

Factors Affecting Successful In Vitro Fertilization Process

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Abstract

Back ground: infertility poses a substantial public health problem for women of reproductive age, globally. Infertility can be overcome with a variety of emerging assisted reproductive technologies (ARTs). **Aim:** The aim of this study was to assess the factors affecting Successful in Vitro Fertilization Process. **Design:** Descriptive study was used in this study. **Sample** All women admitted to IVF process unit at maternity hospital in last two years 500 women and took 125 women in six months. **Setting:** This study was conducted in the in vitro fertilization unit at Ain Shams University Maternity Hospital. **Data collection: include: 4 Tools:tool1** Structured interviewing questionnaire; **Tool2** infertility factors assessment sheets,**Tool3 State** trait anxiety inventory scale **Tool4** likert scale assessment sheet of attitude of couple. **Results** This study showed that there was statistical significant relation between the two study groups regarding factors affecting successful IVF process (Age), while there was highly statistical significant relation between the two study groups regarding their income and BMI. The study revealed that there was no statistical significant relation between the two study groups regarding factors affecting successful IVF process regarding attitude, anxiety, medical, gynecological, obstetric and environmental factors. **Conclusion:** the current study concluded that there was a statistically significant relation between the two study groups regarding their(age ,income, BMI)as the factors affecting successful IVF process. Furthermore, more than half of the unsuccessful group had moderate anxiety level, and uncertain attitude regard IVF process. **Recommendations:** Increase awareness of newly married couples about reproductive health. Design an education program about the IVF process and study its effect on women's anxiety levels.

Key words: factors, successful in vitro Fertilization, age, obesity, psychosocial attitude

Introduction

Infertility is a problem that affects men and women of reproductive ages in all areas of the world. Infertility is typically defined as the inability to achieve pregnancy after one year of unprotected intercourse. If the woman has been trying to conceive for a year or more, the woman should consider an infertility evaluation. However, if the woman is 35 years or older, the woman should consider beginning the infertility evaluation after six months of unprotected intercourse rather than a year (Society et al., 2017).

Although there are various types of Assisted Reproductive Technologies (ART) and more innovative procedures developed every day, IVF has been proven to be the most effective ART procedure. An impressive 99% of ART

procedures are IVF or ICSI (Intracytoplasmic Sperm Injection) procedures (Brunet, 2018).

In Vitro Fertilization (IVF) is a treatment that helps an infertile woman to achieve a pregnancy. The technique involves four main steps: the development of eggs in the woman's ovaries; the removal of eggs from her ovaries; the placement of the eggs and sperm together in the laboratory to allow fertilization to occur, and the transfer of fertilized eggs (embryos) into the woman's uterus for the establishment of pregnancy (Rani & Paliwal, 2016).

There are many factors that affect success of IVF process as ethnicity, the cause of infertility, age, subfertility duration, parity, and lifestyle factors, oocytes retrieved, endometrial thickness, the number of embryos transferred and quality of blastocysts (Azmoddeh et al., 2018).

In Egypt, the chances of IVF success are directly related to the age of the female partner. Efficient treatment has an almost 50% chance of pregnancy with females aged 35 or less. Between ages 35 and 39 chances of success drop to approximately 35-40%; while at the age of 40 chances of pregnancy drop to 20% and at 43 years to 5%. The latest results of cycles performed in one year (2016) had a success rate of embryo survival following thawing (de-freezing of embryos) is around 97% while the chance of becoming pregnant is around 35% (**The Egyptian IVF center, 2018**).

The major complication of IVF is the risk of multiple births which is directly related to the practice transferring of multiple embryos. Sometimes, multiple births are related to increased risk of pregnancy loss, obstetrical complications, prematurity, and neonatal morbidity with the potential for long term damage. Sometimes, there is risk of transferring of chronic disease such as hepatitis B to female patients and their expecting offspring by sperm during their incubation which can be brought to negligible levels (**Bhandari et al., 2018**).

Justification of the study:

The total fertility rate in Egypt dipped from 3.5% in 2014 to 3.1% in 2018, according to a study prepared by UNFPA, with data collected from the birth and mortality registration system implemented in collaboration between the Ministry of Planning, Monitoring and Administrative Reform and the Ministry of Health and Population. Fertility levels are the main determinant of population growth. Since 2006, fertility levels in Egypt were on an upward trend, reaching its highest level in 2014 at 3.5%. Fertility levels decreased at a slow pace in 2017 (3.4) % compared to 2014, but saw a sharp decrease in 2018, reaching 3.1% (**Zheng, 2021**).

Average incidence of infertility is about 15% globally varies in different populations some causes can be detected and treated, whereas other cannot; unexplained infertility constitutes about 10% of all cases (WHO, 2019).

Aim of the study

The aim of this study was to assess the factors affecting Successful in Vitro Fertilization Process.

Research question:

What are the factors that affecting successful in vitro fertilization process?

Subject and method for this study were portrayed under four main designs as follow:

1. Technical design .
2. Administrative design.
3. Operational design.
4. Statistical design.

Technical design:

The technical design used for the study involved the following items, research design, setting of the study, sample of the study and tools for data collection.

Study design:

Descriptive study was utilized to conduct this study.

Study setting:

This study was conducted in the in vitro fertilization unit at Ain Shams University Maternity Hospital. This unit consists of four rooms, two bathrooms, the office of the head of the department, nursing office, nursing room and room for doctors.

Subject:

Sample type:

A convenience sample was used.

Sample size:

All women admitted to in vitro fertilization process unit at Ain Shams University maternity hospital total sample size calculated based on the annual incidence of IVF in last two year 500 women according after equation the total sample 125 women.

$$\text{Sample size, } n = N * \frac{\frac{Z^2 * p * (1-p)}{e^2}}{[N - 1 + \frac{Z^2 * p * (1-p)}{e^2}]}$$

N = Population size,

Z = Critical value of the normal distribution at the required confidence level,

p = Sample proportion,

e = Margin of error

Sample technique: based on formula sample size required were 125 women

Tools and data collection:

Tool I: Structured interviewing questionnaire:

This tool was developed by researcher after passing through extensive and relevant review of literature this tool included the personal Characteristic: (age, residence, level of education and income)

Tool II: Infertility factors assessment sheet:

Assessment sheet was collect by the researcher concerned infertility factors affecting successful IVF process such as women causes, environmental factors, occupational factors, unit of IVF factors, physical factors, medical and gynecological factors related to IVF process.

Tool III: (State Trait Anxiety Inventory)

It included assessment of anxiety level Adapted from Mewton related to in vitro fertilization process included 20 items be measure anxiety for women and modified by the researcher according to the aim of this study. (Mewton et al., 2016).

❖ Scoring system for Psychological scale:

20 statements of questionnaire were used to assess anxiety level related to IVF process.

-All items ranged from (correct answer (3) - uncertain (2) - incorrect answer (1)

Score % = (the observed score / the maximum score) × 100

The total score was from 20-60 grades:

- Mild anxiety <50% (Range score 20-30)
- Moderate anxiety ≥50-75% (Range score 31-50)
- Sever anxiety >75% (Range score 51-60)

Tool IV: likert scale assessment of the attitude: was use to assess attitude of women regarding factors affecting successful in vitro fertilization process, include 25 items to assess attitude of couple with 1 (disagree), 2 (don't know), 3 (agree) (Brezina and Zhao, 2018).

- Total score could range from 25 to 75.

-All items were rated by using a Likert-type scale.

Score % = (the observed score / the maximum score) × 100

The total score was from 25-75 grades:

- Negative attitude < 50% (Range score 25-36)
- Uncertain attitude ≥50-<75% (Range score 37-56)
- Positive attitude >75% (Range score 57-75)

Operational design:

The operational design includes preparatory phase, Pilot study and field work.

Preparatory phase:

It included reviewing current and past, local and international related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection. The developed tools were examined by experts to test their reliability to the study.

Administrative design:

An official approval to conduct this study was obtained from dean of faculty of nursing Ain Shams University, a letter containing the title and aim was directed to administrator of the previous mentioned study setting.

Pilot Study:

A pilot study was conducted on 10% of the total sample from (125) took (13)

women in order to ensure the applicability of the tools and the time needed to complete it was included or excluded from study sample and also to test study process.

Field Work:

After approval from head of department of previous mentioned study setting the researcher visited the study setting 2 days / week at morning shift from 8 am to 2 pm to collect data started from 1 July, 2020 to the end of December, 2020. The researcher started to introduce herself and explained the aim of the study to the women and took oral consent from study. The average number of women interviewed per day were (4-5 women / day) using four tools to carry out the research were the first tool structured interviewing questionnaire within time range (4) minutes and second tool infertility factors assessment sheet, third tool (state trait Anxiety Inventory) in time range (6) mints also fourth tool likert scale assessment sheet regarding attitude of women related to in vitro fertilization process within (5) minutes. The total duration of each interview was (10-15) minutes and filled by the researcher. The researcher repeated previous steps until sample size was completed. After that the researcher took all women finished IVF process to follow outcome IVF after 3 months and categorized according successful and unsuccessful group and found the relation for the women factors that affecting IVF process.

Statistical analysis:

Recorded data was analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data was expressed as mean± standard deviation (SD). Qualitative data was expressed as frequency and percentage.

Ethical Considerations:

- The researcher assured maintaining anonymity and confidentiality of the subject data.
 - Women had informed consent and they are allowed to choose to participate or not in the study and that they have the right to withdraw from the study at any time without penalties.
- #### Results:
- Table (1):** this table shows that there was statistical significant relation between successful and unsuccessful group regarding personal characteristics factors affecting successful in vitro fertilization process (age) at p-value ($p < 0.05$), while there was highly statistical significant relation between successful and unsuccessful group regarding their income at p-value ($p < 0.001$).
- Table (2):** this table shows that there was high statistical significant relation between successful and unsuccessful group regarding factors affecting successful IVF process (BMI) at p-value ($p < 0.001$).
- Table (3):** this table shows that there was a highly statistical significant relation between successful and unsuccessful group of IVF process regarding infertile duration at, (p -value < 0.001) also the table shows a significant relation between successful and unsuccessful group of IVF process regarding using of oral contraceptive pills at (p -value 0.039).
- Table (4):** this table shows that there was statistical significant relation between successful and unsuccessful group of IVF process regarding (Diabetes mellitus) at p-value (< 0.05).
- Table (5):** this table shows that there was a highly statistical significant relation between successful and unsuccessful group of IVF process regarding their IVF unit factors at p-value ($p < 0.001$), while there was no statistical significant relation between successful and unsuccessful group of IVF regarding (Occupational factors) at P-value > 0.05 .
- Table (6):** this table shows that there was no statistical significant relation between

successful and unsuccessful group of IVF regarding total level of anxiety at **P-value >0.05**.

Table (7): this table shows that there was no statistical significant relation between successful and unsuccessful group of IVF and their total level of attitude at **P-value >0.05**.

Table (1): Distribution of study sample according to personal characteristic factors affecting successful IVF process (N=125)

Characteristics	Successful group (n=40)		Un successful group (n=85)		Chi-square test	
	No.	%	No.	%	x ²	p-value
Women Age (years)						
18-	40	100	65	76	9.522	0.002*
30-45	0	0	20	24		
Residence						
Urban	22	55	37	44	1.013	0.314
Rural	18	45	48	56		
Educational level						
Illiterate	6	15	13	15	2.186	0.535
Basic education	6	15	22	26		
Secondary	12	30	24	28		
High education	16	40	26	31		
Consanguinity						
Yes	16	40	33	39	0.005	0.944
No	24	60	52	61		
Income						
Enough	12	30	24	30	16.18	<0.001**
Not enough	28	70	61	70		

Table (2): Distribution of study sample according to physical factors affecting successful IVF process (N=125).

Physical factor	Successful group (n=40)		Un successful group (n=85)		Chi-square test	
	No.	%	No.	%	x ²	p-value
BMI						
18-	8	20	1	2	19.000	<0.001**
25-	23	57	41	48		
30≥	9	23	43	50		
Height						
Mean 158-170cm	40	100	85	100	0.000	1.000
Weight						
Mean <70≥90 kg	40	100	85	100	0.000	1.000

Table (3): Distribution of study sample according to factors related infertility affecting successful IVF process (N=125).

Factors related infertility	Successful group (n=40)		Unsuccessful group (n=85)		Fisher's Exact	
	No.	%	No.	%	FE	p-value
Infertile duration(in years)						
5- years	8	20	13	15	16.18	<0.001**
10- years	27	68	48	57		
15> years	5	12	24	28		
Previous of pregnancy						
No	40	100	85	100	0.000	1.000
Yes	0	0	0	0		
IVF trail						
Once	15	38	31	36	x ² =0.480	0.923
Twice	10	25	26	31		
Triple	12	29	22	26		
>3	3	8	6	7		
Infertility problems						
Obesity	9	21	16	18	x ² =0.267	0.605
Poor sperm motility	4	10	11	13	FE	0.632
Endometriosis	4	10	12	14	FE	0.133
Low sperm production	6	15	10	12	x ² =1.312	0.252
Uterine fibroids	3	8	12	14	3.511	0.061
Polycystic ovary syndrome	4	10	10	12	FE	0.743
Adhesions	9	23	10	12	0.015	0.903
Blocked fallopian tubes	1	3	4	5	FE	0.611
Previous use contraception method						
Intra Uterine Device	0	0	3	4	FE	0.202
Oral Contraceptive Pills	2	5	0	0	FE	0.039*
Implant Contraceptive	0	0	2	2	FE	0.369

Table (4): Distribution of study sample according to medical and surgical factors affecting successful IVF process (N=125).

Medical and surgical Factors	Successful group(n=40)		Unsuccessful group (n=85)		Fisher's Exact	
	No.	%	No.	%	FE	p-value
Diabetes mellitus	1	2.5	13	19.3	FE	0.035*
Hypertension	3	8	12	14	x ² =0.915	0.339
Cardiovascular disease	1	3	1	1	FE	0.413
Anemia	21	53	43	51	x ² =0.043	0.835
Dilatation and curettage	1	2.5	0	0	FE	0.110

Table (5): Distribution of study sample according to environmental factors affecting successful IVF process. (N=125).

Environmental and Occupational factors	Successful group (n=40)		Unsuccessful group (n=85)		Chi-square test	
	No.	%	No.	%	χ ²	p-value
IVF unit environmental	8	20	49	58	15.694	<0.001**
Occupational factors						
Mild working>6h	12	30	17	20	0.055	0.973

Moderate working>8h	16	40	13	15
Heavy working<10h	4	10	6	7

Table (6): Distribution of study sample according to level of anxiety as a factor affecting successful IVF process (N=125).

Level of anxiety	Successful group (n=40)		Unsuccessful group (n=85)		Chi-square test	
	No.	%	No.	%	X ²	p-value
Mild anxiety before IVF	6	15	10	12	0.700	0.705
Moderate anxiety	19	48	47	55		
Sever anxiety	15	38	28	33		

Table (7): Distribution of study sample according to total level of attitude toward IVF process (N=125).

Level of attitude	Successful group (n=40)		Unsuccessful group (n=85)		Chi-square test	
	No.	%	No.	%	x ²	p-value
Negative attitude	1	2	9	11	2.444	0.295
Uncertain attitude	23	58	46	54		
Positive attitude	16	40	30	35		

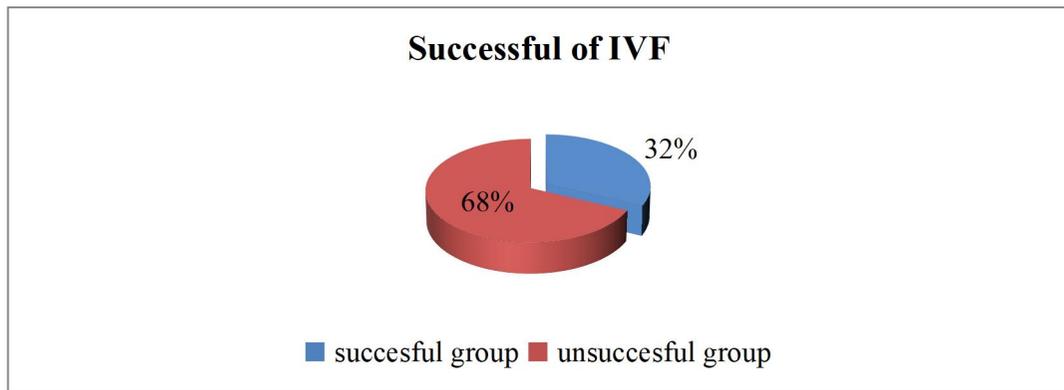


Figure (1): result of IVF process for outcome.

Discussion

In vitro fertilization (IVF) currently represents the most utilized method of ART and is typically associated with the highest clinical pregnancy rate and live birth rate compared with other infertility treatment options (Howell et al., 2020). The most common form of ART is in-vitro fertilization (Virtus Health, 2020), which is a life-changing or transformative service. That is, it is a service aimed at improving consumer well-being by enabling women to conceive who are unable to do

so naturally. While various factors have led to the increasing demand for IVF, most notable is that some women are choosing to try to conceive a child(ren) later in life and fertility rates decline with age (Zemyarska, 2019).

The current study findings showed that there was statistically significant relation between successful and unsuccessful group of IVF regarding their age; where aging affected the success of IVF procedures. This may be explained that the uterus of elderly women has decreased

vascularity, endometrium thickness, and prostaglandin production which were related to embryo implantation.

Similarly, **Sa'adi et al. (2021)** in a cross-sectional study entitled "Association of Patient Characteristics with in Vitro Fertilization (IVF) found that General Hospital, Surabaya" among a total of 102 couples undergoing IVF, 37 couples successfully obtained a pregnancy while the 65 other couples failed IVF, couples that succeed IVF were mostly aged around 25-35 with no reported success among the observed samples at age over 40. This study concluded that out of all the studied patient characteristics, only maternal age was associated with IVF failure with the p value of 0,03.

The current study findings also were supported by **Rendtorff et al. (2017)** results in a study entitled "Pregnancies in Women Aged 45 Years and Older; a 10-Year Retrospective Analysis, in Berlin", which presented data from Charite University Hospital 2004-2014 on the percentage of pregnancies in a group of women: 43.3% for 19-29 years old; 48.8% for 30-39 years old; 5.2% for 40-44 years old; and the smallest percentage of successful pregnancy at 0.34% for women aged over 45 years old. other similar findings were reported by **Wang et al. (2021)**, and **Saphiro et al. (2016)** who stated that successful implantation was found to be associated with the following factors: age, the type of embryo transfers (frozen or fresh), and the number of previous embryo transfers cycles.

The current study showed that there was highly statistical significant relation between successful and unsuccessful group regarding income. This may be explained that the prices of in vitro fertilization process are inversely proportional to the family income in most families, due to the high cost in all centers and hospitals, and one of the biggest problems is that there is no health insurance in Egypt like other European countries.

Whereas there was no statistical significant relation between successful and unsuccessful group regarding consanguinity. This may be explained that the harms of

inbreeding on children plays an important role in determining some aspects of their health that negatively affect the reproduction and health of newborn children, but it did not show any harmful effects on fertility and mortality of children, but the high level of harms of inbreeding on children must be taken into account and avoided as much as possible for what causes inbreeding from congenital diseases of children.

The current study findings also were supported by **Wellhausen, Nachrichten. (2017)**, results in a study entitled "Inbreeding and its relation to genetic diseases" which presented data warned against continuing to marry between relatives, the percentage of consanguineous marriage in some countries is very high, as the percentage of consanguineous marriage in Europe reached small percentage, in Kuwait almost half, in Sudan more than half, and in Egypt the percentage started to decrease and is currently estimated at around third for total population. And many researches stated that the most important advice for inbreeding is to prevent it as much as possible, as the percentage of diseases in children resulting from consanguineous marriage is double that resulting from normal marriage, as a result of the presence of unkind qualities in the husband or wife.

The current study showed that, almost half of successful group and around third of unsuccessful group have highly educational level regarding women. this finding goes in the same line with **Liu et al. (2021)** in a study entitled "Impact of maternal education level on live birth rate after in vitro fertilization: a retrospective cohort study" which concluded that there was no statistically significant relationship between educational level and live birth in patients undergoing fresh or frozen embryo transfer. This may be explained by educational level not affect in this process because all women follow instruction without any hesitation to get a pregnancy and health of fetus and safety through obtaining information from seminar and follow up with obstetric and gynecological specialist.

Furthermore, the current study revealed that there was high statistically significant relation between successful and unsuccessful group regarding BMI as a factor affecting the success of in vitro fertilization process. This may be explained that obese women have an increased risk of ovulation, menstrual disturbances, infertility, polycystic ovarian syndrome, gonadotropin resistance, diminished oocyte embryo quality and implantation failures in IVF patients.

This result was accepted with **Kasum et al. (2018)**, in a study aimed to study the role of female obesity on in vitro fertilization outcomes, concluded that attaining normal body weight using lifestyle modifications, including a healthy diet and exercise over time of several months before and during an IVF treatment, may be successful in achievement of gradual and sustainable weight loss with improvement of IVF outcome.

This result was contradicted with **Mutsaerts et al. (2018)**, although weight loss theoretically should be the first line of treatment for overweight and obese patients undergoing IVF, the investigations on weight loss and pregnancy outcomes were discouraging, because there was no support in recently published studies for the assumption that weight loss before IVF had a beneficial effect on pregnancy outcomes.

Our study reported that there was a highly statistically significant relation between successful and unsuccessful group and their infertile duration. Additionally, other findings as **Mohamed et al. (2018)** agreed with our study results that around half of women had duration of infertility between 5 to 10 years and about one third of studied women were infertile for more than 10 years. Most of them had primary infertility. Furthermore, one quarter of studied women have a history of IVF, around third of women performed IVF had a positive pregnancy test. Also, revealed that women with increased period of infertility decreased the probability of positive pregnancy and most of positive outcomes occurred in women with primary infertility.

Also, there was statistically significant relation between successful and unsuccessful group of IVF regarding, medical and surgical factors such as whale diabetes mellitus. These results disagreed with **Mohamed et al. (2018)** in a study aimed to determine the physical and psychological factors affecting outcomes of women undergoing IVF, which demonstrated that regarding the physical status of infertile women, about half of women free from any health problems with a benefit on the IVF outcomes but other women complain of health problems, most of these diseases were confined to poor ovarian reserve (13%), PCO (6 %) and (4%) with mixed problems. There was statistically significance difference (p value 0.001) regarding the maternal physical health problem and IVF outcomes.

Whereas there was high statistically significant relation between successful and unsuccessful group of IVF process regarding factors affecting IVF unit. This may be explained that all units compete in the success rate of the operation with using modern technologies, the latest laboratories responsible for analyzing hormones and sperm issues, there were highly experienced doctors and many methods for the success of the operation.

According to the state trait anxiety inventory of the current study there was highly statistically significant relation between successful and unsuccessful group of IVF process and their satisfaction regarding to IVF process. This may be explained that anxiety not effect on result of labs or medications or outcome of IVF process.

The results were reported by **Capuzzi et al. (2020)** in a systemic review entitled "Is in vitro fertilization (IVF) associated with perinatal affective disorders". Among a total of 10 articles, three studies found that women who resorted to IVF showed less anxiety and depressive symptoms than those who conceived naturally especially with the progression of pregnancy and in the postpartum.

Prominently, positive attitude regarding the infertility and IVF process among the studied population was found to be inadequate.

Our study revealed that there was no statistically significant relation between successful and unsuccessful group and their total level of attitude.

A study carried by **Bilinović et al. (2019)**, **Ahmed et al. Malina et al. (2020)** aimed to examine the attitudes of infertile women in Serbia towards third-party reproduction, revealed that the negative attitudes were most prevalent among participants with low- and medium-level education.

Conclusion

Based on results, the current study concluded that there was a statistically significant relation between the successful and unsuccessful groups regarding their age. Moreover, there was a highly statistically significant relation between the two groups regarding income- BMI and infertile duration. Furthermore, more than half of the unsuccessful group had moderate anxiety level, and uncertain attitude regard IVF process. Also there was no statistically significant relation between the successful and unsuccessful groups regarding their anxiety level or their attitude toward IVF process regarding factors associated with personal characteristics.

Recommendations

- Increase awareness of newly infertile married couples about reproductive health, and the possible assisted reproductive technologies by health education.
- Design an education program about the IVF process and study its effect on women's anxiety levels.
- Give awareness to the education about healthy life style to improve chance of conception

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