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Outcome of *In Vitro* Fertilization (IVF) Treatment in Infertile Couples-A Retrospective Study

Dr. Hasna Hena Pervin[1]*, Dr. Kazi Farhana Begum[2], Dr. Kaniz Fatema[3], Dr. Nigar Sultana[4], Dr. Farah Noor[5], Dr. Fahmida Zabin[6], Dr. Ayesha Mehnaz[7]

Abstract

Background: In Vitro Fertilization (IVF) offers hope to many infertile couples globally, and understanding the factors associated with pregnancy outcome is crucial for medical professionals and aspiring parents.

Aim of the study: The aim of this study was to assess the outcome of IVF treatment in infertile couples.

Methods: This retrospective study was conducted in Department of Obstetrics and Gynaecology, Nova IVF Fertility Bangladesh, Dhaka, Bangladesh, during the period from February 2022 to January 2024. Total 320 infertile couple were included in this study.

Result: The mean age was 32.4 years (SD±5.6 years). The majority (56.9%) experienced infertility for 1 to 4 years (SD±4.6 years). The causes of infertility varied, with 17.8% due to male factors, 36.3% to female factors, 6.3% combined, and 39.7% unexplained. Most subjects (69.7%) underwent standard IVF, with 33.8% achieving successful pregnancies and 6.9% resulting in live births. Women aged 25-29 and 30-34 had higher success rates. A significant correlation was found between the duration of infertility and successful pregnancy rates, particularly for those experiencing infertility for 4 to 9 years. Male and female infertility factors significantly influenced pregnancy outcomes. AMH levels showed a significant correlation with pregnancy outcomes, with normal AMH levels being more favorable for successful pregnancy and live birth outcomes.

Conclusion: The study finds higher IVF success in the 25-29 and 30-34 age groups, with shorter infertility durations. Male and female infertility factors significantly impact outcomes, and normal Anti-Müllerian Hormone (AMH) levels are linked to better pregnancy results.

Keywords: Outcome; In Vitro Fertilization (IVF) Treatment; Infertile Couples.

Introduction

Infertility, defined as the inability to conceive after one year of unprotected intercourse, affects approximately 10-15% of couples worldwide, making it a significant public health issue [1]. Among the various assisted reproductive technologies (ART) available, in vitro fertilization (IVF) has emerged as a primary treatment modality for various forms of infertility. Since the first successful IVF procedure in 1978, there have been significant advancements in the field, leading to improved success rates and outcomes for infertile couples [2]. IVF involves the process of fertilizing an egg outside the body and then

Affiliation:

[1]Associate Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[2]Assistant Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[3]Associate Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[4]Associate Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[5]Assistant Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[6]Professor & Head, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

[7]HMO, Department of Medicine, Dhaka Medical College Hospital, Dhaka, Bangladesh

***Corresponding author:**
Dr. Hasna Hena Pervin, Associate Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

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implanting the embryo into the uterus. This technique has revolutionized infertility treatment, offering hope to couples who previously had no chance of conceiving a child. The evolution of IVF over the years has been marked by significant technological advancements, including the development of intracytoplasmic sperm injection (ICSI) for severe male factor infertility, preimplantation genetic testing (PGT) for genetic disorders, and improved ovarian stimulation protocols [3]. The success of IVF is influenced by a multitude of factors, including age, underlying infertility causes, ovarian reserve, sperm quality, and lifestyle factors. Advanced maternal age is a well-documented factor that negatively impacts IVF outcomes, primarily due to decreased ovarian reserve and egg quality [4]. Additionally, male factors, such as sperm quality and morphology, play a crucial role in the success of IVF treatments [5]. Recent studies have also highlighted the importance of lifestyle and environmental factors in IVF outcomes. Dietary patterns, for instance, have been shown to influence fertility. Adherence to a Mediterranean diet, characterized by high intake of fruits, vegetables, whole grains, and olive oil, has been associated with improved IVF success rates [6]. Similarly, the role of B vitamins in enhancing oocyte quality and embryo development has been recognized, suggesting the importance of nutritional status in IVF outcomes [7]. The psychological and emotional aspects of undergoing IVF treatment are significant and often underappreciated. Couples undergoing IVF face considerable stress, anxiety, and emotional turmoil, which can impact treatment outcomes. Studies have shown that stress management and psychological support can improve IVF success rates by reducing stress and improving the overall well-being of patients [8]. Technological advancements have played a pivotal role in improving IVF outcomes. The use of advanced imaging techniques for embryo selection, time-lapse imaging, and improved laboratory conditions have all contributed to higher success rates [9]. Moreover, the application of machine learning algorithms in predicting IVF outcomes is a promising area of research. These algorithms can analyze large datasets to identify patterns and factors that influence the success of IVF, thereby aiding in personalized treatment planning [10]. In vitro fertilization has come a long way since its inception, offering hope and a solution to millions of couples facing infertility. The continuous evolution of this field, marked by technological advancements and a deeper understanding of the factors influencing outcomes, holds promise for even higher success rates in the future. However, it is crucial to approach IVF treatment holistically, considering not only the physical but also the emotional and ethical aspects of the journey towards parenthood.

Objectives

To assess the outcome of in vitro fertilization (IVF) treatment in infertile couples.

Methodology & Materials

This retrospective study was conducted in Department of Obstetrics and Gynaecology, Nova IVF Fertility Bangladesh, Dhaka, Bangladesh, during the period from February 2022 to January 2024 for 2 years. Total 320 infertile couple were included in this study. Consent of the study subject and guardians were taken before collecting data. After collection of data, all data were checked and cleaned. After cleaning, the data were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical Packages for Social Sciences version 22. After compilation, data were presented in the form of tables, figures and charts, as necessary. Numerical variables were expressed as mean and standard deviation, whereas categorical variables were count with percentage. P value ≤0.05 was considered statistically significant.

Inclusion criteria:

- Infertile couple
- Female in reproductive age (18-44 years)

Exclusion criteria:

- Couples with chronic disease
- Transferred to another hospital
- Those who did not give consent

Result

Table I demonstrates the demographic characteristics of the study subject. The age distribution of the study population reveals that the largest proportion (33.7%) falls within the 30-34 age group. The participants' mean age is 32.4 years (SD±5.6 years) ranged from 18 to 44 years. In terms of marital duration, the average is 6.1 years (SD±3.7 years). The majority of participants (56.9%) experience infertility for 1 to 4 years, with a mean duration of 4.6 years (SD±5.7 years). The mean AMH level is 2.9 ng/ml, with a standard deviation of 2.6 ng/ml. Indication of infertility shows that 75.3% experience primary infertility, while 24.7% have secondary infertility. Additionally, there are small percentages of participants with comorbidities, including hypothyroidism (3%), hypertension (1%), and prediabetes (0.5%). Figure 1 provides a concise overview of the causes of infertility within the study population. Among the participants, 17.8% are attributed to male factors as the cause of their infertility, while a more significant percentage, 36.3%, is linked to female factors. A smaller proportion, 6.3%, is categorized as combined causes. Interestingly, a substantial portion, 39.7%, falls under the category of unexplained infertility. Table II presents essential information on the pregnancy outcomes of the study subjects following IVF treatment. In terms of fertilization type, the majority of the subjects (69.7%) underwent standard IVF, while 28.1% had Intracytoplasmic Sperm Injection (ICSI),

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1.6% had Testicular Sperm Aspiration (TESA), and a minimal 0.6% underwent Percutaneous Epididymal Sperm Aspiration (PESA). Regarding pregnancy outcomes, 33.8% of the treatments were successful, but a significant 61.9% were unsuccessful, and in 4.4% of the cases, Embryo Transfer (ET) was not performed. For live birth outcomes, only 6.9% resulted in live births, 2.8% ended in abortion or miscarriage, and 24.1% were ongoing pregnancies at the time of the study. Table III displays the relationship between female age groups and successful pregnancy rates among 108 study participants. Women aged 25-29 and 30-34 experienced notably higher success rates, with 33.3% and 30.6%, respectively. In contrast, those under 25 had a 12% success rate, and the rates further declined for the 35-39 (18.5%) and ≥40 (5.6%) age groups. A p-value of 0.010 underscores the statistical significance, highlighting that age is a crucial determinant of successful pregnancy outcomes following IVF treatment in this study. This information emphasizes the need to consider age as a vital factor in fertility treatment decisions. Table IV provides insights into the relationship between the duration of infertility and the successful pregnancy rate among the 108 study participants. The data reveals a noteworthy association between the length of infertility and the likelihood of successful pregnancies. Participants who experienced infertility for 4 to 9 years had a notably higher success rate of 60.2%. In the 5-9 category, 32.4% achieved successful pregnancies. However, as the duration of infertility extended to 10-14 and ≥15 years, the success rates significantly dropped to 5.6% and 1.9%, respectively. The p-value of 0.042 indicates statistical significance, highlighting that the duration of infertility plays a significant role in determining successful pregnancy outcomes following IVF treatment in this study. Table V in the study presents the correlation between male and female infertility factors and the pregnancy rates, distinguishing between successful and unsuccessful pregnancies. The table includes data from a total of 320 cases, with 108 resulting in successful pregnancies and 212 being unsuccessful. In the successful pregnancy group, male factors were identified in 31 cases (28.7%), while female factors were noted in 21 cases (19.4%). Conversely, in the unsuccessful pregnancy group, male factors were present in 26 cases (12.3%), and female factors were significantly higher, observed in 95 cases (44.8%). There was strong statistical significance, indicating that both male and female factors significantly correlate with pregnancy outcomes in this study. Table VI in the study examines the correlation between male and female infertility factors and the rate of successful pregnancy. Out of the 108 successful pregnancies, 31 cases (28.7%) were associated with male factors, while 21 cases (19.4%) were linked to female factors. There is no statistically significant correlation between the type of infertility factor (male or female) and the success rate of the pregnancy. Table VII in the study presents a detailed correlation between Anti-Müllerian Hormone (AMH) levels and various pregnancy outcomes. AMH levels are categorized into three groups: low (<1 ng/ml), normal (1-3.5 ng/ml), and high (>3.5 ng/ml). The table reveals that successful pregnancy outcomes were more common in the normal AMH group (20%) compared to the low (3.1%) and high AMH groups (10.6%), with a statistically significant p-value of 0.006. Live births were also more frequent in the normal AMH group (5%) compared to low (0.3%) and high AMH groups (1.6%). The rates of abortion and miscarriage were relatively low across all groups, with the highest in the low AMH group (1.6%). Ongoing pregnancies were again most common in the normal AMH group (14.4%), followed by the high (8.4%) and low AMH groups (1.3%). The unsuccessful pregnancy rate was highest in the normal AMH group (31.9%), followed by the low (18.1%) and high AMH groups (16.3%). The data suggest a significant correlation between AMH levels and pregnancy outcomes, with normal AMH levels being more favorable for successful pregnancy and live birth outcomes.

Table I: Demographic characteristics of the study subjects (N=320).

Characteristics		n	%
Age (Years)	<25	29	9.1
	25-29	73	22.8
	30-34	108	33.7
	35-39	78	24.4
	≥40	32	10
	Mean± SD	32.4±5.6	
	Range	18-44	
Married for (Year)	Mean± SD	6.1±3.7	
Infertility duration (Year)	01-Apr	182	56.9
	05-Sep	111	34.7
	Oct-14	22	6.9
	15-19	5	1.6
	Mean± SD	4.6±5.7	
Anti-Mullerian Hormone (ng/ml)	Mean± SD	2.9±2.6	
Indication of infertility	Primary	241	75.3
	Secondary	79	24.7
Comorbidity	Hypothyroidism	6	3
	HTN	2	1
	Prediabetic	1	0.5

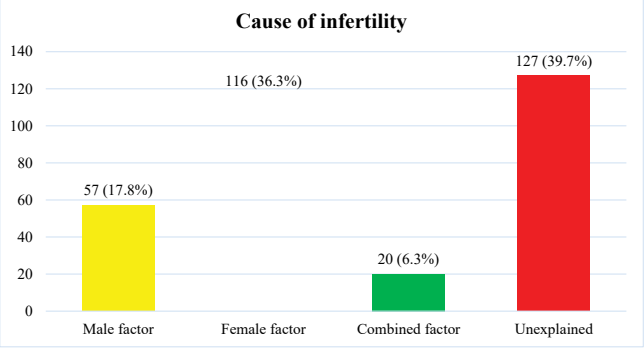

Figure 1: Cause of infertility among the couples (N=320).

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Table II: Pregnancy outcome of the study subjects after IVF treatment (N=320).

Characteristics		n	%
Type of fertilization	IVF	223	69.7
	ICSI	90	28.1
	TESA	5	1.6
	PESA	2	0.6
Pregnancy outcome	Successful	108	33.8
	Unsuccessful	212	66.2
Live birth	Live birth	22	6.9
	Abortion and miscarriage	9	2.8
	Ongoing pregnancy	77	24.1

Table-III: Female age group and successful pregnancy rate (N=108).

Age (Years)	Successful pregnancy		P-value
	n	%	
<25	13	12	0.010[s]
25-29	36	33.3	
30-34	33	30.6	
35-39	20	18.5	
≥40	6	5.6	

P-value obtained from Pearson Chi-square test
P≤0.05 = Significant
s= Significant

Table IV: Correlation between Male and female factor with pregnancy rate.

Infertility (Years)	Successful pregnancy		P-value
	n	%	
01-Apr	65	60.2	0.042[s]
05-Sep	35	32.4	
Oct-14	6	5.6	
≥15	2	1.9	

P-value obtained from Pearson Chi-square test
P≤0.05 = Significant
s= Significant

Table V: Correlation between Male and female factor with successful pregnancy rate (N=108).

	Male factor		Female factor		P-value
	n	%	n	%	
Successful pregnancy	31	28.7	21	19.4	0.1106[ns]

Table VI: Correlation between AMH level with pregnancy outcome (N=320).

Outcome	Low AMH (<1 ng/ml)	Normal AMH (1-3.5 ng/ml)	High AMH (>3.5 ng/ml)	p-value
Successful	**10 (3.1%)**	**64 (20%)**	**34 (10.6%)**	0.006[s]
Live birth	1 (0.3%)	16 (5%)	5 (1.6%)	
Abortion and miscarriage	5 (1.6%)	2 (0.6%)	2 (0.6%)	
Ongoing pregnancy	4 (1.3%)	46 (14.4%)	27 (8.4%)	
Unsuccessful	**58 (18.1%)**	**102 (31.9%)**	**52 (16.3%)**	

P-value obtained from Pearson Chi-square test
P≤0.05 = Significant
s= Significant

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Discussion

This retrospective study was conducted in Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, during the period from February 2022 to January 2024 to assess the outcome of in vitro fertilization (IVF) treatment in infertile couples. The age distribution of the study population, with the largest proportion (33.7%) in the 30-34 age group and a mean age of 32.4 years, aligns with global trends in reproductive health, where women are increasingly delaying childbearing [11]. The age-related decline in fertility is well-documented, with women aged 25-29 and 30-34 experiencing higher IVF success rates (33.3% and 30.6%, respectively) compared to older age groups. This finding is consistent with previous research indicating that female age is a critical determinant of IVF success, primarily due to the age-related decline in ovarian reserve and egg quality [12,13]. The significantly lower success rates in women aged 35-39 (18.5%) and ≥40 (5.6%) underscore the impact of advanced maternal age on IVF outcomes. The study also highlights the relationship between the duration of infertility and IVF success. Participants experiencing infertility for 4 to 9 years had a notably higher success rate (60.2%), while longer durations of infertility were associated with decreased success rates. This trend may be attributed to the progressive nature of certain infertility causes or the psychological and physiological toll of prolonged infertility [14]. The significant drop in success rates for durations of 10-14 and ≥15 years (5.6% and 1.9%, respectively) emphasizes the importance of timely intervention in infertility treatment. The distribution of infertility causes in the study population, with 17.8% attributed to male factors and 36.3% to female factors, is reflective of the multifactorial nature of infertility. The substantial proportion of unexplained infertility (39.7%) highlights the complexity of diagnosing and treating infertility [15]. The correlation between infertility causes and IVF outcomes, particularly the higher success rates in cases attributed to male factors (28.7%) compared to female factors (19.4%), suggests that the etiology of infertility plays a crucial role in treatment success. This finding aligns with other studies indicating that male factor infertility, often addressed through ICSI, may have better IVF outcomes compared to certain female factors [16]. The presence of comorbidities such as hypothyroidism, hypertension, and prediabetes in a small percentage of participants is noteworthy. The predominance of standard IVF (69.7%) over other techniques like ICSI, TESA, and PESA in this study reflects the broader trends in IVF practice. However, the choice of fertilization technique is often dictated by specific infertility diagnoses, with ICSI being more prevalent in cases of severe male factor infertility [17]. The live birth rate of 6.9% and the ongoing pregnancy rate of 24.1% in this study are critical metrics for evaluating IVF success. The relatively low live birth rate and the 2.8% rate of abortion or miscarriage highlight the challenges in achieving and sustaining pregnancies through IVF, which may be influenced by factors such as embryo quality and uterine receptivity [18]. In this study, the correlation between Anti-Müllerian Hormone (AMH) levels and pregnancy outcomes in IVF treatments reveals that successful pregnancy outcomes are more prevalent in the normal AMH group (20%) compared to the low (3.1%) and high AMH groups (10.6%), a finding that is statistically significant (p-value 0.006). This aligns with the research by Broer et al [19], which highlights AMH as a predictor of ovarian response in IVF. The study also found that live births were more frequent in the normal AMH group (5%) compared to the low (0.3%) and high AMH groups (1.6%). The rates of abortion and miscarriage were relatively low across all groups, with the highest in the low AMH group (1.6%). Ongoing pregnancies were again most common in the normal AMH group (14.4%), followed by the high (8.4%) and low AMH groups (1.3%). The unsuccessful pregnancy rate was highest in the normal AMH group (31.9%), followed by the low (18.1%) and high AMH groups (16.3%). These findings are consistent with La Marca A and Sunkara SK20, who discuss the role of AMH in individualizing ovarian stimulation in IVF, and Nelson SM21, who emphasizes the clinical utility of AMH as a biomarker in reproductive medicine.

Limitations of the study

In our study, there was small sample size. Study population was selected from one center in Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

Conclusion and Recommendations

This study concludes that higher success rates of pregnancy in IVF were observed the 25-29 and 30-34 age groups and shorter infertility durations. The analysis of male and female infertility factors showed a significant impact on pregnancy outcomes, emphasizing the need for a comprehensive approach to infertility treatment. Additionally, the study underscores the role of Anti-Müllerian Hormone (AMH) levels in predicting IVF outcomes, with normal AMH levels associated with more favorable results. Future research should focus on prospective studies with diverse populations and larger sample size to validate these findings and explore the underlying mechanisms influencing IVF outcomes.

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