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Factors Associated With Pregnancy Outcomes After Intrauterine Insemination

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Abstract

Infertility is a reproductive disorder defined as the inability to achieve a clinical pregnancy after 12 months or more of regular unprotected intercourse. It may be caused by female and/or male factors. Intrauterine insemination (IUI) is a form of assisted reproduction commonly used to treat subfertility. In Indonesia, infertility affects an estimated 10–15% of couples, equivalent to 4–6 million out of 29.8 million couples of reproductive age. This study aimed to evaluate factors associated with pregnancy success following IUI at Morula IVF Clinic, Jakarta, during January - December 2023. An analytic descriptive design was applied, and associations were tested using the Chi-square method. A total of 199 patients were included, with an overall IUI pregnancy success rate of 8.5%. Successful pregnancies were most frequently observed among wives aged 25 - 35 years, those with a body mass index of 18.5–24.9 kg/m², and cycles with pre-wash semen volume of 2 - 5 mL, sperm concentration >16 million, and sperm motility >30%. Chi-square analysis demonstrated that only sperm motility was significantly associated with IUI success (p=0.029), while wife's age, body mass index, pre-wash semen volume, and sperm concentration showed no significant association.

Keywords: Infertility, Intrauterine Insemination, Sperm Motility, Pregnancy Success.

INTRODUCTION

Marriage in the Indonesian sociocultural context is closely associated with the expectation of having children. Parenthood is widely perceived as a continuation of lineage, a source of emotional fulfillment, and a marker of marital success. Strong social norms often place newly married couples under pressure to conceive within a relatively short time after marriage. Questions regarding pregnancy commonly arise not only from immediate family members but also from the broader social environment. This social construction reflects the central role of fertility in Indonesian society. However, not all couples achieve pregnancy despite engaging in regular unprotected sexual intercourse. This condition is clinically defined as infertility, which refers to the failure to achieve pregnancy after 12 months or more of regular unprotected intercourse (Practice Committee of the American Society for Reproductive Medicine, 2020; World Health Organization, 2023).

Infertility constitutes a disorder of the reproductive system that may involve female factors, male factors, or a combination of both. Globally, approximately 17.5 percent of adults, or one in six individuals, experience infertility at some point during their reproductive life (World Health Organization, 2023). The prevalence shows minimal regional variation, indicating that infertility represents a major global public health issue across high, middle, and low income countries. In Indonesia, it is estimated that 10 to 15 percent of couples of reproductive age experience infertility, affecting approximately 4 to 6 million couples. At the same time, demographic data indicate a decline in fertility rates. The Total Fertility Rate in Jakarta decreased from 5.18 in 1971 to 1.75 in 2020, reflecting significant demographic transition and delayed childbearing patterns (Badan Pusat Statistik, 2020).

The etiology of infertility is multifactorial. In women, common causes include ovulatory disorders, tubal obstruction or damage secondary to infection or endometriosis, and uterine abnormalities. Ovulatory dysfunction accounts for a substantial proportion of female infertility cases (Practice Committee of the American Society for Reproductive Medicine, 2020). In men, infertility is frequently associated with abnormalities in semen parameters, including sperm concentration,

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motility, and morphology (World Health Organization, 2021). In addition to biological determinants, environmental exposure, lifestyle changes, obesity, psychological stress, and delayed reproductive age contribute to declining fertility potential (Agarwal et al., 2021). Infertility also exerts significant psychological and social consequences, including marital stress, emotional distress, and reduced quality of life. Intrauterine insemination (IUI) is one of the commonly utilized assisted reproductive techniques for managing infertility. The procedure involves the placement of processed sperm directly into the uterine cavity around the time of ovulation to enhance the probability of fertilization. IUI is less invasive and more affordable than in vitro fertilization, making it a first line treatment option for selected cases, particularly mild male factor infertility, controlled ovulatory disorders, or unexplained infertility with at least one patent fallopian tube (ESHRE Guideline Group, 2018).

The success rate of IUI varies and depends on several clinical and laboratory factors. Female age remains a primary determinant because ovarian reserve and oocyte quality decline significantly after the age of 35 years (Practice Committee of the American Society for Reproductive Medicine, 2020). Body mass index also influences reproductive outcomes, as obesity disrupts endocrine regulation and ovulatory function. From the male perspective, semen characteristics such as pre wash volume, sperm concentration, and motility correlate with pregnancy outcomes following IUI (World Health Organization, 2021). Sperm preparation techniques, including swim up and density gradient methods, aim to isolate motile and morphologically normal sperm while reducing reactive oxygen species that may damage sperm DNA integrity (Agarwal et al., 2021). Although IUI is widely implemented in fertility centers, reported pregnancy rates differ across populations and clinical settings. In Indonesia, empirical data examining predictors of IUI success remain limited, particularly at the institutional level. Morula IVF Jakarta is one of the major assisted reproductive centers providing infertility services to a substantial number of patients annually. A systematic evaluation of pregnancy success factors in IUI cycles at this center is essential to generate evidence based data that may improve clinical protocols and patient counseling strategies.

Therefore, this study aims to identify the factors associated with pregnancy success in intrauterine insemination at Morula IVF Clinic Jakarta during the period of January to December 2023. Specifically, this study analyzes the association between female age, body mass index, pre wash semen volume, sperm concentration, and sperm motility with pregnancy outcomes. The findings are expected to contribute to the development of evidence based reproductive medicine practices and support clinical decision making in assisted reproductive services.

RESEARCH METHODS

This study applied a quantitative approach using a non experimental analytic descriptive design with a retrospective method. The retrospective design was selected because the study aimed to evaluate pregnancy outcomes and associated factors based on existing medical records of patients who had undergone intrauterine insemination procedures. The researchers did not manipulate any variables or provide interventions. Instead, they analyzed previously documented clinical and laboratory data to identify patterns related to pregnancy success. This design is appropriate for assessing clinical outcomes within a defined time frame and allows efficient use of available medical records while maintaining ethical feasibility. The study was conducted at Morula IVF Clinic Jakarta, one of the assisted reproductive centers providing intrauterine insemination services. Data extraction and processing were carried out in February 2025. The medical records reviewed covered intrauterine insemination cycles performed from January to December 2023. This defined period ensured uniformity of clinical protocols and laboratory standards applied during the treatment cycles.

The population of this study consisted of all married couples who underwent intrauterine insemination treatment at Morula IVF Clinic Jakarta. The sample included couples who underwent intrauterine insemination procedures during the period of January to December 2023 and met the predefined eligibility criteria. The study used purposive sampling, a non probability sampling

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technique that selects subjects based on specific characteristics aligned with the research objectives. This technique was chosen to ensure that only cases with complete and relevant clinical information were included in the analysis. The inclusion criterion was patients who underwent intrauterine insemination at Morula IVF Clinic Jakarta between January and December 2023. The exclusion criteria included patients whose intrauterine insemination outcomes could not be identified or confirmed and patients with incomplete medical records related to the variables under study. These criteria were applied to maintain data validity and ensure accurate outcome assessment.

The independent variables examined in this study were wife's age, husband's age, wife's body mass index, pre wash semen volume, sperm concentration, and sperm motility. These variables were selected based on clinical relevance and previous evidence suggesting their influence on intrauterine insemination outcomes. The dependent variable was the success of intrauterine insemination, defined as biochemical pregnancy confirmed after the procedure. Biochemical pregnancy was determined based on documented laboratory results recorded in the patient's medical record following the insemination cycle. Data were collected using secondary data derived from medical records. The documentation method was applied to extract demographic data, anthropometric measurements, semen analysis parameters before sperm preparation, and pregnancy outcomes. A structured data extraction form was developed to ensure systematic and consistent recording of relevant variables. Only data that fulfilled the study criteria were included in the dataset. The use of medical records minimized recall bias and reflected actual clinical practice. Administrative approval was obtained from the clinic, and patient confidentiality was preserved by anonymizing all identifying information during data processing.

Data analysis was performed using univariate analysis to describe the distribution and frequency of each variable. The results were presented in tables and graphical formats to provide a clear overview of patient characteristics and pregnancy outcomes. Statistical analysis was conducted using Statistical Package for the Social Sciences software for Windows version 24.0. Prior to analysis, data were coded, entered, and cleaned to ensure completeness and accuracy. The use of univariate analysis aligned with the descriptive objective of the study, which aimed to identify the distribution of pregnancy success and associated factors among patients undergoing intrauterine insemination during the specified period.

RESULTS AND DISCUSSION

RESULTS

This study involved 199 patients who underwent intrauterine insemination (IUI) at Morula IVF Clinic Jakarta from January to December 2023 in accordance with the inclusion criteria. The collected variables included wife's age, husband's age, wife's body mass index (BMI), semen volume, sperm concentration, sperm motility, and pregnancy outcome following IUI.

Univariate Analysis

Patient Characteristics

Table 1. Distribution of Patients Undergoing IUI at Morula IVF Clinic Jakarta, January–December 2023

No	Characteristic	Frequency (n)	Percentage (%)
1.	**Wife's Age**		
	17-24 years	5	2.5
	25-35 years	144	72.4
	> 35 years	50	25.1
2.	**Wife's BMI**		
	<18,5	12	6
	18,5-24,9	114	57.3

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	25-29,9	54	27.1
	30-34,9	17	8.5
	35-39,9	2	1
3.	**Sperm Volume**		
	<2 ml	26	13.1
	2-5 ml	164	82.4
	>5ml	9	4.5
4.	**Sperm Concentration**		
	<16 million	12	6
	≥ 16 million	187	94
5.	**Sperm Motility**		
	<30 %	18	9
	≥ 30 %	181	91
	Total	199	100

Based on Table 3.1, most patients were aged 25–35 years (72.4%), followed by those aged >35 years (25.1%), while only 2.5% were aged 17–24 years. Regarding BMI, the majority of patients were within the normal range (18.5–24.9) at 57.3%. However, 36.6% were categorized as overweight to obesity class II. Most semen samples showed volume between 2–5 ml (82.4%). The majority of patients had sperm concentration ≥16 million (94%) and sperm motility ≥30% (91%).

Pregnancy Outcome

Table 2. Pregnancy Outcome Following Intrauterine Insemination at Morula IVF Clinic Jakarta, January–December 2023

IUI Outcome	IUI Outcome	IUI Outcome
Not Pregnant	182	91.5
Pregnant	17	8.5
Total	199	100

Among 199 patients, 17 achieved biochemical pregnancy, resulting in an overall pregnancy rate of 8.5%. The remaining 182 patients (91.5%) did not achieve pregnancy.

Bivariate Analysis

Association Between Wife's Age and Pregnancy Success

Table 3. Association Between Wife's Age and Pregnancy Success

Wife's Age	IUI Success		*p-value*
	Not Pregnant n (%)	Pregnant n (%)	
17-24 years	5 (2,5%)	0 (0,0%)	
25–35 years	130 (65,3%)	14 (7,0%)	0,566
>35 tahun	47 (23,6%)	3 (1,5%)	

The highest pregnancy rate was observed in women aged 25–35 years (7.0%). Chi square analysis showed no statistically significant association between wife's age and IUI success ($\chi^2 = 1.137$; $p = 0.566$).

Association Between Wife's BMI and Pregnancy Success

Table 4. Association Between Wife's BMI and IUI Success

IMT	IUI Success		*p-value*
	Not Pregnant n (%)	Pregnant n (%)	
<18,5	9 (4,5%)	3 (1,5%)	
18,5-24,9	106 (53,3%)	8 (4,0%)	
25,0-29,9	50 (25,1%)	4 (2,0%)	0,287
30,0-34,9	15 (7,5%)	2 (1,5%)	
35,0-39,9	2 (1,0%)	0 (0,0%)	

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Pregnancy success was highest among women with normal BMI. However, chi square analysis showed no significant association between BMI and IUI success ($\chi^2 = 5.001$; $p = 0.287$).

Association Between Pre-Wash Semen Volume and IUI Success

Table 5. Association Between Pre-Wash Semen Volume and IUI Success

Sperm Volume	IUI Success		*p-value*
	Not Pregnant n (%)	Pregnant n (%)	
<2 ml	24 (12,1%)	2 (1,0%)	
2-5 ml	149 (74,9%)	15 (7,5%)	0,625
>5 ml	9 (4,5%)	0 (0,0%)	

The highest pregnancy rate occurred in the 2–5 ml group. Statistical analysis indicated no significant association between semen volume and IUI success ($\chi^2 = 0.941$; $p = 0.625$).

Association Between Sperm Concentration and Pregnancy Success

Table 6. Association Between Sperm Concentration and IUI Success

Sperm Concentration	IUI Success		*p-value*
	Not Pregnant n (%)	Pregnant n (%)	
<16 million	10 (5,0%)	2 (1,0%)	0,299
≥16 million	172 (86,4%)	15 (7,5%)	

Pregnancy occurred more frequently in the ≥16 million group. However, no statistically significant association was found between sperm concentration and IUI success ($\chi^2 = 1.079$; $p = 0.299$).

Association Between Sperm Motility and Pregnancy Success

Table 7. Association Between Sperm Motility and Pregnancy Success

Sperm Motility	IUI Success		*p-value*
	Not Pregnant n (%)	Pregnant n (%)	
<30 %	14 (7,0%)	4 (2,0%)	0,029
≥30 %	168 (84,4%)	13 (6,5%)	

Pregnancy success was higher in patients with sperm motility ≥30%. Chi square analysis showed a statistically significant association between sperm motility and IUI success ($\chi^2 = 4.740$; $p = 0.029$). This finding indicates that sperm motility was significantly associated with pregnancy outcome in this study population.

DISCUSSION

Patient Characteristics

In this study, most women who underwent intrauterine insemination (IUI) were aged 25–35 years (n = 144). A similar pattern was reported by Philippe (2010), where the largest proportion of IUI patients were aged 31–35 years (n = 145). Arzu (2013) also reported that the most common age group among IUI patients was 30–35 years (n = 405). This distribution suggests that infertility frequently becomes clinically apparent during the productive reproductive age range, leading couples to seek fertility treatment, including IUI.

Regarding body mass index (BMI), most women were in the normal BMI category (18.5–24.9), with 114 patients in this group. Rachel (2020) similarly reported that the largest proportion of IUI patients had normal BMI (18.5–24.9), accounting for 47%. LaTasha also found that the most common BMI category among IUI patients was 18.5–24.9, with 792 patients. These findings indicate that most IUI patients fall within the normal BMI range. Nevertheless, 83 patients (36.6%) in the present study were classified as overweight to obesity class II, which is clinically relevant because excess body weight may influence endocrine function and reproductive outcomes.

For semen parameters, the largest proportion of patients had pre-wash semen volume between 2–5 mL (n = 164). Most patients also had sperm concentration ≥16 million (n = 187). A comparable study by Erhong (2014) reported that the largest group of IUI patients had sperm concentration ≥20

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million (n = 497). In addition, most patients in the present study had sperm motility ≥30% (n = 181). This aligns with Leila (2018), which reported that 86.6% of IUI patients had sperm motility >30% (n = 303). Overall, these distributions support the clinical practice that IUI is commonly offered when semen quality is within normal limits or only mildly impaired.

IUI Success Rate

This study reported a pregnancy rate of 8.5%, with 17 pregnancies among 199 IUI cycles. This result is comparable to Jain (2019), who reported a pregnancy rate of 7.4% across 1,027 IUI cycles and identified female age as a key determinant, with the highest pregnancy rate among women aged 19–24 years. In contrast, Sharma (2019) reported a higher pregnancy rate of 15.7% in 380 IUI cycles and highlighted patient age, infertility indication, and number of IUI cycles as important predictors. Zhang (2014) also reported a pregnancy rate of 12.95% in 672 IUI cycles among 307 couples, emphasizing total progressive motile sperm as a key factor. Zadehmodarres (2008) reported an even higher pregnancy rate of 22% in 350 IUI cycles, with higher success among women younger than 30 years. Differences in success rates across studies may reflect variations in patient selection, infertility diagnosis, ovarian stimulation protocols, semen preparation procedures, and the definition of pregnancy outcomes used.

Association Between Wife's Age and IUI Success

In this study, the highest pregnancy frequency occurred in women aged 25–35 years (n = 14; 7%). This pattern is consistent with findings from a fertility center at Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand, which reported that increasing female age significantly reduced fertility outcomes in IUI cycles. Women aged <35 years showed higher pregnancy rates per patient than women aged >40 years. The International Islamic University Malaysia (IIUM) Fertility Centre also reported that women aged >40 years had pregnancy probabilities below 5%, and those aged >45 years had pregnancy rates around 0.5%. In that study, only 3 out of 39 women aged 40–44 years achieved pregnancy (7%), likely due to declining oocyte quality and reduced endometrial receptivity.

Despite the descriptive trend, the chi-square analysis in the present study indicated that wife's age was not significantly associated with IUI success. This finding is consistent with Leila (2018), which also reported no significant correlation between female age and IUI success (p = 0.578). The absence of statistical significance may be influenced by sample distribution across age categories and other clinical factors not included in the analysis.

Association Between Wife's BMI and IUI Success

In this study, pregnancy success by BMI was most frequently observed in women with normal BMI (18.5–24.9), with 8 pregnancies (4.0%). This is consistent with findings from Zeynep Kamil Gynecologic and Pediatric Training and Research Hospital, which reported that higher BMI negatively affected IUI outcomes and that IUI success increased 2.6-fold among women with BMI <25.00. Very low BMI may also impair reproductive outcomes through hormonal imbalance and disrupted ovulation, which is essential for achieving pregnancy following IUI.

However, the chi-square analysis in the present study showed that BMI was not significantly associated with IUI success. Several studies have similarly reported non-significant associations between BMI and pregnancy outcomes in IUI. Nevertheless, most evidence suggests that increasing BMI is linked to reduced oocyte quality and metabolic-endocrine disturbances, including insulin resistance and androgen excess, which may cumulatively reduce fertility potential.

Association Between Pre-Wash Semen Volume and IUI Success

The highest pregnancy frequency in this study occurred in the pre-wash semen volume group of 2–5 mL (n = 15; 7.5%). Elvan (2013) reported similar clinical pregnancy rates between low and high semen volume groups (14.0% vs 15.7%). Clinically, low semen volume (hypospermia) may reduce the probability of sperm reaching the oocyte and may reflect reduced seminal components such as fructose, enzymes, and prostaglandins, which support sperm function. Conversely, excessively high

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semen volume may dilute semen, lowering sperm concentration per milliliter and potentially reducing fertilization efficiency.

Despite these biological considerations, the present study found no significant association between pre-wash semen volume and IUI success based on chi-square analysis. This finding is consistent with Elvan (2013), which also reported no significant relationship between semen volume and IUI outcome.

Association Between Sperm Concentration and IUI Success

In this study, pregnancy success was most frequently observed among patients with sperm concentration ≥16 million (n = 15; 7.5%). However, pregnancy also occurred in patients with sperm concentration <16 million (n = 2; 1.0%), and the difference was not statistically significant. This finding is consistent with observations from the IIUM Fertility Centre, which reported the highest pregnancy rates among men with sperm counts >30 million (19.6%), while men with sperm counts <20 million showed a lower success rate (5.5%). Higher sperm concentration may increase the probability that sufficient sperm reach the fallopian tube and encounter the oocyte.

Nevertheless, the present study found no significant association between sperm concentration and IUI success. This aligns with Ashok (2021), which also reported that sperm concentration did not significantly influence IUI outcomes. This suggests that other semen indicators, particularly those reflecting functional sperm competence, may be more predictive than concentration alone.

Association Between Sperm Motility and IUI Success

In this study, pregnancy success was more frequent in the group with sperm motility ≥30% (n = 13; 6.5%), although pregnancies also occurred in the <30% motility group (n = 4; 2.0%). Evidence from Seoul National University Hospital (SNUH) indicates that pre-wash sperm motility is a strong predictor of pregnancy success, where higher baseline motility typically corresponds with more favorable outcomes after sperm preparation. A study from Chaim Sheba and Serelin Medical Center in Israel by Adrian Shulman and colleagues reported that optimal sperm motility was approximately 47.5%, emphasizing that motile sperm have greater capacity to reach the fertilization site.

The occurrence of pregnancy among patients with motility <30% in the present study may be explained by the sperm washing process, which can improve post-wash motility by selecting more progressive motile sperm. Therefore, low pre-wash motility does not eliminate the possibility of pregnancy, although it may reduce the probability.

Importantly, chi-square analysis in this study demonstrated a statistically significant association between sperm motility and IUI success. This finding supports the conclusion that sperm motility is a meaningful predictor of IUI outcomes. This result is consistent with Leila (2018), which reported that sperm motility had a positive effect on IUI success and was significantly associated with pregnancy outcomes.

CONCLUSION

This study evaluated the factors associated with pregnancy success in intrauterine insemination (IUI) at Morula IVF Clinic Jakarta during the period of January to December 2023. A total of 199 patients underwent IUI, and 17 achieved biochemical pregnancy, resulting in an overall success rate of 8.5%. The study aimed to identify the distribution of pregnancy success based on female age, body mass index, and semen parameters, and to determine which factors were associated with successful outcomes. The findings show that the highest proportion of pregnancy success based on female age occurred in women aged 25–35 years (7%). Based on body mass index, the highest pregnancy rate was observed in women with normal BMI (18.5–24.9), accounting for 4%. Regarding semen parameters, the highest pregnancy rates were found in patients with pre-wash semen volume of 2–5 mL (7.5%), sperm concentration ≥16 million (7.5%), and sperm motility ≥30% (6.5%). Statistical analysis demonstrated that sperm motility was significantly associated with IUI success, whereas female age, BMI, semen volume, and sperm concentration were not significantly associated with

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pregnancy outcomes in this study population. These findings indicate that among the variables examined, sperm motility plays a key role in predicting pregnancy success following IUI. In conclusion, this study provides empirical evidence regarding the distribution and determinants of pregnancy success in IUI at Morula IVF Clinic Jakarta. The results contribute to the understanding of clinical and laboratory factors influencing IUI outcomes and may support clinicians in patient selection, counseling, and optimization of treatment strategies. Further research using multivariate analysis and larger sample sizes is recommended to explore additional predictors and strengthen the evidence base for assisted reproductive practices.

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