

Pattern of Changes in Semen Characteristics in Subfertile Males of South Asian Subcontinent: Analysis of 1,000 Semen Samples

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ABSTRACT

Aim: To investigate and compare whether semen quality has changed in South Asian subfertile males attending three different infertility units.

Objectives: To characterize the semen parameters of subfertile men in South Asian region and to study the prevalence of abnormal semen parameters of subfertile males of South Asian subcontinent.

Materials and methods: Study period – January 2014 to December 2014.

Setting:

Centre for Assisted Reproduction, BIRDEM, Dhaka, Bangladesh
Malhotra Nursing Home, Agra, Uttar Pradesh, India
Lahore Institute of Fertility and Endocrinology, Lahore, Punjab, Pakistan

The possible decline in semen parameters related to male fertility was evaluated by determining the volume, sperm count, motility, viability, and morphology in individuals attending infertility clinics. WHO 2004 initially and then WHO 2010 criteria were used to analyze the semen sample.

Results: There was no significant age difference among the participants from three different countries. There was significant increase rate of azoospermia in all the population groups especially in Bangladeshi population. Necrozoospermia (100%) immotile sperm is higher in Pakistani populations compare to Bangladeshis and Indians. Normal sperm parameters (Normozoospermia) rate is compatible in Pakistani and Indian male but lower rate is noted in Bangladeshi population.

No significant changes were noted in oligozoospermia group but significant changes in asthenozoospermia noted in Bangladeshi population compare two other two countries

Statistical analysis: Statistical analysis were performed by using Statistical Software Package (SAS) version 9.1.3 (SAS Institute Inc., Cary, NC, USA).

Conclusion: Our finding suggested that the values of sperm parameters were in agreement with WHO criteria, significantly different in subfertile men of this region.

A further study with good quality collaborative long term research should be carried out, including aspects such as semen quality, reproductive hormones and xenobiotics as well as a strict definition of fecundity in this region is needed.

Keywords: Decline semen in SouthAsian region, Necrozoospermia, Subfertile men.

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INTRODUCTION

The quality of semen is one of the most valuable indicators of reproductive health of males. Besides, semen analysis plays a critical role in the diagnosis and treatment of male infertility. Much has been made in the medical and lay literature of an alleged decline in human sperm counts worldwide. More than 100 articles have appeared in peer-reviewed literature in the past 50 years on this topic.¹

The debate around the temporal trends in sperm parameters has been a hot topic since the last couple of years. Meta-analyses of the studies conducted since the 1950s report a decrease in sperm concentration in industrialized countries. Low environmental exposures to endocrine disruptors, especially during fetal growth, are suspected to explain such damage as well as effects on other reproductive outcomes such as testicular cancer and male urogenital malformations.²

Of particular concern were the cellular and physiological functions even in minute doses. This gave birth to the concept that exposure to such endocrine disruptors could produce clinically detectable changes in human reproductive functions in utero and early exposures are a potential cause of long-term male reproductive disorders.

Evidence of a decreasing trend in sperm count and the percentage of sperm motility or normal sperm morphology over the last decades have been gathered from France, Scotland, Italy, Denmark, India, and Tunisia. These findings are an important concern since men with

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reduced sperm count < 40 M/mL were indicated to experience fecundity. The global temporal trend in semen quality is still debatable.³

Regional differences in semen quality have been reported for some areas in USA, Europe, Japan, India, and China. The European study of fertile men showed that sperm concentration of Danish men was 74% of that of Finish men and 82% of the Scottish men. In Southwest China, the semen parameters' values of men were markedly different from those of other Chinese, Americans, and Europeans.⁴

Environmental pollution, a major source of reactive oxygen species (ROS) production, has also been implicated in the pathogenesis of poor sperm quality. Occupational exposure to toxicants, including heavy metals, organic solvents, and pesticides, has been widely associated with poor reproductive dysfunction in male.⁵⁻⁸

In Bangladesh, India, and Pakistan (i.e., South Asia) we use WHO reference values to assess the reproductive health of men, and there is no such data for the semen parameters in different countries of south Asia.

This study aims to evaluate the semen parameters of subfertile couples of the South Asian subcontinent and to compare the regional variations.

MATERIALS AND METHODS

The study samples were male partners from couples attending three reputed infertility centers of CARE – Centre for Assisted Reproduction, BIRDEM, Bangladesh; ART-Rainbow IVF, Agra, India; and LIFE – Lahore Institute of Fertility and Endocrinology, Pakistan. Subfertile men were those whose female partners failed to conceive but had no diagnosed fertility disorders after 1 year. Randomly selected thousands of samples were taken for the study.

Each individual completed an extensive questionnaire regarding age, social status, occupation, and the reproductive history.

Semen samples were collected by masturbation after 3 to 5 days of sexual abstinence in clean metal free plastic containers. After liquefaction semen analysis was carried out according to WHO 2014 guidelines using Meckler's counting chamber.

Semen findings in subfertile men were categorized as normal, azoospermia, oligozoospermia (1–5 M/ml), oligoasthenozoospermia (> 5 M/ml and motility < 40%), asthenozoospermia (rapid linear < 32% motility), and necrozoospermia (100% immotile sperm) (Table 3).

Statistical Analysis

Statistical analysis was performed by using the Statistical Software Package (SAS) version 9.1.3 (SAS Institute Inc., Cary, NC, USA). Because semen parameters follow

markedly skewed (nonnormal) distributions, the 25th to 75th percentiles, medians, means, and standard deviations were calculated.

Results

In total, 3,000 semen samples were taken from three different institutes of three different countries of the same geographical location. All samples were from male partners of couples who are trying to get pregnant for at least 1 year without any contraceptive procedures.

The total population of Lahore is 6.3 million (2014). The population of Uttar Pradesh, India, is 210 million, but in Agra the population is only 1.7 million. The total population in Dhaka city is 15 million. The literacy rates of these regions have been shown in Table 1.

Variables of interest regarding the study population's socioeconomic characteristics were poorly filled and missing values for professional activity and tobacco consumption respectively.

Table 2 shows the World Health Organization (WHO) normal forms and their reference values from 2004 and 2010.

Table 1: Regional statistics of literacy rate

Country	Adult literacy rate	Youth literacy rate (Age 15–24 years)
World average	84% (2010)	89.6% (2010)
India	74.04% (2011)	81.1% (2006)
Pakistan	50.2% (2007)	70.8% (2011)
Bangladesh	53.5% (2007)	63.6% (2001)

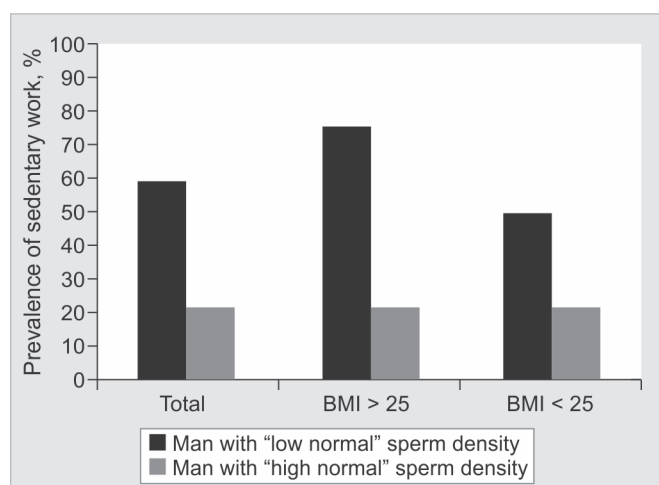
"UNESCO Institute for Statistics." Stats.uis.unesco.org. Retrieved 2014-07-02

Table 2: WHO norms

Parameter	Lower reference WHO 2004	Lower reference WHO 2010
Semen vol (ml)	>2	1.5
Sperm conc. (10 ⁶ ml)	20	15
Total motility %	50	40
Progressive motility (PR %)	25	32
Morphology (normal forms %)	>30	40

Table 3: Findings of this study

Parameters	Bangladesh	India	Pakistan
Normozoospermia	60%	85%	83.6%
Azoospermia	15.5%	08%	6.6%
Gross oligozoospermia Count: 1–5 M/mL	06%	02%	3.8%
Oligoasthenozoospermia Count: > 5 M/mL Rapid linear motility: < 32%	13%	06%	16.8%
Asthenozoospermia Total motility: < 40%	31.5%	15%	16.7%
Necrozoospermia 100% immotile sperm	3.5%	01%	9.1%



Graph 1: The prevalence of sedentary work by sperm concentration and body mass index (BMI, kg/m²) among men with normal sperm concentration

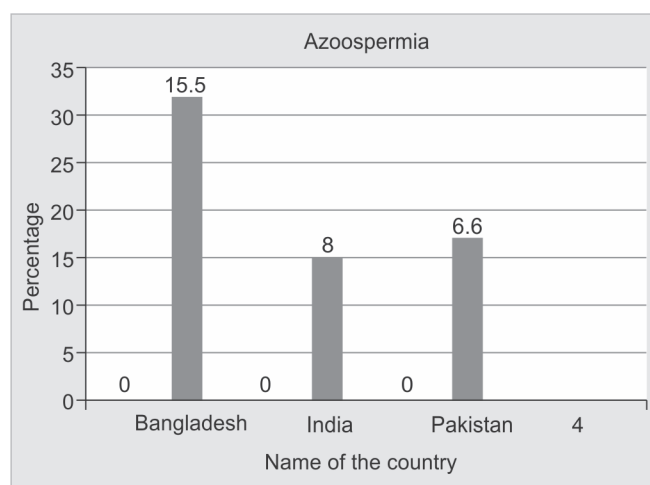
There was no significant age difference among the participants from three different countries.

Most of reviewed papers showed that smoking reduces sperm production, sperm motility, sperm normal forms and sperm fertilizing capacity through increased seminal oxidative stress and DNA damage. Some smokers may not experience reduce fertility, men with marginal semen quality can be benefit from quitting smoking. In this study it was difficult to accumulate the necessary information regarding occupational exposure and other socioeconomic characteristics of the study population as the data were collected from three different settings. Besides controversies have been seen reading socio demographic markers of the study group.

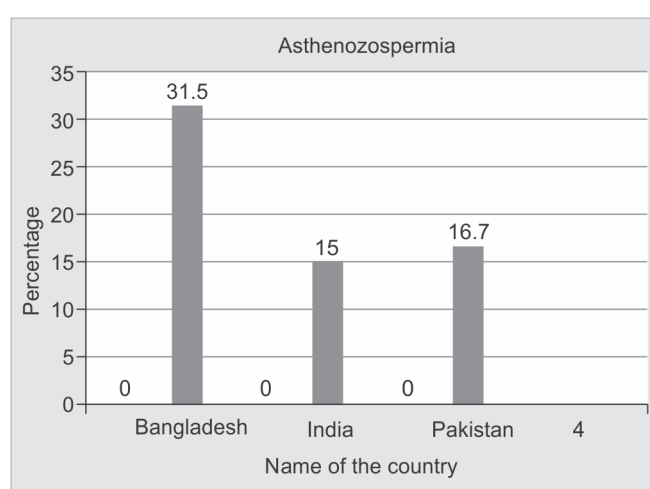
Regarding the duration of marriage no significant difference was found. The prevalence of sedentary work was 60% among men with poor semen quality. This difference was not significant. When men with normal semen quality were split into low normal and high normal sperm concentration subgroups, sedentary work was significantly more common among men with lower sperm concentration (59%) compared to the men with higher sperm concentration (22%). The difference in the prevalence of sedentary work between the high normal and low normal concentration subgroups was observed among both men with BMI < 25 kg/m² and BMI > 25 kg/m² (Graph 1).

There was a significant increase in azoospermia in all the population groups especially in the Bangladeshi population (Graph 2).

Necrozoospermia (100%) immotile sperm is higher in the Pakistani population compared to the Bangladeshi and Indians. Normal sperm parameters (normozoospermia) rate is compatible in Pakistani and Indian male but lower in Bangladeshi population.



Graph 2: Percentage of azoospermia rates in three different countries



Graph 3: Percentage of asthenozoospermia rates in three different countries

No significant changes were noted in the oligozoospermia group. Significant changes in the asthenozoospermia group were noted in the Bangladeshi population compared to the other two countries (Graph 3).

DISCUSSION

Sperm concentration is higher in Indian and Pakistani populations compared to the Bangladeshi population in the normozoospermia group. This could be due to food habits and lifestyle. It has been seen in other studies that sperm concentration of fertile Saudi men was nearly two times higher than that recorded for the Americans or Danish fertile men and was also higher than the values reported for other populations, such as French, Scottish, Italian, and Chinese men, whereas Japanese men had the lowest sperm concentration.⁵

Sperm motility was also lower than that reported in different populations. This difference could be due

to endocrine, ethnic, geographical, environmental, nutritional, or lifestyle variations. The higher temperatures in Bangladesh during most of the year may affect sperm motility. In addition, difference in genetic factors may be due to different polymorphisms in the genes involved in influencing these parameters.⁶

In comparison with other studies, azoospermia rate is higher in Bangladeshi population (15%) than in India (8%) and Pakistan (6.6%).

The relatively low sperm motility in the general population of this subcontinent and the relative high prevalence of azoospermia are of important implications with respect to infertility, and further studies using large numbers of fertile and subfertile subjects with additional information on their smoking, socioeconomic condition, and lifestyle-related factors are recommended.⁷

Occupational exposure to toxicants, including heavy metals, organic solvents, and pesticides, has been widely associated with reproductive dysfunction in males as well as females. The possible mechanisms include both a direct effect on reproductive organs and an indirect effect resulting in hormonal imbalance that is crucial for growth, sexual development, and many other essential physiological functions. Albeit environmental factors, whatever the route of exposure, can undoubtedly affect the male reproductive tract development and function, we must be circumspect of the wide range of behavioral, medical, and other factors that can potentially damage the male reproductive health. All these factors may contribute to a decrease in fertility rates. To elucidate the causative effects of these observations, research efforts would require nontraditional collaboration between demographers, epidemiologists, clinicians, biologists, wildlife researchers, and genetics and molecular biologists.

CONCLUSION

Our finding suggested that the values of sperm parameters were in agreement with WHO criteria, significantly different in subfertile men of this region.

A further study with good-quality collaborative long-term research, including aspects such as semen quality, reproductive hormones, and xenobiotics as well as a strict definition of fecundity in this region, is needed.

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