Original Research Article

Cross-Sectional Study of Semen Analysis in Type 2 Diabetic Men

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Abstract

Background: Diabetes is an endocrine disorder with effects on various body systems. Its impact on male reproductive system has been of interest to the researchers. This cross-sectional study was done to assess the semen parameters among type 2 diabetic men attending the reproductive biology unit at our tertiary care centre. **Methods:** This was a cross-sectional study. Thirty diabetic males in the age group of 25 – 55 years on oral hypoglycaemic drugs for ten or more than ten years visiting reproductive biology unit of Physiology Department at the Government Medical College, Aurangabad for the evaluation of semen parameters were enrolled as cases and thirty non-diabetic fertile males having one or more than one child were enrolled as controls. Fasting and post meal blood glucose levels were evaluated. Semen sample was collected after abstinence of four days. Semen analysis was done on Biovis Computer Assisted Semen Analysis; CASA 2000.Sperm morphology was done manually after staining technique using Diff-quick method. Results were analysed statistically between the groups by applying Student 't' test. **Results:** The Mean ± Standard Deviation (SD) value of fasting blood sugar (mg %) in diabetics and nondiabetics was 107.7 ± 27.87 and 85.73 ± 11.98 and post meal blood sugar was 159.53 ± 52.49 and 110.97 ± 13.97 respectively. Mean ± SD value of sperm concentration (million/ejaculate) was 133.14 ± 43.92 and 136 .19 ± 58.08 in diabetics and nondiabetics respectively. Mean ± SD value of sperm motility (%) was 58.17 ± 17.93 and 68 .74 ± 15.07 in diabetics and nondiabetics respectively. Mean ± SD value of normal sperm morphology (%) was 26.8 ± 12.36 and 62.00 ± 16.51 in diabetics and nondiabetics respectively. **Conclusions:** The study results reflect no significant difference in sperm concentration and motility among diabetic subjects on oral hypoglycaemic agents being evaluated for infertility as compared to non-diabetic fertile subjects. Sperm morphology evaluation showed significantly less percentage of normal sperms among the diabetic subjects on oral hypoglycaemic agents.

Key Word: Sperm motility, Sperm morphology, Hyperglycaemia.

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INTRODUCTION

Diabetes is rapidly progressing and reaching epidemic proportions in India with reported figures of more than 62 million diabetes patients.[1,2] In the year 2000 itself, India with an approximate 31.7 million diabetes patients attained the status of diabetes capital of the world with the highest number of diabetic people and was followed by China in the second place with around 20.8 million diabetics and the United States third in the list with 17.7 million diabetics. As per estimates from a research study, the global diabetes prevalence is predicted to double from about 171 million diabetics in the year 2000 to approximately 366 million diabetics by the year 2030 with India expected to contribute maximally to the diabetes disease burden. [3] Infertility is another phenomenon which is considered to be impacting an increasing number of couples, especially in recent decades. As per estimates by the World Health Organisation, the prevalence of primary infertility in India

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ranges from 3.9% to 16.8%.[4] Among the Indian couples seeking infertility treatment, the contribution of the male factor has been found to be approximately 23%. [5] However, as per a more recent report, it has been stated that nearly half the cases of infertility among the Indian couples are related to disorders in the male partner. [6] Diabetes is an endocrine disorder with defects in either insulin secretion or its action or both factors. It leads to altered carbohydrate metabolism as well as alterations in protein and fat metabolism. [7] Diabetes is known to have effects on various body systems. Due to the lack of research reports regarding the influence of diabetes on male reproductive health and its impact on semen quantity and quality parameters, it was not often explored as a cause of male infertility. [8] However, this approach was challenged by findings that highlighted the subtle changes at the molecular level due to diabetes that impact sperm quality and function. [9] A recent study has shown that there is a high prevalence of subfertility among diabetic patients. [10] In another study, infertility prevalence in men with type 2 diabetes was 35.1%. [11] Semen analysis is considered as a fundamental and single most useful investigation with 89.6% sensitivity which can detect 9 out of 10 men with a problem of male infertility. [12] It is a simple process by which the assessment of sperm formation (count) and sperm maturity, quality (motility, morphology) can be done. [13] With this perspective, the data regarding semen parameters in male type 2 diabetes patients among the infertile couples under evaluation; may give an insight into the interplay of semen quality and Type 2 diabetes. This cross-sectional study was done to assess the semen parameters among type 2 diabetic men on oral hypoglycaemic drugs attending the reproductive biology unit for evaluation of infertility at the Physiology Department of our tertiary care centre.

METHODS

The present study was a cross-sectional design study. Thirty diabetic males in the age group of 25 – 55 years on oral hypoglycaemic drugs for ten or more than ten years visiting reproductive biology unit of Physiology Department at the Government Medical College, Aurangabad for the evaluation of semen parameters were enrolled as cases and thirty non-diabetic fertile males having one or more than one child were recruited as controls. Subjects with type I DM, on insulin therapy, hypertension, Ischemic Heart Disease, smokers, h/o trauma, drugs and medico-legal cases were excluded from the study. The study design was approved by the ethics and research committee of the institute. Informed consent was taken from the subjects prior to enrolment. The study subjects were explained about the purpose and procedure of the study, and they were assured of keeping it confidential, a unique identification code was given to each subject. Fasting and post-meal blood glucose levels of all study subjects were evaluated. The semen sample was collected in a sterile container after abstinence of four days by masturbation method. Semen analysis was done on Biovis Computer Assisted Semen Analysis; CASA 2000 after liquefaction time of 30 minutes. This system provides computer images of semen analysis. CASA 2000 reports sperm concentration and motility automatically while morphology was done manually after staining technique using Diff-quick staining method. Results were analysed statistically between the groups by applying the independent Student 't' test and p-value < 0.05 was considered to be statistically significant.

OBSERVATIONS

Table 1 shows baseline characteristics of subjects. Table 2 shows the blood glucose levels and Table 3 shows the semen analysis parameters among the study subjects.

Table 1: Baseline Characteristics

Parameters	Cases (Diabetics) Mean ± SD	Controls (Non-diabetics) Mean ± SD
Age (years)	43.4 ± 6.85	42.56 ± 7.66
Height (cm)	166.63 ± 7.82	167.93 ± 9.32
Weight (kg)	72.1 ± 7.68	70.2 ± 8.15
BMI (kg/m^2)	26.11± 3.55	24.85 ±1.57

Table 2: Blood Glucose Levels in Study Subjects

Parameters	Cases (Diabetics) Mean ± SD	Controls (Non-diabetics) Mean ± SD
Fasting blood glucose (mg %)	107.7 ± 27.87	85.73±11.98
Post meal blood glucose (mg %)	159.53 ± 52.49	110.97±13.97

Table 3: Semen Parameters in Study Subjects

Sperm Parameters	Cases (Diabetics) Mean ± SD	Controls (Non-diabetics) Mean ± SD	p value
Concentration (millions/ejaculate)	133.14 ± 43.92	136.19 ± 58.08	0.8196 (NS)
Motility (%)	58.17 ± 17.93	68.74 ± 15.07	0.164(NS)
Morphology(Normal)	26.8 ±12.36	62.00 ± 16.51	<0.0001 (HS)

NS-non-significant, HS-Highly significant

DISCUSSION

In our present study, results reflect no significant difference in sperm concentration and motility among diabetic subjects on oral hypoglycaemic agents being evaluated for infertility as compared to non-diabetic fertile subjects. Sperm morphology evaluation showed significantly less percentage of normal sperms among the diabetic subjects on oral hypoglycaemic agents. Diabetes and its association with infertility have been of interest to researchers, and recently there have been studies evaluating the role of diabetes in male infertility. It has

been reported that primary infertility (16%) and secondary infertility (19.1%) prevalence was significantly more in diabetic patients in comparison with non-diabetic patients. Also, the prevalence of secondary infertility was higher in diabetes patients that may be speculated to be due to the progression of diabetes or long duration of diabetes affecting the fertility potential. Additionally, a study gave the conclusion that diabetes without any complications did not show a difference in sperm motility in comparison with healthy males. It has been suggested that evaluation of the impact of diabetes on semen quality should account for the duration of disease, control of glucose levels in the patient, presence of complications and the type of treatment used. [11, 14, 15] The present study results indicate semen parameters in subjects on treatment with oral hypoglycaemic agents for more than ten years, however, the study limitation was that data regarding complications had not been gathered. A large number of human and animal model studies have found that diabetes impacts male fertility via multiple mechanisms like altered spermatogenesis, degenerative changes in testes, altered metabolism of glucose in the Sertoli cells, reduction of testosterone production and secretion, dysfunction of ejaculation, and reduction of libido.[9, 14, 16-21] Hyperglycaemia is reported to affect sperm quality and decrease male fertility. The correlation of blood glucose levels and testicular damage is an established factor, and oxidative stress in diabetes has been found to be linked to complications of diabetes and associated with severe changes in the structure and function of the testes. [22-25] Similar to our study results, Delfino *et al*. reported that type 2 diabetes patients showed significantly compromised sperm morphology although the sperm concentration was normal. [26] Singh AK *et al*. study done at Sewagram, Wardha in our Maharashtra state reported that Type 2 diabetes has a negative impact on sperm parameters. [27] There is a need for early detection of diabetes and timely management, and also all males under evaluation for infertility must be assessed for diabetes. Appropriate management of diabetes and also antioxidant therapy has been known to improve the semen quality.[28, 29] The study limitations are cross-sectional study design with relatively less sample size. Further studies with case-control, cohort or experimental design and an adequate sample size across various centres are needed to understand the association and possible management of the problem further. To conclude, the study results reflect no significant difference in sperm concentration and motility among diabetic subjects on oral hypoglycaemic agents being evaluated for infertility as compared to non-diabetic fertile subjects. Sperm morphology evaluation showed significantly less percentage of normal sperms among the diabetic subjects on oral hypoglycaemic agents.

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