Blackwell Publishing

Asian J Androl 2006; 8 (1): 89–93
DOI: 10.1111/j.1745-7262.2006.00050.x

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·Original Article·

Prevalences of oligozoospermia and azoospermia in male partners of infertile couples from different parts of India

Rajvi H. Mehta[1], Sanjay Makwana[2], Geetha M. Ranga[3], R. J. Srinivasan[4], S. S. Virk[5]

[1]*Hope Infertility Clinic and Research Foundation, Bangalore 560042, India*
[2]*Vasundhara Hospital and Fertility Research Centre, Jodhpur 342003, India*
[3]*Karthekeya Medical Research and Diagnostic Centre, Kalina, Mumbai 400098, India*
[4]*Dr Tilak's Laboratory, Kurnool, Andhra Pradesh 518001, India*
[5]*Virk Hospital, Jalandhar 144003, India*

Abstract

Aim: To determine whether there was any regional variation in the prevalence of azoospermia, oligozoospermia and mean sperm counts in male partners of infertile couples from different parts of India. **Methods:** Data on 16 714 semen samples analyzed over the past five years from six different laboratories located in five cities of India were collated and evaluated. **Results:** There was a regional variation in the prevalence of azoospermia. The prevalence of azoospermia was extremely high in Kurnool and Jodhpur (38.3 % and 37.4 %, respectively). There was also a regional variation in the prevalence of oligozoospermia (51 %) in Kurnool. There was no significant difference in the mean sperm counts in normospermic men. **Conclusion:** There is a regional variation in the prevalence of azoospermia and oligozoospermia in the male partners of infertile couples from different regions of India. The prevalence of azoospermia in Kurnool and Jodhpur is higher than any other worldwide reported literature. Further studies need to be carried out to determine the cause of this. *(Asian J Androl 2006 Jan; 8: 89–93)*

Keywords: oligospermia; male infertility; prevalence studies

1 Introduction

The male has been identified as a contributor to infertility in 40 %–50 % of infertile couples. However, there appears to be a geographical variation in the prevalence of male infertility with its prevalence amongst infertile couples being as high as 59 % in France [1], 26 %–32 % in the UK and Kashmir Valley in India, and about 36 % in South Africa, Indonesia and Finland. Other studies indicated that there was also a regional variation in the mean sperm concentration in men from different regions of the USA and France [2–4]. Geographic, ethnic, climatic and occupational factors have been suggested to be responsible for the regional differences in the sperm counts in men [3, 5].

There had been no such studies in India although it is a large country and a pluralistic society with consider-

Correspondence to: Dr Rajvi H. Mehta, Hope Infertility Clinic and Research Foundation, 12 Aga Abbas Ali Road, Bangalore 560042, India.
Tel: +91-80-2558-3836
E-mail: mehtat@vsnl.com
Received 2004-08-12 Accepted 2005-05-23

able regional variation in its ethnicity, occupational and dietary habits. In view of these differences, a retrospective study was carried out to determine whether there exists any regional variation in the prevalences of azoospermia, oligozoospermia and the mean sperm counts in male partners of infertile couples in different parts of India.

2 Materials and methods

2.1 Participating laboratories

Six laboratories in five parts that routinely perform semen analyses for diagnosis of infertility participated in this study. These were Hope Infertility Clinic, Bangalore; Dr Tilak's Laboratory, Kurnool; Dr Naga Sulochana's laboratory, Kurnool, Andhra Pradesh; Karthekeya Medical Research and Diagnostic Centre, Mumbai; Dr Virk's Hospital, Jalandhar and Vasundhara Hospital and Fertility Research Centre, Jodhpur. Of these five parts, Bangalore and Mumbai are metropolitan cities while the other three are smaller towns.

2.2 Data collection

All the participating laboratories provided data on the total number of semen samples analyzed in the past five years. They also provided the data on the number of semen samples that were azoospermic (no sperm in the ejaculate); oligozoospermic (sperm concentration of less than 20×10^6/mL) and the number of samples with "normal" sperm concentration (20×10^6/mL or more). The mean sperm count in the "normal" group was also provided.

Data on a total of 16 714 semen samples were obtained from the five Indian cities of Bangalore, Jalandhar, Jodhpur, Kurnool and Mumbai. Table 1 provided the number of samples studied in each city.

Table 1. Number of samples studied in each of the five cities/ towns.

City/town	samples number
Bangalore	1 627
Jalandhar	7 567
Jodhpur	1 341
Kurnool	2 723
Mumbai	3 456

2.3 Semen analysis

Semen samples were obtained from the male partners of infertile couples undergoing standardized investigation for the diagnosis of the cause of infertility. In all the laboratories, the samples were collected by masturbation following an abstinence period of 3–5 days. All the laboratories providing the data followed the WHO methodology for determining sperm concentration [6]. The semen samples were diluted using the semen diluting fluid and then loaded on to a Neubauer counting chamber (Neubauer, Weber, England) and the sperm concentration in million/mL of sample was determined. Azoospermic samples were centrifuged and labeled as azoospermic only if no sperm were detected in the centrifuged pellet.

2.4 Data analysis

The data from the six laboratories were collated at the Hope Infertility Clinic and the percentages of azoospermic, oligozoospermic and the mean sperm concentration in men with normal sperm concentration for each city were determined. The differences in the prevalence of azoospermia and oligozoospermia between the different cities were statistically compared using the chi-squared test.

3 Results

3.1 Prevalence of azoospermia

The prevalence of azoospermia was found to be ex-

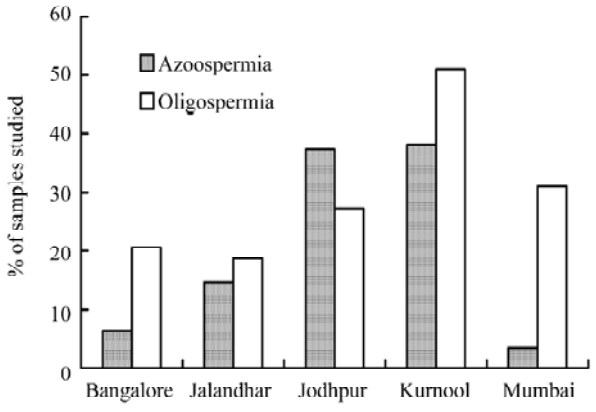

Figure 1. Percentage of azoospermia and olgospermia in five parts of India.

tremely high in Kurnool and Jodhpur (38.2 % and 37.3 %), respectively. The prevalence was 14.6 % in Jalandhar, and less than 10 % in Mumbai and Bangalore (Figure 1).

3.2 Prevalence of oligozoospermia

The prevalence of oligozoospermia was also extremely high in Kurnool (51 %); it was 31 % in Mumbai and between 15 % and 30 % in other three of the cities (Figure 1).

The prevalences of azoospermia and oligozoospermia were significantly ($P < 0.01$) different among the five cities as analyzed by the chi-squared test.

3.3 Mean sperm counts

The mean sperm counts in the men with normal sperm concentrations (i.e. sperm concentration of $\geq 20 \times 10^6$/mL) in the metropolitan cities of Bangalore and Mumbai were 46×10^6/mL and 43×10^6/mL, respectively, and were 63×10^6/mL, 63×10^6/mL and 65×10^6/mL in Jalandhar, Jodhpur and Kurnool, respectively.

4 Discussion

The prevalences of azoospermia and oligozoospermia in the metropolitan cities of Mumbai, Bangalore and Jalandhar were similar to those reported in most other parts of the world [1, 8]. However, the prevalences of azoospermia in Kurnool (38.2 %) and Jodhpur (37.3 %) were higher than those reported from any part of the world (Italy: 4.7 %; Siberia: 8.6 %; Indonesia: 12 %; Ethiopia: 26 %; Mexico: 19.9 %; Mongolia: 20 %; Nigeria: 6.4 %–16 %; South Africa: 9 % and Zimbabwe: 24 % [1, 7–12]).

Methodological bias and errors were well-documented problems of analysis of semen data from different laboratories [13]. Such errors can occur while comparing data on sperm motility or morphology but cannot occur while diagnosing azoospermia. Furthermore, data from Kurnool were obtained from two laboratories and the prevalences of azoospermia and oligozoospermia were similar in both laboratories. Therefore, the high prevalence of azoospermia cannot be attributed to any methodological bias or errors.

It is important to state here that none of the laboratories/centers, which participated in this study offered treatment specifically for male infertility or were run by a urologist. In fact, both the centers in Kurnool were run by gynecologists. Therefore, a positive selection bias towards increased observation of azoospermia and/or oligozoospermia in Kurnool and Jodhpur because of increased referrals of male infertility patients can be ruled out.

The cause for this high prevalences of azoospermia in Kurnool and Jodhpur was not clear. There could be several potential causes. We were postulating on the possible causes based on the geographical and environmental peculiarities of these two places.

4.1 Possible cause for azoospermia in Jodhpur

Fluorosis was endemic in Jodhpur (http://education.vsnl.com/fluorosis). The maximal fluoride levels in drinking water in the Jodhpur district range from 5.7 mg/L to 38.7 mg/L (Susheela A.K., personal communication, 2003).

Exposure to high (3 mg/d–27 mg/d) fluoride levels was known to have a detrimental effect on the male reproductive system in animals and can also cause a disruption of reproductive hormones in men [14]. Serum testosterone levels were also reported to be significantly lower in men living in the fluorosis endemic areas than those in those living in non-endemic areas [15]. Studies on experimental animals have shown that chronic administration of fluoride to rabbits resulted in the disruption and degeneration of the spermatogenic cells in the seminiferous tubules, which were devoid of spermatozoa [16]. Electron microscopic studies revealed a wide variety of structural defects in the flagellum, acrosome and nucleus of the spermatids of the fluoride treated rabbits.

It may be possible that the high prevalence of azoospermia in Jodhpur could be associated with the high levels of fluoride presented in drinking water. Studies need to be carried out to test whether there is an association between fluoride levels in drinking water and azoospermia.

4.2 Possible cause for azoospermia in Kurnool

Azoospermia and oligozoospermia have been demonstrated among workers exposed to pesticides [17]. It was likely that extensive pesticides use could be the cause for the high prevalence of azoospermia in Kurnool. Seventy-five percent of the population residing in the Kurnool district of Andhra Pradesh were involved in agriculture and allied activities (http://www.aponline.gov.in/quicklinks/apfactfile.html). Cotton is the second major crop after jowar cultivated in this district. Cotton cultivation necessitates extensive use of pesticides. Ento-

mologist Derek Russel stated that although cotton occupies only 5 % of the India's fields, these fields use more than half of India's pesticides (http://www.nri.org/Inthefield/india_pests.htm).

The chief industries in Kurnool are weaving of coarse cotton cloth and cotton presses. Oil is extracted from cotton-seed and this crude extract is used for cooking by the economically weaker sections of society and the residues fed to cattle.

Gossypol, a phenolic compound isolated from the seeds, stems and roots of the cotton plant, had been known for years as the toxic principle left in the cottonseed cake after cottonseed oil extraction. Clinical trials with Gossypol in China have shown that the drug caused a decrease in motile sperms and then a decrease in sperm counts ultimately leading to azoospermia [18]. Interestingly, we also observe a high prevalence of oligozoospermia as well as azoospermia in Kurnool. It was possible that exposure of men to cotton or cottonseed oil could be responsible for the high prevalences of azoospermia and oligozoospermia in Kurnool.

Apart from these compounds, viz. fluoride, pesticide, cotton seed which are hypothesized to be a potential cause of the high prevalences of azoospermia and oligozoospermia in Kurnool and Jodhpur, there could be several other agents or causes could be responsible for the high prevalence of semen abnormalities in these cities. What is shocking is the observation of the extremely high prevalence of azoospermia in Kurnool and Jodhpur.

The mean sperm counts were lower in normospermic men in the metropolitan cities of Mumbai and Bangalore than in those of the smaller cities of Kurnool, Jodhpur and Jalandhar. We had earlier reported an inverse correlation between the air pollution index of suspended particulate matter in the environment and sperm counts [19]. This could possibly be the reason for relatively low mean sperm concentrations in men in these cities. Recently, de Rosa *et al*. [20] from Italy have also reported on poor semen quality in toll booth workers exposed to air pollutants, especially vehicular emission, as compared with controls. In conclusion, there is a regional variation in the prevalences of azoospermia, oligozoospermia and mean sperm concentrations in male partners of infertile couples.

Acknowledgment

The authors are grateful to Dr T. C. Anand Kumar for his suggestions and critical comments on the manuscript. We also thank Dr Naga Sulochana of Kurnool for sharing the data from her laboratory.

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