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The effect of presence of facultative bacteria species on semen and sperm quality of men seeking fertility care

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Abstract
Introduction: Infections of male urogenital tracts may contribute to male infertility. However, the effects of bacterial presence on sperm quality and fertility are controversial.
Objectives: We investigated the occurrence of non-specific bacteria and quality/quantity of semen of infertile and fertile control groups in Nigeria.
Subjects and methods: We investigated 162 infertile and 54 fertile men. Spermiogram, culture, bacterial isolation and characterization were conducted.
Results: We report 114/162(70.4%) occurrence of bacteria species, 49.4% of such were Gram positive and 21% Gram negative: *Staphylococcus aureus* (29.6%) and *Escherichia coli* (10.5%) had the highest occurrence for each group respectively. On semen quality/quantity, we report 14.2% azoospermia, 52.5% oligozoospermia and 33.3% of normozoospermia. The mean sperm concentrations were 10×7/ml and 41×10 6/ml for oligo and normozoospermia respectively. Majority (52%) of azoospermic group had no bacterial growth. *S. aureus* was the most implicated among the bacterial positive group. Within the ologozoospermic category, 28% had no bacterial growth, 28% had *S. aureus* and 11.8% *E. coli*. The normozoospermic patients had 18.5% no bacteria contamination, 33.3% had *S. aureus*, 13% had *E. coli*. From the analysis, the normozoospermic group with bacterial contamination had lower sperm concentrations compared with those without contamination. It was apparent that factors other than bacterial contamination may contribute more to oligozoospermia (compare: "no bacteria" group mean sperm concentration 8.97×106/ml, Gram positive bacteria contaminated group 17.74×106/ml and Gram negative bacteria

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contaminated group 13.66 × 106/ml). The mean progressive motility ratios were lower (15.6 [a]% + 18.3 [b]%) = 33.9%) against WHO standard (a + b = >50%) and control RPM (a) = 55.3%. Generally, the semen quality (vol., rapid progressive motility, sperm concentration and immotility) were significantly lower than the fertile group, $P = 0.0005$, <0.0001, <0001 and 0.0335, respectively.
Conclusions: Although bacterial presence in semen reduced mean sperm concentration and viability, thereby contributed to oligozoospermia and by extension the chances of siring a child, however, factors other than bacterial presence may contribute more. Improved interpretative approaches of semen analyses are highlighted.

Introduction

Infertility constitutes medical and socio-cultural problems globally [1], and bacterial infections contribute to about 15% of male infertility [2]. The WHO study Centre in Africa reported 50% of male contributory factors of infertility [3,4], and 46% of those reported history of sexually transmitted infections [4].

Infections of the male genitourinary tract may contribute to infertility by adversely affecting sperm function, causing inflammatory disorder, anatomical obstruction, scaring and initiating leucocyte response with its concomitant oxidative stress. The effects of these conditions may be sperm damage, elevated leucocyte response (pyospermia), poor motility (asthenospermia) and immature forms (tetratospermia) [5]. The remote effect usually is low sperm quality and hence male infertility [5–8].

Microbial genital tract infections could be specific (Chlamydosis caused by *Chlamydia trachomatis*, gonorrhoea caused by *Neisseria gonorrhoea*, ureaplasmosis caused by *Ureaplasma urealyticum* and trichomoniasis caused by *Trichomonas vaginalis*) and non-specific (facultative) aetiology (mainly by: *Enterobacteriaceae* e.g. *E. coli*), *Staphylococci, Streptococci*, *Klebsiella spp*., and yeast-like cells (a fungus) [9,10].

One of the most frequently isolated microorganism from male patients with genital tract infections or semen contamination is *Escherichia coli* [11]. The negative influence (qualitative and quantitative alterations) of this species on sperm quality was associated partially to its effect on motility [11] and to the impaired acrosomal function, as demonstrated at the ultrastructural level by Diemer et al. [12]. The influence of Gram-positive uropathogenic bacteria on sperm morphology and function has been poorly investigated until now. Mehta et al. [13] reported that aerobic cocci are present in about 50% of semen samples of male partners in infertile couples. *Enterococcus faecalis* was isolated from 53% of patients, *micrococci* from 20% and alpha-haemolytic *streptococci* from 16% of the infected samples. Increased prevalence of genital tract infections caused by *E. faecalis* was associated with compromised semen quality in terms of sperm concentration and morphology and the presence of *micrococci* and alpha-haemolytic *streptococci* does not appear to exert any detrimental effect on sperm quality [14]. Although no significant depressor effect of *enterococci* on sperm motility was observed, some researchers described, in an in vitro study, a negative influence on membrane integrity of human sperm head, neck and mid piece [14], probably mediated by hemolysin, a well-known virulence factor of *enterococci*.

While primary infertility was reported higher in other regions of the world, secondary infertility was reported as more common in Africa [9]. The reasons adduced to this included, but not limited to: inadequate health care services, improper use of antibiotics and the new trends in drug resistance [9].

Although, positive correlations between azoospermia, presence of microorganisms and poor semen quality and quantity in male patients have been reported [10,15] the interplay between semen bacterial contamination and male infertility is still subject to controversy, since some reports on the presence of bacteria in semen specimens of infertile men had somewhat similar occurrence to those observed in some fertile males [8,16].

Knowledge of certain sexual and fertility conditions such as oligzoospermia, azoospermia, impaired sperm motility, decreased sexual drive, weak erection, and premature ejaculation are critical for primary evaluation of infertility in men. Semen analysis is not a test for fertility because normal values are subjective and have been difficult to determine for fertile and infertile men. However, clinical studies have tried to establish "limits of adequacy" using semen analysis below which the chances of initiating a pregnancy may become more difficult. These parameters are not absolute because some fertile men may have values below these "limits of adequacy". Conversely, some infertile men have normal semen parameters by standard analysis and that in most cases the result interpretations are subjective due to lack of adequate and unified information on the roles of nonspecific microbes globally. In Africa, available studies are inadequate. Therefore, in other to make semen analysis more efficacious, give more statistical interpretations to certain semen parameters and, assess the role of facultative bacteria in alterations of the integrity of human reproductive system, this study was designed to investigate the occurrence of facultative bacteria contaminants in semen and their possible effect on quality and quantity of sperm cells among men attending fertility clinic in Lagos, Nigeria.

Subjects and methods

Patient's recruitment

One hundred and sixty-two (162) out of 566 patients attending selected fertility clinics in Lagos, between 2006 and 2013 and had regular unprotected sex with their spouses without conception for between 1 and 2 years and above were involved in the study.