

## A STUDY ON EFFECTS OF TOBACCO CHEWING ON VARIOUS SEMEN PARAMETERS

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**Abstracts: Backgrounds and objectives:** Previous studies suggest a deleterious effect of tobacco abuse on semen quality, but their results have not been consistent. We studied the association between current trends of tobacco chewing and its deleterious effects on semen characteristics. **Material and method:** Our study was performed on 145 normal asymptomatic healthy males (50 controls, 95 tobacco chewers) with age-group between 18-47 years. The effects of both severity and duration of tobacco chewing on semen parameters were studied. **Results and Interpretation:** We observed an inverse dose–response relation between tobacco chewing and semen volume, total sperm count and percentage motile and viable sperm. Heavy or long term tobacco chewers had a lower sperm concentration than control group. **Conclusion:** We observed a dose and duration dependent association between tobacco exposure, lower sperm concentration and higher risk of oligozoospermia.

**Key Words:** Semen quality, sperm concentration, oligozoospermia

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### Introduction:

Although tobacco abuse in any form is a widely recognized health hazard and a major cause of mortality, people continue to consume it on a regular basis. According to the world health organization (WHO) approximately one third of world population older than 15years, are consuming tobacco.<sup>11,17</sup> Tobacco chewing is one of the most extensively used potentially hazardous social habits throughout the world but more extensively prevalent in South East Asia . Tobacco consumption is now increasing rapidly throughout the developing world and is one of the biggest threats to current and future world health.<sup>24</sup> the highest prevalence of it is observed in young adult male during their reproductive period between 20 to 39 years.<sup>25</sup>

Today tobacco consumption 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.<sup>24</sup>

Smokeless tobacco contains a large number of substances including nicotine and recognize carcinogens and mutagens such benzopyrene, dimethylnitrosamine.<sup>13</sup> various mutagens and carcinogens or other toxic components disrupt the testicular microcirculation and cause DNA or chromosomal damage in germinal cells. In India

chewing tobacco is systematically associated with socio economic markers at the individual and household level. Individual with no education are 2.69 times more likely to smoke and chew tobacco than those with a post graduate education.<sup>13</sup> A recent study found that chewing tobacco in men is related to a decrease in overall sperm quality (including count, motility and form). According to the study, the rate of oligoasthenoteratozoospermia (a condition that includes decreased sperm motility, abnormal sperm shape and low sperm count) is very high.

A numbers of studies have shown that tobacco abuse detrimentally affects sperm concentration, volume, motility and morphology and damage the DNA<sup>2,3,5,10,11</sup>. Thus, the present study was aimed to affirm the deleterious effects of tobacco abuse on various semen parameters.

Semen parameters of tobacco chewers were compared with those of tobacco non-chewers. Since tobacco chewing is more prevalent in Saurashtra region and paucity of literature detailing such study in this region, more tobacco chewers were included in study group.

Thus, the present study was aimed to affirm the deleterious effects of tobacco chewing on various semen parameters.

### Material and Methods

: The study was conducted on 145 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 clinic, Surgery and medicine outpatient departments of hospital and adult volunteers from society. Here the study group were infertile group.
- No. of subject: Total 145 (50 were control and 95 were tobacco chewers) 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 tobacco chewing per day. Mild tobacco chewers when less than 3 times a day, moderate chewers when 3-6 times a day and severe when more than 6 times a day. The tobacco chewers according to the duration were divided into short term, 1-10 years and long term 11-20 years.

Semen Analysis

The study was 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

- Assessment of sperm concentration (number of sperm per ml) and sperm count (number of sperm/ ejaculate) is conducted after liquefaction. A makler chamber is used for counting the sperm cells. The dilution required for assessing sperm number. Seminal fluid is first diluted with formalin-bicarbonate solution which immobilizes the sperm and makes them easier to count.

- Preparing a wet preparation for assessing microscopic appearance, sperm motility.

- Sperm motility within semen should be assessed as soon as possible after liquefaction of the sample, preferably at 30 minutes, but in any case within 1 hour, following ejaculation, to limit the deleterious effects of dehydration, pH or changes in temperature on motility.

- The lower reference limit for total motility is 40%

- Assessing sperm vitality (if the percentage of motile cells is low). The most common viability assessment involves staining with Eosin Y followed by the blue black counter stain of Nigrosin. The

viable sperm with its intact cell membrane will not take up the dye and remain unstained.

#### Statistical Analysis

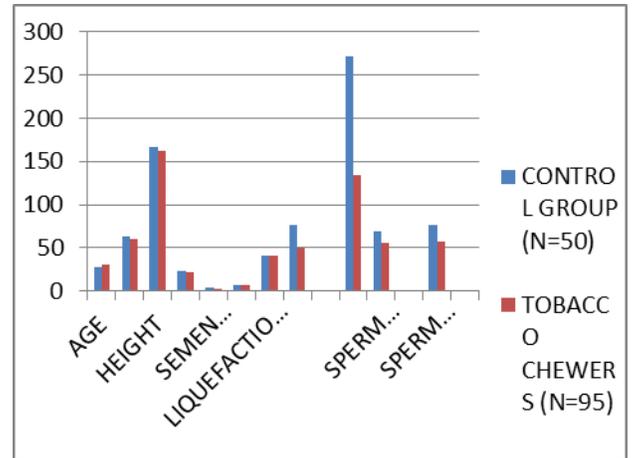
Data was expressed as mean value  $\pm$  standard deviation and comparisons between the three groups were performed using one-way analysis of variance (ANOVA), and unpaired t test was used for comparisons between two groups.

#### Result:

**Table I: Anthropometric and semen parameters between tobacco chewers and control group.**

PARAMETERS	CONTROL GROUP (N=50)	TOBACCO CHEWERS (N=95)
Age	28.34 $\pm$ 4.81	30.87 $\pm$ 5.80
Weight	62.98 $\pm$ 4.90	59.80 $\pm$ 6.20
Height	166.06 $\pm$ 5.05	162.80 $\pm$ 8.80
Bmi	22.78 $\pm$ 1.90	22.54 $\pm$ 3.30
Semen volume(ml)	3.55 $\pm$ 0.70	2.63 $\pm$ 0.58*
Seminal ph	7.46 $\pm$ 0.19	7.43 $\pm$ 0.40
Liquefaction time(mins)	40.42 $\pm$ 6.57	41.32 $\pm$ 5.05
Sperm concentration (millions/ml)	76.6 $\pm$ 12.05	49.96 $\pm$ 11.08*
Total sperm count (millions)	271.65 $\pm$ 67.36	134.04 $\pm$ 51.10*
Sperm motility (percentage)	68.62 $\pm$ 9.94	56.48 $\pm$ 9.57*
Sperm viability (percentage)	75.94 $\pm$ 6.51	57.45 $\pm$ 10.90*

\*P value <0.05 significant

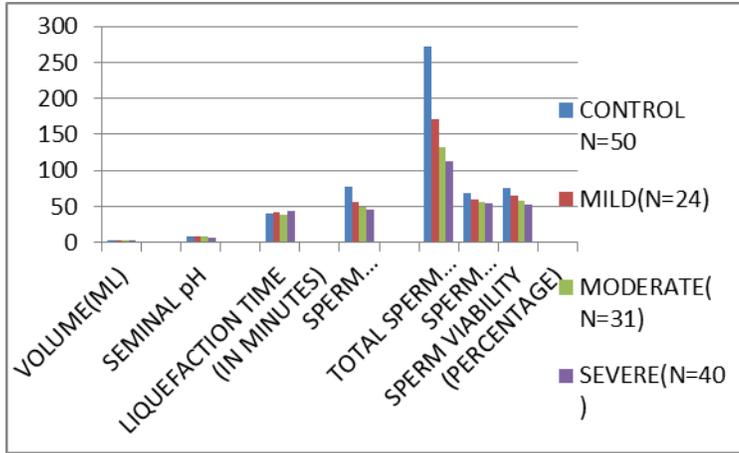


**Table II: Semen parameters of control group and different subgroups of tobacco chewers**

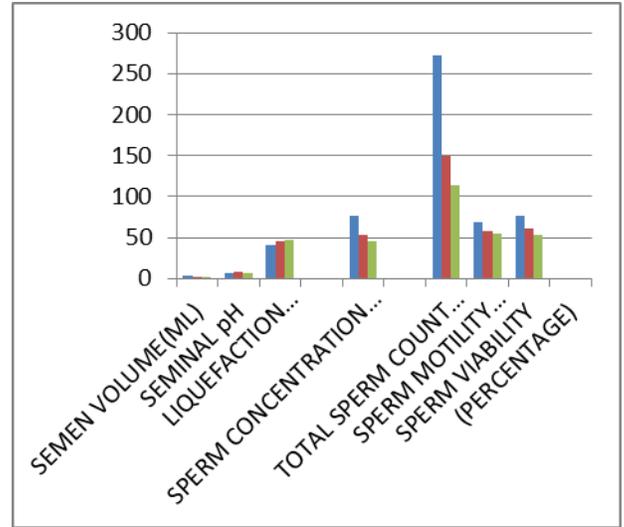
Semen parameters	Control group (N=50)	Tobacco chewers (n=95)		
		Mild (n=24)	Moderate (n=31)	Severe (n=40)
Semen volume(ml)	3.55 $\pm$ 0.70	2.88 $\pm$ 0.77*	2.62 $\pm$ 0.52*	2.44 $\pm$ 0.45*
SEMINAL pH	7.46 $\pm$ 0.19	7.45 $\pm$ 0.31	7.53 $\pm$ 0.25	7.41 $\pm$ 0.19
Liquefaction time( mins)	40.42 $\pm$ 6.57	41.45 $\pm$ 6.70	38.73 $\pm$ 6.85	43.30 $\pm$ 7.78
Sperm concentration (millions/ml)	76.6 $\pm$ 12.05	56.75 $\pm$ 10.84*	49.54 $\pm$ 9.30*	46.25 $\pm$ 8.76*
Total sperm count millions	271.65 $\pm$ 67.36	171.52 $\pm$ 51.32*	131.80 $\pm$ 53.1*	113.36 $\pm$ 35.50*
Sperm motility(%)	68.62 $\pm$ 9.94	60.45 $\pm$ 7.14*	56.41 $\pm$ 12.79*	54.15 $\pm$ 7.05*
Sperm viability(%)	75.94 $\pm$ 6.51	64.25 $\pm$ 12.25*	57.67 $\pm$ 11.34*	53.30 $\pm$ 7.25*

\*P value<0.001– Significant

Table II shows comparison of semen parameters between control group and mild, moderate and severe tobacco, 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.



Graph: 2.



Graph: 3

Table III: Semen parameters of control group, short term and long term tobacco chewers.

Parameters	Control	Duration of tobacco chewing	
		Short term (1-10 yrs) (n=55)	Longterm (11-20yrs) (n=40)
Semen volume	3.55±0.70	2.73±0.76*	2.45±0.62*
Seminal ph	7.46±0.19	7.50±0.30	7.45±0.32
Liquefaction time(mins)	40.42±6.57	41.10±8.16	40.30±7.78
Sperm concentration (millions/ml)	76.6±12.05	52.69±11.85*	44.22±7.86*
Total sperm count (milions)	271.65±67.36	149.14±55.56*	105.36±32.53*
Sperm motility (%)	68.62±9.94	58.18±10.80*	53.50±5.47*
Sperm viability(%)	75.94±6.51	60.54±12.09*	52.10±9.50*

\*p value<0.001– significant

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

**Discussion:** The results of our study showed that the tobacco abuse adversely affects semen parameters. In this study we observed a statistically significant dose–response relationship between current tobacco chewing 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 tobacco chewing.

Although various studies have demonstrated that chewing tobacco is associated with the abnormal semen parameters<sup>7,12</sup> however contradictory finding by Kunzle et al <sup>16</sup> are also available, he found out no correlation between chewing tobacco and semen parameters.

The mechanism behind the harmful effect of tobacco on semen quality is not fully understood. Disturbance of the hypothalamo–pituitary–gonadal system or mild hypoxia caused by the disruption of the testicular microcirculation are possible explanations, but a direct toxic effect of the many chemical components on the germinative epithelium is a more likely explanation <sup>6</sup>. Oxidants in tobacco are thought to damage sperm DNA. Thus, we found that tobacco chewing in adult life impairs semen quality moderately and independently of prenatal exposure to tobacco. It would be sensible to advise men to abstain from tobacco to avoid decreased fecundity.

**Conclusion:** We observed a dose and duration dependent association between tobacco exposure,

lower sperm concentration, total sperm count, motility and viability.

#### References:

1. Agarwal, A and A. Saleh, 2002. Role of oxidative stress in male infertility; Rationale, significance and treatment. *Urol. Clin*, 29; 616-627
2. Agarwal, A, S Hamamah and M. Shekarriz, 1994. Reactive oxygen species and fertilizing capacity of spermatozoa. *Contracept. Fert. Sex* :327-330 Arabi M, Moshtaghi H. (2005). Influence of cigarette smoking on spermatozoa via seminal plasma. *Andrologia*, 37 (4): 119-2
3. Armstrong, J.S M Rajaskrishnan, W. Chamulitrat, P. Gatti, W.J Hellstrom and S.C. Sikka, 1999. Characterisation of reactive oxygen species induced effects on human spermatozoal movement and energy metabolism. *Free radic. Biol. Med* .26: 869-880
4. Asplund K. Smokeless tobacco and cardiovascular disease. *Prog Cardiovasc Dis* 2003; 45: 383-94.
5. Aydos K, Guven MC, Can B, Ergun A. Nicotine toxicity to the ultrastructure of the testis in rats. *BJU Int* 2001; 88: 622-6.
6. Banerjee A, Pakrashi A, Chatterjee S, Ghosh S, Dutta SK. Semen characteristics of tobacco users in India. *Arch Androl*. 1993 Jan-Feb; 30(1): 35-40.
7. Benowitz NL. Cigarette smoking and nicotine addiction. Med Benowitz NL. Systemic absorption and effects of nicotine from smokeless tobacco. *Adv Dent Res* 1997; 11: 336-4
8. Brunnemann, K.D., Genoble, L. & Hoffmann, D. (1985) N-Nitrosamines in chewing tobacco : An international comparison. *J. agric. Food Chem.*, 33, 1178-1181
9. Chia SE, Ong CN, Tsakok FM (1994a) Effects of Cigarette Smoking On Human Semen Quality. *Arch Androl*. 33: 163-8.
10. Christen, A.G. & Glover, E.D. (1981) Smokeless tobacco: Seduction of youth. *World Smoking Health*, 6, 20-24
11. Dikshit RK, Buch JG, Mansuri SM. Effect of tobacco consumption on semen quality of a population of hypofertile males. *Fertil Steril* 1987; 48: 334-6
12. Evans HJ, Fletcher J, Torrance M, Hargreave TB. Sperm abnormalities and cigarette smoking. *Lancet* 1981; 1: 627-9
13. H. Kuper, H.-O. Adami, P. Boffetta, Tobacco use, cancer causation and public health impact, *Journal of Internal Medicine* 2002; 251: 455-466
14. Heimann, R.K. (1960) Tobacco and Americans, New York, McGraw-Hill, pp. 8, 65, 118-119, 23.
15. Hoffmann D, Djordjevic MV. Chemical composition and carcinogenicity of smokeless tobacco. *Adv Dent Res* 1997; 11: 322-9.
16. Kunzle R, Mueller MD, Hanggi W, Birkhauser MH, Drescher H, Bersinger NA. Semen quality of male smokers and nonsmokers in infertile couples. *Fertil Steril* 2003; 79: 287-91.
17. Merino G, Lira SC, Martinez - Chequer JC. (1998). Effect of cigarette smoking on semen characteristics of a population in Mexico. *Arch Androl*, 41 (1): 11-5.
18. Ochedalski T, Lachowicz - Ochedalska A, Dec W, Czechowski B. (1994). Evaluating the effect of tobacco on some semen parameters in men of reproductive age. *Ginekol Pol*; 85 (2): 80-6. *BJU Int* 2006; 97(2): 324-6.
19. Osser S, Backman-Ramirez A, Liedholm P (1992): Semen quality of smoking and non smoking men in infertile couple in a Swedish. *Acta Obste-Gynecol Scand*, 71: 215-218
20. Ozgur K, Isikoglu M, Seleker M, Donmez L. Semen quality of smoking and non-smoking men in infertile couples in a Turkish population. *Arch Gynecol Obstet* 2005; 271: 109-112.
21. Pakrashi A, Chatterjee S. Effect of tobacco consumption on the function of male accessory sex glands. *Int J Androl* 1995; 18(5): 232-6.
22. Saleh RA, Agarwal A, Sharma RK, Nelson DR, Thomas AJ Jr. Effect of cigarette smoking on levels of seminal oxidative stress in infertile men: a prospective study. *Fertil Steril* 2002; 78: 491-9

23. Said, T.M. G. Ranga and Agarwal , 2005.Relationship between semen quality and tobacco chewing in men undergoing infertility evaluation. Fert.ster. 84:649-653
24. WHO Report on global tobacco epidemic, 2008: the MPOWER package , Geneva: World Health Organization. 2008. ISBN 978-92-4-15968-2.
25. Wynder, E.L. and Hoffman , D .Tobacco and health .A social challenge, N Eng J Med:300;894-903

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