing infertility. The prevalence ranges between 3.5%–16.7% in developed countries and 6.9%–9.3% in developing nations, with a median global rate of 9% (Azizah et al., 2022). In Indonesia, approximately two million people are affected (Kemenkes RI, 2022). Encouragingly, about 90% of infertility cases have identifiable causes, and nearly half can achieve pregnancy within one year when managed appropriately (Miller, C. M., et al, 2023).

Infertility may originate from female factors (35–50%), male factors (40–50%), or unexplained causes (up to 30%) (Oats, J. J., & Boyle, J., 2022). In women, ovulation dysfunction (OD) is a leading cause, and Polycystic Ovary Syndrome (PCOS) is the most common contributor, accounting for 40–50% of infertility cases related to ovulatory disorders (Azizah et al, 2022). PCOS is a complex endocrine disorder affecting 5–20% of women of reproductive age (Sirait, B. I., et al, 2023). It is characterized by hormonal imbalance, hyperandrogenism, insulin resistance, and ovarian dysfunction, often resulting in irregular ovulation or anovulation. The pathophysiology involves multifactorial components such as genetic predisposition, metabolic disturbances, and hypothalamic-pituitary-ovarian axis dysregulation (Ghiasi Hafezi, S., et al., 2024).

Diagnosis of PCOS is typically based on the Rotterdam criteria from the European Society for Human Reproduction and Embryology (ESHRE) and the American Society for Reproductive Medicine (ASRM) (2003), which require two of three findings: clinical or biochemical hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology, after exclusion of other causes (Dirga A, et al 2024). The National Institutes of Health (NIH, 2012) later emphasized the importance of describing PCOS phenotypes (A–D) to better understand its variability and treatment implications.

Women with PCOS not only struggle with infertility but also face higher risks of pregnancy-related complications such as gestational diabetes, hypertension, preeclampsia, and miscarriage (Lizneva, D., et al., 2016). Assisted reproductive technologies (ART), especially in vitro fertilization (IVF), have become a key therapeutic option for PCOS patients who fail to conceive through natural or pharmacological means. IVF involves external fertilization of oocytes followed by embryo transfer to the uterus and provides an opportunity for conception when natural ovulation is impaired (Phillips, K., et al., 2023).

Despite advancements in reproductive medicine, variations in fertilization and embryogenesis outcomes among PCOS patients remain underexplored, particularly in Indonesia. Most studies have focused on hormonal or biochemical factors, leaving a gap in understanding early embryonic development quality among this population. Therefore, this study aims to analyze the fertilization and embryogenesis success rates in PCOS patients undergoing IVF at the Morula IVF Clinic Jakarta during January–December 2024. The findings are expected to provide evidence-based insights to improve clinical

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decision-making, optimize embryo transfer strategies, and enhance IVF success in PCOS patients.

Method

This descriptive retrospective study was conducted to evaluate the success rates of fertilization and embryogenesis and to analyze related influencing factors among patients with Polycystic Ovary Syndrome (PCOS) undergoing in vitro fertilization (IVF) at the Morula IVF Clinic Jakarta. The research took place from January to May 2025 using secondary data obtained from patient medical records between January and December 2024.

The study population included all PCOS patients who underwent IVF during the specified period, and total sampling was applied. From 96 eligible patients, 66 met the inclusion criteria, which required a PCOS diagnosis based on the Rotterdam ESHRE/ASRM 2003 criteria, participation in the IVF program, and complete medical records. Patients were excluded if they had partners with sperm abnormalities or other reproductive disorders such as adenomyosis, endometriosis, tubal abnormalities, diminished ovarian reserve, or unexplained infertility.

The independent variable was the diagnosis of PCOS among IVF patients, while the dependent variables were fertilization and embryogenesis success. Fertilization success was defined as the percentage of oocytes that achieved normal two-pronuclei (2PN) formation relative to the total number of mature oocytes (MII). Embryogenesis success was assessed based on embryo quality observed at the cleavage stage (Day 3) and the blastocyst stage (Days 5–6). Additional clinical parameters included age, body mass index (BMI), antral follicle count (AFC), Anti-Müllerian Hormone (AMH), and basal levels of Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH).

Data were collected through several stages: (1) editing, to ensure completeness and accuracy of patient records; (2) coding, to convert qualitative information into numerical data; (3) data entry, where coded data were input into the Statistical Package for the Social Sciences (SPSS); and (4) cleaning, to verify data accuracy and consistency.

Data were analyzed using univariate analysis to describe the characteristics of patients and to calculate fertilization and embryogenesis success rates. Results were presented in the form of frequency and percentage tables, supplemented with graphical representations for better interpretation. All statistical analyses were performed using SPSS for Windows version 26.0.

Result and Discussion

1. Result

This study evaluated the fertilization and embryogenesis success rates in PCOS patients undergoing IVF at Morula IVF Clinic Jakarta from January to December 2024. The results, summarized in the following tables, present patient characteristics, fertilization outcomes, and embryo quality at different developmental stages, followed by brief scientific interpretations.

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Tabel 1

Clinical Characteristics of PCOS Patients Undergoing IVF at Morula IVF Clinic
 Jakarta (January–December 2024)

No.	Characteristics	Category	Frequency (n)	Percentage (%)
1	Age	≤ 35 years > 35 years	47 19	71.2 28.8
2	Body Mass Index (BMI)	<18.5 (Underweight) 18.5–22.9 (Normal) 23–24.9 (Overweight) 25–29.9 (Obesity I) ≥30 (Obesity II)	4 27 12 13 10	6.1 40.9 18.2 19.7 15.2
3	Antral Follicle Count (AFC)	0–4 (Very Low) 5–8 (Low) 9–19 (Normal) ≥20 (High)	0 2 38 26	0 3.0 57.6 39.4
4	Anti-Müllerian Hormone (AMH)	≤0.3–0.9 ng/ml (Low) ≥1.0 ng/ml (Normal) ≥3.0 ng/ml (High)	0 4 62	0 6.1 93.9
5	Basal FSH (IU/L)	≤5 (Low) >5–<10 (Normal) ≥10 (High)	19 43 4	28.8 65.2 6.1
6	Basal LH (IU/L)	<3 (Low) 3.1–7.9 (Normal) ≥8 (High)	5 44 17	7.6 66.7 25.8

2. Discussion

Present the research findings systematically, using tables (font size 10, single spacing 1.0), graphs, or diagrams to clarify the data. Use subheadings if necessary to distinguish each section. Explain and interpret the research findings by referring to relevant literature or theories. Apply a critical approach to evaluate the results.

Table 2

Characteristics of the Respondent

No	Variable	Median	Standard Deviation	Min	Max
1.	Age (years)	31.24	4.452	22	44
2.	Triglycerides (mg/dL)	126.38	93.93	32	416
3.	HDL (mg/dL)	45.58	9.06	18	67
4.	BP Systolic (mmHg)	118.34	12.44	100	160
5.	BP Diastolic (mmHg)	71.04	9.63	60	95
6.	Fasting Blood Sugar (mg/dL)	94.75	29.19	75	265
7.	Height (cm)	166.33	9.085	149	189
8.	Body Weight (kg)	83.06	16.64	56	150
9.	BMI (kg/m ²)	29.86	4.42	25.16	46.3
10.	Total Caloric Intake (kcal)	1744.9	270.88	1190	2607

Most patients were aged ≤35 years (71.2%) with normal BMI (40.9%) and normal ovarian reserve (AFC 9–19; 57.6%). High AMH levels (93.9%) and normal FSH–LH patterns indicated preserved ovarian function typical of PCOS.

Table 3

Overall Fertilization Rate among PCOS Patients Undergoing IVF

Parameter	Total (n)	Percentage (%)
Mature oocytes (MII)	873	100
Oocytes with normal 2PN formation	659	75.49

Out of 873 mature oocytes, 659 achieved normal fertilization (2PN), resulting in a fertilization rate of 75.49%. This success aligns with international IVF standards and suggests good oocyte maturity and optimized laboratory conditions.

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Table 4
Embryo Quality at Cleavage Stage (Day 3)

Embryo Grading	Frequency (n)	Percentage (%)
Excellent	0	0
Good	247	37.5
Moderate	198	30.0
Poor	214	32.5
Total	659	100

At Day 3, 37.5% of embryos were of good quality, while 32.5% were poor. The absence of excellent-grade embryos indicates that early embryonic development in PCOS patients may be influenced by hormonal and metabolic factors such as insulin resistance and oxidative stress.

Table 5
Embryo Quality at Blastocyst Stage (Day 5)

Embryo Grading	Frequency (n)	Percentage (%)
Excellent	5	0.8
Good	230	34.6
Moderate	63	9.5
Poor	366	55.1
Total	664	100

By Day 5, the majority of embryos were classified as poor quality (55.1%), while 34.6% remained good. The decline in embryo quality from cleavage to blastocyst stages reflects developmental arrest possibly related to cytoplasmic immaturity or altered follicular environments—both common in PCOS pathophysiology.

Conclusion

The findings of this study indicate that the clinical characteristics of patients with Polycystic Ovary Syndrome (PCOS) undergoing in vitro fertilization (IVF) at the Morula IVF Clinic Jakarta between January and December 2024 were dominated by women aged ≤ 35 years (71.2%), representing the optimal reproductive age group. Most patients had a normal nutritional status (40.9%), although more than half (53.1%) were categorized as overweight or obese. In terms of ovarian reserve parameters, the majority of patients exhibited normal-to-high antral follicle counts (97%) and elevated Anti-Müllerian Hormone (AMH) levels (93.9%), reflecting the hormonal profile typically observed in PCOS. Basal Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH) levels were predominantly within the normal range (65.2% and 66.7%, respectively), followed by lower FSH levels (28.8%) and higher LH levels (25.8%), indicating variable gonadotropic function among patients.

The overall fertilization rate (FR) reached 75.9%, with 659 of 873 mature oocytes successfully fertilized following the ICSI procedure. Of these, 659 embryos developed to the cleavage stage (Day 3), and 664 embryos reached the blastocyst stage (Day 5), although embryo quality decreased over time. On Day 3, most embryos were graded as good or moderate, while by Day 5, poor-quality embryos increased to 55.1%, demonstrating a natural selection process during in vitro culture. These results suggest that while PCOS patients show high oocyte fertilization capacity, embryogenesis outcomes remain limited by hormonal and metabolic factors intrinsic to the syndrome. Continuous embryo monitoring and individualized IVF protocols are therefore essential to optimize clinical success and improve reproductive outcomes in women with PCOS.

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