

A Study on Effects of Cigarette Smoking on Various Semen Parameters



Medical Science

KEYWORDS : cigarette smoking , semen quality, sperm concentration, oligozoospermia

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ABSTRACT

Backgrounds and objectives: Previous studies suggest a deleterious effect of cigarette smoking on semen quality, but their results have not been consistent. We studied the association between current smoking and semen characteristics.

Material and method: Our study was performed on 105 normal asymptomatic healthy males (50 control , 55 smokers) with age-group between 18-47 years. The effects of both severity and duration of smoking on semen parameters were studied.

Results: we observed an inverse dose–response relation between smoking and semen volume, total sperm count and percentage motile and viable sperm. Heavy smokers had a lower sperm concentration than non-smokers.

Conclusion: We observed a dose and duration dependent association between tobacco exposure, lower sperm concentration and higher risk of oligozoospermia.

INTRODUCTION

Although cigarette smoking is a widely recognized health hazard and a major cause of mortality, people continue to consume cigarettes on a regular basis. According to the world health organization (WHO) approximately one third of world population older than 15 years, are smokers.^{11,17} Despite of world-wide anti-smoking campaigns, smoking is very common. It is one of the most extensively used potentially hazardous social habits throughout the world. Smoking is now increasing rapidly throughout the developing world and is one of the biggest threats to current and future world health. The highest prevalence of smoking is observed in young adult male during their reproductive period between 20 to 39 years.

Today smoking has been established as a number one preventable cause of death and disease in the countries worldwide. About 30-40% of the all the death from cancer are associated with tobacco consumption. Recent data suggest that smoking is not only associated with lung cancer but also associated with increased incidence of cancer in larynx, oral, esophagus, cervix, bladder, pancreas and even leukemia .

Cigarettes smoke contain a large number of substances including nicotine, carbon monoxide and recognize carcinogens and mutagens such as radioactive polonium, benzopyrene, dimethylnitrosamine.⁹ Inhalation of cigarette smoke leads to absorption via pulmonary circulation and reach the seminal plasma and provides the toxic environment for spermatozoa. Various mutagens and carcinogens or other toxic components in cigarette smoke disrupt the testicular microcirculation and cause DNA or chromosomal damage in germinal cells.

A numbers of studies have shown that tobacco smoking detrimentally affects sperm concentration, volume, motility and morphology and damage the DNA.^{2,3,5,10,11} In addition smoking has been correlated with poor sperm function and decreasing in the fertilizing capacity of sperm.^{8,16} Smokers have more oxidative DNA damage in their sperm than non smokers. However some studies have found no association between smoking and sperm quality and sperm function^{14,15}. Thus, the present study was aimed to affirm the deleterious effects of cigarette smoking on various semen parameters.

Materials and Methods

The study was conducted on 105 cases after obtaining permission from Institutional Ethics Committee. The subjects, enrolled for the study were informed about the study and procedural details and an informed consent was obtained. In order to exclude conditions that might influence the results, the recruitment of subject was done on the basis of following criteria.

Inclusion criteria:

- **Age group:** 18 to 47 years
- **Recruitment of subjects:** Patient attending Infertility clinics, Surgery and medicine outpatient departments of

hospital and adult volunteers from society.

- **No. of subject:** Total 105 (50 were control and 55 were smokers).

Exclusion criteria:

- Age less than 18 & more than 47 years
- No alcohol abuse/ Not on medications/No urogenital disease or developmental anomalies.
- No h/o occupational exposure to toxic chemicals or higher temperature, No h/o of surgery of urogenital disease/ any endocrine disorders

Clinical assessment

A detailed history and physical examination was conducted and patients were categorized according to the frequency of cigarette smoking per day. Mild smokers when 1-10 cigarettes per day, moderate smokers when 11-20 cigarettes a day and severe smokers when more than 20 cigarettes per day. The smokers according to the duration of smoking were divided into short term, 1-10 years and long term ,11-20 years.

Semen Analysis

The study will be conducted in Central Clinical Laboratory of hospital. Semen analysis was performed as per WHO standard guidelines. Suboptimal sperm collection remains a frequent cause of error in the semen analysis. Therefore the instructions for the semen productions were strictly followed before producing the semen .It was emphasized to patients that there should be 2 to 7 days of sexual abstinence before collection. Sterile wide mouth, non - toxic plastic containers were used and they were labelled with the patient identifying information.

Macroscopic examination:

In the first 5 minutes:

After collecting the semen sample and proper labelling all necessary information of patient on the container it was placed in an incubator (37 °C) for liquefaction.

Between 30 and 60 minutes

Assessment of liquefaction time, semen volume and pH were noted.

Liquefaction time

Semen sample was allowed to liquefy in the incubator for at least 20 minutes and then checked for completion of liquefaction. If the semen is not fully liquefied, it may be returned to the incubator until coagulum disappears. Normal semen sample should liquefy maximally in 45 mins.

Semen Volume

Measurement of semen volume was done with the graduated test tube

Seminal pH

A drop of semen was spread evenly on to the pH paper and the colour change was compared with calibration strip.

Microscopic examination

- Preparing a wet preparation for assessing microscopic appearance, sperm motility
- The dilution required for assessing sperm number.
- Assessing sperm vitality (if the percentage of motile cells is low).
- Making semen dilutions for assessing sperm concentration for assessing sperm number

Statistical Analysis

Data was expressed as mean value $\pm$ standard deviation and comparisons between the three groups were performed using one-way analysis of variance (ANOVA), and unpaired *t* test was used for comparisons between two groups.

RESULTS**Table1: SEMEN PARAMETERS OF CONTROL GROUP AND SMOKERS**

PARAMETERS	CONTROLGROUP (N=50)	SMOKERS (N=55)
SEMEN VOLUME(ML)	3.55 $\pm$ 0.70	2.65 $\pm$ 0.60*
SEMINAL PH	7.46 $\pm$ 0.19	7.45 $\pm$ 0.24
LIQUEFACTION TIME(MIN)	40.42 $\pm$ 6.57	40.85 $\pm$ 6.07
SPERM-CONCENTRATION (MILLIONS/ML)	76.6 $\pm$ 12.05	44.01 $\pm$ 10.50*
TOTAL SPERM COUNT(MILLIONS)	271.65 $\pm$ 67.36	112.66 $\pm$ 30.35*
SPERM MOTILITY(PERCENTAGE)	68.62 $\pm$ 9.94	50.67 $\pm$ 7.60*
SPERM VIABILITY(PERCENTAGE)	75.94 $\pm$ 6.51	51.28 $\pm$ 7.76*

Table 1 shows semen parameters in both control group and smokers, it shows that semen parameters like semen volume , sperm concentration ,total sperm count, sperm motility and sperm viability is decrease in the smokers compare to the control group. These parameters were statistically significantly differs from that of control group.

TABLE 2 SEMEN PARAMETERS OF CONTROL GROUP AND DIFFERENT SUBGROUPS OF SMOKERS

SEMEN PARAMETERS	CONTROL GROUP (N=50)	SMOKERS (N=55)		
		MILD (n=21)	MODERATE (n=24)	SEVERE (n=10)
SEMEN VOLUME(ML)	3.55 $\pm$ 0.70	2.85 $\pm$ 0.63*	2.58 $\pm$ 0.70*	2.41 $\pm$ 0.58*
SEMINAL PH	7.46 $\pm$ 0.19	7.41 $\pm$ 0.29	7.50 $\pm$ 0.54	7.40 $\pm$ 0.80
LIQUEFACTION TIME(MIN)	40.42 $\pm$ 6.57	41.66 $\pm$ 6.80	41.16 $\pm$ 8.00	39.05 $\pm$ 7.60
SPERM-CONCENTRATION (MILLIONS/ML)	76.6 $\pm$ 12.05	46.47 $\pm$ 6.16*	42.79 $\pm$ 6.64*	41.80 $\pm$ 3.85*
TOTAL SPERM COUNT (MILLIONS)	271.65 $\pm$ 67.36	121.94 $\pm$ 31.39*	111.43 $\pm$ 21.50*	96.10 $\pm$ 20.50*
SPERM MOTILITY (PERCENTAGE)	68.62 $\pm$ 9.94	53.52 $\pm$ 7.83*	50.16 $\pm$ 7.50*	45.90 $\pm$ 3.57*
SPERM VIABILITY (PERCENTAGE)	75.94 $\pm$ 6.51	53.90 $\pm$ 7.76*	50.20 $\pm$ 6.86*	48.00 $\pm$ 6.32*

*P value<0.001– Significant

TABLE 3 SEMEN PARAMETERS OF CONTROL GROUP, SHORT TERM SMOKERS AND LONG TERM SMOKERS

SEMEN PARAMETERS	CONTROL GROUP N=50	SMOKERS (DURATION OF SMOKING IN YEARS)	
		SHORT TERM (1-10yrs) (N=40)	LONG TERM (11-20yrs) (N=15)
SEMEN VOLUME(ML)	3.55 $\pm$ 0.70	2.70 $\pm$ 0.68*	2.53 $\pm$ 0.50*
SEMINAL PH	7.46 $\pm$ 0.19	7.44 $\pm$ 0.37	7.46 $\pm$ 0.43

LIQUEFACTION TIME	40.42 $\pm$ 6.57	44.72 $\pm$ 7.55	44.93 $\pm$ 7.80
SPERM CONCENTRATION (MILLIONS /ML)	76.6 $\pm$ 12.05	44.87 $\pm$ 6.02*	41.73 $\pm$ 5.50*
TOTAL SPERM COUNT (MILLIONS)	271.65 $\pm$ 67.36	116.00 $\pm$ 34.85*	103.80 $\pm$ 33.03*
SPERM MOTILITY (PERCENTAGE)	68.62 $\pm$ 9.94	52.82 $\pm$ 7.03*	44.93 $\pm$ 8.30*
SPERM VIABILITY (PERCENTAGE)	75.94 $\pm$ 6.51	52.17 $\pm$ 7.72*	45.46 $\pm$ 3.99*

*P value<0.001– Significant

Table2 shows comparison of semen parameters between control group and mild, moderate and severe smokers, it shows that semen parameters like semen volume, sperm concentration, total sperm count , sperm motility and sperm viability were statistically significantly different from that of control group.

Table 3 shows comparison of semen parameters between control group and short term and long term smokers, it shows that semen parameters like semen volume, sperm concentration, total sperm count , sperm motility and sperm viability were significantly lower in long term smokers than that of control and short term smokers.

DISCUSSION

The results of our study showed that the cigarette smoking adversely affects semen parameters. In this study , we observed a statistically significant dose–response relationship between current cigarette smoking and several semen characteristics. The sperm concentration, the semen volume, the total sperm count and the percentage of motile and viable sperm dropped with increased duration and severity of smoking.

Although various studies have demonstrated that cigarette smoking is associated with the abnormal semen parameters^{1,6,11} however contradictory finding are also available. Kemal Ozgur et al , Osser et al did not find any statistically significant difference between the control group and smokers in terms of various semen parameters. Heavily (severe) smokers and long term smokers had lower mean sperm concentration and a lower total sperm count ,motility, semen volume than non-smokers .

The mechanism behind the harmful effect of smoking on semen quality is not fully understood. Disturbance of the hypothalamo–pituitary–gonadal system or

mild hypoxia caused by the disruption of the testicular micro-circulation are possible explanations, but a direct toxic effect of the many chemical components in the cigarette smoke on the germinative epithelium is a more likely explanation⁶. Oxidants in cigarette smoke are thought to damage sperm DNA, and smokers have more oxidative DNA damage in their sperm than do non-smokers².

In conclusion, we found that tobacco smoking in adult life impairs semen quality moderately and independently of prenatal exposure to tobacco smoke. It would be sensible to advise men to abstain from smoking to avoid decreased fecundity.

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