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Understanding Female Infertility: A Prospective Study on Prevalence and Associated Factors

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ABSTRACT

Background: Female infertility is a global health concern affecting millions of women, with causes ranging from hormonal imbalances and ovulatory disorders to structural abnormalities and lifestyle factors. Conditions like PCOS, endometriosis, and tubal blockages contribute significantly to infertility rates. Understanding its prevalence, risk factors, and treatment options is crucial for developing effective therapeutic strategies and improving reproductive health outcomes.

Material & Method: This prospective study analyzed 118 young females with primary or secondary infertility to assess prevalence and contributing factors. Data were evaluated using the Chi-square test, with graphical representations. Key parameters included infertility type, BMI range, menstrual cycle regularity, bleeding duration, and correlations between diagnosis, age, and infertility type to identify patterns and risk factors.

Result: This study revealed a higher prevalence of primary infertility than secondary infertility. PCOS was the most common diagnosis, followed by PCOD and ovarian cysts. Most participants had normal BMI, though many were overweight or obese. Sedentary lifestyle, weight gain, and menstrual irregularities were prominent factors influencing infertility prevalence

Conclusion: The study highlights PCOS as the leading cause of infertility, with primary infertility being more prevalent. Lifestyle factors, including obesity and physical inactivity, significantly influenced reproductive health. Menstrual irregularities were also common. Early diagnosis, lifestyle modifications, and targeted interventions are crucial for improving fertility outcomes and reducing infertility-related burdens.

Keywords: *Infertility, Body Mass Index, Lifestyle, Risk Prevalence.*

1. INTRODUCTION

Infertility is a significant global health concern, affecting millions of couples and contributing to both psychological and social distress. (Dourou, 2023) The World Health Organization (WHO) defines infertility as the inability to conceive after 12 months of regular, unprotected sexual intercourse. (Garolla, 2021) Female infertility, in particular, is influenced by a complex interplay of physiological, genetic, environmental, and lifestyle factors. (Carson, Diagnosis and management of infertility: a review, 2021) It can manifest as primary infertility, where a woman has never conceived, or secondary infertility, where conception is difficult after a previous successful pregnancy. The causes of female infertility are diverse, often involving ovulatory disorders, structural abnormalities, hormonal imbalances, and underlying medical conditions. (Olooto, A review of Female Infertility; important etiological factors and management., 2012) (Concepción-Zavaleta, 2023) Common etiological factors include ovulatory dysfunctions such as polycystic ovary syndrome (PCOS), hypothalamic dysfunction, and premature ovarian insufficiency. (Moridi, 2019) Other contributing factors include fallopian tube blockages due to infections, endometriosis, uterine fibroids, cervical abnormalities, genetic disorders, autoimmune conditions, and lifestyle factors such as obesity, smoking, alcohol consumption, and exposure to endocrine-disrupting chemicals. (Singh, 2017)

The prevalence of infertility varies globally, with an estimated 8–12% of reproductive-age couples affected. (Borumandnia, 2021) (Cox, 2022) In India, female infertility accounts for approximately 40–50% of infertility cases among couples seeking medical assistance. Rising cases of lifestyle-related disorders, increased maternal age, and conditions such as PCOS and endometriosis have contributed to the growing incidence of infertility. (Agiwal, 2023) (Shivani Bhadkaria, 2023) The pathophysiology of female infertility is complex and varies depending on the underlying cause. Hormonal imbalances disrupt the hypothalamic-pituitary-ovarian axis, leading to irregular ovulation or anovulation. (Yatsenko, 2019) (Mutter, 2014) Conditions such as PCOS result in excessive androgen production, follicular arrest, and impaired oocyte maturation, while tubal dysfunction caused by infections or scarring can prevent gamete transport and fertilization. (Witchel, 2019) (Palomba, 2023) Additionally, poor endometrial receptivity may hinder implantation, and immune dysregulation, such as the presence of anti-ovarian antibodies, can further impair reproductive function. (Fahs, 2023) Several risk factors, including advancing age, weight imbalances, metabolic disorders like diabetes and thyroid dysfunction, and a history of reproductive health issues, contribute to female infertility. (Mallikarjuna, 2015)

ABBREVIATION TABLE:

Abbreviation	**Full Form**
PCOS	Polycystic Ovary Syndrome
PCOD	Polycystic Ovarian Disease
BMI	Body Mass Index
WHO	World Health Organization
ART	Assisted Reproductive Technologies
IUI	Intrauterine Insemination
IVF	In Vitro Fertilization
IEC	Independent Ethics Committee
ICMR	Indian Council of Medical Research
PID	Pelvic Inflammatory Disease

Management of female infertility requires a multidisciplinary approach, ranging from lifestyle modifications to advanced medical interventions. Synthetic treatments include ovulation induction therapy using clomiphene citrate, letrozole, and gonadotropins, as well as hormonal therapies to correct thyroid dysfunction, hyperprolactinemia, or progesterone deficiency. (Vasta, 2021) Assisted reproductive technologies (ART), such as intrauterine insemination (IUI) and in vitro fertilization (IVF), are commonly employed in cases of severe infertility, while surgical interventions like laparoscopic removal of fibroids, ovarian drilling for PCOS, and hysteroscopic correction of uterine anomalies may be necessary in some cases. (Jain, 2023) (Garceau, 2002) In addition to conventional treatments, natural and alternative therapies play a crucial role in enhancing reproductive health. Lifestyle modifications, including a balanced diet, regular exercise, and weight management, have been shown to improve fertility outcomes. (Feng, 2021) Nutritional supplements such as folic acid, omega-3 fatty acids, vitamin D, and antioxidants provide additional support. Herbal remedies, including Myo-inositol, Vitex agnus-castus, and Ashwagandha, aid in hormonal balance and ovarian function. (Akbaribazm, 2021) Stress management techniques such as acupuncture, yoga, and meditation have also been reported to enhance fertility.

Female infertility is a multifaceted condition requiring a comprehensive and personalized approach to diagnosis and treatment. Advances in reproductive medicine, coupled with increased awareness of lifestyle factors, have significantly improved fertility outcomes. Early diagnosis and individualized treatment strategies that integrate both synthetic and natural interventions are essential in optimizing reproductive health and increasing the likelihood of conception. (Carson, Diagnosis and management of infertility: a review, 2021) (Lindsay, 2015)

2. MATERIAL & METHOD

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki (Brazil, October 2013), the ethical standards for medical research involving human subjects, and the Indian Council of Medical Research (ICMR) ethical guidelines. Prior to initiation, the study protocol was thoroughly reviewed and approved by an Independent Ethics Committee (IEC). Written informed consent was obtained from all participants before any study-related procedures were undertaken. Participation was

entirely voluntary, with each subject making an informed decision after receiving comprehensive details about the study.

Study Design and Selection Criteria

This prospective study aimed to assess the prevalence and contributing factors of infertility among young females. A total of 118 female patients suffering from primary or secondary infertility, with or without multifactorial etiologies, were included in the study. Pregnant, lactating, and menopausal women, as well as patients undergoing ovariectomy, were excluded. The study was conducted in the Department of Gynecology at Parul Sevashram Hospital, Vadodara, Gujarat, India, over six months (November 2023–April 2024).

Patient profiles and relevant clinical data were collected in coordination with gynecologists. The study comprehensively examined demographic characteristics, lifestyle factors, reproductive history, underlying medical conditions, and previous fertility treatments to understand the prevalence and potential causes of infertility.

Evaluation Parameters

The study evaluated the prevalence and types of infertility, diagnostic patterns, and their correlation with various factors, including:

- Body Mass Index (BMI) range
- Menstrual cycle regularity and duration of menstrual bleeding
- Correlation between infertility diagnosis and age
- Correlation between diagnosis and type of infertility

Statistical Analysis

Data analysis was performed using the Chi-square test, along with graphical representations such as pie charts and bar graphs to enhance clarity and comprehension. The findings provide region-specific insights into infertility, contributing to healthcare awareness and future research in reproductive health.

RESULT

Prevalence of participants according to the types of Infertility

Among the 118 participants, 84 (71%) were diagnosed with primary infertility, whereas 34 (29%) experienced secondary infertility. This finding suggests a higher prevalence of primary infertility within the studied population.

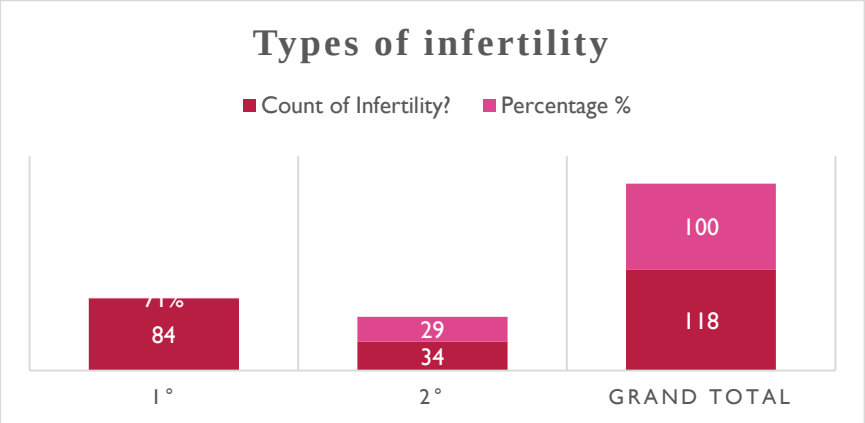

FIG.1 PREVALENCE ACCORDINT TO TYPES OF INFETILITY

Prevalence of participants according to diagnosis

The diagnosis distribution indicated that the most common causes of infertility were polycystic ovary syndrome (PCOS) in 48 (40.67%), polycystic ovarian disease (PCOD) in 21 (17.79%), ovarian cysts in 16 (13.55%), and uterine fibroids in 11 (9.32%). Other less frequent diagnoses included pelvic inflammatory disease, cervical stenosis, unexplained infertility, uterine polyps, and endometriosis. (Figure 2)

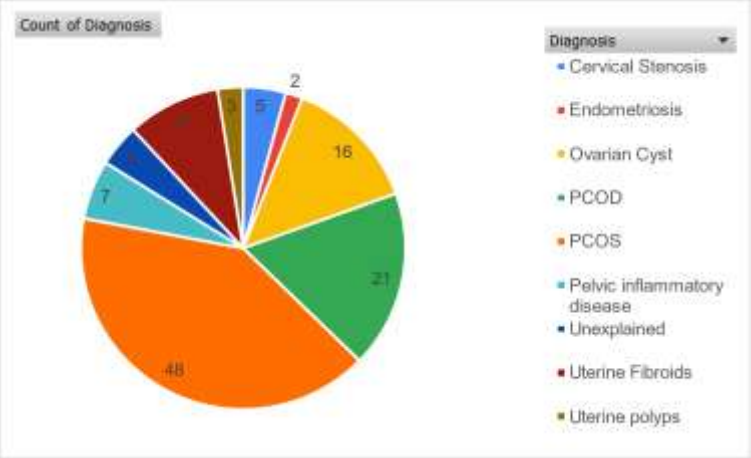

FIG.2 PREVALANCE OF PARTICIPANTS ACCORDING TO DIAGNOSIS

Prevalence of participants according to BMI range

The BMI distribution revealed that the majority, 73 (61.9%), had a normal BMI, while 29 (24.6%) were overweight, 14 (11.9%) were obese, and 2 (1.7%) were underweight. (Figure 3)

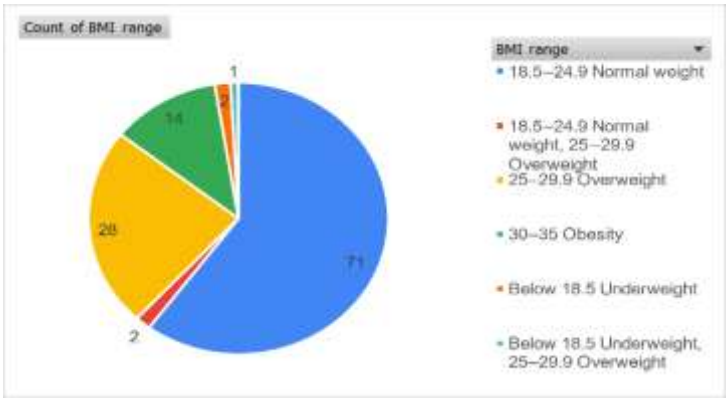

FIG.3 PREVALENCE OF PARTICIPANTS ACCORDING TO BMI RANGE

Prevalence of Participants according to regularity of Periods

In our study, 91 (77.12%) reported having regular menstrual cycles, while 27 (22.88%) experienced irregular cycles. Since menstrual regularity is a key factor influencing female fertility, these findings highlight its potential impact on reproductive health.

FIG.4 REGULARITY OF PERIODS

Prevalence of Participants according to menstrual bleeding days

The duration of menstrual bleeding varied among participants. The majority, 65 (55.08%), reported a duration of 3–4 days, while 42 (35.59%) experienced bleeding for less than 3 days. A smaller proportion reported bleeding lasting 4–5 days, 5–6 days, or more than 6 days. (Figure 5)

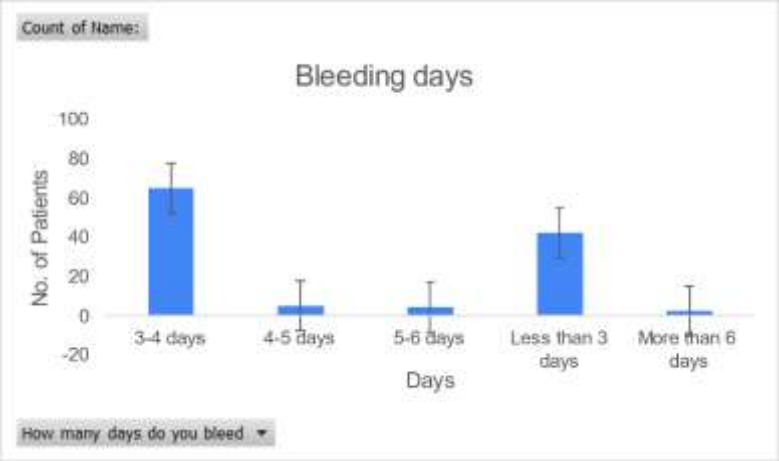

FIG.5 PREVALENCE OF PARTICIPANTS ACCORDING TO MENSTRUAL BLEEDING DAYS

Exercise and Weight Gain

Among the 118 participants, 76 (64.40%) did not engage in any form of exercise, while 42 (35.60%) reported engaging in regular physical activity. This indicates that a majority of the participants led a sedentary lifestyle, which could be a contributing factor to their reproductive health concerns.

Similarly, in terms of weight gain, 77 (65.25%) participants did not experience any significant weight gain, whereas 41 (34.75%) reported an increase in body weight. The distribution suggests that weight changes may vary among individuals and could be influenced by multiple factors, including lifestyle and underlying medical conditions. (Figure 6 & 7)

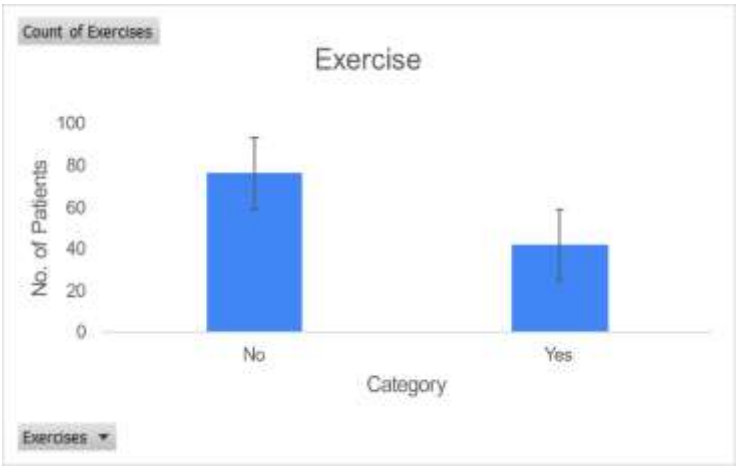

FIG.6 ACCORDING TO EXERCISE

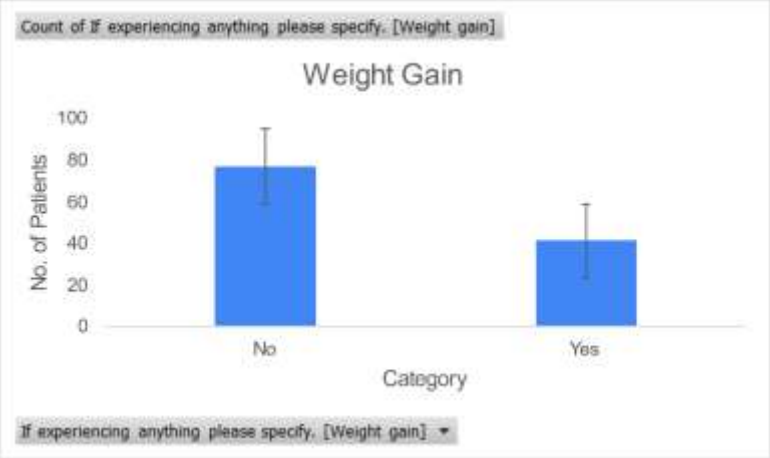

FIG.7 ACCORDING TO WEIGHT GAIN

Correlation between diagnosis & type of infertility

A total of 118 cases were analyzed, with varying distributions of diagnoses across primary (1°) and secondary (2°) infertility, as detailed in Table 7. Among all conditions, polycystic ovary syndrome (PCOS) was the most commonly diagnosed, affecting 48 (40.68%) cases; however, the distinction between primary and secondary infertility was not specified. Similarly, polycystic ovarian disease (PCOD) was identified in 21 (17.8%) cases, though the specific breakdown for primary and secondary infertility was unavailable.

Ovarian cysts were reported in 16 (13.56%) cases, though the precise classification within primary or secondary infertility was not provided. Uterine fibroids were observed in 11 (9.32%) cases, with 5.932% associated with primary infertility and 3.389% with secondary infertility. Additionally, cervical stenosis was diagnosed in 7 (5.93%) cases, where 4.237% were linked to primary infertility and 1.694% to secondary infertility.

Less common conditions included pelvic inflammatory disease (PID), identified in 5 (4.24%) cases, with 2.542% contributing to primary infertility and 1.694% to secondary infertility. Similarly, unexplained infertility was observed in 5 (4.24%) cases, where 3.389% had primary infertility and 0.847% had secondary infertility. Endometriosis was diagnosed in 2 (1.69%) cases, both occurring in women with primary infertility. Uterine polyps were found in 3 (2.54%) cases, with 1.694% associated with primary infertility and 0.847% with secondary infertility.

Some conditions did not contribute specifically to either primary or secondary infertility. This distribution highlights PCOS as the most prevalent condition, while other causes, such as PID, endometriosis, and unexplained infertility, were relatively rare. (Figure 8)

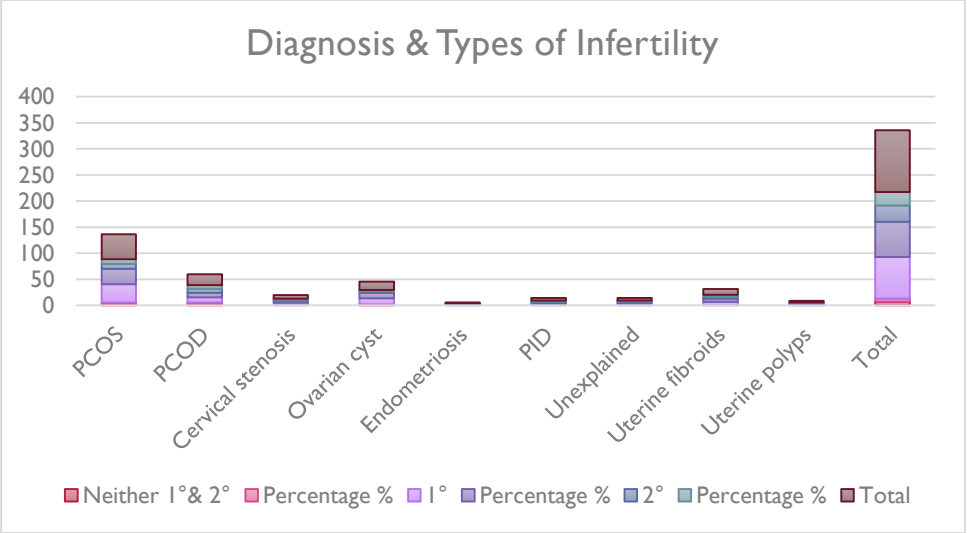

FIG.8 CORRELATION BETWEEN DIAGNOSIS & TYPES OF INFERTILITY

Correlation between diagnosis & age

The correlation between age and diagnosis revealed distinct patterns across different age groups. In the 15–25-year age group, PCOS was the most prevalent condition, diagnosed in 12 (10.16%) cases, followed by PCOD in 9 (7.62%) cases. Cervical stenosis and ovarian cysts were identified in 3 (2.54%) and 7 (5.93%) cases, respectively, while pelvic inflammatory disease (PID) was observed in 1 (0.84%) case. The remaining participants in this age group were diagnosed with other conditions.

In the 25–35-year age group, PCOS remained the most frequently diagnosed condition, affecting 31 (26.27%) cases. PCOD was identified in 10 (8.47%) cases, while cervical stenosis and ovarian cysts were observed in 3 (2.54%) and 9 (7.62%) cases, respectively. Additionally, pelvic inflammatory disease and unexplained infertility were each diagnosed in 3 (2.54%) cases, while endometriosis was reported in 1 (0.84%) case. The remaining participants in this age group had other diagnoses.

In the 35–45-year age group, the prevalence of infertility-related conditions was lower. PCOS was diagnosed in 5 (4.23%) cases, while PCOD was found in 2 (1.69%) cases. Cervical stenosis, endometriosis, and pelvic inflammatory disease were each identified in 1 (0.84%) case. The remaining participants in this age group were diagnosed with other conditions.

Overall, PCOS was the most prevalent condition across all age groups, with the highest occurrence in the 25–35-year age group, followed by the 15–25-year group. The frequency of diagnoses declined in the 35–45-year age group, indicating a possible age-related trend in infertility-related conditions. (Figure 9)

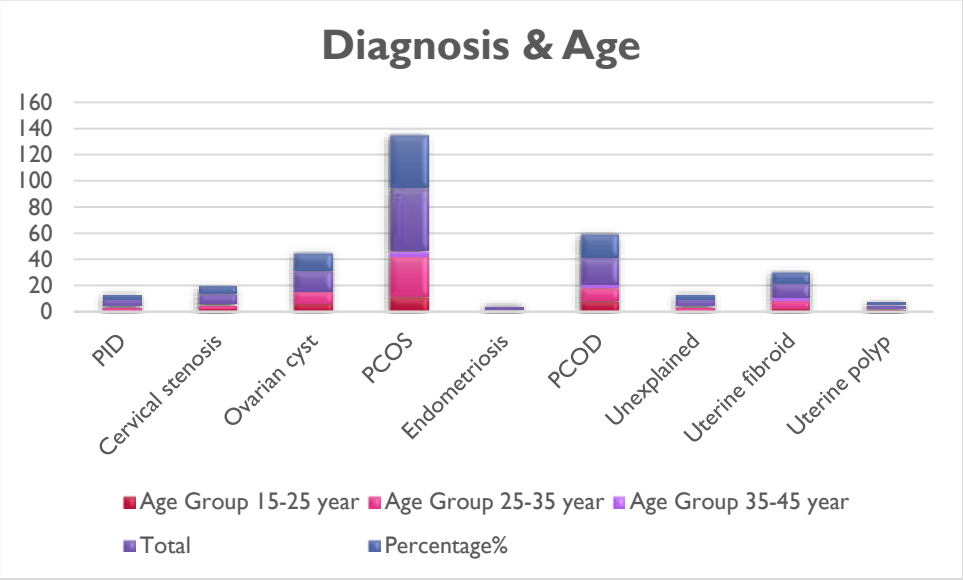

FIG.9 CORRELATION BETWEEN DIAGNOSIS & AGE

Chi-square of diagnosis and type of infertility

Observed value:

Row Labels	Primary	Secondary	Unexplained	Grand Total
Endometriosis	2	0	0	2
Cervical stenosis	5	2	0	7
Ovarian cyst	12	3	1	16
PCOD	10	8	3	21
PCOS	35	10	3	48
Unexplained	4	1	0	5
Uterine fibroids	7	4	0	11
Uterine polyps	2	1	0	3
Grand Total	80	31	7	118

Table 8. Chi-square of diagnosis and type of infertility observed value.

Expected value:

Row Labels	Primary	Secondary	Unexplained
Endometriosis	1.3559322	0.52542373	0.11864407
Cervical stenosis	4.74576271	1.83898305	0.41525424
Ovarian cyst	10.8474576	4.20338983	0.94915254
PCOD	14.2372881	5.51694915	1.24576271
PCOS	32.5423729	12.6101695	2.84745763
Unexplained	3.38983051	1.31355932	0.29661017
Uterine fibroids	7.45762712	2.88983051	0.65254237
Uterine polyps	2.03389831	0.78813559	0.1779661

Table 9. Chi-square of diagnosis and type of infertility expected value.

The p value 0.44977101 there is a significant association between the diagnosis and age. The p value 0.86820667 there is a significant association between the diagnosis and type of infertility, as detailed in (table 8) and (table 9). Null hypothesis is accepted, p value is 0.86820667 so there is a significant association between diagnosis and type of infertility.

3. DISCUSSION

The present study provides critical insights into the prevalence of various infertility-related conditions and their correlation with age, body weight, lifestyle factors, and menstrual health. Primary infertility was more prevalent than secondary infertility, suggesting that reproductive health challenges predominantly impact women attempting to conceive for the first time. Among the diagnosed conditions, polycystic ovary syndrome (PCOS) emerged as the most common, aligning with existing literature that recognizes it as a leading cause of anovulatory infertility. Polycystic ovarian disease (PCOD) and ovarian cysts were also frequently observed, highlighting the significant role of ovarian dysfunction in infertility cases.

The age-wise distribution of infertility-related conditions showed that PCOS was most prevalent in women in their reproductive years, particularly in the mid-age range, with a decline in older age groups. This pattern aligns with previous studies indicating that PCOS manifests during peak reproductive years and significantly affects ovulatory function. Similarly, ovarian cysts and cervical stenosis were more frequently observed in younger women, while conditions like uterine fibroids and endometriosis were more common in the older reproductive age group. The presence of unexplained infertility further underscores the complexity of infertility etiology and the need for a more comprehensive diagnostic approach.

Lifestyle factors, including exercise habits and weight gain, played a crucial role in the study population. A significant proportion of participants did not engage in regular exercise, suggesting a sedentary lifestyle, which is known to negatively impact reproductive health and metabolic function. Additionally, weight gain was reported by a substantial number of participants, a well-established risk factor for hormonal imbalances and ovulatory dysfunction, particularly in conditions such as PCOS. These findings reinforce the importance of lifestyle modifications, including weight management and physical activity, in improving fertility outcomes.

Menstrual health is a key determinant of fertility, and the study found that most participants reported regular menstrual cycles, whereas a notable proportion experienced irregular cycles. Given that menstrual irregularities are often linked to anovulation, these findings emphasize the necessity of evaluating hormonal profiles and ovulatory function in infertile women. Additionally, the duration of menstrual bleeding varied, with most participants reporting a typical bleeding duration, while fewer experienced extended or shortened patterns. These variations in menstrual characteristics may provide further insights into the underlying endocrine and reproductive disorders affecting fertility.

Overall, the findings highlight that PCOS remains the most prevalent infertility-related condition, particularly among women in their reproductive years, with lifestyle factors such as physical inactivity and weight gain potentially contributing to reproductive dysfunction. The study underscores the need for personalized treatment strategies, including early diagnosis, weight management, and hormonal assessments, to improve fertility outcomes. Further research with larger sample sizes and

longitudinal follow-up is warranted to better understand the long-term implications of these findings on fertility and reproductive health.

Future research with larger cohorts and longitudinal follow-ups is needed to deepen our understanding of the long-term effects of these contributing factors on reproductive health. Addressing these challenges through targeted interventions can help enhance fertility prospects and overall reproductive well-being in affected individuals.

Several prevalence studies have demonstrated that infertility is a significant public health concern with substantial socioeconomic implications. It is influenced by a complex interplay of social and organic factors, necessitating a multidimensional approach to prevention, diagnosis, and early intervention. While access to specialized healthcare professionals is crucial, it alone is not sufficient to address the challenges faced by couples attempting to conceive. Structured programs that integrate education, counseling, and lifestyle support can play a pivotal role in optimizing fertility outcomes. Encouraging appropriate lifestyle modifications, including weight management, physical activity, and stress reduction, may not only enhance natural conception rates but also reduce the need for costly and invasive infertility treatments. (Petraglia, 2013)

Several prevalence studies have demonstrated that PCOS is a leading contributor to infertility, with affected women more likely to experience difficulties conceiving, report infertility, and require fertility hormone treatments. Regardless of BMI, PCOS remains a primary determinant of reproductive challenges, emphasizing the need for targeted strategies to optimize fertility in this population. Given the substantial health and economic burden associated with infertility and assisted reproductive treatments, early intervention and management of PCOS-related infertility are crucial. (Joham, 2015)

4. CONCLUSION

The findings of this study highlight the high prevalence of PCOS as the leading cause of infertility, particularly among women in their reproductive years. The study also underscores the significant impact of lifestyle factors, such as physical inactivity and weight gain, on reproductive health. Menstrual irregularities were observed in a notable proportion of participants, further emphasizing the need for hormonal and ovulatory assessments in infertility management.

Given the multifactorial nature of infertility, a comprehensive approach involving early diagnosis, lifestyle modifications, and personalized treatment strategies is essential to improve fertility outcomes.

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