Semen Microbiological Profile and Male Infertility among Patients in Kanchipuram district, South India

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Abstract

Male infertility can be caused by various factors impacting sperm production, function, or delivery including microbiological profile of the semen. This study assessed the semen microbiological profile of different age groups of informed and consented male patients (n=121) with infertility issues who were visiting the biomedical laboratory in Kanchipuram district, Tamil Nadu, India. The semen samples were subjected to various analyses, *viz.,* colour, smell, viscosity, motility, morphology, volume, and various other biochemical analyses. The results revealed that the non-motile sperm counts ranged from 5-98% among the age groups 25-30 years while it was up to 100% among the age groups 31-35 and 36-40 years. Total bacterial count of the semen samples showed that the presence of yeast and Gram negative bacteria were predominant while Gram positive bacteria were least represented. The study reveals that there is a correlation between overall sperm quality and microbiological profile suggesting that microbial infection could play a significant role in male infertility.

Keywords: Male infertility, Bacteriological profile; Semen quality; Sperm count.

Introduction

Samples of semen are microbiologically profiled to determine the types and quantities of microorganisms present. Men with infertility or suspected infections may benefit from this test, although it is not routinely performed. Among the microorganisms found are *Lactobacillus*, *Prevotella*, and several bacteria from the phyla *Firmicutes*, *Proteobacteria*, *Actinobacteria*, and *Bacteroidetes* (Rivera et al., 2022). Bacteria can potentially affect sperm parameters and overall quality of semen based on their composition and abundance. The causative organism of a genital tract infection can be identified with a semen culture if signs or symptoms are present (Baud et al., 2019). Study results indicate that certain age groups may be more likely to find specific bacterial species in their semen samples, though the exact relationship between age and microbiological profiles has yet to be determined. According to a study, men aged 30-39 are more likely to experience bacteriospermia (the presence of bacteria in semen). Study results revealed that 26-30 year old patients were most likely to have significant bacterial growth on their semen (Thanki et al., 2021).

Through semen analysis, characteristics of the semen are often evaluated as a factor in male infertility. Antisperm antibodies, viscosity, pH, and sperm concentrations are key factors, as well as sperm motility, morphology, and volume. It is possible to identify fertility issues if these parameters are abnormal (Aleisa, 2013). Male infertility is often caused by a low sperm count, also known as oligospermia. It is typical for sperm concentrations to be between 15 million and 20 million per milliliter of semen during pregnancy. The number of sperm, their motility, morphology, as well as other characteristics of the semen can impact male fertility significantly. For diagnosing and treating these issues, sperm analysis plays an essential role (Adiga et al., 2008). However, there exists lacuna in the semen characteristics in infertility

patients in many parts. Hence, the present study has been aimed to examine and reveal the semen quality and microbiological characteristics of consented male infertility patients attending the medical laboratory in Kanchipuram district, Tamil Nadu, India.

Materials and methods

The present research was informed and consented study, conducted in the Dr.Borus Research Institute, Chennai, where the samples were collected routinely from the patients with male infertility. The size of the sampling was 121 which were collected after informing the patients and after getting consent in a standardized format. The semen samples were collected and processed according to the WHO guidelines (WHO, 2021). The recruitment process was carried out from March 2023 to November 2023. Male partners attending the infertility clinic were included. Diagnosis of such conditions was made by a thorough physical examination including estimation of testicular volume, followed by imaging and hormonal profile if required.

A written informed consent was taken from all study participants. Data collection included baseline demographic information, medical history, and details of co-morbid conditions. History included a detailed sexual history such as frequency of intercourse, sexual health issues, history of possible sexually transmitted diseases, and sexual contact with commercial sex workers. Participants were also subjected to a thorough physical examination. After semen collection, the sample was sent for both routine semen analysis and microbiological testing (Cappuccino and Sherman, 1999; Cheesbrough and McArthur, 1976). The microbiological evaluation included microscopic examination of Gram-stained smear and culture for bacteria and other routine procedures for fungus (yeast) employing specific culture media.

The obtained data on demography of the patients, semen characteristics and microbiological data were tabulated and subjected to statistical analysis using SPSS computer software.

Results and discussion

The semen samples collected from different age groups of male infertility patients exhibited varying physical, biological and morphological characteristics. The viscosity of the semen was high to moderate among the 25-30 years age group where the normal viscosity was found in minimum samples. The colour, smell, liquefaction, total count and motility varied greatly among the different age groups of patients analyzed. Figure 1 depicts the Average motility (total motility, progressive motility, non-motile, vitality) of sperms collected from different age groups of consented patients attending medical laboratory in Kanchipuram district, Tamil Nadu, India. The total motile count was 34, 17, and 31% for the age groups 25-30 years, 31-35 and 36-40 years respectively while the non-motile sperm counts were very high (Figure 1). Asthenozoospermia is a condition in which a significant percentage of sperm in a semen sample have difficulty moving effectively, causing infertility in men. Motility is generally thought to be normal when at least 40% of the sperm can reach an egg. A low motility sperm sample is one that has less than 32% efficient movement (Dcunha et al., 2020; Turner, 2006).

In a semen sample, the microbiology quality is determined by the presence and type of microorganisms (bacteria, fungi, etc.). Infertility or infections can result from certain microorganisms present in semen, even though semen is not sterile (Moretti et al., 2008). In this study, most of the semen samples revealed positive for glucose and zinc while the total microbial count showed the presence of either yeast or bacteria or both. Gram negative bacteria frequently observed were *Pseudomonas aeruginosa, Klebsiella pneumoniae,* and *Escherichia coli* while the Gram positive bacterium was represented by *Streptococcus pneumoniae* alone among the

positive samples. The fungal species, *Candida albicans* was the only organism frequently found in the semen samples of the patients under investigation in this study (Figure 2). Within the positive samples, a percentage occurrence of yeast (*Candida albicans*) was 57.3% among the age group of 25-30% which was the highest record among the other age groups examined in this study (Figure 3).

It is difficult to identify specific bacteria based solely on the nationality of an individual, but studies have identified a variety of bacteria in semen samples from India, including *Enterococcus faecalis*, *Staphylococcus aureus*, and *Escherichia coli* (Kataria et al., 2024). There are various reasons why these bacteria could be present in semen, including infections related to sexual transmission, urinary tract infections, or other reproductive tract infections (Weng et al., 2014). A study by Vilvanathan and co-workers in 2016 revealed that teratozoospermia was the most common abnormality observed (81.17%) followed by asthenozoospermia (28.23%). The prevalence of bacteriospermia was 35.3%. *Enterococcus faecalis* (30%) was the most common organism isolated followed by coagulase negative *Staphylococcus* (23.33%), *Staphylococcus aureus* (20%), and *E. coli* (10%). Other less frequently isolated organisms were *Klebsiella pneumoniae* (6.66%), *Proteus* sp. (6.66%), and *Citrobacter* sp. (3.33%) (Vilvanathan et al., 2016).

Conclusions

As a component of healthy semen, it may play a beneficial role in preserving the quality of the organ. Researchers are still trying to figure out the exact mechanisms behind the association between male infertility and specific bacteria present in semen. It has been established that the composition of the semen microbiome can vary significantly between individuals, influenced by genetics, lifestyle, and other factors. In the present study, the

examined semen samples revealed that the infertility patients had less motile characteristics and more microbiological infections as to that of positive samples.

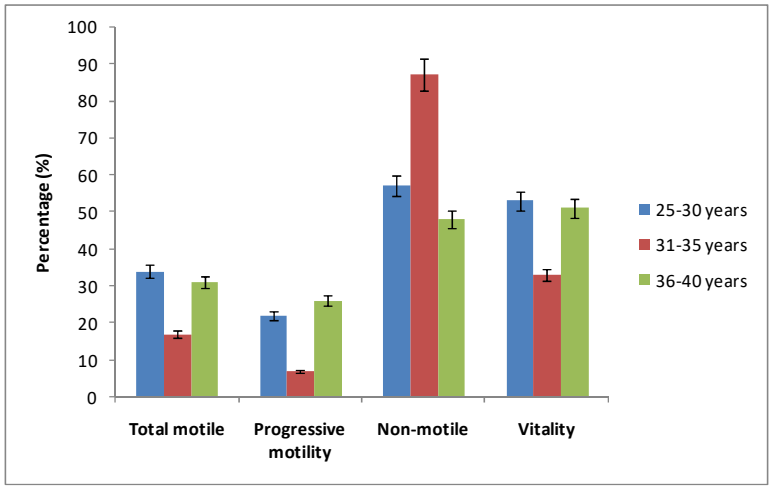

Figure 1. Average motility (total motility, progressive motility, non-motile, vitality) of sperms collected from different age groups of consented patients attending medical laboratory in Kanchipuram district, Tamil Nadu, India.

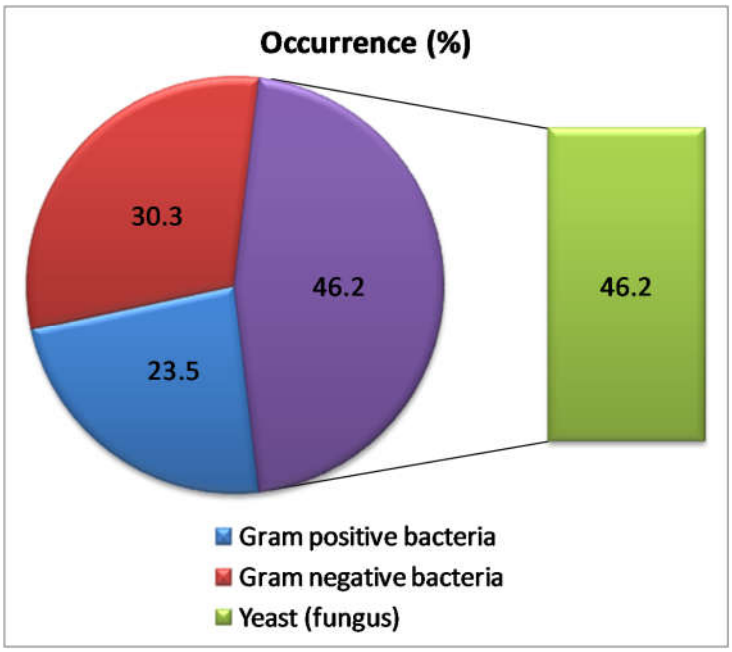

Figure 2: Occurrence percentage of microorganisms in semen samples collected from consented patients attending medical laboratory in Kanchipuram district, Tamil Nadu, India.

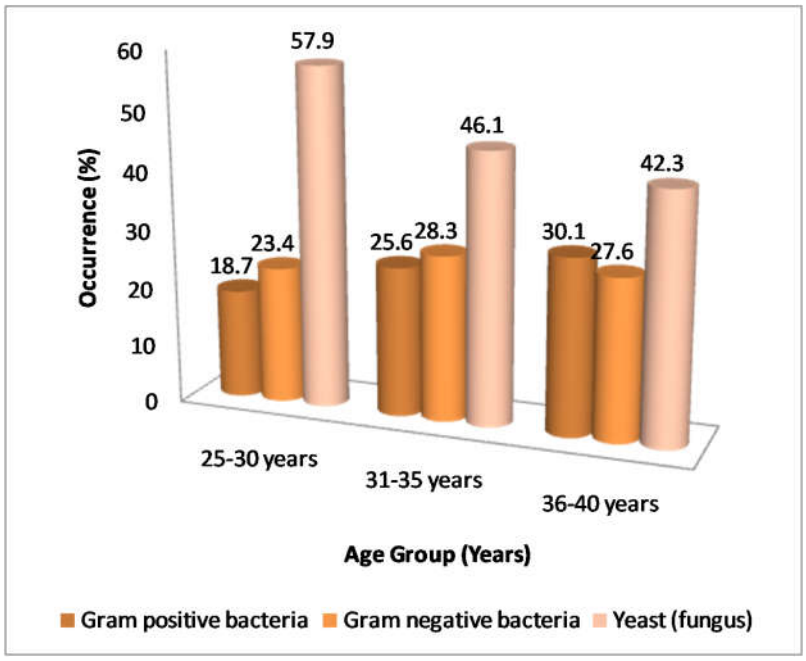

Figure 3: Age group-wise occurrence percentage of microorganisms in semen samples collected from consented patients attending medical laboratory in Kanchipuram district, Tamil Nadu, India.

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