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PREVALENCE OF MALE INFERTILITY AND SEMEN ABNORMALITIES IN GILGIT, PAKISTAN

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Abstract

The aim of current study was to investigate the prevalence of male infertility and semen abnormalities in Gilgit, Pakistan, through the identification of common semen abnormalities. The study was conducted from November 2024 to May 2025 at Family Health Hospital, Aga Khan Hospital, PHQ hospital and City Hospital, Gilgit. A total of 114 semen samples were collected and analyzed according to the World Health Organization 2021 guidelines. Semen parameters included sperm count, motility, morphology, vitality, pH, and presence of white blood cells. Most common abnormality was Oligospermia, identified in 14.04% of cases, followed by Leukospermia (8.77%), Necrozoospermia (7.02%), Azoospermia (4.39%), and Asthenospermia (3.51%). These abnormalities suggest an appreciable burden of male infertility in this region. The results highlighted the importance of early diagnosis, regular semen analysis, and improve reproductive health services. Awareness programs and early interventions are recommended to deal with male infertility in Gilgit-Baltistan, Pakistan.

INTRODUCTION

Infertility can be defined as, when a couple failed to achieve a successful pregnancy after regular sexual intercourse of one year without using any protection or contraceptive method **(Mahdi, 2022).** It has been a major problem that has affected human beings since the earliest of time. The couple is considered infertile if they become unable to get pregnant after one year of regular, unprotected, intercourse during the woman fertile times **(Moazzam *et al.*, 2015).**

Along with investigations and treatment, it is a complex phenomenon, the suffering couples also need emotional and psychological support **(Alam, 2009).** It has been a central concern for the survival of human species since pre-historic ancient history **(Moazzam *et al*., 2015).** According to **Ambreen *et al*., (2018**) 40% of infertility causes are due to men, 30% to women and 20% to both sexes and 10% remain unexplained, while according to WHO 60-80 million couples globally suffer from infertility **(Khalid *et al*., 2018)**. So, it is globally reproductive health care issue and its social and psychological consequences cannot be ignored.

World Health Organization estimates 60-80- million couples in the world suffering from subfertility; when a couple face difficulty to getting pregnant, it does not mean they are completely infertile, but it means it is taking a longer time than normal to have a baby, One in every four couple in developing countries has been found to be affected by fertility **(Fayyaz *et al*., 2020).** It is a rising problem worldwide, around 15% of couples all over the world are affected physically, emotionally, and socially, particularly in third world nations such as Pakistan due to infertility. In rural areas of Pakistan where most of the population live, the awareness of health- related issues is low. Because of this, infertility is still a serious problem with approximately 22% infertility rate in Pakistan **(Khizar *et al., 2024)*.**

The most essential, valuable and single investigations that is considered as gold standard for detecting infertility in male is Semen analysis **(Khalid *et al*., 2018).** It exposes crucial information about sperm production, its motility, workability, clearance of male genital tract, and secretion of accessory organs as well as ejaculation and emission **(Khan *et al*., 2021).**

In our society, infertility is considered as a women problem and many husbands hesitate to undergo multiple tests. Under these circumstances, semen analysis serves as easy and useful means of testing male infertility before moving on to more detailed investigations **(Siddiqui *et al*., 2018).** If semen analysis is carried out with proper care and following the 2021 world health organization guidelines, it remains an extremely useful test for learning about the man's infertility. It yields valuable information that assists in determining potential problems and directs the next course of treatment or testing **(Franken & Oehninger, 2012)**.

Infertility is seen as a serious social problem in almost every culture and society. Its prevalence varies from region to region, but it is more common in developing countries. This is primarily due to fact that these areas usually do not have the facilities required for proper testing and treatment, unlike developed countries where such services are more available **(Ramzan *et al*., 2015).** On other hand,

male infertility is linked with several other factors including hormonal imbalance, infections in the genital tract, immune system issues, smoking, alcohol use, aging, environmental factors like pesticides and toxins, radiation and genetic conditions **(Unar *et al*., 2024)**. However several risk factors can contribute to male infertility, which includes smoking, drinking alcohol, being overweight, having a history of same injuries of reproductive organs, along with consuming too much caffeine all these factors are linked with this issue **(Resident, 2023)**.

In the assessment of male infertility, it is essential to consider these factors as well as the development of secondary sexual characteristics, clinical examinations of gonadal development, hormonal tests and seminal analysis and if needed a morphological examination of a testicular biopsy **(Asif *et al*., 2021).**

Infertility is a global health issue. A couple said to be infertile which has not been able to have a baby despite their desire to conceive **(Khizar *et al*., 2024).** Infertility is affecting many couples including those in Pakistan. In rural areas of the country, there is a lack of awareness in majority of populations about reproductive health. As a result, infertility causes emotional pain, social pressure and mental tension. Although an increasing number of couples are facing this issue, it is still not receiving enough attention in public health discussions. The reasons for infertility, prevalence and the awareness about it among people will be researched in this study. Increase awareness and providing health services and assistance to such couples is aimed through this research.

Objectives;

- To assess the prevalence of male infertility in Gilgit.
- To identify common semen abnormalities.
- To provide data to improve awareness and healthcare services.

MATERIAL AND METHOD

Study Area

Gilgit, situated approximately at 35.920834° N latitude and 74.308334° E longitude, is one of the natural and culturally enriched places on this earth. The place is full of picturesque beauty with clean rivers and valleys that draw tourists and nature enthusiasts across the globe to visit **(Wazir, 2020)**.



Figure 1: Map of the study area

Despite its beauty and well-established culture, Gilgit has some issues, particularly in the field of healthcare. Quality medical care, including reproductive health care, remains difficult to reach to many individuals. By conducting this study on male infertility in Gilgit, this contributes to improve healthcare and enhance better health for the individuals residing in this beautiful region.

Study Design

The study focused on male infertility in Gilgit, Pakistan. The primary work was carried out at the Family Health Hospital Laboratory with additional collaboration from Aga Khan Hospital Gilgit, City Hospital Gilgit and PHQ hospital Gilgit. Twice a week, visits were made for the collection and analysis of semen samples, specifically examining conditions such as Oligospermia, Asthenospermia, Necrozoospermia, Azoospermia, Leukospermia, and other related factors. The goal of this research was to better understand the prevalence and abnormalities of male infertility in the Gilgit region.

Methodology for Sample Collection

Semen analysis was carried out to assess male infertility and detect semen abnormalities. Semen samples were obtained by masturbation following the world health organization (WHO) 2021 guidelines **(Boitrelle et *al*., 2021)**. Each participant was guided to maintain 3-5 days of sexual avoidance before providing the sample **(Ambreen *et al*., 2018; Atifa Afsheen et *al*., 2016; Murtaza et *al*., 2018)**. The semen was collected in a sterile, wide-mouthed container and kept at body temperature to preserve sperm viability. Samples collected outside the laboratory were transported within 30-60 minutes under controlled temperature conditions. Upon arrival at the laboratory, each sample was allowed to liquefy completely at room temperature (approximately 30 minutes). Standard semen analysis was performed according to the World Health Organization guidelines. All analyses were performed by ensuring accuracy and consistency.

Physical assessment

Each semen sample was examined physically according to The Sixth Edition of the WHO Manual for Human Semen Analysis (July 2021), to observe four important factors.

First, Semen volume in ml was measured from a graduated pipette. Second, colour and appearance were checked by examining the sample. A normal sample should be Whitish-Grey coloured, whereas, yellow or reddish colour indicate a problem. Third, viscosity was examined with a dropper or pipette. Usually, semen liquefies within 15 to 30 minutes, but if it remains thick, it can slow down sperm movement. Lastly, the pH level was checked with a digital pH meter. It should range between 7.2 and 8.0, if it is too acidic or too alkaline, it may indicate an underlying problem **(Boitrelle et al., 2021)**.

Microscopic Examination

During microscopic examination of semen, several important things were carefully checked by following the guidelines of semen analysis mentioned in the Sixth Edition of the WHO Manual for Human Semen Analysis published in July 2021 **(Boitrelle et al., 2021).**

Microscopic analysis of semen plays a vital role in understanding male fertility. This examination focuses on several important factors;

One of the main things checked is the sperm count, which tells how many sperm are present in 1 ml of semen. A healthy semen sample usually contains 16 million or more sperm per ml. Makes working dilution (1:20), that means 1 part semen mixed with 19 parts diluting solution and then takes 0.5ml semen and mixed it with 0.95 ml diluting fluid to make it 1 mL diluted sample. Then loaded the counting chamber and placed a clean cover slip on the chambers. First focused with 10x to locate the central big square which contain 25 smaller squares, then changed to 40x objective to see sperms clearly.

Calculation formula

$$\text{Sperms/mL} = \frac{Total\ Sperm\ Counted\ \times Dilution\ Factor\ (20) \times 10^4}{\text{Number of squares counted}}$$

Another key factor is sperm motility, which looks at how well the sperm are able to move, and at least 42% should be actively moving. A drop of well-mixed undiluted semen is placed on a clean slide and very carefully covered with a cover slip. Then both motile and immotile sperms are counted at least in 5 fields with a minimum count of 200 and find the percentage.

Calculation formula

$$\%\text{Motility} = \frac{(\text{Total sperm } - \text{ Non motile sperm })}{\text{Total sperms}} \times 100$$

The morphology of sperm, meaning their shape and structure, is also examined. Normally, at least 4% of sperm should have a proper shape, including a normal head, mid piece, and tail.

Sperm vitality shows how many sperm are alive, and at least 58% should be living in a normal sample.

The presence of white blood cells (WBCs) may suggest an infection, which can negatively impact sperm health and fertility. In fresh, unstained semen pus cells appears as round, transparent cells. Presence of many pus cells is known as Leukospermia. **(Ambreen et al., 2018; Atifa Afsheen et al., 2016; Boitrelle et al., 2021; Murtaza et al., 2018).**

RESULTS

In this study, semen samples from 114 men were tested and divided into four groups. The results showed that Normospermia was present in 71 individuals (62.28%). Oligospermia was detected in 16 individuals (14.03%), mainly within the 16–25 and 26–35 age groups. Necrozoospermia was observed in 8 individuals (7.01%), while Leukospermia appeared in 10 cases (8.77%). Azoospermia was found in 5 individuals (4.38%), and Asthenospermia in 4 individuals (3.5%). Overall, various semen abnormalities were more common among younger and middle-aged men. These findings provide important insights into the prevalence of different types of male infertility within the studied population. Table 1 explain it completely as given below;

Table 1: Distribution of Semen Abnormalities by Age Groups

	Age Groups				
Factors	16-25	26-35	36-45	46 >	**Total**
Oligospermia	6	5	4	1	16
Asthenospermia	2	2		_	4
Necrozoospermia	2	5	_	_	8
Azoospermia	3	2	_	_	5
Leukospermia	4	4	_	2	10
Normospermia	11	38	14	8	71
Total	28	56	19	11	114

Table 2 shows the distribution of semen abnormalities among the studied cases, including oligospermia, leukospermia, asthenospermia, azoospermia, and Necrozoospermia. The number of cases with their respective percentages highlights the prevalence pattern of these abnormalities, indicating their contribution to male infertility in the study population.

Table 2: Distribution of Semen Analysis Outcomes with Percentage (N = 114)

Semen Condition	**Number of Cases**	**Percentage%**
Normospermia	71	62.28%
Oligospermia	16	14.04%
Leukospermia	10	8.77%
Necrozoospermia	8	7.02%
Azoospermia	5	4.39%
Asthenospermia	4	3.51%

The distribution of semen abnormalities such as oligospermia, leukospermia, asthenospermia, azoospermia, and Necrozoospermia are represented in a clear and comparative way this highlighting their percentage and prevalence among cases, as shown in figure 2.

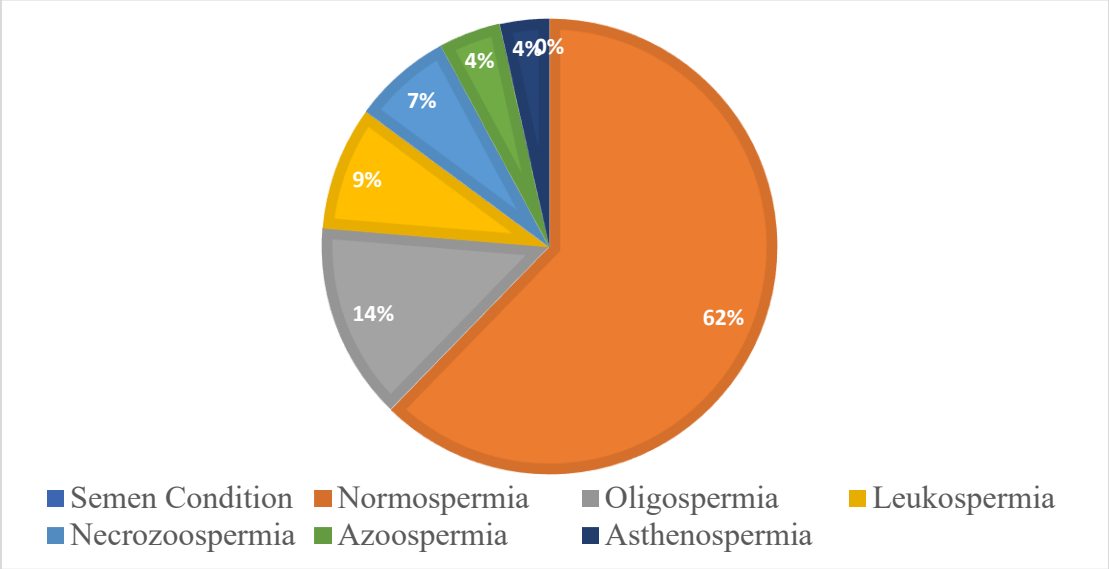


Figure 2: Semen condition and number of cases.

Figure 2 explain the distribution of semen abnormalities in different age groups of the studied men. The results show that oligospermia was the most frequent abnormality, most observed in the younger age group 16-25 and 26-35 years. Asthenospermia (4 cases), azoospermia (5 cases), leukospermia (10 cases), and Necrozoospermia (8 cases) were also present, but their number were lower compared to oligospermia. The results highlights that the younger age groups (16 – 35 years) contributed the highest proportion of semen abnormal cases, while the older age groups showed fewer abnormalities. This suggested that male infertility issues are not limited to older man but are increasingly affecting younger individuals as well.

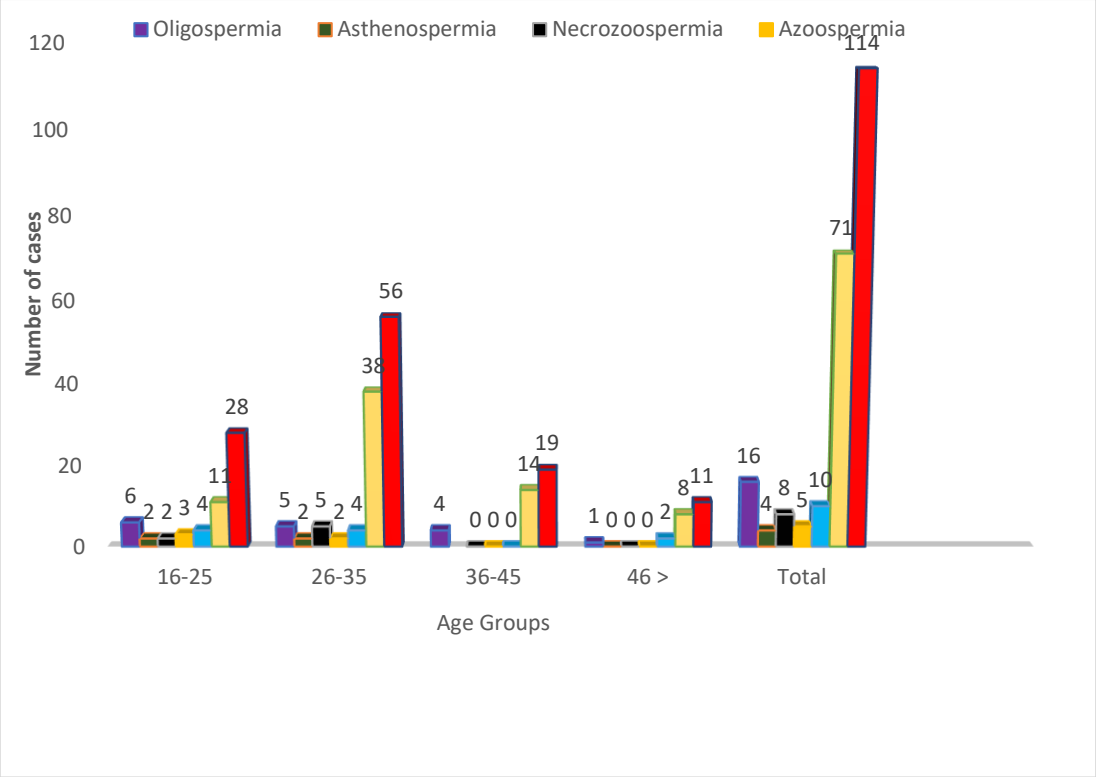


Figure 3: Distribution of semen abnormalities in different age groups

In this study, semen samples of 114 males from Gilgit were analysed to determine the common causes of male infertility, applying the World Health Organization 2021 guidelines to access multiple semen parameters. The findings showed that normospermia was seen in 62.28% of the participants, whereas abnormal semen profile was 37.72% of them.

The predominant abnormality observed was oligospermia, affecting 14.04% of the cases. This result is similar to the findings of **Mahdi, (2022)**, who reported a 12% prevalence among Iraqi men, and supports the observation by **Shaikh *et al*., (2011)** In Karachi also reported that oligospermia and asthenospermia as leading contributors to infertility.

In addition to oligospermia, leukospermia was present in 8.77% of samples, the condition suggests infection or inflammation in the male reproductive system. This is consistent with the findings of **Atifa Afsheen *et al*., (2016),** who reported semen infections like pyospermia in many patients, which is common but often ignored cause of male infertility. Such findings are especially important in area like Gilgit, where health care access is limited, and infection may go untreated for long period.

Another finding was Necrozoospermia, representing the sperm in the semen are death, was identified in 7.02% of cases. This observation resonates with the study of **Ramzan *et al*., (2015**), who found poor sperm vitality and DNA damage in infertile men in Khyber Pakhtunkhwa. They also linked these problems to hormonal or genetic factors directly. The presence of dead sperm cells highlights the importance of further investigations to understand the full picture of male infertility.

Azoospermia or complete absence of sperm in semen, appeared in 4.39% of cases. This is comparable to **Mahdi, (2022)**, who reported 4.5% azoospermia in his study. In the study by **Fayyaz *et al*., (2020)**, azoospermia was also seen in 8 of their 200 cases. These studies support the findings of this study and conformed that azoospermia is a serious issue but not most common condition in reproductive health.

Interestingly, Asthenospermia, which is low sperm motility, was the least common abnormality at 3.51% of the cases. However, in study by **Khalid et *al*., (2018),** and **Khan *et al*., (2021)**, where asthenospermia accounted for over 31.3% and 28% of cases respectively. This difference might be because of regional factors like climate, pollution, stress level, or diet differences between Gilgit and big cities like Lahore and Karachi.

By comparing the total results of this study with the National data, the findings seem parallel to the national trends identified by **Irfan *et al*., (2015)**, they also found that sperm count and motility issues were the top causes of male infertility in Pakistan. They also highlighted risk factors like smoking, stress, and past infections. Although this study did not delve deeply into these factors, but likely affect men in Gilgit as well. The lifestyle and lack of awareness in Gilgit population may be silently contribute to these sperm abnormalities, just like in other regions of the country.

A particularly notable discovery of this research is that the highest number of semen abnormalities was in the younger age groups (16-25 and 26-35). This is supported by the study of **Murtaza *et al*., (2018)**, who observed similar age – related trends. This might be because of risk factors like smoking, stress, and past infections factors explored by **(Irfans et al., 2015).**

Lastly, the emotional and social impact of infertility cannot be ignored. **Khizar *et al*., (2024)** discussed how infertility causes depression, anxiety, and loss of social respect in many cultures. During the study many men were shy, afraid, or hesitant to provide samples or talk about infertility, some even believed it was only a female issue. This underlines the critical necessity for public education, counselling, and male involvement to dismantle myths and promote reproductive health awareness.

CONCLUSION

This study concludes that semen abnormalities are among the major causes of male infertility in Gilgit, with oligospermia being the most common abnormality and asthenospermia being the least frequent. The findings also exposed that younger men experienced higher infertility rates, indicating a growing health concern in the region. Semen analysis proved to be a simple, reliable, and cost-effective method for the early detection of such abnormalities. Raising awareness and ensuring timely diagnosis can significantly help in reducing the infertility burden. Overall, this research highlights the urgent need for improved healthcare policies and facilities in Gilgit, Pakistan.

RECOMMENDATIONS

- The current results demand the need of public awareness programs about male infertility.
- It is recommended that to encourage man to undergo semen analysis early.

- It is also recommended that the government provide affordable reproductive health services in Gilgit.
- The present study recommended that further studies on genetics, hormonal, and environmental causes.
- It is suggested to promote long-term reproductive health monitoring in Gilgit.

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