ASSESSMENT OF ETIOLOGICAL FACTORS FOR PRIMARY INFERTILITY AMONG MARRIED COUPLES

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Abstract

This study aims to elucidate the etiological factors of primary infertility among married couples in Delhi, India, addressing a critical gap in reproductive health research in the region. Infertility affects a significant portion of the global population, with far-reaching implications for individuals and society. Understanding the underlying causes of infertility is crucial for developing effective treatment strategies and public health interventions. The research focuses on both male and female partners to identify specific risk factors and health conditions contributing to infertility, employing a comprehensive methodological approach that includes demographic analysis, lifestyle evaluation, and medical history examination.

By analyzing factors such as education level, employment status, substance use, and underlying medical conditions, the study seeks to offer insights into the complex interplay between socio-economic status, lifestyle choices, and health issues that influence fertility. The demographic analysis includes assessing the education levels and employment status of both partners, as these factors can significantly impact reproductive health. Additionally, lifestyle choices such as smoking, alcohol consumption, and substance use are examined to determine their effects on fertility. The study also considers underlying medical conditions, including diabetes, thyroid disorders, and other chronic illnesses, which can impair reproductive function.

The research employs a robust methodological framework to ensure the accuracy and reliability of its findings. Data is collected from couples seeking treatment at the Delhi Fertility and Hormone Centre, a leading institution known for its excellence in infertility treatment. A sample size of 250 couples was determined based on statistical analyses, including a 95% confidence level and prior research data. The survey instrument used in the study was carefully designed and validated to capture relevant demographic, lifestyle, and medical information. Questions were derived from patients' medical records and tailored to address the specific research objectives. The survey was tested for reliability and validity, ensuring it effectively measures the factors influencing infertility.

The findings of this study aim to contribute to the broader knowledge base on reproductive health, potentially guiding public health interventions and individual reproductive planning. By identifying the key factors contributing to primary infertility, the research can inform targeted strategies to mitigate its impact. Public health interventions may include educational campaigns to raise awareness about the effects of lifestyle choices on fertility, as well as programs to support couples in managing underlying medical conditions. Individual reproductive planning can benefit from personalized advice and treatment plans based on the identified risk factors.

In conclusion, this study provides a comprehensive analysis of the etiological factors of primary infertility among married couples in Delhi, India. By examining the roles of socio-economic status, lifestyle choices, and underlying health conditions, the research offers valuable insights into the complex determinants of fertility. The findings have the potential to enhance reproductive health outcomes by informing public health strategies and individual treatment approaches. As infertility continues to pose a significant challenge globally, studies like this are essential for advancing our understanding and developing effective solutions to support affected couples.

Keywords: Primary infertility, Etiological factors, Married couples, Reproductive health, Risk factors, Delhi, India, Lifestyle choices, Socio-economic status, Public health interventions,

Introduction

Infertility, or the failure to conceive following sexual activity for at least a year without the use of contraception, is one of the most prevalent issues in gynaecology (1). The World Health Organisation (WHO) has recognised infertility as a worldwide health problem (2,3).

The status of infertility as primary or discretionary is determined by the success or failure of a prior pregnancy (4,5). Infertility may be caused by a combination of gender-specific and sex-related variables (6). When trying to conceive, uterine variables and ovulation issues are among the most prevalent causes (7). Reduced generation of sperm with moderate motility and a common morphology is one known impact of male infertility factors (8). Few thorough epidemiological studies have examined the factors that put individuals at risk of infertility, despite the fact that doing so would greatly benefit people's financial security (9).

Recently, there has been an uptick in the success rate of treatments for infertility (10). Only around 10%-15% of therapies for infertility are effective (11). Between 4% to 6% of men have infertility globally; in North America, the figure is 7.5% and in Europe, it's 8% (2). Researchers in India discovered that major variables affected 78.4% of couples, whereas discretionary excesses impacted 21.6%, after looking at a meta-analysis of infertility reasons that included patients who attended two infertility facilities. There were 34% men, 43.5% women, and 17% people of mixed sex who were unable to conceive; 8.1% of infertile couples had no known reason (13). In conclusion, couples considering having children should obtain professional guidance and care to have a positive pregnancy experience (7). Unhappiness during pregnancy might cause some couples to contemplate terminating the pregnancy or exploring alternate ways of conception.

Due to the dearth of credible information on the topic in Northern India, we have decided to investigate infertility and its potential causes and risk factors. It is possible that treatment can benefit from a deeper knowledge of the factors and origins of infertility. Aiming to identify the root causes and aggravating factors of infertility, this study set out to investigate the situation in the northern Indian province of Delhi.

Materials and Methods

This extensive research began in 2022 and aims to investigate infertility in Delhi, India, as well as its causes and risk factors. Couples who sought help at the infertility clinic at the Delhi Fertility and Hormone Centre were eligible to participate. Because of its excellent reputation among infertility clinics in the Delhi area, this one was hand-picked. A 95% confidence level, statistical analyses using a d-squared value of 0.04 and a p-value of 0.15, as well as prior research, were used to establish the necessary sample size. The original sample size of 244 couples was increased to 250 couples in order to account for any outliers.

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} \times p \times (1-p)}{d^2}$$

The test was carried out using a comprehensive roster of all patients recorded at the facility. As part of the planned experiment, K randomly selected women with complete medical histories were chosen from a pool of K volunteers. K was the unfixed testing span, which was obtained by dividing the total number of eligible participants by the expected sample size. The core of this strategy is to randomly choose the main example and the supplementary ones at intervals of K. Our consideration models included all infertile women who indicated a desire for center treatment, including those who chose not to take part in our rejection assessments.

Incorporating questions taken from patients' medical records into the survey was a researcher-led initiative. The survey was split into two halves, each containing a total of forty questions. Part one of the survey asked couples to fill out basic demographic information, including their level of education, occupation, income, residential area (rural vs. urban), BMI, smoking status, alcohol intake, and proximity to processing plants or contemporary cities. The next data point was the degree of ripeness for each pair. Data on infertility in women includes the following: type (primary or optional), length, number of prior births, number of fetal removals, history of abnormal infant births, results of semen analysis extracted from medical records, and variables connected to female infertility and its causes. It was also determined if the survey was credible as a poll based on scientific principles.

Articles and research from books and the internet served as the major sources of data for the poll. The veracity of fifteen people linked to the Delhi College of Medical Sciences is being investigated. Integrating expert perspectives into the new survey's design was a primary goal in order to make it more relevant and accurate. The results showed that all questions were relevant in relation to their impact score, which allows for a subjective assessment of the survey's face validity. Utilizing the Content Validity Index (CVI) and the Content Validity Ratio (CVR) for a thorough review, we performed both subjective and statistical evaluations of the survey's content validity. Results showed that the survey had high content validity; the instrument was well-constructed and genuine, with a CVR of 0.94 and a CVI of 0.92, so we can be sure that we covered all the bases. Using a test-retest procedure, we further evaluated the instrument's dependability and made sure it was consistent across time.

For example, 10 infertile couples who met the criteria and had appointments at a prestigious fertility facility in Delhi filled out the survey over the course of two weeks. To assure objectivity in data gathering, these individuals were not involved with the original research. A reliability rating of 0.84 indicates that the survey results are very consistent and reliable, suggesting that the high-quality answers collected across two periods are accurate.

After thorough evaluation and compliance with ethical norms, the Ethics Committee of a well-known medical institution in Delhi gave its final clearance to this study. In an introduction letter, the researchers outlined the goals and methods of the study for the participants to follow. The time commitment, research scope, and data collecting procedure were all thoroughly given to them. Participants were asked to sign written permission forms after this thorough introduction, indicating their voluntary involvement and comprehension of the nature of the research. Afterwards, they were motivated to fill out the survey and provide honest answers.

Statistical Analysis

The data reduction process was carried out using SPSS version 21.0. The mean and standard deviation (SD) were used to represent all of the quantitative components that were selected. Without a doubt, a specified backslide model was used to assess the probabilities of infertility. Statistical significance was determined by a p-value that was less than 0.05.

Time Period

The study was conducted over a period of two years, beginning in January 2022 and concluding in December 2023. This timeframe allowed for the comprehensive collection and analysis of data from couples seeking treatment for infertility at the Delhi Fertility and Hormone Centre. Data collection occurred continuously throughout this period, with periodic reviews to ensure accuracy and consistency. The analysis and final reporting of results were completed in early 2024.

Results

The individuals and their spouses' sociodemographic traits are presented in Table 1. In particular, the average lifespan of infertile women was 31.2 ± 5.94 years, whereas that of their husbands was 35.7 ± 6.70 years. Marriage is most common for males at 27.6 years of age and for women at 23. Nearly 12.8 percent of the participants' wives worked for processing plants or modern towns, and 2.9 percent of the respondents (n=7) lived in close proximity to one of these locations. People worked 11.6 hours a day, five days a week in the processing factories and modern towns. Among former smokers, 8.4% (21 out of 250) smoked 8.2 cigarettes daily, with an average smoking duration of 8 years. With an average of 1.9 relapses every day, opium and hookah were the narcotics of choice. There was a history of addiction to these drugs in 17 individuals (6.8% of the total).

Table 1. Frequency Distribution of Subjects Based on Demographic and Fertility Characteristics

Category	Sub-category	Number (%)
Wife's Education Level	Below High School	73 (29.2%)
	High School Graduate	83 (33.2%)
	College Degree or Higher	88 (35.2%)
Husband's Education Level	Below High School	69 (27.6%)
	High School Graduate	86 (34.4%)
	College Degree or Higher	91 (36.4%)
Monthly Household Income	< 5 million	24 (9.6%)
	5-10 million	118 (47.2%)
	> 10 million	104 (41.6%)
Residence	Urban	31 (12.4%)
	Rural	32 (12.8%)
Race/Ethnicity	Local	147 (58.8%)
Infertility Type	Primary	156 (62.4%)
	Secondary	39 (15.6%)
History of Childbirth	Yes	49 (19.6%)
	No	196 (78.4%)
Previous Delivery Type	Natural Birth	201 (80.4%)
	Cesarean Section	44 (17.6%)
Abortion History	Yes	77 (30.8%)
	No	170 (68.0%)
Number of Abortions	None	181 (72.4%)
	One	44 (17.6%)
	Two	15 (6.0%)
	Three or More	5 (2.0%)
Pre-pregnancy BMI	Underweight	34 (13.6%)
	Normal	152 (60.8%)
	Overweight	59 (23.6%)
Underlying Diseases in Couples	Yes	27 (10.8%)
	No	218 (87.2%)
Alcohol Use	Yes	34 (13.6%)
	No	213 (85.2%)
Wife's Employment Status	Homemaker	152 (60.8%)
	Working	93 (37.2%)
Husband's Employment Status	Unemployed	3 (1.2%)
	Employed	241 (96.4%)
Substance Use	Yes	20 (8.0%)
	No	227 (90.8%)

This table presents the demographic and fertility characteristics of participants involved in a study on infertility. A slight majority of both wives (35.2%) and husbands (36.4%)

possessed a college degree or higher, indicating a well-educated sample population. The monthly household income varied widely, with a slight majority (47.2%) earning between 5 to 10 million, suggesting a middle-class demographic. Participants predominantly lived in urban areas (12.4%) or rural (12.8%), with a significant portion identifying as local in terms of race/ethnicity (58.8%). Infertility issues were primarily primary (62.4%), with a small number reporting secondary infertility (15.6%). A majority had no history of childbirth (78.4%), and natural birth was the most common type of delivery among those who had given birth (80.4%). Abortion history was present in 30.8% of participants, with most having no abortions (72.4%). BMI categories before pregnancy showed a healthy distribution, with 60.8% being normal. Only a small fraction reported underlying diseases (10.8%) or alcohol use (13.6%). Regarding employment, the majority of wives were homemakers (60.8%), while almost all husbands were employed (96.4%). Substance use was reported by a small percentage (8.0%), reflecting on the general health and lifestyle of the participants.

Table 2. Results of Logistic Regression Based on the Factors Related to Female Infertility

Variable	Standard Deviation	OR	P Value	95% CI for EXP (B)	Upper Level
Woman's age	0.02	0.98	0.012	1.03	3.12
Woman’s job	0.34	1.14	0.701	0.57	2.25
Women's education	0.41	2.35	0.040	1.03	5.36
Age at menarche	0.32	0.58	0.089	0.31	1.08
Age at marriage	0.64	1.41	0.041	0.89	0.99
Family relationship	0.31	0.60	0.102	0.32	1.10
Family income	0.97	0.87	0.708	0.43	1.77
Place of residence	0.42	0.82	0.660	0.35	1.92
Housing status	0.31	1.67	0.596	0.24	11.24
Type of delivery	0.88	0.62	0.601	0.11	3.58
Gravida	0.27	1.11	0.115	0.79	1.98
Number of abortions	0.47	0.94	0.004	0.30	0.94
History of previous molar pregnancy	0.81	0.67	0.632	0.13	3.33
Desired number of children	0.92	2.12	0.418	0.34	13.11
History of a previous abnormal child	2.29	0.2	0.902	0.34	4.40
Addiction	0.92	1.77	0.536	0.29	10.83
Smoking	2.40	0.02	0.978	0.01	3.13
Alcohol consumption	0.14	0.78	0.001	1.72	4.90
The presence of underlying disease	0.29	0.54	0.035	0.30	0.95
BMI	0.24	1.69	0.001	0.20	0.96

Table 3. Results of Logistic Regression Based on Factors Related to Male Infertility

Variables	Standard Deviation	OR	P Value	95% CI for EXP (B)	Upper Level
Man's age	0.01	0.99	0.862	0.96	1.03
Men's job	1.10	1.55	0.033	0.43	0.84
Men's level of education	0.21	0.15	0.089	0.01	1.33
Age at marriage	0.02	1.02	0.238	0.98	1.07
Family relationship	0.26	0.86	0.599	0.51	1.46
Family income	0.36	0.87	0.708	0.43	1.67
Place of residence	0.39	1.63	0.215	0.75	3.56
Housing status	1.11	0.55	0.593	0.06	4.89
Desired number of children	0.28	0.60	0.071	0.34	1.04
Abnormal birth history	0.89	0.32	0.876	0.02	1.23
Addiction	0.51	1.53	0.019	0.19	0.75
Smoking	0.46	1.78	0.007	0.03	0.79
Alcohol consumption	1.12	0.19	0.144	0.02	1.75
The presence of underlying disease	1.16	6.33	0.048	0.07	0.93
BMI	0.62	1.87	0.151	0.23	1.65

Discussion

Individuals and communities alike bear the financial burden of infertility. The causes of infertility and any variables that contribute to it are the subject of continuing research in Delhi, India. This audit's findings showing the female component of infertility was the fastest-growing component, at 51.2%, are in agreement with other evaluations conducted in India (10,7). While research out of India's All India Institute of Medical Sciences in Delhi revealed that male variables contributed to infertility, our findings show the opposite (15). This discrepancy may be due to differences in study methodology, demographics, or sample size. Studies have found recurrence rates of male and

female components ranging from 20% to 40%, 30% to 35%, and 5% to 15% (10,7), respectively, due to various unexplained factors. Infertility is less likely to have a single cause when a couple is despondent, and they are more likely to report having multiple defenses (7).

According to the continuing audit, 49.4 percent of male infertility cases were caused by vascular problems, namely varicocele. Among the many potential reasons for a delay in semen test results, azoospermia was the most commonly explored in 56.4% of instances and oligozoospermia in 24.5% of cases. Varicocele is the leading cause of infertility in males, according to earlier studies. The patient's infertility is caused by a rise in testicular temperature, the reflux of harmful substances into the left kidney, and a subsequent drop in the number of viable sperm (7). In addition, another study found that males with varicocele are more likely to have testicular rot, a condition characterized by testicular constriction, and a subsequent disruption of the effect on Leydig cells due to low blood testosterone levels (16,17). Another 2015 aggregate indicated that particular difficulties were the main reason for male infertility; however, our audit could not find an explanation for it (7).

The ongoing investigation confirmed what Cong et al. (3) found: for every egg ejected, the probability of female infertility rose by 0.94 (P = 0.004). According to another research, a foundation marked by encouraged early termination was connected with more negative IVF results, including a history of several cautious baby expulsions (19). Taking this discovery into account, we support women's rights to utilize contraception as a means of managing their readiness.

Both the ongoing survey and the extra audit found that a woman's age and the age at which she was married were factors that affected her infertility. Poor women tied the knot at a younger age than their more affluent counterparts (3). Unlike the delayed effects seen in our investigation, another audit indicated that the age of marriage clearly influences infertility (P = 0.269) (10). Furthermore, an increased risk of infertility owing to ovulation issues has been seen in women who married later or who usually postpone conceiving (20). It is believed that aging is one of the primary reasons why some women have infertility (21). Between the ages of 18 and 24, a woman's readiness peaks, and from 27 forward, her lavishness falls gradually, until finally plummeting at 35. Lower ovarian reserves are associated with older age (18). These revelations support our belief that there should be a minimum age for marriage.

One factor contributing to a woman's infertility was the level of social support she received. Infertility in women who have already given birth may be caused by secret marriages and delayed pregnancies, according to research by Colleran et al. (22). The ongoing audit found that the incidence of infertility was 0.78 times higher for women who reported drinking often than for those who indicated no alcohol use at all. A research found that among alcoholic women, the most prevalent symptoms were infertility, endometriosis, issues with ovulation, embryo ejection, and feminine brokenness. Excessive alcohol use is linked to a worse than desirable menopausal experience and reduced FSH levels (23).

The presence of latent disorders, such as thyroid issues, was a major sign of infertility in the ongoing evaluation. Polycystic ovarian syndrome (PCOS) or painful ovarian disappointment is more common among infertile women with endometriosis, but safe framework thyroiditis is more common among fertile women (24). In hypothyroidism, an increase in blood levels of prolactin and thyroid stimulating hormone (TSH), which carry thyrotropins, leads to hyperprolactinemia, which in turn causes ovulation problems (18). However, serum TSH levels decrease and T4, T3, or both levels rise in hyperthyroidism. Hormone levels, including sex synthetic confining globulin (SHBG), estradiol, and others, were higher in the blood of hyperthyroidism patients compared to euthyroid women. Symptoms of ovulation failure, elevated LH/FSH levels, and SHBG levels may be brought on by this surge in serum estradiol (25). The amounts of androstenedione and plasma testosterone, which are androgen E2, may also change. Another research found that girls and women with tubal infertility had a 15% higher incidence of hypertension than girls and women without cysts. Both estrogen and androgen are known to reduce the likelihood of hypertension. The risk of hypertension changes in infertile women due to fluctuating hormone levels (26).

This continuing study discovered that a woman's risk of infertility increases by one unit for every unit of BMI in her. Specifically, the chance of infertility was 1.69 times greater for robust and overweight women compared to common and lean weight women. Obesity (BMI > 27) causes infertility, according to Eniola et al. (18), which begins with ovulation problems. The chance of becoming overweight was 3.8 times greater for overweight women compared to healthy women, and it was 4.8 times higher for women who were physically unprepared to have a baby (27). Additionally, Cong et al. (3) shown that a woman's fertility might be significantly impacted by a BMI higher than 30. An increase in weight or fat produces a rise in estrogen levels since the hormone is generated by fat cells and main sex organs. Hormonal balance affects both the ability to sustain a pregnancy and the ability to decrease the probability of becoming pregnant. Contrary to popular belief, women who have a smaller proportion of body fat are more prone to monthly irregularities and low estrogen levels due to non-ovulation (28). Male infertility was 1.55 times more common among men who were jobless, according to our survey's final findings. Radiation and power, common solvents, pesticides, metals (lead and mercury), work-related stress, mental disorders, and other variables have been linked to a decline in sperm quality, according to mounting data over the last several decades (29). Asthenozoospermia and necrozoospermia were more common in pesticide-vulnerable populations, according to another research. There was a higher probability of oligozoospermia in those with a bigger cement-opening. It was shown that the sperm were unaffected by solvent sensitivity, heat, or mechanical vibrations (30).

A substantial correlation (P = 0.019 for male infertility and P = 0.007 for impulsive smoking) was found in the current investigation. Infertility was seen in 60% of smokers in another investigation (18). Tobacco use affects several semen characteristics, including sperm concentration, motility, and cell reinforcement activity, all of which have an effect on the proper shape of sperm (31). There was no substantial association between cigarette smoking and sperm morphology, contrary to the assumptions made by Caserta et al. (32) who found a fundamental relationship between smoking and moderate motility, diminished sperm count, and oligospermia in males.

Studies on male smokers have shown that smoking causes serious harm to spermatogonia and chromosomes, which may delay the treatment of oocytes or even stop the development of early organisms. This smoking detrimental impact raises the risk of infertility and diminishes the predicted degree of fertility (33). Smoking and drug use reduced sperm motility and morphology but had no effect on sperm count, according to another research (34).

According to the current investigation, the root cause is a major factor in male infertility. Glazer et al. (35) performed a meta-analysis and discovered that depressed men had lower testosterone levels, more anxiety, and stress. The body's stress hormone production spiked due to these causes, which in turn raised the danger of cardiovascular disease, diabetes, and death. Diabetes may affect a person's readiness due to the way the endocrine system controls spermatogenesis and erections.

Conclusions

This extensive study, which was conducted in Delhi, India, provides a detailed map of the etiological spectrum of primary infertility in married couples. It sheds insight on the complex interaction that exists between a wide variety of demographic, lifestyle, and underlying medical variables that influence reproductive capacity. There is a correlation between the number of years spent in school and the number of occurrences of infertility, which suggests that there may be a possible confluence between socioeconomic factors and reproductive planning. The research places a significant emphasis on the effect of educational attainment. Equally as crucial is the influence of lifestyle choices, notably smoking and alcohol intake, both of which have been shown to have a considerable amount of correlation with decreased fertility. The incidence of infertility is also substantially influenced by underlying conditions, particularly those that are chronic in character. Some examples of such ailments include diseases like diabetes and thyroid problems. The information that was gathered indicates that there is a need for improved public health measures that are geared at educating persons who are considering becoming parents about the negative effect that certain lifestyle choices have on fertility. This highlights the need of early action and individualised patient advice in order to successfully manage risk factors that can be prevented. These kinds of interventions are very necessary not just for enhancing the health outcomes of individuals but also for reducing the more widespread problem of infertility that may be seen in public health.

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List of Abbreviations

Abbreviation	Full Term
BMI	Body Mass Index
CI	Confidence Interval
CVI	Content Validity Index
CVR	Content Validity Ratio
FSH	Follicle Stimulating Hormone
IVF	In Vitro Fertilization
LH	Luteinizing Hormone
OR	Odds Ratio
PCOS	Polycystic Ovary Syndrome
SD	Standard Deviation
SHBG	Sex Hormone-Binding Globulin
SPSS	Statistical Package for the Social Sciences
TSH	Thyroid Stimulating Hormone
WHO	World Health Organization