

A Study on the Trend in Semen Parameters of Males from Ahmedabad City (Gujarat), Over a Two-Decade Period

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ABSTRACT Current available literature shows that there is a definite declining trend in sperm counts in several countries across the globe leading to an increase in infertility in several regions. Even in several areas which economically belong to the third world of developing countries, there are reports of an increase in the number of infertility cases. In particular, most reports indicate a decline in sperm count and/or a decrease in semen quality. The present study was therefore carried out to determine the trend in sperm density and motility, which could result in a possible fertility decline among males in the areas in and around Ahmedabad city, Gujarat State. Data were obtained by evaluating semen parameters from samples collected from males of proven fertility, from a cross section of the normal population over a period of 20 years. The analysis was carried out as part of various research studies related to assessment of infertility and includes evaluation of physical characteristics of semen, sperm count, motility, viability and morphology of semen samples of donors of proven fertility, included as the Control/ Normal group. The data obtained in recent years (2000-2005) from our laboratory was compared to semen parameters obtained every five-seven years, over the last two decades (1983-2005). There appears to be no significant decline ($p < 0.2$) in semen parameters of normal individuals, as observed in other parts of world.

INTRODUCTION

Infertility is a disorder that results in much trauma, emotional instability and psychological stress, which in turn has an adverse bearing on the physiology and psychology of the individual, particularly in a social set-up such as ours, with a strong emphasis on child-bearing.

Two decades earlier Hudson et al. (1985) reported that 40% of infertility could be attributed to the male factor. However in recent years both, couple infertility and male factor infertility have shown an alarming rate of increase. A recent report on the status of infertility in our country, India (Anand Kumar 2004) states that nearly 50% of infertility is related to reproductive anomalies or disorders in the male. In addition, in over 25% of infertility cases, no detectable cause can be traced after routine tests, which leaves the case as unexplained infertility.

There is growing evidence from current reports that fertility is declining in several countries all over the world. There are reports of

fertility decline in the U.S. population, particularly among certain ethnic groups (Dorsten 1999). Kohler (2000) has suggested a similar decline in fertility through demographic studies in Germany, while 1994 micro census in Russia also revealed a drop in the total fertility rate from 2.01 to 1.38 in those populations. Available literature also shows decreased fertility trends in several countries including Bulgaria, Czech Republic, Hungary, Poland (Philopov and Kohler 2000), as well as in the United Kingdom (Hassons and Killick 2003) and Norway (Sanger 2003).

Even in countries of the third world there is a definite indication that the number of infertility cases being evaluated has increased over the last 10-20 years. Although there is the problem of population explosion, infertility affects several million couples at the individual level. Decreased fertility has been reported in Ghana from 1988 to 1998 (Denrose and Ezech, 2005), as well as in Africa (Moultrie and Timaeus 2003). Basu (2000) has also shown a decline in fertility in India.

In particular there is growing evidence that male infertility is on the decline, with reports of falling sperm counts and decline in semen quality. Carlsen et al. (1992) reported a decline in human sperm concentration over a fifty-year period from 1938 to 1990, a report that generated much controversy but nevertheless uncovered a matter of

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grave concern for the scientific community. Brake and Krause (1992) have also published data on the deteriorating quality of semen. DeMouzon et al. (1996) have provided data with sound statistical and methodological support, which clearly suggest a decrease in semen quality among men in France since 1950. Similarly, Irvine et al. (1996) have published evidence of waning semen quality while Fisch et al. (1996), have reported lower sperm counts in the past decade. There are also a few reports from our country (India) suggesting a decline in fertility, with a reduction in sperm counts.

According to Bromwich et al. (1994) the decline in sperm counts may in fact be explained on the basis of a change in the 'Normal Values' over the years. Olsen et al. (1995) have reviewed the declining trend in sperm counts by substantiating the findings with reliable statistical models.

The causes for such fertility decline have also been extensively evaluated. There are several reports stating that pollution, chemically grown foods, lack of nutrition, diet, stress and altered lifestyle are some of the causes related to decline in fertility. The most commonly attributed factor being the increasing exposure to environmental oestrogen mimicking chemicals (Marmor et al. 1998).

However, there are no systematic studies to indicate whether or not males of the population in this part of India show a similar trend of declining sperm counts and fertility. The present study was therefore carried out to determine whether a similar fall in sperm counts and semen characteristics could be observed in males from Western India, particularly in Ahmedabad and its vicinity.

MATERIALS AND METHODS

The possible decline in semen parameters related to male fertility was evaluated by determining volume, sperm count, motility, viability and morphology in normal individuals using standard methods. The study covers a twenty year research period during which, all analyses were carried out in this laboratory by the same investigator. All conditions were maintained at the same standards, including periods of abstinence (3-4 days) and collection methods. Samples were collected from donors of proven fertility, ranging in age between 25 to 40 years.

Donors were taken randomly from a cross section of society. A minimum of 300 samples were taken for each study covering a span of five years.

Volume: The total volume of the ejaculate was determined, soon after liquefaction, in a graduated centrifuge tube and the volume was recorded to the nearest 0.1 ml.

Sperm Count and Motility: The sperm count and percent motility were determined using a Haemocytometer Neubauer chamber, according to the standard WHO (1992) method.

Viability: The percent viability of spermatozoa was determined using 0.1% Trypan blue according to procedure described by Talbot and Chacon (1981).

Sperm Morphology: Sperm morphology was evaluated according to the WHO criteria, where sperm abnormalities were observed and scored using the Papanicolaou staining technique (WHO 1992).

RESULTS

The data was obtained from a cross-section of the local population (men of proven fertility) over a period of 20 years as determined through earlier studies carried out in our laboratory, as well as data of normal individuals collected from laboratories in the vicinity. The data include volume, sperm count, motility, viability and sperm morphology of semen samples of the individuals as mentioned earlier.

It was observed that the volume of semen samples analysed showed no significant decline from 1985-2005 (Table 1). As shown in table 2 the sperm count was compared from 1985 to 2005 a span of 20 years. The statistical analyses revealed that there was no significant decline ($p < 0.2$) in the sperm count between the years 1985-2005 in spans of 5 years. Hence, from 1985 to 1990 and onwards to 2000- 2005, an insignificant variation was obtained indicating no significant decline in sperm count.

Table 1: Volume of semen from normal individuals

Year	Volume (ml)
1985-1990(n=390)	3.5 $\pm$ 0.3
1990-1995(n=310)	4.7 $\pm$ 1.3
1995-2000(n=300)	4.2 $\pm$ 0.3
2000-2005(n= 370)	3.9 $\pm$ 0.5
2000-2005*(n=400)	4.1 $\pm$ 0.8

*Data collected from Pathological Laboratories in the vicinity.

Values are MEAN $\pm$ S.E.

It was also observed from table 2, that the sperm motility showed no significant decline from 1985 to 1990 and thereafter in the intervals of 5 years. The study reveals therefore that there was an insignificant decline in sperm motility ($p < 0.2$) from 1985 to 2005.

Table 2: Sperm count and Motility in semen from normal individuals:

Year	Sperm density (million/ml)	Motility (%)
1985-1990(n=390)	86 $\pm$ 10.70	78 $\pm$ 5.30
1990-1995(n=310)	95.0 $\pm$ 24.00	73.2 $\pm$ 11.00
1995-2000(n=300)	120 $\pm$ 15.00	75 $\pm$ 4.50
2000-2005(n= 370)	80.22 $\pm$ 1.20	69.15 $\pm$ 7.40
2000-2005*(n=400)	83.68 $\pm$ 4.58	74.43 $\pm$ 4.24

*Data collected from Pathological Laboratories in the vicinity.

Values are MEAN $\pm$ S.E.

From table 3 it could be observed that the sperm viability remained within the 80-90% range showing no significant decline in the span of 20 years. Further it was observed that the percentage of sperm abnormalities was insignificantly altered ($p < 0.1$) in the semen samples scored from 1985 to 2005. The data obtained indicates that there is no significant decline in sperm count, motility, viability and sperm abnormalities, over the period of 20 years (1985-2005) as assessed from semen samples of normal individuals.

Table 3: Viability and Abnormal sperm morphology in semen from normal individuals

Year	Viability (%)	Abnormal sperm morphology (%)
1985-1990(n=390)	80.5 $\pm$ 7.3	18.5 $\pm$ 3.0
1990-1995(n=310)	90 $\pm$ 5.3	15.1 $\pm$ 2.1
1995-2000(n=300)	90 $\pm$ 4.3	12.5 $\pm$ 2.3
2000-2005(n= 370)	89.6 $\pm$ 7.9	18.6 $\pm$ 3.1
2000-2005*(n=400)	86.8 $\pm$ 11.6	15.5 $\pm$ 1.7

*Data collected from Pathological Laboratories in the vicinity.

Values are MEAN $\pm$ S.E.

DISCUSSION

The present study was an attempt to determine whether the population of Gujarat and Ahmedabad city in particular, showed evidence of declining trends in semen parameters, as assessed through semen analyses over the past 20 years.

There is growing evidence from recent literature that fertility is declining significantly in several parts of world. WHO (1991) has carried out a systematic study on prevalence of infertility in developed and developing countries. Several reports are available suggesting a declining trend in fertility, and in particular sperm counts, from various parts of the globe. Since 1992 there have been numerous reports which have shown conflicting results - from sperm count improvement to its decline in different populations.

These reports have set the impetus for the present investigation, where we wished to determine whether the population in this area showed a similar trend of sperm count decline as observed in countries all over the world. In particular, the study was aimed at determining whether semen parameters showed a decline in quality over the past two decades, in the immediate population of Ahmedabad city. The volume of the samples analysed did not show any significant variation over the period from 1985 to 2005. From the results obtained, it was evident that there was no significant decrease in the sperm count and motility as recorded from our observation from 1985 to 2005, a span of 20 years. These findings are contrary to those of several investigators (Carlsen et al. 1992; Auger et al. 1995; Irvine et al. 1996; deMouzon et al. 1996; Fisch et al. 1996) who have reported lower sperm counts in past five decades. In the present study, no such finding was obtained, where the data indicated an insignificant decline in sperm count and motility. Similarly, the evaluation of sperm viability and morphology from samples collected, also revealed insignificant changes over this period of time.

In addition, data from this laboratory was compared to that collected from other laboratories in the vicinity, in the years 2000- 2005. Their results also revealed no significant change in semen parameters, as compared to data obtained earlier. These findings suggest that semen parameters were not significantly lowered in these populations in the last 20 years. These observations hold special significance in the light of evidence that Ahmedabad is the third most polluted city in the country, since it has been well established that the human sperm count is extremely susceptible to harmful environmental pollutants.

Despite these evidences and the fact that pollution indices are increasing in Ahmedabad

city and its vicinity, our observations suggest that there is no significant alteration in sperm count, motility, viability and morphology over the period of 20 years, as compared to reports of declining sperm numbers from other parts of the world.

CONCLUSIONS

From the data obtained over the twenty year period considered in this investigation, it is evident that there is no significant change in the semen profile of individuals considered as the Normal, Control group and the routine semen parameters in samples from such individuals recorded no significant alteration. This indicates that unlike most Western populations that witness declining fertility trends, male fertility in the areas studied do not show any significant change.

RECOMMENDATIONS

Further in-depth study is necessary to evaluate the biochemical and functional changes in the spermatozoa, as well as to determine, corresponding to census data, whether there is any evidence of fertility decline in these Western regions of India. To the best of our knowledge no such systematic studies have been carried out to date and there is a paucity of information on the real trends in male and female fertility.

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