Original Research Article

A study on effect of tobacco on semen quality

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Abstract

Introduction: Male infertility has a significant contribution in cases of infertility. Different habits among males i.e. smoking, tobacco chewing and alcohol intake have found adverse influence on sperm count and sperm motility. The mechanisms according to which tobacco affects spermatozoa are poorly understood. Some of the studies focused on the relation between cigarette smoking and the principal semen analysis, variable such as concentration, Morphology and Motility. In this study, we compared the sperm parameters-concentration and motility between tobacco consumers and tobacco non-consumers. **Objectives:** To identify the role of smoking and tobacco chewing in decreasing sperm count and motility. **Methods:** Total 100 semen samples from the cases of infertility reported at GMERS Medical College & Hospital were taken in this study. The results of tobacco chewers and smokers were studied and compared according to WHO guidelines, to that of tobacco non-consumers. **Results:** Out of 100 samples 59 showed decreased sperm count of which 41 men were tobacco consumers. 44 out of 100 samples showed decreased progressive motility, of which 29 men were tobacco consumers. **Conclusion:** Tobacco consumption either as smoking or tobacco chewing have a role in deteriorating the sperm quality and therefore in infertility of the male partners.

Key words: Semen, Tobacco, Sperm count, Sperm motility

Introduction

According to WHO infertility is "a disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse". Male infertility has a significant contribution in cases of infertility. Besides general physical status, genetics, hormones and accompanying illnesses, routine semen examination remains the principle index of male fertility evaluation. Modern lifestyle and urbanization have been implicated as the factors responsible for male infertility. Tobacco contains nicotine. It is accepted that nicotine and its metabolite cotinine may lead to poor semen function and resultant infertility [1]. Studies have examined the effects of tobacco consumption either in the form of chewing or smoking, on human seminal quality. It is likely that smoking adversely affects male reproductive health [2]. Semen analysis, at the same time being a very simple and fundamental test, remains the key investigation to study their impact in cases of male infertility. As the cases of infertility are increasing there is a need to study its causative factors and take measures to curb the same. So this study is conducted to assess the effect of tobacco-one of the causative factor associated with male infertility on semen quality with the help of seminal analysis. This article is published to study the association between tobacco and deteriorating sperm concentration and motility so that necessary steps can be taken to improve fertility rates by decreasing one of the causative factors of infertility-tobacco.

Materials and Methods

Place and type of study- It is a retrospective study carried out in Department of Pathology- Central laboratory, GMERS Medical College & Hospital, Junagadh, Gujarat from January 2018 to December 2018.

Sampling method- Semen samples were collected by masturbation in a sterile container or in semen collecting condom after abstinence of 2 to 7 days, allowed to liquefy and analyzed immediately thereafter, primarily for sperm count and motility.

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Sample collection- Semen samples were collected by masturbation in a sterile container after abstinence of 2 to 7 days. Immediately after ejaculation into the collection vessel, semen is typically a semisolid coagulated mass. Within a few minutes at room temperature, the semen usually begins to liquefy (become thinner), at which time a heterogeneous mixture of lumps will be seen in the fluid. As liquefaction continues, the semen becomes more homogeneous and quite watery, and in the final stages only small areas of coagulation remain. The complete sample usually liquefies within 15 minutes at room temperature, although rarely it may take up to 60 minutes or more allowed to liquefy and analyzed immediately thereafter, primarily for sperm count and motility [3]. Examination was done via light microscopy of the wet preparation after proper liquefaction of the semen sample and results were compared to the WHO standards [4]. Motility was assessed by evaluating 200 sperms per sample using the sperm progression rating according to WHO criteria as follows:

A, Rapid forward progressive motility;

B, Slow or sluggish progressive motility;

C, Non-progressive motility;

D, Immobility.

WHO criteria for normal semen were taken as reference value [4]

Liquefaction time	Complete in 60min
Volume	1.5ml
Color	Opalescent white
pH	>7.1
Concentration (ml)	15 million
Progressive motility	32%
Vitality	58%
Morphology	4%
Leukocytes (ml)	< 1 million
Mar test	<50% sperm with bound particles

Inclusion criteria- Total 100 cases of clinically diagnosed infertility, reported at GMERS Medical College and Hospital, Junagadh in the year 2018 were included in this study. The age group of cases was 22 – 45 years. Participants were questioned regarding their careers, smoking and tobacco chewing habits, and medical and family histories. Study group were compared for two characteristics one is for number of sperm count and other is for progressive motility. For normal comparison WHO criteria [4] were taken into consideration. Those who had smoked or chewed tobacco for ≥12 months were considered chronic smokers or tobacco chewers respectively i.e. chronically addicted.

Exclusion criteria- Previous disease or surgery associated with reproductive function (including varicocele, cryptorchidism, epididymitis, mumps, azoospermia); vasectomy and vasectomy reversal.

Statistical methods- The data was processed with simple statistical analysis and p value was calculated. *P*-value < 0.05 was considered statistically significant.

Ethical consideration and permission- The necessary approval to conduct this study was obtained from the Institutional Ethics Committee (IEC) of the college before starting the study. In the present study no any scoring system or any surgical procedure were used.

Results

The results of this study are tabulated as follows:

Table 1 shows that out of 100 samples studied 59 showed decreased sperm count, of which 41 were addicted to either smoking or tobacco, 26 were chronic smokers, 36 chronic tobacco chewers, of them 21 smoked and chewed both, and 18 men were free of addiction.

Table-1: Distribution according to sperm count.

Relation of sperm count and tobacco addiction	Low sperm count	Normal sperm count	Total
Chronically Addicted	41	14	55
Free of Addiction	18	27	45
Total	**59**	**41**	**100**

Table 2 reveals that 44 samples showed decreased progressive motility of the sperm, of which 29 were addicted to either smoking or tobacco chewing in 100 tested samples.

Table-2: Distribution according to sperm motility.

Relation of sperm motility and tobacco addiction	Low sperm motility	Normal sperm motility	Total
Chronically Addicted	29	26	55
Free of Addiction	15	30	45
Total	**44**	**56**	**100**

The p value in our study was 0.005. This value is less than 0.05 which means there is a negative correlation between sperm count and sperm motility and tobacco addiction and the result obtained is statistically significant. Hence it is obtained in the result that tobacco addiction deteriorates semen quality by decreasing sperm quality and motility.

Discussion

Patterns of male fertility vary greatly among regions and even within regions. A combination of social habits e.g. cigarette smoking, environmental conditions and genetics are suspected to contribute to this variation [5]. According to the World Health Organization (2002), approximately one-third of the world's male adult population (above 15 years of age) smokes. The combustion of tobacco yields about 4000 chemical compounds, some of which are deadly toxic. Given that cigarette smoke contains more than 30 compounds known to be mutagens, or carcinogens such as" radioactive polonium, benzo (a) pyrine, dimethylbenz (a) anthracene, dimethylnitrosamine, naphthalene, and methylnapthalene" which have a direct deleterious effects on humanembryos and female and male germ cells are probable (Zenzes, 2000) [6].

There are many toxic substances in cigarettes. Among them is cadmium, which has been proven experiment-tally to disrupt spermatogenesis and decrease sperm concentration in smokers [7]. Tobacco smoking was also associated with a significantly reduced level of zinc in seminal plasma, which is thought to be one of the important factors that affect sperm motility [8].

Other harmful substances associated with smoking are alkaloids, nitrosamines, and cotinine, which produce reactive oxygen species like free radicals and peroxides. These species attack the integrity of DNA in the sperm nucleus by causing base modification, DNA strand breaks, and chromatin packing. The result is DNA fragmentation that can increase the sperm abnormal forms in smokers [9].

Nicotine has been shown to increase the free radicals in the sperm. At the same time it also increases the susceptibility of the sperm to free radicals. It has been emphasized that human spermatozoa are particularly susceptible to oxidative stress-induced damage by reactive oxygen species (ROS) because their plasma membranes are rich in polyunsaturated fatty acids [10]. The ROS in tobacco smoking induce lipid peroxidation of the sperm plasma membrane; this is considered to be the key mechanism in inducing sperm damage that leads to decreased sperm viability, sperm concentration, sperm motility, and increased morphology defects [11,12].

In present study a significant difference (p=0.005) is seen in addicted and non- addicted in terms of semen quality this means tobacco addiction has significant negative relation with sperm count as well as motility in adult males and thus increasing the chances of male infertility. The present result showed that the majority of cases were tobacco chewers.

The semen parameters (e.g. density, total sperm counts, motility, viability and normal morphology) of all cases were significantly poorer than that of the controls in a study by Chia et al (2000) [13].

Wong et al (2000) evaluated the impact of cigarette smoking on male factor subfertility and the semen parameters of sperm count, motility, and morphology by questionnaire and determination of the cotinine concentrations in blood and seminal plasma of fertile and sub fertile males [14].

In a cohort study Künzle et al. (2003) observed that cigarette smoking was associated with a significant decrease in sperm density (−15.3%), total sperm count (−17.5%), total number of motile sperm (−16.6%), and citrate concentration (−22.4%) [15].

Smokers had significantly less spermatozoa with motility grade B (9.37% versus 11.9%, P<0.05) than nonsmokers infertile men in a prospective study Taszarek-H et al. (2005) [16].

A significant deleterious effects of tobacco smoking on semen volume and sperm concentration, motility, and abnormal forms.

The correlation analysis placed special emphasis on the negative impact of smoking on sperm motility in a study conducted by Hussein et al (2011) [17].

In 1985, Kulikausk as et al. found that smokers had a significantly decreased spermatozoa count and motility when compared with nonsmokers, but they found no significant difference in abnormal sperm morphology [18].

A study by Said et al. (2005) concludes that tobacco chewing is strongly associated with a decrease in sperm quality and to a lesser extent with oligoas the nozoospermia or azoospermia [19].

In a retrospective comparative study Coelho et al. (2009) analyzed the effects of cigarette consumption on semen parameters of 327 men in Portugal. The semen parameters were first compared between smokers and nonsmokers and then a heavy smokers/light smoker's analysis took place. A total of 135 (41%) were smokers and 55 (40.7%) were heavy smokers.

The demographic characteristics were similar between groups. The tobacco use was associated with an increased incidence of oligo/azoospermia, without difference in the other semen parameters. It was also noted a negative correlation between heavy smoking habits and semen volume abnormalities [20].

The results of this study are in agreement with that found by Collodel et al (2009) who demonstrated that the sperm motility, sperm concentration, and fertility index decreased and the percentage of sperm pathologic features increased as the number of cigarettes smoked daily increased [21].

According to Centers for Disease Control and Prevention (2009), sperm from chronic smokers were 75 % less fertile than sperm from nonsmokers [22].

A significant difference is seen in tobacco addicted and non-addicted male in terms of semen quality in a study by Choksi T et al (2015) [23].

All the above studies are consistent with our study.

Conclusion

From our study we concluded thatTobacco addiction has significant negative relation with sperm count as well as motility in adult males and thus increasing the chances of male infertility.

Contribution by different authors- In this manuscript, study was done by Dr. Bhumi and manuscript prepared by Dr. Mukund.

What this study adds to existing knowledge? From our study we came to know that tobacco addiction has significant effect on deteriorating semen quality and thus we can spread awareness on quitting tobacco addiction to improve semen quality and decrease the rate of male infertility so that there is overall decline in cases of infertility which is on rise in present day world.

Findings: Nil; **Conflict of Interest**: None initiated
Permission from IRB: Yes

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