

ORIGINAL ARTICLE

Frequency of Abnormal Sperm Motility in Male Smokers with Primary Infertility

SYEDA SAHAR ZAHRA¹, UZMA KHALID², PARI IMAN GUL³, ASIM IQBAL QURESHI⁴, NIMRAH SATTAR⁵, ISHFAQ UL HAQ⁶

¹Consultant Gynaecology, Royal Health Care Hospital Multan

²Consultant, Gynaecology, Social Security Hospital Shahdara

³Consultant, Gynaecology, Mukhtar A. Sheikh Hospital Multan

⁴Assistant Professor, Gynaecology, Bakhtawar Amin Hospital Multan

⁵Senior Registrar, Gynaecology, BVH Bahawalpur

⁶Medical Officer, Gynaecology, RHC Laal Suhanra

Correspondence to: Dr. Syeda Sahar Zahra, Email: drkash226@gmail.com, Cell: 03067302600

ABSTRACT

Objective: To assess the frequency of abnormal sperm motility and related factors in male smokers with primary infertility.

Place and duration of the study: From 8th Feb 2021 to 8th Feb 2022 at Gynaecology Department of Bakhtawar Amin Trust Teaching Hospital Multan for 1 year

Study design: A retrospective study

Methodology: A total of 120 patients were included in the study among which 100 patients were smokers and 20 patients were non-smokers. For sample collection, patients were asked to masturbate and collect the first portion of ejaculate to ensure the maximum amount of sperm. Semen analysis was done on regular basis under a light microscope according to WHO guidelines. After the semen liquefaction, the 10 μ l of the sample was analyzed on a glass slide covered with a coverslip. For evaluating the motility, 200 spermatozoa were counted in 5 fields at 200x magnification.

Results: Six non-smokers (30%) showed low motility. In comparison, 76 smokers (63.3%) showed low motility. Low motility was observed more in smokers as compared to smokers. The difference between motility in smokers and non-smokers was statistically significant (<0.001) (Chi sq= 23.55). Cigarette smoking also affected the sperm count as 24 (20%) smokers had a low sperm count.

Conclusion: Smoking affects vital sperm characteristics such as sperm count and motility and in turn, be a potential cause of subfertility or infertility.

Keywords: Cigarette smoking, male fertility, sperm count, sperm motility.

INTRODUCTION

Tobacco smoking is one of the significant causes of death globally and is a recognized health hazard by public health institutions⁽¹⁾, however, smoking is a widespread habit among people of all ages. According to the WHO, 1/3rd of the world's male population that is aged more than 15 years (35%) are smokers^(1, 2). Most of the smokers were young males that were in their fertile phase i.e more than 40% of the smokers were aged between 20-39 years⁽³⁾.

Infertility is referred to the inability to get pregnant after 1 year of unprotected sexual intercourse without any administration of contraceptives. The WHO defines infertility as the incapacity of conceiving a child after 24 months of trying, this definition is globally accepted among research and clinical literature⁽⁴⁾. Almost 30-50% of the infertile individuals report the main cause of infertility as the male factor infertility with abnormal semen which is observed in every 1 among 20 men^(5, 6). According to a study, male and female factors contribute to the cause of infertility by 40% each⁽⁷⁾. Male infertility is caused by a number of factors that are mostly developed during the early reproductive period. Couples who are infertile due to a male partner can look up to various treatments to get pregnant such as intracytoplasmic sperm injection (ICSI).

Smoking is always regarded as injurious to health due to its harmful effects on the lungs and heart, however, not much awareness is spread about its effects on male fertility. This is because the carcinogens in tobacco affect the dividing cells including germ cells. Literature shows that smoking alters the semen causing a decrease in its viability, motility, sperm density and morphology. The effect of smoking on male fertility and sperm is less researched. Hence this study aims to assess the frequency of abnormal sperm motility and related factors in male smokers with primary infertility.

METHODOLOGY

A retrospective study was conducted from 8th Feb 2021 to 8th Feb 2022 at Gynaecology Department of Bakhtawar Amin Trust Teaching Hospital Multan. A total of 120 patients were included in the study among which 100 patients were smokers and 20 patients

were non-smokers. The patients were divided on basis of their smoking history i.e. smoking for more than 5 years and less than 5 years respectively. The patients included were aged between 25 and 40 years old, suffered from primary infertility and smoked at least 10 cigarettes every day. The patients who were exposed to heat and chemicals occasionally, suffered from cryptorchidism, varicocele and hydrocele and underwent surgery for their treatment, suffered diabetes mellitus, high blood pressure and tuberculosis and patients who were taking any long-term medication were excluded from the study.

Patient history was noted including their smoking duration and cigarettes they smoked every day. Patients were asked to observe sexual resistance for three days to observe sperm motility and sperm count efficiently. For sample collection, patients were asked to masturbate and collect the first portion of ejaculate to ensure the maximum amount of sperm. The sample was not collected in a condom due to the presence of spermicidal agents. Ejaculate, after coitus interruptus was also not used as its first portion, is lost.

The sample was collected in a dry, leak-proof plastic container. Semen analysis was done on regular basis under a light microscope according to WHO guidelines. After the semen liquefaction, the 10 μ l of the sample was analyzed on a glass slide covered with a coverslip. For evaluating the motility, 200 spermatozoa were counted in 5 fields at 200x magnification. The motility was categorized as progressive, non-progressive and immotility. A number of sperms were calculated by using a modified Neubauer counting chamber. The total number of sperms was calculated by multiplying the number of counted sperms by 50,000/ml. A similar method was repeated in non-smokers.

All the data was evaluated by SPSS version 20. A p-value less than 0.001 was statistically significant. A Chi-square test was performed to compare the results between smokers and non-smokers.

RESULTS

A total of 120 patients were included in the study among which 100 were smokers and 20 were non-smokers. 49 patients (40.8%) among the smokers had a smoking history of more than 5 years

and 51 patients (42.5%) had been smoking for less than 5 years. (Table I)

The sperm motility status is shown in Table II. 6 non-smokers (30%) showed low motility. The cause is which is unknown as it was not due to cigarette smoking. In comparison, 76 smokers (63.3%) showed low motility. Low motility was observed more in smokers as compared to smokers. The difference between motility in smokers and non-smokers was statistically significant (<0.001) (Chi sq= 23.55). Cigarette smoking also affected the sperm count as 24 (20%) smokers had a low sperm count (Table III). However, the effect of smoking on sperm motility was more than on sperm count (Chi sq= 26.1).

Table I: Patients' demographic data

Smoking history	Patients (n=120)
Non-smokers	20 (16.7%)
Smokers for more than 5 years	49 (40.8%)
Smokers for less than 5 years	51 (42.5%)

Table II: Sperm motility in study patients and comparison between smokers & non-smokers

Motility	All study patients (n=120)	Non-Smokers (n=20)	Smokers for less than 5 years	Smokers for more than 5 years
Normal motility (>32%)	44 (36.6%)	14 (70%)	20 (50%)	10 (16.7%)
Low motility (<32%)	76 (63.3%)	6 (30%)	20 (50%)	50 (83.3%)

Table III: Sperm count of study patients and comparison between smokers and non-smokers

Sperm count (15 million/ml)	All study patients (n=120)	Non-Smokers (n=20)	Smokers for less than 5 years	Smokers for more than 5 years
Normal count	96 (80%)	20 (100%)	38 (95%)	36 (60%)
Low count	24 (20%)	0	2 (5%)	24 (40%)

DISCUSSION

The effects of cigarette smoking on human health have been studied by many studies but its impact on the male reproductive system has not been discussed much. Smoking affects sperm quality by increasing the concentration of lead and cadmium in the body. In some cases, the injuries by these chemicals can be masked by good testicular function. Sperm count shows the effectiveness of spermatogenesis and sperm motility shows its functional ability and sperm maturation. Sperm motility is primarily done by its flagella tail and it gathers its energy from the mitochondrial-rich mid-piece. Sperm motility is important for functioning in terms of transportation and penetration of the ovum for fertilization. Therefore, it plays a vital part in male fertility.

Literature shows that sperm motility must be maintained in the female reproductive system and ATP hydrolysis provides energy for this motility. Zavos et al⁽⁸⁾ concluded that low sperm motility led to abnormal flagellum ultrastructure and sperm tail. Garrett et al⁽⁹⁾ show that high sperm motility and in turn good sperm morphology lead to high pregnancy rates.

In our study, cigarette smokers had a low sperm count and motility especially in patients with a long smoking history i.e more than 5 years. Among all study patients, 76 (63.3%) had low sperm motility and 24 (20%) had low sperm count. Therefore, it can be concluded that sperm count is less impacted than sperm motility. These results are consistent with Zakarya Bani Meri et al.,⁽¹⁰⁾ which report that heavy smokers had a significantly low sperm count than occasional smokers. This study also showed the effect of smoking on sperm motility, morphology and white blood cells that can cause male subfertility. Nadeem et al.,⁽¹¹⁾ also reported that the chemicals in tobacco cigarettes can affect the chromosomes and sperm functionality. They showed that smoking affected sperm count and motility, decreasing reproductive ability.

The sperm morphology worsened and the sperm count decreased with the increase in cigarettes smoked per day. Same results have been reported by Vine MF et al.,⁽¹²⁾ Shaaraway M et al.,⁽¹³⁾ Somwanshi et al.,⁽¹⁴⁾ Vytas Kaulikauskas et al.,⁽¹⁵⁾ Al Bader A et al.,⁽¹⁶⁾ Vogt et al.,⁽¹⁷⁾ and Arabi M⁽¹⁸⁾. One study contradicted the results of our study and the studies mentioned above. Azar Aghamohammadi et al.⁽¹⁹⁾ indicated that cigarette smoking was not hazardous to sperm as only the sperm count and semen volume differed in smokers and non-smokers. But non-smokers were healthier than smokers generally.

CONCLUSION

Smoking affects vital sperm characteristics such as sperm count and motility and in turn, be a potential cause of subfertility or infertility.

Authors Contribution

Sahar, Nimrah, Asim, conceived, designed and did statistical analysis & editing of manuscript
 Ishfaq, Uzma, Pari, Nimrah, did data collection and manuscript writing

Asim, Sahar, Pari, did review and final approval of manuscript

Grant Support & Financial Disclosures: None

REFERENCES

- Bundhun PK, Janoo G, Bhurtu A, Teeluck AR, Soogund MZS, Pursun M, et al. Tobacco smoking and semen quality in infertile males: a systematic review and meta-analysis. *BMC public health*. 2019;19(1):1-11
- Ranganathan P, Rao KA, Thalaivarasai Balasundaram S. Deterioration of semen quality and sperm-DNA integrity as influenced by cigarette smoking in fertile and infertile human male smokers—A prospective study. *Journal of Cellular Biochemistry*. 2019;120(7):11784-93
- Corona G, Sansone A, Pallotti F, Ferlin A, Pivonello R, Isidori A, et al. People smoke for nicotine, but lose sexual and reproductive health for tar: a narrative review on the effect of cigarette smoking on male sexuality and reproduction. *Journal of endocrinological investigation*. 2020;43(10):1391-408
- Medicine PCotASfR. Definitions of infertility and recurrent pregnancy loss: a committee opinion. *Fertility and Sterility*. 2020;113(3):533-5
- Vander Borgh M, Wyns C. Fertility and infertility: Definition and epidemiology. *Clinical biochemistry*. 2018;62:2-10
- Mollaahmadi L, Keramat A, Ghiasi A, Hashemzadeh M. The relationship between semen parameters in processed and unprocessed semen with intrauterine insemination success rates. *Journal of the Turkish German Gynecological Association*. 2019;20(1):1
- Tüzer V, Tuncel A, Göka S, Bulut SD, Yüksel FV, Atan A, et al. Marital adjustment and emotional symptoms in infertile couples: gender differences. *Turkish Journal of Medical Sciences*. 2010;40(2):229-37
- Zavos PM, Correa JR, Antypas S, Zarmakoupis-Zavos PN, Zarmakoupis CN. Effects of seminal plasma from cigarette smokers on sperm viability and longevity. *Fertility and sterility*. 1998;69(3):425-9
- Garrett E, Reid A, Schürer K, Szreter S. Changing family size in England and Wales: Place, class and demography, 1891–1911: Cambridge University Press; 2001.
- Meri ZB, Irshid IB, Migdadi M, Irshid AB, Mhanna SA. Does cigarette smoking affect seminal fluid parameters? A comparative study. *Oman medical journal*. 2013;28(1):12
- Nadeem F, Fahim A, Bugti S. Effects of cigarette smoking on male fertility. *Turkish Journal of Medical Sciences*. 2012;42(8):1400-5
- Vine MF, Chiu-Kit JT, Hu P-C, Truong KY. Cigarette smoking and semen quality. *Fertility and sterility*. 1996;65(4):835-42
- Shaarawy M, Mahmoud KZ. Endocrine profile and semen characteristics in male smokers. *Fertility and Sterility*. 1982;38(2):255-7
- Somwanshi S, Madole M, Bikkad M, Bhavthakar S, Ajay G, Bhgwat S. Effect of cigarette smoking on Sperm Count and sperm Motility. *Journal of Medical Education & Research*. 2012;1:30-8
- Kulikauskas V, Blaustein D, Ablin RJ. Cigarette smoking and its possible effects on sperm. *Fertility and sterility*. 1985;44(4):526-8
- Al-Bader A, Omu A, Dashti H. Chronic cadmium toxicity to sperm of heavy cigarette smokers: immunomodulation by zinc. *Archives of andrology*. 1999;43(2):135-40
- Vogt H-J, Heller W-D, Borelli S. Sperm quality of healthy smokers, ex-smokers, and never-smokers. *Fertility and sterility*. 1986;45(1):106-10
- Arabi M. Nicotinic infertility: assessing DNA and plasma membrane integrity of human spermatozoa. *Andrologia*. 2004;36(5):305-10
- Aghamohammadi A, Zafari M. The impact of cigarette smoking on sperm parameters: a cross-sectional study. *Age*. 2011;36(7.76):35-23