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Geographical differences in semen characteristics of 13 892 infertile men

Haitham Elbardisi [a,*], **Ahmad Majzoub** [a], **Sami Al Said** [a], **Khalid Al Rumaihi** [a], **Walid El Ansari** [b,c,d], **Alia Alattar** [e], **Mohamed Arafa** [a,f]

[a] *Department of Urology, Hamad Medical Corporation, Doha, Qatar*
[b] *Department of Surgery, Hamad General Hospital, Doha, Qatar*
[c] *College of Medicine, Qatar University, Doha, Qatar*
[d] *School of Health and Education, University of Skövde, Skövde, Sweden*
[e] *Department of Obstetrics and Gynecology, Hamad Medical Corporation, Qatar*
[f] *Department of Andrology, Cairo University, Cairo, Egypt*

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KEYWORDS

Male infertility;
MENA;
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ABBREVIATIONS

ABF, abnormal sperm forms;
MENA, Middle East and North Africa;
PMot, progressive motility;
SDF, sperm DNA fragmentation

Abstract ***Objective:*** To assess the relationship between geographical differences and all semen parameters, across 13,892 infertile men of 84 diverse nationalities, recruited at a specialised tertiary hospital that represents the main healthcare provider in Qatar. Male infertility is an important and global public health problem. Despite this, there is a significant scarcity of epidemiological male infertility and semen analysis research in the Middle East and North Africa (MENA) region, as well as geographical comparisons with other parts of the world.

Patients and methods: Retrospective study of semen findings of 13 892 infertile men assessed at the Male Infertility Unit at Hamad Medical Corporation, in Qatar between January 2012 and August 2015. Based on country of origin, patients were categorised into those from the MENA region (n = 8799) and non-MENA patients (n = 5093). The two groups were compared across demographic features and semen characteristics: age, sperm volume, sperm total motility, sperm progressive motility (PMot), abnormal sperm forms (ABF), and sperm DNA fragmentation (SDF).

Results: The whole sample's mean (SD) age was 35.7 (0.7) years, sperm concentration was 32.3 (0.25) × 10^6 sperm/mL, total motility was 45.4 (0.2)%, sperm PMot was 25.1 (0.2)%, and ABF was 79.9 (0.2)%. Overall, 841 patients had azoospermia

* Corresponding author at: Hamad Medical Corporation, P.O. Box 3050, Doha, Qatar.
E-mail address: helbardisi@hamad.qa (H. Elbardisi).

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(6.05%), 3231 had oligospermia (23.3%), 4239 had asthenospermia (30.5%) and 6772 had teratospermia (48.7%). SDF (1050 patients) was abnormal in 333 patients (31.7%). MENA patients were significantly younger than their non-MENA counterparts and had a greater semen volume. Non-MENA patients had significantly higher sperm counts, total motility and PMot, and lower ABF. SDF showed no statistical difference between the two groups. MENA patients had significantly higher prevalence of oligospermia, asthenospermia, and teratospermia; and lower prevalence of normal sperm concentration, normal motility, and normal morphology. Throughout the 4 years of the study, MENA patients constantly had significantly lower sperm counts; generally lower sperm total motility percentage and generally lower quality sperm morphology. We compared patients by age ($\leq$40 and $>$40 years): in the patients aged $\leq$40 years, the same results as for the overall study were reproduced; in the $>$40-years group, the same results were reproduced with the exception of morphology, which was not significantly different between the MENA and non-MENA patients.

Conclusion: Semen quality is generally lower in male infertility patients from the MENA region compared to non-MENA regions.

Introduction

The absence of conception over a period of 1 year in couples who are engaged in regular unprotected sexual intercourse indicates infertility. Infertility is a worldwide public health concern, affecting 15% of all couples of reproductive age; and male causes, including reduced semen quality, are solely responsible for ~25% of these [1]. When infertility is suspected, couples usually undergo standard investigations including ovulation and tubal patency tests for women, and semen analysis for men. When the test results return normal, the couples are diagnosed with unexplained infertility, which is prevalent in 22–28% of the general population [2].

In cases of male infertility, a wide range of factors has been examined to assess their associations with semen parameters, including sperm motility, density, and morphology. For instance, demographic features e.g. age play an important role in male infertility. As men grow older, their testosterone levels are reduced leading to hypogonadism; their semen quality measurements show decreased sperm motility, viability, and semen volume [3]; and greater DNA damage has been observed in infertile men aged $>$40 years [4]. In addition, other genetic factors also affect men's fertility: genetic mutations manifested through anomalies and microdeletions of the Y chromosome can cause spermatogenesis failure, and thus lead to male infertility [5].

Lifestyle characteristics can also adversely affect men's semen quality. Lower sperm concentration and decreased total sperm count have been associated with obesity, whilst improved sperm progressive motility (PMot) is associated with eating healthy diets [6]. Moreover, obesity, stress, alcohol abuse, and smoking have deleterious effects on sperm parameters and sperm DNA fragmentation (SDF) [7–9].

Similarly, environmental pollution, through exposure to chemical or physical agents produced by human activities such as pesticides, solvents and heavy metals, can alter sperm production and trigger hormonal imbalances, which in turn lead to infertility in men [10]. Furthermore, seasonal changes can affect semen quality, where studies have confirmed that men produce higher sperm count during winter or spring than in the summer [11].

Recently, an important emerging factor that has been reported to influence semen quality parameters is the geographical or regional differences. A study in Denmark compared semen concentration of men from a rural area to men from an urban setting, and reported a significantly higher sperm concentration amongst men from the rural area. However, the difference was attributed to sampling procedures rather than the geographical area per se [12]. Similarly, a study in France described significant differences across all seminal characteristics based on the geographical area from which the samples were collected. The seminal volume and total sperm count were lowest in Toulouse, and highest in Caen and Lille. However, sperm motility percentage was highest in Bordeaux and lowest in Tours [13]. Likewise, significant differences in total sperm count were reported amongst semen samples from four European countries (Finland, Denmark, France, and Scotland). Danish men had the lowest sperm concentrations whilst Finnish men had the highest [14]. Such geographical differences in semen characteristics as presented by these studies remain unexplained.