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Decline in semen parameters from 2000 to 2016 among Bangladeshi men attending a tertiary care hospital

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Abstract

Introduction: The objective of this study was to analyze longitudinal changes in semen parameters of Bangladeshi men. We hypothesized that semen parameters declined for this population. Methods: We retrospectively analyzed semen data from men aged 16–44 years who sought care for general sperm quality or updates on fertility status at an infertility clinic in Dhaka, Bangladesh, from January 2000 to June 2016 (n = 13,953). Samples with incomplete data were excluded (n = 43). The WHO normal criteria and semen analysis procedures were used to evaluate parameters of the remaining 13,810 specimens. Samples with missing values on sperm concentration (n = 4187) were excluded from concentration analyses. Age and duration of abstinence at testing were recorded and adjusted for. Data were imported into SAS® 9.4 statistical software. Temporal significance was investigated using one-way ANOVA for mobility parameters and Chi-square test for raw concentration. Logistic regression analyzed the effects of confounders on azoospermia and raw concentration, while median regression modeling adjusted confounders for concentration, total motility, and rapid linear (RL) motility. Results: Age distribution was significantly correlated with annual parameter changes (interaction test, P < 0.0001). Adjusted total motility and RL motility declined by 20% from their maximum values to end of the study (P < 0.0001). Raw concentration lacked clear trends and was unaffected by adjustment. Azoospermia increased by 10% between the 2000–2010 and 2011–2016 participants (odds ratio = 0.10 [0.14–0.16]). Conclusion: In agreement with the hypothesis, Bangladesh makes attending this clinic have experienced decline in semen parameters (total motility and RL motility) and increased frequency of azoospermia.

Materials and Methods

The Ethical Review Committee of the Diabetic Association of Bangladesh approved the protocol of this study (Memo no: BADAS-BRE/REC:16/0019). Participants were required to provide signed consent for their analysis results to be included in the study database and received signed analysis reports for their personal records.

Study population and participants

Data collection for this study was conducted in the Centre for Assisted Reproduction (CARE) at the Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM) from January 2000 to June 2016. CARE is one of the largest infertility clinics in Bangladesh and a major center for infertility referrals. A majority of patients at CARE reside in Dhaka, Bangladesh, but services are also provided to patients from other regions in the country and those visiting from overseas.

The overall study population consisted of 13,953 participants. A total of 143 participants were excluded from analysis due to incomplete data. 6187 datasets did not have quantitative sperm concentration values and were excluded from raw concentration analyses. Data is not available for 2006 and thus data from 2000 to 2005 and 2007 to June 2016 is included.

Semen analysis procedures and calculations

All semen analyses were conducted by a single laboratory technician who used the same type of laboratory materials for the entire duration of the study. The methods used for semen analysis are outlined in the WHO’s Laboratory Manual for Examination and Processing of Human Semen (4th and 5th ed.). Participants provided semen samples through masturbation or intercourse at the on-site masturbatorium. 3-5 days of abstinence before sampling was advised, and duration was recorded. Samples were liquefied for 30 min and then gently vortexed before 2–3 drops were extracted. Drops were loaded into a Makler counting chamber (0.01 mm × 0.01 mm grid) and observed under a phase-contrast microscope at ×10 magnification. Concentration was found by estimating the total number of spermatozoa (in millions per milliliter) in 10 consecutive grid squares. If the count was >150 million/mL, the sum of spermatozoa in the whole grid was divided by 10 to give the concentration reading. The sperm with rapid, streamline motion in the semen were grouped as Grade A. Grade B sperm moved slowly, and Grade C sperm lacked movement. Total motility was calculated as Grade A sperm + Grade B sperm. Rapid linear (RL) motility only accounted for the percentage of Grade A sperm. The laboratory technician determined morphology by adjusting the microscopic view to a higher magnification so that physical characteristics of the spermatozoa were visible. The count of sperm that were not in the normal tadpole shape or swim abnormally were considered to have abnormal morphology. The percentage of sperm with abnormal morphology was estimated based on the magnification of the grid, proportional to the overall 10 × 10 Makler chamber grid.

Statistical analysis

The dataset (n = 13,810) was imported from an electronic database into SAS® 9.4 statistical software (Cary, North Carolina) for analysis. Because normally tests showed the semen parameters to be severely skewed, median (interquartile range) was reported for parameter baseline. Age, duration of abstinence, and liquefaction were reported as mean ± standard deviation. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively. Significance of difference between annual means and medians was found through parametric one-way ANOVA and non-parametric one-way ANOVA, respectively.

Due to the incompleteness of the quantitative concentration dataset, qualitative azoospermia concentration diagnosis was evaluated in logistic regression analysis since it is definitive. Other qualitative diagnoses such as normozoospermia and oligozoospermia were not used in analysis because the WHO criteria changed between 1989 and 2010 affected diagnosis frequencies. For the criteria change, concentration diagnosis frequencies were adjusted separately based on the WHO 2010 criteria. Morphology reporting in the dataset was inconsistent from analysis beyond 2006.

Results

Baseline semen characteristics, age, and duration of abstinence of the study population (n = 13,810) are shown in Table 1. The average age of participants was 35 ± 6.6 years, and age distribution was significantly correlated with annual parameter changes (P < 0.0001) [Table 1]. Duration of abstinence (P = 0.05) and liquefaction (P = 0.07) remained unchanged in annual comparisons, both averaging around 3.2 ± 3.8 days and 1.0 ± 0.8, respectively. All semen parameters (concentration, total motility, RL motility, and normal morphology) appeared to vary significantly with age. The sperm parameters of all the participants are described in Table 1.
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