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Dr. Anu Nagpal
MBBS, MS, Department of Gynecology, Fellowship in Infertility and IVF Consultant Gynaecologist, Obstetrician and Infertility Specialist Nagpal Nursing Home, Gurugram, Haryana, India

Dr. Prateek Girotra
MBBS, DNB, Department of Orthopaedics, BPS Government Medical College for Women, Khanpur Kalan, Sonepat, Haryana, India

Dr. Divya Nagpal
MBBS, DGO, Consultant, Department of Gynecologist and Obstetrician, Nagpal Nursing Home, Gurugram, Haryana, India

Dr. Lata Nagpal
MBBS, DGO Consultant, Department of Gynaecologist and Obstetrician, Nagpal Nursing Home, Gurugram, Haryana, India

Dr. Sanjeev Kumar Nagpal
MBBS, DCH, Consultant, Department of Pediatrician and Neonatologist, Nagpal Nursing Home, Gurugram, Haryana, India

Corresponding Author:
Dr. Prateek Girotra
MBBS, DNB, Department of Orthopaedics, BPS Government Medical College for Women, Khanpur Kalan, Sonepat, Haryana, India

Study of the effect of smoking on sperm count in male infertility

Dr. Anu Nagpal, Dr. Prateek Girotra, Dr. Divya Nagpal, Dr. Lata Nagpal and Dr. Sanjeev Kumar Nagpal

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Abstract
Cigarette smoking, one of the main causes of preventable morbidity and mortality, has a multitude of well-known side effects. Tobacco smoking is considered one of the major factors leading to male infertility. A lot is known now about the carcinogens in tobacco cigarette smoke and their resultant effects on organs like lungs and urinary bladder, but their effects on fertility status have been less documented. The present study was aimed at studying the effect of cigarette smoking on sperm count in infertile men. A total of one hundred infertile men (50 Nonsmokers and 50 Smokers) between the age group 20-45 years were taken into this study. The Sperm count in the infertile nonsmokers and the infertile smokers group were compared using Z Test. Infertile Smokers which were divided into Group A (≥1 and ≤10 cigarettes/ day), Group B (>10 and <20 cigarettes/ day) and Group C (≥20 cigarettes/ day) were analyzed for Sperm count levels by ANOVA Test. It was observed that the sperm count was significantly lower (p<0.01) in an infertile smokers group than the infertile nonsmokers group. It was also observed that the sperm count was significantly decreased (p<0.05) in relation to the quantity of cigarette smoking.

Keywords: Smokers, non-smokers, infertile, sperm count

Introduction
Tobacco smoking among the young generation is becoming worse day by day [1]. Smoking has been linked to a myriad of adverse health outcomes, including cardiovascular disease, respiratory disease, and cancer of the lungs, bladder, cervix, esophagus, kidney, pancreas, and stomach. More recently, researchers have begun to explore the relationship between cigarette smoking and reproductive health [2].
Infertility is defined as the inability to achieve pregnancy after one year of unprotected intercourse. It has been reported that tobacco smoke contains some of the most deadly toxic chemicals. Smokers inhale directly and absorb the following substances: nicotine, carbon monoxide, nitrogen oxide, mutagenic compounds and cadmium. Most of them are known to be mutagens and carcinogens, directly affecting male and female gametes and embryos [3].
Male infertility plays a key role in conception difficulties of up to 40% infertile couples [4, 5]. The term 'male infertility' does not constitute a defined clinical syndrome but rather a collection of different conditions exhibiting a variety of etiologies and varying prognosis.
There is a correlation between cigarette smoking in infertile men and increased leukocyte infiltration into semen. The latter has been linked to significantly increased levels of seminal oxidants i.e. Reactive Oxygen Species (ROS) [6]. Cigarette smoking is an avoidable lifestyle factor observed to have a negative impact on male fertility [7].
The aim of our study was to compare sperm count in infertile men who were cigarette smokers with infertile non-smoking men, in order to ascertain the effect of cigarette smoking on the quality of seminal fluid.

Aims and Objectives
To study the effect of cigarette smoking on sperm count in infertile men and to compare sperm count in infertile nonsmoker and infertile smoker men.

Material and Methods
This study was carried out in Maharishi Markandeshwar Institute of Medical Sciences and Research between September 2013 to October 2015 in Obstetrics and Gynaecology Department.

Inclusion Criteria

100 primary infertile men in the reproductive age group (20 to 45 years) were enrolled in this study, of which 50 were smokers and 50 were non-smokers.

The smokers were divided into the following groups

Group A (n = 24) - (≥1 and ≤10 cigarettes/ day),
Group B (n = 15) - (>10 and <20 cigarettes/ day)
Group C (n = 11) - (≥20 cigarettes/ day)

Exclusion Criteria

1. History of tobacco chewing and alcohol intake.
2. History of injury to tests, varicocele, hydrocele or undescended testes.
3. History of any chronic illness like Tuberculosis, diabetes, hypertension, thyroid disease.
4. History of UTI, occupational exposure to chemicals or excess heat.
5. Azoospermic Subjects.
6. A history of taking drugs like Vitamin E, Vitamin C or Glutathione.

Sample collection and semen analysis: Semen samples were collected by masturbation into a sterile, wide mouthed container, after at least 72 hours (3 days) of sexual abstinence. Samples were allowed to liquefy at room temperature (25ºc) for at least 45 minutes. After liquefaction, samples were analyzed for sperm count according to World Health Organization (WHO) guidelines [8].

Results

In the present study, all the calculations and statistics were done using Microsoft Excel 2007 and "graph pad prism 5 software" version 5.01 was used. A 'p' value of less than 0.05 ($p < 0.05$) was considered to be statistically significant. A 'p' value of less than 0.01 ($p < 0.01$) was considered to be statistically highly significant. For each parameter, the mean value and standard deviation were calculated. Z test was applied to study the difference between infertile Nonsmokers group and infertile Smokers group. Sperm count in all three groups of infertile Smokers were compared using one way ANOVA (analysis of variance) test.

Table 1: Comparison of sperm count in infertile non-smokers and infertile smokers group

Parameter	Non Smokers (N=50)	Smokers (N=50)	p value
Sperm Count (millions/ ejaculate)	55.64±30.92	46.22±36.56	< 0.01

Table 2: Comparison of sperm count in three groups of infertile smokers

Group	N	Sperm Count (million/ejaculate)	P value
A	24	55±40.80	< 0.05
B	15	30.24±32.20	
C	11	16.4±16.40	

Data presented as MEAN±SD. P value equals level of significance

Discussion

Cigarette smoking is a serious health problem of most societies. Consumption of tobacco exerts widely adverse effects on different aspects of health. The results obtained in the present study showed that the mean ± SD of sperm count in infertile nonsmoker men was 55.64 ± 30.92 (millions/ejaculate) and in infertile smoker men the value was 46.22±36.56 (millions/ejaculate).

The intergroup comparison of the sperm count showed that the sperm count was decreased in the infertile smokers group. The difference of the mean sperm count in both the groups was statistically significant. The sperm count decreased in accordance with severity of smoking and these values were statistically significant ($p<0.5$).

Also, when the sperm count in different groups of infertile smokers was compared, it showed a p value of < 0.05, stating that the sperm count significantly decreases with the quantity of cigarettes smoked in a day.

The above results of the present study are in accordance with the following studies: Chia *et al.* [9] reported that sperm concentration decreased due to smoking. Goverde *et al.* [10] disclosed the sperm count difference between heavy smokers and nonsmoking men. Kunzle *et al.* [7] found a significant decrease in sperm density of smoking males, compared to non-smoking controls. Ramlau-Hansen *et al.* [11] found a 19% lower sperm concentration in smoking men, compared to non-smokers. Mehrannia [12] showed that sperm concentration was significantly lower in the nonsmoker men than in smoker men. Ochedalski *et al.* [13] found that sperm count was lower in smokers when compared to nonsmokers.

The serum level of nicotine & cotinine adversely affects spermatogenesis [14]. Zinc is vital for spermatogenesis. Its deficiency leads reversibly to reduce sperm count [15]. Cigarette smoking causes significant decrease in seminal plasma zinc in smokers. Decrease in seminal plasma zinc may be associated with a decrease in antioxidant defenses which could be a contributor to the effects of cigarette smoking on sperm parameters like sperm count. Also, there is a clear correlation between seminal plasma zinc levels and the extent of smoking. Zn deficiency induces atrophy of seminiferous tubules and causes failure of spermatogenesis [16].

Cigarette smoke adversely affected germ cells in testis and there is secretory deficit of Leydig and Sertoli cells on exposure to cigarette smoke. Cigarette smokers were also shown to have higher levels of circulating estradiol and decreased levels of LH, follicle-stimulating hormone (FSH) and prolactin than non-smokers, all of which can negatively impact spermatogenesis [17]. Thus, the results of our study state that cigarette smoking has a negative effect on the sperm count.

Conclusion

It is concluded from our study that cigarette smoking adversely affects sperm count and deterioration in semen quality appears in direct proportion to the number of cigarettes smoked.

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