must realize that it is not a co-creator. No doubt it is a species gifted to think, recollect and foresee, and added to this is the power of science and technology. This power must not be misused and abused. Therefore, human being must become a responsible species: scriptures talk of such a responsibility.

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SCIENTIFIC CORRESPONDENCE

Declining semen quality in Bangaloreans: A preliminary report

The antifertility effects of environmental pollutants have been known since Roman times when the lead content of drinking vessels was suspected to be the cause of declining populations in the upper classes[1]. A recent study in China has shown that exposure to low levels of lead causes an impairment of male fertility as evidenced by low volume of the ejaculate, low sperm concentrations and increase in incidence of nonviable spermatozoa[2]. Sperm counts in Parisians declines at a yearly rate of 2.1% in contrast to Frenchmen living in Toulouse who did not show any change[3,4]. The major difference between these two studies is that Toulouse is a rural area of France with a low population as well as car density and industrial pollution as compared with Paris. A drop in total sperm count has been reported in Greater Athens where there is an increase in air pollution[5]. More extensive studies carried out in Europe and the USA have shown that the human sperm concentrations as well as the incidence of morphologically normal and motile spermatozoa are progressively declining over the last few decades[6–10]. This decline has been attributed to air pollutants especially the xeno estrogens[11,12].

The purpose of this retrospective (1992 to 1996) study was to determine whether there was any marked change in semen quality in the 1625 men who had come for semen analysis to Hope Infertility Clinic, Bangalore. Semen data, viz. volume, sperm concentration and percentage of motile and morphologically normal spermatozoa, during these five years was correlated with changes for the same period in air pollution indices, viz. suspended particulate matter (SPM), sulphur dioxide and lead content. SPM refers to solid and semi solid material found in the atmosphere which are less than 0.1 μm in size. SPM is a complex mixture of soot, ashes, dirt, soil, dust, pollens, molds and other carbon-based particles and acid aerosols. Particulate pollution comes from wood burning, car exhaust, mining, construction activity, plants, changes in humidity and diesel emissions.

All semen analyses were carried out in the same laboratory using methods described in the WHO Manual[13]. Data was categorized as: azoospermia (absence of sperms); oligospermia (sperm concentration < 20 million/ml); asthenospermia (> 50% of sperms nonmotile) and teratospermia (> 50% of sperms were morphologically abnormal) and tabulated year-wise.

The average values of the major air pollutants: SPM, sulphur dioxide and lead for Bangalore were obtained from the Central and State Pollution Control Boards for the years 1992 to 1996 (Table 1).

The data was analysed using a Microsoft Excel software package. The mean volume of semen and the mean concentration of sperms in 1992 and 1996 was compared using the Student's *t* test. The relationship between the semen volume, sperm concentration and the average values of the air pollutants was measured by determining the correlation coefficient between the two variables.

Mean semen volume and mean sperm concentrations were significantly

Table 1. Mean semen volumes, sperm concentrations, incidence of oligospermia and SPM values in 1992 and 1996

Year	Semen volume (ml)	Sperm concentration (millions per ml)	Oligospermia (%)	SPM ($\mu g/m^3$)
1992 ($n = 410$)	3.5	69 + 2.97	25	141
1996 ($n = 118$)	3.0	43 + 3.67	35	245

($P < 0.05$) lower in 1996 as compared to those in 1992. The other most significant change observed was that the incidence of oligospermia increased from 25% in 1992 to 35% in 1996 (Table 1). There was no significant change in the incidence of azoospermia, asthenospermia, or teratospermia.

There was good inverse correlation between the ambient SPM concentrations on one hand and semen volume and sperm concentration on the other ($r = -0.8193$ and -0.83087 respectively for semen volume and sperm concentration vs SPM). A similar correlation could not be discerned between semen characteristics and ambient levels of sulphur dioxide and lead.

The results of this retrospective study, which indicate a decline in semen quality during the five years of study, are similar to those made in USA and Europe[3–10]. A significant finding is the inverse correlation between the mean semen volume and sperm concentration on one hand and SPM on the other as well as the rising incidence of oligospermia with a progressive deterioration of the environment. Bangalore is one of the fastest growing cities of Asia with a concomitant rise in the human population, motorized vehicular traffic and in the increased use of diesel generators – all of these contribute to the rise in total air pollution levels in the city. In addition to SPM, the organic and inorganic material that bind to it are substances well known to have detrimental effects on spermatogenesis and accessory sex glands.

The present study is far from comprehensive. Nevertheless, it clearly shows that semen volume, sperm concentrations and the incidence of oligospermia have drastically changed in such a manner that is indicative of reduced male fertility during the last five years. These findings give cause for concern about the altered reproductive health status of men *vis-à-vis* deterioration of environmental conditions. Spermatozoa are single cells and are likely to be the most vulnerable cells in the body to altered environmental conditions. If men are thus affected, surely women too would be similarly influenced by the environment. There is therefore an urgent need to carry out an in depth study of declining reproductive health parameters *pari passu* with environmental degradation. Such studies are underway in our Centre.

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Bambusa vulgaris blooms, a leap towards extinction?

BAMBUSA vulgaris[1] belonging to the tribe Bambuseae of Poaceae is the most widely grown bamboo throughout the tropics. Though described in 1810, the origin and nativity of this species is still debated[2–5], and it survives only in cultivation. Adaptability to different agroclimatic conditions, high culm strength, utility in various ways, high pulping quality, easy response to vegetative propagation, vigorous growth, quick recovery of clumps after felling and rare flowering are some advantages of this species.

The incidence of flowering in this species is very rarely reported. Blooming occurred in Bangladesh during 1851 and 1879, in Sri Lanka in 1863, India (Calcutta) in 1890 and Singapore in 1892 (refs 2, 6, 7). After the lapse of over a century, another flowering was reported in Bangladesh[8,9] during 1979, 1980–81 and 1983–84. Though not clearly indicated, Soderstrom and Ellis[4] studied flowering samples of *B. vulgaris* that flowered in Kandy district of Sri Lanka as late as 1970s. The flowering cycle is believed to be 80 (±8) years[10]. During each occurrence of flowering only a few clumps were involved[3,8,11] and no report of gregarious flowering exists. Unusually, flowering was not followed by fruit setting in any recorded history and eventually clumps involved perished[3,8,10]. Banik[10], however, reported a clump which 'stopped flowering and revived'. Except a doubtful report by Lantican *et al.*[12] seeds of *B. vulgaris* remain to be botanically known[2–5]. As flowering does not result in fruit setting, it was subsequently doubted[8,9] whether this condition will lead to the eventual extinction of this unique species.

We observed, in May 1996, five clumps of this species in flowering in two private areas near the police station, Cherthala (9.42°N, 76.2°E), Alappuzha district in Kerala. (*Exsiccate*: 24 May 1996, *K. C. Koshy 28668, 28669*; TBGT). Incidentally, this is the report of its flowering from India after 100 years. Out of the five flowered clumps, culms in four were yellow with green stripes and the other with culms yellow (with green stripes) and green (with yellow stripes) together. Two clumps in one area were completely leafless and in full bloom (complete flowering[10]). No new shoots were produced from these clumps.