

Clinical, demographic and psychological characteristics of infertile male smokers in Northeast China

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Abstract

Objectives: To investigate clinical, demographic and psychological characteristics of infertile male smokers in northeast China.

Methods: Serum and semen samples were collected from infertile men. Semen analysis was performed according to conventional procedures. Serum follicle-stimulating hormone, luteinizing hormone and testosterone levels were quantified. Psychological anxiety and depression were evaluated by the self-rating anxiety scale (SAS) and self-rating depression scale (SDS), respectively.

Results: Both SDS and SAS scores were significantly higher in smokers ($n = 704$) than in nonsmokers ($n = 372$); in addition, sperm viability and motility were significantly lower in smokers than in nonsmokers. Spearman's correlation coefficient analysis revealed significant positive correlations between duration of smoking and SDS and SAS scores, and between cigarettes smoked per day and SDS and SAS scores.

Conclusions: Cigarette smoking has a negative effect on sperm viability and motility, and is associated with increased SDS and SAS scores.

Keywords

Male infertility, Semen quality, Smoking, Psychological anxiety

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Introduction

Smoking is a known risk factor in male infertility, but the effects of smoking on semen quality are unclear. In infertile men, cigarette smoking is associated with damaging effects on sperm density, viability, motility and morphology,^{1–6} as well as affecting semen volume.^{6–8} Smoking has

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also been shown to have detrimental effects on sperm parameters and seminal zinc levels in both fertile and infertile men,^{2,4,9} and heavy smoking can affect sperm concentrations.^{10,11} These effects are related to the both the number of cigarettes smoked and the duration of smoking.² Others have reported, however, that cigarette smoking has no effect on semen or sperm parameters.^{12,13} The effects of smoking on reproductive hormones are also unclear, with studies showing varying and contradictory effects on serum follicle-stimulating hormone (FSH), luteinizing hormone (LH), testosterone, and total testosterone (TT) levels.^{3,8,14-16}

Infertility can have psychological effects.¹⁷ Infertile men are socially isolated, show more anxiety¹⁸ and are more vulnerable to severe anxiety than fertile men.¹⁹ Male partners in infertile couples experience greater psychological distress than fertile men,²⁰ and hormonal disturbances and the effectiveness of infertility management are related to mood disorders.²¹ Additionally, psychological stress may be associated with the effect of cigarette smoking on the quality of semen, since lower sperm density and abnormal sperm are related to psychological stress,⁹ and psychosocial anxiety is related to cigarette smoking.²²

The present study investigated clinical, demographic and psychological characteristics of infertile male smokers in northeast China. The relationships among psychological stress, smoking and quality of semen were also evaluated.

Patients and methods

Study population

The study enrolled men who sought treatment for infertility at the Andrology Outpatient Clinic, the Second Hospital of Jilin University, Changchun, China, between January 2013 and December 2014. A physical examination was conducted in each

participant to determine age, height, weight, and testicular volume (assessed using a Prader orchidometer). All patients completed a detailed questionnaire regarding smoking history and frequency, marital history, education level, monthly income, working conditions and medical history.

The study protocol was approved by the ethics committee of the Second Hospital of Jilin University, Changchun, China, and all participants provided written informed consent.

Study parameters

Anxiety and depression were evaluated using the self-rating anxiety scale (SAS) and the self-rating depression scale (SDS), respectively, as validated for Chinese populations.²³ An SAS score ≥ 50 and SDS score ≥ 53 indicated anxiety and depression, respectively.

Semen analysis was performed according to procedures recommended by the World Health Organization, 1999.²⁴

From all patients, peripheral blood (5 ml) was collected using routine methods into sterile tubes without additives, stored at room temperature for 30 min, then centrifuged at 1000 g for 10 min. Serum was stored in sterile tubes at -20°C until use. Serum FSH, LH and testosterone levels were quantified via electrochemiluminescence immunoassay (Roche Diagnostics, Mannheim, Germany).

Statistical analyses

Data were presented as mean \pm SD or n (%) and compared using independent-samples t -test or χ^2 -test. Spearman's correlation coefficient analysis was used to determine possible correlations with smoking status. Data were analysed using SPSS[®] version 17.0 (SPSS Inc., Chicago, IL, USA) for Windows[®]. P -values < 0.05 were considered statistically significant.

Results

The study included 1076 male patients with infertility (mean age 30.1 ± 4.75 years; age range 19–54 years). Of these, 704 were smokers (duration 1–20 years, 2–40 cigarettes/day) and 372 were nonsmokers. Demographic and psychological characteristics of the study population are shown in Table 1. Both left and right testicular volumes were significantly lower in smokers than in nonsmokers ($P < 0.001$ for each comparison). SDS and SAS scores were significantly higher in infertile male smokers than in nonsmokers ($P < 0.01$ and $P < 0.001$, respectively). There were no significant between-group differences in age, duration of infertility, height, weight, education level or monthly income.

The clinical characteristics of infertile men are shown in Table 2. Sperm viability and motility were significantly lower in smokers than in nonsmokers ($P = 0.005$

and $P = 0.002$, respectively). There were no significant between-group differences in semen volume, sperm count or FSH, LH and testosterone levels.

Spearman's correlation coefficient analysis revealed significant negative correlations between duration of smoking and sperm viability ($r = -0.106$, $P < 0.01$) and motility ($r = -0.093$, $P < 0.01$), and between cigarettes smoked per day and sperm viability ($r = -0.123$, $P < 0.01$) and motility ($r = -0.121$, $P < 0.01$). There were significant positive correlations between duration of smoking and SDS ($r = 0.062$, $P < 0.05$) and SAS scores ($r = 0.088$, $P < 0.01$), and between cigarettes smoked/day and SDS ($r = 0.070$, $P = 0.05$) and SAS scores ($r = 0.103$, $P = 0.01$).

Discussion

The effect of smoking on semen quality in infertile men is unclear. The Practice

Table 1. Demographic and psychological characteristics of infertile men from northeastern China, stratified according to tobacco smoking.

Characteristic	Smokers <i>n</i> = 704	Nonsmokers <i>n</i> = 372	Statistical significance ^a
Age, years	29.88 ± 4.71	30.41 ± 4.81	NS
Duration of infertility, years	3.34 ± 2.91	3.66 ± 3.32	NS
Height, cm	175.96 ± 7.82	176.26 ± 7.53	NS
Weight, kg	76.05 ± 6.83	75.28 ± 7.53	NS
Left testicular volume, cc	14.11 ± 4.74	16.80 ± 4.02	$P < 0.001$
Right testicular volume, cc	14.38 ± 4.75	17.09 ± 4.18	$P < 0.001$
Education level			NS
Graduate	31 (4.4)	17 (4.6)	
University	249 (35.4)	135 (36.3)	
Senior high	385 (54.7)	195 (52.4)	
Junior high	39 (5.5)	25 (6.7)	
Monthly Income, RMB			NS
Low, <2000	483 (68.6)	241 (64.8)	
High, ≥2000	221 (31.4)	131 (35.2)	
SDS score	43.15 ± 8.75	41.46 ± 9.49	$P = 0.005$
SAS score	47.64 ± 7.34	45.69 ± 8.18	$P < 0.001$

Data presented as mean ± SD or *n* (%).

^aStudent's *t*-test or χ^2 -test.

NS, not statistically significant ($P \geq 0.05$); SDS, Self-rating Depression Scale; SAS, Self-rating Anxiety Scale.

Table 2. Clinical characteristics of infertile men from northeastern China, stratified according to tobacco smoking.

Parameter	Smokers n = 704	Non-smokers n = 372	Statistical significance ^a
Semen volume, ml	3.57 ± 2.68	3.75 ± 3.42	NS
Sperm concentration, × 10 ⁶ /ml	52.46 ± 50.27	56.14 ± 51.01	NS
Sperm viability, %	48.30 ± 24.08	52.53 ± 22.66	P = 0.005
Sperm motility, %	24.43 ± 19.95	28.57 ± 21.26	P = 0.002
FSH, mIU/ml	6.97 ± 5.18	6.80 ± 5.27	NS
LH, mIU/ml	7.16 ± 5.45	6.94 ± 5.56	NS
Testosterone, ng/ml	3.12 ± 1.86	3.27 ± 2.58	NS

Data presented as mean ± SD.

^aStudent's *t*-test.

Committee of the American Society for Reproductive Medicine reported that, according to available biological, experimental and epidemiological data, up to 13% of infertility can be attributed to cigarette smoking.²⁵ Cigarette smoking can accelerate the loss of reproductive function; 22% of semen parameters and sperm function are poorer in smokers than nonsmokers, and these effects are dose-dependent.²⁵ Testicular volume was significantly lower in smokers than nonsmokers in the present study, although this finding may be related to the varying aetiology of the study population.

Low-income individuals have been shown to consume more tobacco products than those with higher incomes.³ There were no significant between-group differences in age, duration of infertility, height, weight, education level or monthly income in the present study, but sperm viability and motility were significantly lower in smokers than in non-smokers: these findings are in accordance with those of others.^{2,4-6} In addition, we found no significant between-group differences in semen volume, sperm count, or FSH, LH and testosterone levels, which is also consistent with other studies.^{8,16}

Infertile men have an increased risk of psychological problems, and consideration of such issues is important in the diagnosis and treatment of infertility. Psychosocial

interventions are efficacious for couples undergoing infertility treatment, since reducing psychological distress can improve clinical pregnancy rates.²⁶ The management of psychological factors has an important preventative role in treating infertility.^{27,28} Psychological interventions from each person in a partnership can help each partner to support the other.²⁹

A key factor in the relationship between infertility and psychological anxiety is the duration of infertility and treatment,³⁰ since treatment-related psychological anxiety is linked to cigarette smoking level.³¹ Both SDS and SAS scores were significantly higher in smokers than in nonsmokers in the present study, but they remained within the normal range. Correlation analysis revealed that both duration of smoking and number of cigarettes smoked per day were positively correlated with and SDS and SAS scores in the present study.

In conclusion, cigarette smoking has a negative effect on sperm viability and motility, and is associated with increased SDS and SAS scores in men from Northeast China. Infertile men with psychological anxiety tend to smoke more cigarettes than fertile men, therefore psychological effects should be taken into account in the treatment of male infertility. Infertile men who are smokers should be encouraged to stop smoking to improve their reproductive potential.

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Declaration of Conflicting Interest

The authors declare that there are no conflicts of interest.

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