Original Article

Patterns of Semen Analysis and Insights into Male Infertility: A Regional Experience from Bangladesh

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Abstract

Background: Male infertility is a significant global health issue, often identified through semen analysis. Affecting 8-12% of couples globally, infertility is often due to sperm abnormalities, varicocele, endocrine disorders, infections, and genetic factors. Environmental exposures, lifestyle factors, and nutritional deficiencies also contribute. Semen analysis, a primary diagnostic tool, measures parameters like sperm count and mobility but has limitations. Despite its importance, semen analysis is underutilized due to social stigma, especially in conservative societies. **Aim of the study:** This study aims to evaluate the patterns of semen analysis parameters among men seeking fertility. **Methods:** This prospective observational study was conducted over one year from July 2023 to June 2024 at Satkhira Medical College and Hospital, Bangladesh, targeting 109 male participants referred for semen analysis related to infertility and venereal infections. Using purposive sampling, males aged 15-60 years with no prior treatments affecting semen quality were included. Exclusions were those with previous treatments or inability to provide a sample. Participants provided semen samples after 3-4 days of abstinence and analyzed within 60 minutes. Following WHO guidelines, samples were assessed for sperm concentration, motility, morphology, and volume. Data were collected via validated questionnaires, with ethical approval and informed consent. Statistical analysis was performed using SPSS. **Results:** The study involved participants primarily aged 30–39 years (41.28%), with 56.88% having a normal BMI, 26.61% overweight, and 7.34% underweight. Infertility duration was most commonly 1–3 years (38.53%). Most had normal semen volume (73.39%, mean 3.07±0.77 mL), with 11.01% having low volume. Moderate sperm concentration (15–50 million/mL) was seen in 50.46%, with low levels in 26.61%. Diagnoses included oligospermia (31.19%), azoospermia (25.69%), and asthenozoospermia (22.94%). High pus (95.41%) and epithelial cell prevalence (92.66%) were noted. **Conclusion:** The study on male infertility revealed high rates of oligospermia, azoospermia, and asthenozoospermia. The presence of pus and epithelial cells suggests underlying infections. These findings stress the need for targeted interventions and lifestyle modifications to address male infertility.

Keywords: Semen Analysis and Male Infertility.

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Introduction

Infertility is a significant global health issue that encompasses physical, psychological, and social dimensions. It is clinically defined as the failure to achieve a successful pregnancy after 12 months or more of regular unprotected sexual intercourse [1]. Infertility can be categorized into primary infertility, where a couple has never achieved a pregnancy, and secondary infertility, which occurs when there has been at least one prior conception but the couple is unable to conceive again [2]. Globally, infertility affects approximately 8-12% of couples, with prevalence rates ranging from 5% to 30% across different regions [3,4]. It is primarily attributed to abnormalities in sperm motility, morphology, concentration, and count [5]. Common causes include varicocele, endocrinal disorders, infections of the male reproductive tract, ejaculatory disorders, chromosomal aberrations, genetic mutations, and idiopathic factors where no specific cause can be identified [6]. Environmental exposures, sedentary lifestyles, smoking, alcohol consumption, nutritional deficiencies, and advanced age are also significant risk factors [6,7]. Semen analysis is the cornerstone of male infertility evaluation, serving as a primary diagnostic tool to assess fertility potential [1]. This test involves measuring parameters such as sperm count, mobility and semen volume [5]. However, semen analysis has limitations, including its inability to assess the process of capacitation in the female reproductive tract, the acquisition of sperm surface proteins, and the sperm's ability to fertilize an egg [1]. Despite these challenges, it remains an indispensable tool, particularly in resource-limited settings where access to advanced diagnostic techniques is constrained [8]. Globally, 30-50% of men have semen quality issues of unknown origin, with contributing factors ranging from infections to oxidative stress and environmental exposures [9]. For instance, oxidative stress, which increases inflammatory cytokines in seminal plasma, can impair sperm quality and damage DNA [10]. Nutritional deficiencies, such as low Vitamin D levels, also play a crucial role in influencing sperm health [11]. Other lifestyle factors, including occupational exposure to heat and chemicals, excessive use of electronic devices, and tight clothing, are additional risk factors for male infertility [6]. Despite its clinical significance, semen analysis is often underutilized due to social stigma and embarrassment, particularly in conservative societies [5]. Efforts to standardize semen analysis have included the use of computer-assisted semen analysis (CASA) to improve accuracy and minimize human error. However, adherence to the World Health Organization (WHO) guidelines for conducting semen analysis remains inconsistent across laboratories [12]. In rural and resource-constrained settings, the lack of access to reproductive healthcare services further compounds the challenges of diagnosing and managing male infertility [8]. Understanding the regional patterns of semen parameters is essential to address the growing burden of male infertility, particularly in resource-limited settings like Bangladesh, where reproductive healthcare access is often inadequate. This study aims to evaluate the patterns of semen analysis parameters among men seeking fertility evaluation in Bangladesh, focusing on the prevalence of abnormalities and their associations with demographic and clinical factors.

Methodology

This meticulously designed prospective observational study was conducted within the Department of Gynecology and Obstetrics at Satkhira Medical College and Hospital, Satkhira, Bangladesh. The study spanned a comprehensive period of one year, from July 2023 to June 2024. A purposive sampling method was

employed to select a well-defined cohort of 109 male participants referred to the laboratory for semen analysis as part of infertility evaluations and investigations into venereal infections. The selection process adhered to rigorously applied inclusion and exclusion criteria to ensure the scientific validity, reliability, and clinical applicability of the findings.

Inclusion Criteria

This study included males aged between 15 and 60 with no history of prior treatment or medications known to affect semen quality or fertility.

Exclusion Criteria

Males with a history of treatment, such as antioxidant therapy, surgical interventions (e.g., varicocelectomy or seminal tract reconstruction) and patients who were unable to provide a semen sample by masturbation were excluded.

Sample Collection

Participants were instructed to maintain abstinence from sexual activity for 3–4 days before providing semen samples. Samples were collected aseptically via masturbation into sterile, wide-mouthed containers within the hospital premises to prevent contamination. The samples were analyzed within 60 minutes of collection to ensure accuracy and reliability.

Semen Analysis

Semen analysis was conducted following the standardized protocols outlined by the World Health Organization (WHO) [1]. The samples were categorized based on sperm concentration into three primary groups: Normospermia, Sperm count between 15 million/ml and 120 million/ml, Oligospermia; Sperm count below 15 million/ml; Azoospermia, Complete absence of sperm in the ejaculate. Additionally, parameters such as ejaculate volume, the presence of pus cells, motility, and morphology were assessed. Sperm abnormalities were classified as follows, based on WHO definitions: Asthenospermia: Reduced sperm motility; Teratozoospermia: Abnormal sperm morphology; Oligospermia: A combination of reduced sperm count, poor motility and abnormal morphology; Hypospermia: Ejaculate volume less than 2 ml.

Data Collection

Data collection was performed using a structured and validated questionnaire that captured a broad spectrum of variables, including demographic data and clinical information. To ensure informed participation, each participant was given a detailed explanation of the study's objectives, methodology, and potential implications. Written informed consent was obtained from all participants before inclusion in the study. Ethical approval was obtained from the institutional ethics review board before initiating the study.

Statistical Analysis

The collected data were systematically compiled into detailed tables and figures, supplemented by comprehensive narratives for enhanced clarity. Statistical analysis was performed using SPSS software (version 26). Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

Results

The study participants were primarily aged 30–39 years (41.28%), with 56.88% having a normal BMI of 18.5–24.9, while 26.61% were overweight and 7.34% underweight (Table 1). The duration of infertility was most commonly reported as 1–3 years (38.53%), followed by 4–6 years (25.69%), and over 7 years (22.02%), with only 13.76% experiencing infertility for less than a year (Table 2). In this study, most participants provided normal semen volume of 1.5–4.5 mL (73.39%, mean 3.07±0.77 mL), while 11.01% had low semen volume (<1.5 mL). Regarding sperm concentration, moder-

ate levels (15–50 million/mL) were observed in 50.46% of participants, and low levels (<15 million/mL) were present in 26.61%, with a mean sperm concentration of 77.85±25.24 million/mL (Table 3). Sperm motility patterns showed average progressive motility of 52.32% (range 10–75%), while non-progressive motility accounted for 26.02% and immotile sperm for 21.41% on average (Table 4). Diagnoses revealed oligospermia in 31.19% of cases, followed by azoospermia in 25.69%, asthenozoospermia in 22.94%, and teratozoospermia in 20.18% (Table 5). Additionally, a high prevalence of pus cells (95.41%, mean 6.03±2.41) and epithelial cells (92.66%, mean 4.34±2.08) was observed in the study population (Table 6).

Table I. Demographic and lifestyle characteristics of study participants (n=109).

Variable		Frequency n (%)
Age (year)	20-29	18 (16.51)
	30-39	45 (41.28)
	40-49	33 (30.28)
	50-59	13 (11.93)
BMI (kg/m²)	< 18.5	8 (7.34)
	18.5-24.9	62 (56.88)
	25-29.9	29 (26.61)
	30+	10 (9.17)

Table II. Duration of infertility among study patients (n=109).

Duration of Infertility (years)	Frequency n (%)
< 1	15 (13.76)
1-3	42 (38.53)
4-6	28 (25.69)
7+	24 (22.02)

Table III. Distribution of semen volume and sperm concentration among study patients (n=109).

Variable		Frequency n (%)	Mean±SD
Semen Volume (ml)	< 1.5	12 (11.01)	3.07 ± 0.77
	1.5-4.5	80 (73.39)	
	> 4.5	17 (15.6)	
Sperm Conc. (M/mL)	29 (26.61)	29 (26.61)	77.85±25.24
	55 (50.46)	55 (50.46)	
	25 (22.94)	25 (22.94)	

Table IV. Sperm motility patterns among study patients (n=109).

Motility	Range	Mean±SD
Progressive Motility (%)	52.32±16.92	10-75
Non-progressive Motility (%)	26.02±14.33	10-80
Immotile (%)	21.41±6.78	10-40

Table V. Distribution of cases of semen parameters among study patients (n=109).

Diagnosis	Frequency n (%)
Oligospermia	34 (31.19)
Azoospermia	28 (25.69)
Asthenozoospermia	25 (22.94)
Teratozoospermia	22 (20.18)

Table VI. Presence of pus cells and epithelial cells in study patients (n=109).

Variables	Frequency n (%)	Mean±SD	Range
Presence of Pus cell	104 (95.41)	6.03±2.41	1-10
Presence of Epi cell	101 (92.66)	4.34±2.08	1-10

Discussion

Infertility is a common medical problem, with the male factor being involved in approximately 50% of cases [13]. It is influenced by a variety of factors, including lifestyle habits, environmental exposures, and

underlying medical conditions, which can impair semen quality and sperm function [14]. Semen analysis remains the cornerstone diagnostic tool for evaluating male infertility, providing critical insights into sperm concentration, motility, morphology, and seminal fluid characteristics [15]. Recent studies emphasize the importance of region-specific data to understand the demographic and cultural determinants influencing male reproductive health, particularly in low-resource settings like Bangladesh. By analyzing patterns of semen parameters, researchers can identify prevalent abnormalities and tailor interventions to improve fertility outcomes in affected populations. In our study, we investigated the patterns of semen analysis and their implications for male infertility within a Bangladeshi cohort. The majority of participants were aged between 30–39 years (41.28%), followed by those aged 40–49 years (30.28%). This demographic distribution aligns with prior studies [16]. Over half of the participants (56.88%) had a normal BMI, while 26.61% were categorized as overweight. This is a notable finding, as previous research highlights an association between increased BMI-impaired spermatogenesis and hormonal imbalance, which are key contributors to subfertility [17]. Regarding the duration of infertility, most participants (38.53%) experienced infertility for 1-3 years, while 25.69% had infertility for 4-6 years. Moreover, our study observed that prolonged infertility (>7 years) was reported in 22.02% of participants. These findings are consistent with those of Diallo et al., who reported a mean infertility duration of 5.3 years [18]. Semen analysis is a crucial diagnostic tool for male infertility, and in the present study, we found that a majority of men (73.39%) had semen volumes between 1.5-4.5 mL, with a mean of 3.07±0.77 mL. Interestingly, 11.01% of the participants exhibited semen volumes below the threshold of 1.5 mL, a finding indicative of hypocupremia. These results are consistent with observations reported in prior studies, which highlight the prevalence of this condition among individuals with infertility [19]. However, a significant portion of participants exhibited abnormal sperm concentrations, with 26.61% showing concentrations lower than 15 million/mL, a hallmark of oligospermia. This finding is consistent with studies from India and China, where oligospermia is one of the most common diagnoses in male infertility [20]. Our analysis also revealed that 25.69% of participants were diagnosed with azoospermia, a more severe form of infertility. Azoospermia is a critical condition that warrants further evaluation for underlying causes, such as genetic factors or blockages in the reproductive tract [21]. Similarly, asthenozoospermia, affecting 22.94% of our participants, is another common condition that impairs sperm motility. Sperm motility is a key determinant of male fertility, and our study found a mean progressive motility of 52.32±16.92%. This is lower than the WHO's reference value of 32% for progressive motility, suggesting that many participants had suboptimal sperm motility [22]. Non-progressive motility and immotility were also significant in our cohort, which aligns with findings from another study that identify sperm motility as a major factor in male infertility [23]. In terms of sperm morphology, 20.18% of our study participants exhibited teratozoospermia, which is consistent with the findings of Atashpour et al. (2018), who reported that abnormal sperm morphology is often associated with male infertility. Sperm morphology plays a crucial role in male fertility, with the proportion of morphologically normal spermatozoa in the ejaculate being biologically significant. Sperm cells exhibiting abnormal

morphology can negatively impact fertilization rates [24]. In terms of sperm morphology, 20.18% of our study participants exhibited teratozoospermia, which is consistent with the findings of Tilahun et al. (2022), who reported that abnormal sperm morphology is often associated with male infertility [19]. It is also comparable to other studies conducted in Nigeria [25]. Our study also assessed the presence of pus and epithelial cells in semen samples. The findings indicated a high frequency of pus cells (95.41%) and epithelial cells (92.66%) in the majority of the samples. This suggests a potential underlying infection or inflammation in the male reproductive system, which is a known factor contributing to infertility [26].

Limitations of the study

The cross-sectional design precludes establishing causal relationships between observed semen abnormalities and infertility. Detailed hormonal profiles and genetic analyses were not included, which could provide deeper insights into the etiology of male infertility. Additionally, lifestyle factors were self-reported, introducing the possibility of reporting bias.

Conclusion

In conclusion, the study highlights significant insights into male infertility through a comprehensive analysis of semen parameters among a Bangladeshi cohort. High rates of oligospermia (31.19%), azoospermia (25.69%), and asthenozoospermia (22.94%) were observed. The presence of pus cells and epithelial cells in many samples suggests potential underlying infections. These findings emphasize the need for targeted interventions and lifestyle modifications to address male infertility.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

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