

## THE EFFECT OF CIGARETTE SMOKING ON SEMEN QUALITY OF INFERTILE MEN

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### ABSTRACT

**Objective:** To evaluate the effects of cigarette smoking on semen quality of infertile men.

**Methodology:** Two hundred fourteen infertile men who had been smoking cigarette and one hundred thirty infertile non smokers' men participated in this study. Seminal volume, sperm concentration, motility, viability, and morphology were examined.

**Results:** The quality of spermatozoa obtained from smokers were much lower than non-smokers (P<0.01). The sperm concentration, viability and forward progression were negatively correlated with cigarette smoking (P<0.01).

**Conclusions:** Smoking does affect the semen quality of infertile men.

**KEYWORDS:** Cigarette smoking, Male infertility, Semen quality.

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### INTRODUCTION

Despite worldwide anti-smoking campaigns, cigarette smoking is very common. Experimental studies indicated that in rats exposed to smoking, serum levels of nicotine and cotinine were increased which adversely affected spermatogenesis and sperm fertilizing potential.<sup>1,2</sup> However, in regard to the clinical studies on relationship between smoking and male reproduction, the literature results have been no conclusive. Cigarette smoking may be associated with sub-fertility in men and my result in decreased sperm concentration, lower sperm motility, and a reduced percentage of morphologically normal sperm.<sup>3,4</sup> Some studies have reported that the association between man

smoking and semen quality was stronger in healthy men than in the infertile population.<sup>5,6</sup>

The objective of this study was to evaluate the effects of cigarette on the sperm quality of men attending the infertility center.

### SUBJECTS AND METHODS

**Patients:** This study was conducted in the academic university Hospitals. Men with age of 25-45 years, including one hundred thirty non-smokers and two hundred fourteen smokers, with a history of infertility, who were able to provide an ejaculate, were consecutively evaluated. Subjects who participated in the study had never had urogenital or serious systemic disease. They never used any contraceptive. Their spouses were apparently fertile women as indicated by physical and laboratory examinations, seventy five fertile, non smoker men, with age of 25-40, who had children, served as the controls.

The smokers were categorized as mild ( $\leq 10$  cigarettes per day), moderate ( $>10$  and  $\leq 20$  cigarettes per day), and heavy smokers ( $>20$  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.

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*Semen Analysis:* Semen samples were collected by masturbation in a clean specimen container after a sexual abstinence for 3-6 days, allowed to liquefy and evaluated immediately thereafter according to WHO guidelines.<sup>7</sup> Ejaculate volume, PH, and time to liquefaction were measured. The results of semen analyses were classified according to the nomenclature of semen viables.<sup>7</sup>

Normozoospermia was diagnosed when sperm concentration, motility and morphology were within the reference values. The reference value for sperm concentration was  $\geq 50\%$  sperm with forward progression (categories 'a' and 'b') or  $\geq 25\%$  sperm with category 'a' movement, and for morphology 30% sperm with normal morphology respectively.

*Statistics:* Data were presented as mean as, if applicable, and the significance of differences were analyzed by t-test. Statistical analysis was performed by means of SPSS 7.5 for windows software packet. The significance of differences was set at  $P < 0.05$ .

### RESULTS

In all, three hundred forty four men were evaluated for infertility; of these, one hundred thirty were nonsmokers and two hundred fourteen smokers respectively. The semen volume acidity, and the sperm concentration, viability and forward progression (Grade) were much lower in the smokers than in the nonsmokers ( $p < 0.01$ , Table-I). The semen parameters were

Table-I: Semen quality of infertile and fertile groups

Semen	Infertile smokers	Infertile Non-smokers	Fertile controls
	(N=214)	(N=130)	(N=75)
Volume (ml)	2.5±0.08	2.7±0.07	3±0.09
PH	7.8±0.02	7.7±0.02	7.6±0.03
Count (×10 <sup>6</sup> /ml)	45.2±1.7	54.04±2.5	91.3±3.5
Viability (%)	45.2±1.8	51.1±2.1	80±1.2
Grade (0-4)	2.5±0.04	2.7±0.06	3.2±0.03

Note: All values are means±SD.  $P < 0.01$

much lower in the nonsmokers of infertile men than in the fertile men ( $P < 0.01$ ).

No significant differences in the results of semen quality were seen between mild, moderate and short term smokers and nonsmokers. Most semen parameters in the heavy and long term smokers are significantly lower than their corresponding values in the nonsmokers ( $P < 0.05$  or  $0.01$ , Table-II).

### DISCUSSION

The possible detrimental effects of cigarette smoking on male reproductive performance, and specifically on semen parameters, is of great interest and available data is quiet conclusive.<sup>8-12</sup>

In addition, because of the recent desire to better understand and treat infertility in men, it has become important to assess the possible side effects of cigarette smoking on male reproduction.<sup>11-13</sup> Chemical agents or mutagens may affect male reproduction via direct effect on the testes and their ability to produce sperm

Table-II: Semen quality of different group

Semen	Amount (cigarettes/day)			Duration (years)		NON smokers
	1-10	10-20	>20	1-10	11-20	
	66	76	72	166	60	130
Volume (ml)	2.6±0.08	2.5±0.2	2.2±0.1*	2.6±0.06	2.5±0.1	2.7±0.08
PH	7.9±0.02	7.95±0.02	7.94±0.01*	7.9±0.01	7.9±0.02	7.85±0.02
Count (×10 <sup>6</sup> /ml)	48.2±2.2	45.1±2*	44.2±3*	50.4±2	40.3±4.2*	54.3±3.04
Sperm viability (%)	48.3±3.2	45.7±3.1*	42.2±2.1*	51.5±1.9	40.8±4.3*	51.3±3.1
Grade (0-4)	3±0.02	2.9±0.02	2.5±0.03*	2.9±0.08	2.53±0.06*	2.98±0.09

\*  $p < 0.01$ , ·  $p < 0.05$

via the process known as spermatogenesis.<sup>13-16</sup> Those mechanisms may involve the hormonal control of spermatogenesis or may directly affect the germ and sertoli cells within the somniferous tubules.<sup>11,13,17,18,19-21</sup>

Although there is some evidence to the contrary, a number of studies have shown higher incidences of abnormally shaped sperm cells as well as decreased motility and sperm concentration in men who smoke.<sup>9,11,16,22-26</sup>

In the current study, we investigated the effect of smoking on the semen quality of infertile men, particularly in heavy and long term smokers. The results indicated that smoking significantly reduced the ejaculate volume: Every smoker should be encouraged to stop smoking, especially if a pregnancy is planned. Cigarette smoke contains a lot of known toxins, which may have detrimental effects on fertility. Simply stopping smoking could prevent the toxins contained in cigarette smoke.

## REFERENCES

1. Yamamoto Y, Isoyama E, Sofikitis N, Miyagawa I. Effects of smoking on testicular function and fertilizing potential in rats. *Urol Res* 1998;26:45-8.
2. Reddy A, Sood A, Rust PF, Busby JE, Varn E, Mathur RS, et al. The effect of nicotine on in vitro sperm motion characteristics. *J Assist Reprod Genet* 1995;12:217-23.
3. Lewin A, Gonen, O, Orvieto R, Schenker J. Effect of smoking on concentration, motility and zona-free hamster test on human sperm. *Arch Androl* 1991;27:51-4.
4. Sofikitis N, Miyagawa I, Dimitriadis D, Zavos P, Sikka S, Hellstrom W. Effects of smoking on testicular function, semen quality and sperm fertilizing capacity. *J Urol* 1995;154:1030-4.
5. Zimaman J, Brown C, Selevan G, Clegg D. Semen quality and human fertility: a prospective study with healthy couples. *J Androl* 2000;21:145-53.
6. Vine F. Smoking and male reproduction: A review *Int J Androl* 1996;19:323-37.
7. World Health organization. Laboratory manual for the examination of human semen and sperm cervical mucus interaction. 3rd/ed. Cambridge: Cambridge University Press; 1992.
8. Stillman J. Smoking and reproduction. *Fertile Steril* 1986;46:545-66.
9. Handelsman J, Conway J, Boylan M, Turtle R. Testicular Function in sperm donors: Normal ranges and the effects of smoking and varicocele. *Int J Androl* 1984;7:369-82.
10. Karagounis, Papanikolav A, Zavous M. Semen parameters compared between smoking and non-smoking men: smoking intensity and semen parameters. *Infertility* 1985;8:373-9.
11. Hoidas S, Williams E, Tocher L, Itargreave B. Scoring sperm morphology from fertile and infertile cigarette smokers using the scanning electron microscope and image analysis. *Fertile Steril* 1985;43:595-8.
12. Kulikauskas V, Blaustein D, Ablm RJ. Cigarette smoking and its possible effects on sperm. *Fertile Steril* 1985;44:526-8.
13. Fisher- fischbein J. The effects of pharmaceuticals, environmental, and occupational aspects on sperm motility. In Gagnon C, editor. *Controls of sperm motility: biological and clinical aspects*. Boca Raton (FL): CRC Press, 1990.
14. Mattison DR. The effects of smoking on fertility from gametogenesis to implantation. *Environ Res* 1982;28:410-33.
15. Ravenholt RT. Circulating mutagens from smoking. *N Engl J Med* 1982;307:309-12.
16. Corrao A, Guindon E, Sharma N, Shokoohi F. Tobacco control country profiles. American Cancer Society, Atlanta 2000;32.
17. Klaiber L, Broverman M, Pokoly B, Albert J, Howard J, Sherer F. Interrelationships of cigarette smoking, testicular varicoceles, and seminal fluid indexes. *Fertile Steril* 1987;47:481-6.
18. Klaiber L, Broverman M. Dynamics of estradiol and testosterone and seminal fluid indexes in smokers and non smokers. *Fertile Steril* 1988;50:630-4.
19. Ramlau-Hansen CH, Thulstrup AM, Aggerholm AS, Jensen MS, Toft G, Bonde JP. Is smoking a risk factor for decreased semen quality? A cross-sectional analysis. *Hum Reprod* 2007;22(1):188-96.
20. Gaur DS, Talekar M, Pathak VP. Effect of cigarette smoking on semen quality of infertile men. *Singapore Med J* 2007;48(2):119-23.
21. Pasqualotto FF, Sobreiro BP, Hallak J, Pasqualotto EB, Lucon AM. Cigarette smoking is related to a decrease in semen volume in a population of fertile men. *B J Urology Int* 2006;97(2):324-6.
22. Rantala L, Koskimies L. Semen quality of infertile couples comparison between smokers and nonsmokers. *Andrologia* 1986;1:42-6.
23. Saaranen M, Suonio S, Kauhanen O, Saarikoski S. Cigarette smoking and Semen quality in men of reproductive age. *Andrologia* 1987;19:670-6.
24. Martini AC, Molina RI, Estofan D, Senestrari D, Fiore de Cuneo M, et al. Effects of alcohol and cigarette consumption on human seminal quality. *Fertil Steril*. 2004;82(2):374-7.
25. 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(2):109-12.
26. 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(2):287-91.