Indian J. Applied & Pure Bio. Vol. 40(3), 1920-1924 (2025). **ISSN: 0970-2091**
A web of Science Journal

Comparison of Sperm quality and fertility outcome of Diabetes mellitus patients and Healthy persons

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Abstract

The aim of the present study is to evaluate the effects of Diabetes Mellitus (DM) on sperm quality and fertility outcomes in human males. Observational studies focused on the relationship between DM, semen parameters (semen volume, sperm count, sperm motility sperm viability and couple infertility and sexual symptoms) and healthy person have been reported and critically discussed here, with the attempt to derive evidence-based conclusions. Study was conducted on the 30 Diabetes patient and 30 healthy persons (Control group). Patient's medical history have been studied and effect of diabetes on reproductive output observed and was compared with healthy person. Diabetes patients were further divider into 3 categories on the bases of duration of diabetes i'e DM < 5 years, DM 5-10Years and DM>10 Years). Results showed that there is significant difference between the sperm volume sperm count of Diabetes and control group. Also total motitly is higher in control group.

Key words : Male infertility, Diabetes mellitus, healthy person, Sperm quality, fertility outcome.

Study area: Study has been conducted in Khurana hospital and IVF center Sirsa (Haryana) (https://khuranahospital.com/). Study conducted on the 30 Diabetes patient and 30 Control persons (non-diabetes person). Patient's medical history studied and effect of diabetes on reproductive output is observed and compared with healthy person. There was variation in methodology as per requirement.

DM is a hormonal and metabolic disorder which causes many complications and affects multiple organs and systems in the human body including the male reproductive system. Although the molecular basis of diabetes-caused male sexual and reproductive dysfunction is not completely known yet, abundant evidence shows that multiple factors and mechanisms are involved in the process. The study begins by categorizing male

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participants into two main groups: Control Group (Healthy persons), healthy men who gave consent to participants undergo semen analysis, which serves as a control group, and diabetic patients. However, diabetic men who only suffer from diabetes and agree to participate are included in semen analysis. Both the groups are asked about their habits and infertility status to evaluate the result correctively.

Table-1 Showing the categorization of Age Group of control and Diabetes groups

Age	Control Group	Diabetic Group (DM1)
20-25	2	3
26-30	12	9
31-35	6	8
36-40	8	7
41-45	2	3
Total	30	30

Sperm count and Semen volume :

Normal sperm count: ranges from 15 million to over 200 million sperm per milliliter of semen, (15million:200million/mL). A low sperm count, known as oligospermia, occurs when the count is fewer than 15 million sperm per milliliter. Volume is measured in milliliters (ml).

Result showed in present study that semen volume found to be higher in control group (3.6 ± 1.3) than DM group (3.2 ± 4.7, 2.7±1.2, 2.4± 1.8, **P =0.003**).Similarly Sperm Count is found to be higher in control group (326.7 ± 176.4) than diabetes groups (230.67±146.34, 210.34±165.40, 119.31±103.10, **P=0.004**). Semen quality is characterized by decreased sperm concentration and motility, as well as high incidence of sperm DNA damage, DNA breakage, and sperm apoptosis.

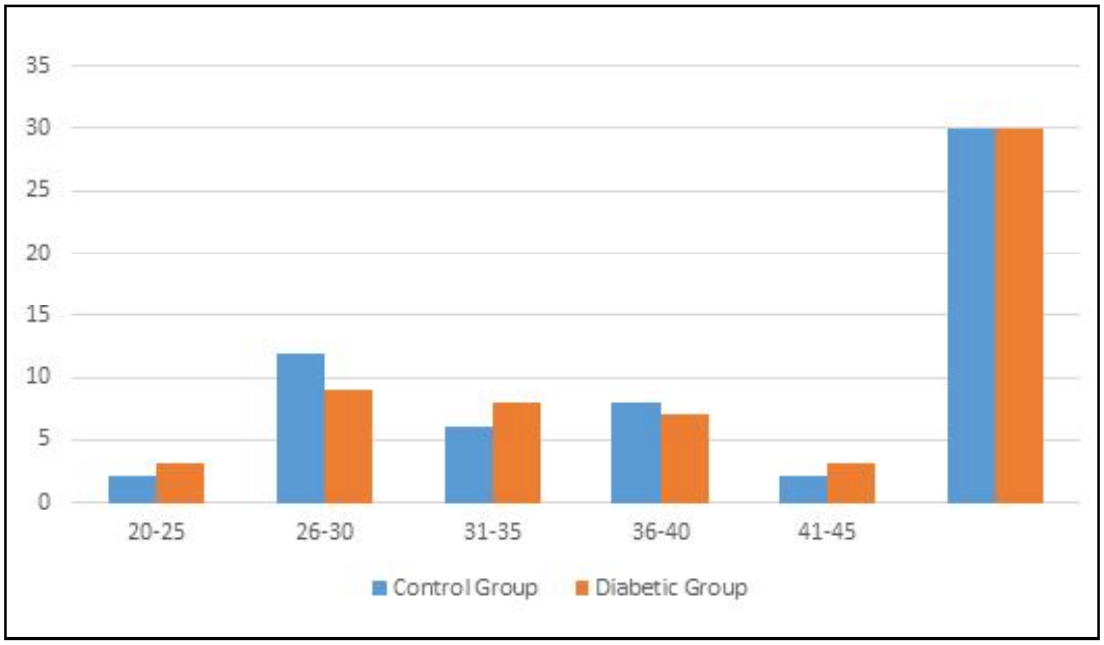

Table-3. Showing the Sperm Count and Semen Volume of Control and Diabetes Groups

	Control Group (N=30)	Diabetic patients (n=30)			*P* Value
		DM1 <5 years	DM1 (5- 10 years)	DM1 >10 Years	
Sperm Count (10^6 per ml)	326.7 ± 176.4	230.67±146.34	210.34±165.40	119.31±103.10	P=0.004
Semen Volume (ml)	3.6 ± 1.3	3.2 ± 4.7	2.7 ± 1.2	2.4±1.8	P=0.003

Samples are considered normal if the volume is above 1.5 ml. semen volume and sperm motility and morphology were significantly lower in type 1 DM patients, whereas seminal fructose and glucose were significantly higher[4]. Even though the sperm count was lower in these adolescent patient with diabetes, the difference was not significant when compared with the control group. Agbaje *et al*.[1] also examined spermatozoa from 27 diabetic and 29 non-diabetic men with the same average age. They found that even though semen volume in diabetic men was significantly lesser than controls (2.6 vs. 3.3 ml), there were no significant differences in sperm concentration, Petroianu *et al*.,[5] also observed no differences in seminal concentration and rates of motile spermatozoa between diabetic and healthy men.

Sperm motility :

Sperm Motility measures the percentage of sperm that move efficiently. A normal motility rate is 40% or higher (32-75%) as well as the ones that are able to "swim" in terms of rapidly progressive, slowly progressive, or non-progressive. A sperm sample is considered normal when more than 40% of sperm are able to move and over 32% are able to make forward progress.

Table-4. Showing the total motility (Progressive motility + Non Progressive motility) of Control and Diabetes Groups

	Control Group (N=30)	Diabetic patients (n=30)			*P* Value
		DM1 <5 years	DM1 (5- 10 years)	DM1 >10 Years	
Progressive motility (PR %)	70.12±9.47	61.32 ±4.16	50.34±9.23	45.59±7.65	0.005
Non Progressive (%)	19 ±2.87	40±5.40	34±7.17	69±5.07	0.032
Total motility (PR+NP%)	85.1 ± 17.7	62.8± 34.1	55.02± 18.4	46.8± 16.8	0.052

Result showed progressive and non-progressive motility of sperm. Progressive motility of control is higher as compared to diabetes groups (70.12±9.47 vs 61.32 ±4.16,50.34±9.23, 45.59±7.65. non progressive motility is found much significantly higher in diabetes patient (DM1 >10) i'e 69±5.07. total motility is higher in control groups (85.1 ± 17.7) than in diabetes groups (62.8± 34.1,55.02± 18.4, 46.8± 16.8) and also showed the significant difference and effect (*P*=0.052) Motility is impaired due to damage to sperm mitochondria, which are essential for providing energy. Previous studies indicate that although diabetic men show sperm concentration, motility and morphology within normal parameters by conventional standards but they have higher levels of nuclear DNA fragmentation (nDNA) and mitochondrial DNA deletions (mtDNA). The nDNA fragmentation is significant

Sperm morphology and Sperm vitality :

To evaluate the sperm morphology the "the Kruger Strict Criteria" is followed. The Kruger criteria, also known as the strict criteria, are used to evaluate sperm morphology. This system assesses the shape and structure of sperm, providing valuable information about male fertility potential.

Table-5. Showing the Sperm morphology and Sperm Viability of Control and Diabetes Groups

	Control Group (N=30)	Diabetic patients (n=30)			*P* Value
		DM1 <5 years	DM1 (5- 10 years)	DM1 >10 Years	
Sperm Morphology	9.2 ± 7.6	8.92 ± 8.0	8.86 ± 9.3	8.65 ± 3.7	0.641
Sperm Viability (%)	82.0 ± 15.6	80.0 ± 5.40	79.0 ± 16.2	78.0 ± 19.1	0.467

Result showed that is there no significant difference between the sperm morphology of control group and diabetes groups. Sperm morphology and sperm viability is not as much effected by diabetes as data showed in present study (Control group 9.2 ± 7.6, and Diabetes groups8.92 ± 8.0, 8.86 ± 9.3, 8.65 ± 3.7 ***P*= 0.641**, sperm viability of control group 82.0 ± 15.6 and diabetes grupos 80.0 ± 5.40, 79.0 ± 16.2, 78.0 ± 19.1, P= **0.467**). Ali *et al*.,[2] showed a highly significant increase in total sperm count and sperm concentration in patients with type 1 and type 2 DM. However, sperm motility and semen volume were lower than controls, whereas sperm morphology and the quality of sperm motility were unaffected[2]. Bhattacharya *et al*.,[3] evaluating52 DM men and 66 controls,found lower semen volume, sperm total count and normal morphology and higher sperm motility in DMmen.

Couple Infertility

	Control Group (N=30)	Diabetic patients (n=30)			*P* Value
		DM1 <5 years	DM1 (5- 10 years)	DM1 >10 Years	
Couple infertility (%)	1± 2.13	5.92 ± 16.0	28.86 ± 9.30	68.65 ± 3.74	0.064
Sexual Symptoms (%)	2± 4.12	7± 9.43	34 ± 2.54	72± 9.03	0.004

A higher prevalence of couple infertility was found in the Diabetic group (5.92 ± 16.0, 28.86 ± 9.30, 68.65 ± 3.74 with respect to controls (1± 2.13). Under the sexual Symptoms sexual Desire and ejaculation is studied and result showed the significant difference between the control and diabetes groups (Control group 2± 4.12 vs. Diabetes groups 7± 9.43, 34 ± 2.54, 72± 9.03, **P= 0.004).**

Diabetes (DM1) affects the quality of semen and modifies the typical sperm characteristics. Spermatogenesis disorders are caused by diabetes mellitus (DM), which damages the hypothalamic-pituitary-gonadal axis (HPGA), decreases hypothalamic secretion of gonadotropin-releasing hormone (GnRH), and lowers plasma levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), and prolactin-related testosterone secretion (PRL and T). Reduced pituitary protein synthesis and gonadotropin release result from impaired glucose utilization brought on by insulin insufficiency. The impact of DM1 must be assessed in light of the disease's duration, glycemic control, occurrence of complications, and therapy type.

References :

1. Agbaje IM, DA Rogers, and CM McVicar (2007). *Hum Reprod. 22*(7): 1871-1877.
2. Ali ST, RN Shaikh, NA Siddiqi, and P Q Siddiqi (1993). *Arch Androl. 30*(1): 47-54.
3. Bhattacharya SM, M Ghosh, and N. Nandi (2014). *J Obstet Gynaecol Res. 40*(1): 167-171.
4. Padrón RS, A Dambay, R Suárez, and J. Más (1984). *Acta Diabetol Lat. 21*(2): 115-121.
5. Petroianu A, LR Alberti, M Antonio, B de Melo and LM de Almeida (2009). *Einstein. 7:* 407–410.