

The impact of cigarette smoking on semen parameters in infertile Sudanese males in Khartoum

Salah Eldin Omar Hussein¹, Kamal Eldin Hussein Elhassan², Shamsoun Khamis Kafi³

1- College of Applied Medical Sciences, Department of Medical Laboratory Technology, University of Taibah, Kingdom of Saudi Arabia and College of Medical Laboratory Science, University of Sciences and Technology, Sudan

2- Faculty of Medical Laboratory Science, The National Ribat University, Sudan.

3- Faculty of Medicine, The National Ribat University, Sudan

*Corresponding author: Salah Eldin Omar Hussein, E-mail: Salah.omr@live.com

Abstract

This descriptive cross-sectional study was conducted during the period August 2012 to July 2015. The study included 300 apparently infertile cigarette smoker volunteers (as a test group) and 300 apparently infertile non cigarette smoker volunteers (as a control group). Semen parameters (volume /ml, count x 10⁶, motility % and morphology %) in two groups were compared.

All study subjects were selected randomly from Dr. Alsir Abualhassan fertility center .The test group and the control group, were matched in term of age, socioeconomic status and sex (all were males).

The sperm motility was significantly reduced, while abnormal sperm morphology was significantly raised while semen volume, sperm count were not significantly change in the test group compared to the control group. Mean \pm SD for infertile smokers versus controls show:

Sperm count (10.1 \pm 2.9) versus (11.8 \pm 3.0) x 10⁶, (P = 0.140), sperm motility (30.0 \pm 5.3) % versus (31.5 \pm 5.7), (P = 0.031), sperm morphology (91.6 \pm 3.1) versus (89.1 \pm 4.3)%, (P = 0.001), semen volume (2.3 \pm 0.55) versus (2.4 \pm 0.62) ml, (P = 0.183).

Keywords: Semen parameters in infertile Sudanese

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Introduction

Male infertility is a problem of the reproductive system, and the word infertility itself means not fertile, and that would be equivalent to sterility. Sterility means that a man is totally unable to have a child (1). The World Health Organization (WHO) and the American Society for Reproduction Medicine Practice Committee defines infertility as no conception after at least 12 months of unprotected sexual intercourse (2). Infertility can be permanent (irreversible) or sub fertility which means the probability of spontaneous conception may be decreased . All men who are sterile would be considered infertile, but not all men who are infertile are sterile, because an infertile man can father a child with medical help or with simple change in his life style (3,4).

A man is responsible in about 20% of infertility among couples, and contribute to infertility with a woman in another 30-40% . Infertility can either be primary or secondary; primary male infertility is when the man has never impregnated a woman, while secondary male infertility is when a man has impregnated a woman irrespective of the outcome of the pregnancy . Men with secondary infertility, in general, have better chance of future fertility (5,6). Duration of infertility is defined as the number of months during which the couple has been having sexual intercourse without the use of any contraceptive method. This indicator gives an important information about the couple's future fertility, if the duration of infertility of 3 years or less the couples have a better chance of future pregnancy, but if the duration has been longer, then there is a severe biological problem. But in general couples tend to seek medical advice after a shorter duration of infertility (7,8).

Despite worldwide anti-smoking campaigns, cigarette smoking is very common. The highest prevalence of smoking is observed in young adult males during their reproductive period (46% smokers between 20 and 39 years. About 30% of the Austrian male population aged 15 and older are smokers. Smoking among men is increasing in Central and Eastern Europe. Overall 35% of European men smoke, with a prevalence of 44% or even higher in the Eastern parts (Bulgaria, Greece, Turkey) and 30% in the Western parts (UK, Sweden, Finland) of Europe (9). Cigarette smoking may be associated with sub-fertility in males and may result in decreased sperm concentration, lower sperm motility, and a reduced percentage of morphologically normal sperm respectively (10,11). Nineteen studies evaluating the influence of smoking on semen parameters in infertile men and nine studies in fertile men have been published so far . The major shortcoming of these studies is a small overall patient number (only two studies included >500 men, and >200 smokers). In a recent meta-analysis , including 27 studies on the association between cigarette smoking and semen quality, a mean reduction in sperm concentration of 13%, a mean reduction of sperm motility of 10%, and a

mean reduction of morphologically normal sperm of 3% was reported in smokers (12,13). Most of the studies, however, which reported a significant difference in semen quality were performed in normal, non-infertility clinic men. Unfortunately, in 25 out of 27 studies in this meta-analysis, the number of smokers was <200 men. Another major shortcoming is the lack of accurate smoking dose information (14).

Materials and Methods

This study was descriptive cross-sectional, and analytical case-control study. The study was done in, Dr. Alsir Abualhassan and Nile fertility centers, Khartoum State in Sudan, during the period from August 2012 to July 2015.

The target population was infertile Sudanese smokers aged 20-50 years attending the study areas for medical care. Long standing cigarette smokers (5 years and more) were included as a test group in this study, while men with known causes of infertility, using contraceptive methods, newly married men (less than one year married) and men with chronic diseases or use chronic medications.

Sample size of 600 Sudanese men were included in this study (300 infertile smokers and 300 healthy fertile men as control group). The sample size was calculated based on the formula for unmatched case-control studies. Open EPI-INFO statistical package version 7 was used with 99% two sided confidence level, 80% power and 40% of controls exposed, 57% of cases exposed and odds ratio > 2. The ratio of controls to cases is 1:1.

Interviews with the cigarette smokers and the controls were done to obtain the clinical data. A questionnaire was specifically designed to obtain information which helps in either including or excluding certain individuals in or from the study. Clinical history & diagnosis of the test group and the control group were checked by a physician.

Semen samples were collected from smokers and non smokers by masturbation in sterile polypropylene containers after sexual abstinence of 3.5 days. Semen volume was measured. Routine semen analysis was carried out by light microscopy. The concentration, motility and morphology of spermatozoa were assessed according to WHO criteria (WHO, 1992).

Finally the results were analyzed by SPSS version 19. The mean and SD were obtained and "t" test used for comparison. Linear regression was also used for correlation. P.

value was obtained to assess the significance of the results (p value of < 0.05 was considered to be significant).

Results

A total 600 infertile Sudanese males were recruited to participate in this study, included 300 smokers and 300 non-smokers as control.

The mean age of participate was 42.5 ± 7.6 year for range 37 – 51 year the infertile smokers and 41.0 ± 6.3 year range 35 – 52 year for the infertile non-smokers. However these variation in the age between the smokers and non-smokers was not statistically significant P value 0.31 (Figure 1).

The study revealed statistically difference in the mean of sperm motility and abnormal sperm morphology between the infertile smokers and non-smokers, P values 0.031 & 0.001 respectively. However these was statistically insignificant differences between the two groups regarding the means sperm count and semen volume (Table 1).

The semen analysis showed increased the number of the infertile smokers with oligoasthenoterato-zoospermia compared with the another semen classifications (Table 2).

Significant positive correlation was found between the abnormal sperm morphology and with both ; the duration of cigarette smoking / years and the number of cigarette smoking / day (Figure 2, 3) . While negative correlations was observed between the motility of the sperms and with both ; the duration of cigarette smoking / years and the number of cigarette smoking / day (Figure 4, 5).

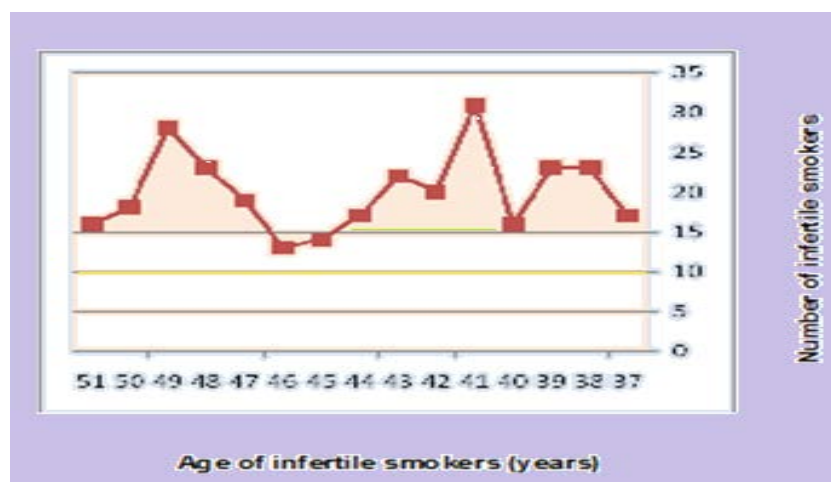


Figure 1: Distribution of the age according to the number of infertile smokers.

Table 1. Comparison of the means of sperm count, sperm motility, sperm morphology, semen volume between the test group (n = 150) and the control group (n = 150)

Variable	(Infertile smokers), (mean + SD	(Infertile non smokers), (mean + SD)	P. value
Sperm count x 10⁶	(10.1+ 2.9)	(11.8 + 3.0)	0.140
Range	(6.5 – 13.5)	(9.0 – 14.0)	
Sperm motility %	(30.0 + 5.3)	(31.5 + 5.7)	0.031
Range	(23.0 – 41.0)	(25.0 – 40.0)	
Abnormal sperm morphology %	(91.6 + 3.1)	(89.1 + 4.3)	0.001
Range	(87.0 – 100.0	(79.0 – 96.0)	
Semen volume ml	(2.3 + 0.55)	(2.4 + 0.62)	0.183
Range	1.5 – 3.0)	(1.8 – 2.9)	

- The table shows the mean \pm SD, range in brackets () and probability (P)
- T-test was used for comparison.

Table 2. The number of infertile smokers by semen classification

Semen classification	Number of infertile Smokers	% of infertile smokers
Oligozoospermia	18	6 %
Oligoastheno/terato-zoospermia	36	12 %
Oligoasthenoterato-zoospermia	162	54 %
Sterile	9	3 %
Azoospermia	45	15 %
Aspermia	3	1 %
Cryptospermia	21	7 %
Necrospermia	6	2 %

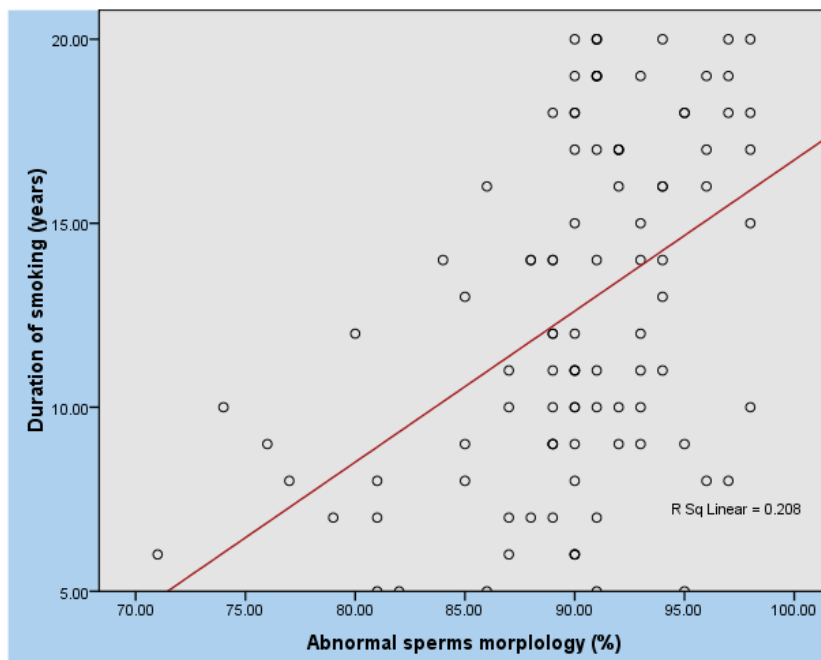


Figure 2: A scatter plot shows strong positive correlation between the abnormal sperms morphology and the duration of cigarette smoking / years ($r = 0.208$, $P = 0.028$).

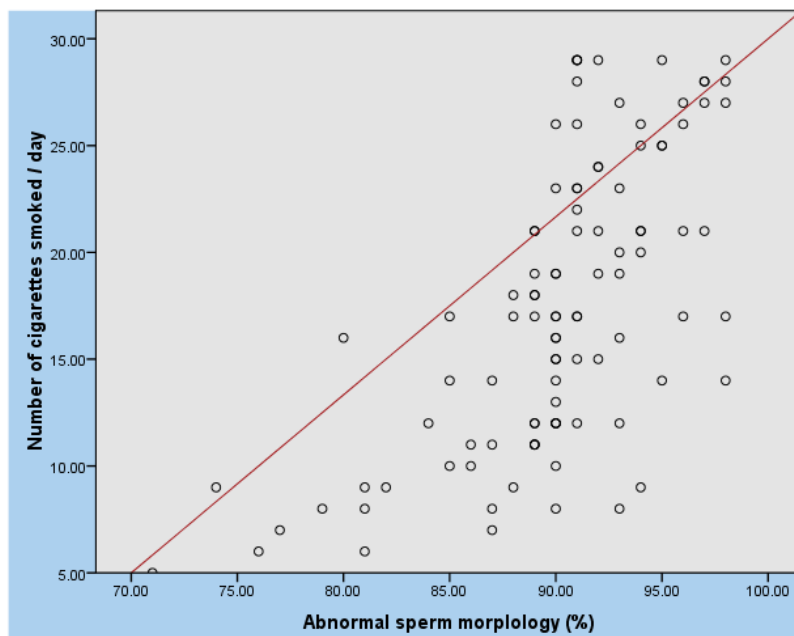


Figure 3: A scatter plot shows strong positive correlation between the abnormal sperms morphology and the number of cigarettes smoked / day ($r = 0.357$, $P = 0.017$).

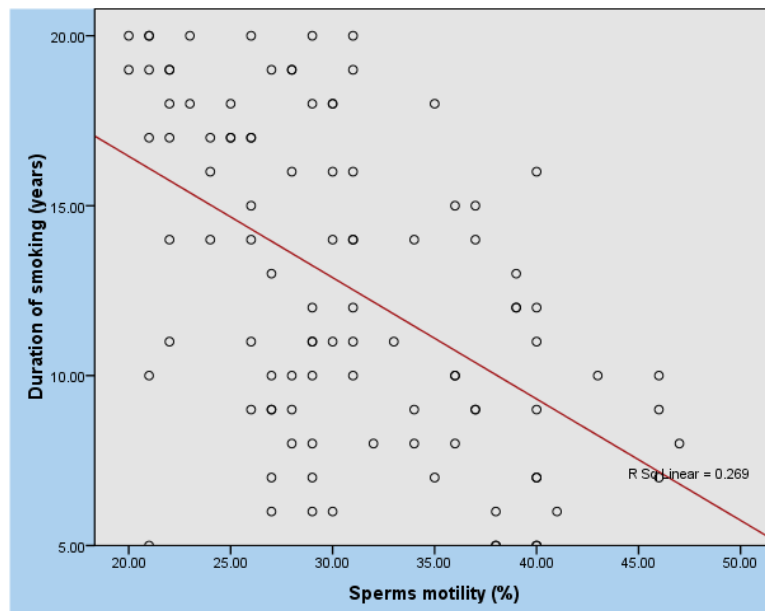


Figure 4: A scatter plot shows strong negative correlation between the sperms motility (%) and the duration of cigarette smoking / years ($r = 0.269$, $P = 0.03$).

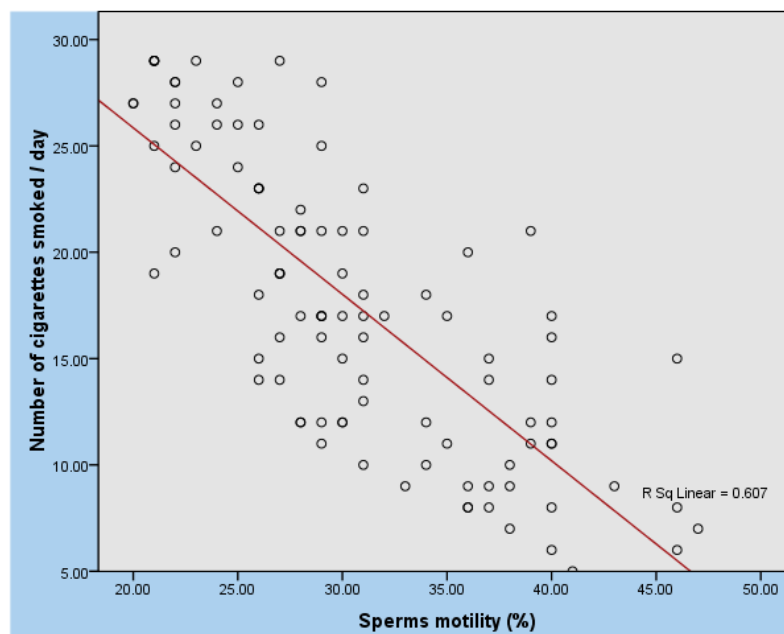


Figure 5: A scatter plot shows strong negative correlation between the sperms motility and the number of cigarettes smoked / day ($r = 0.607$, $P = 0.011$).

Discussion

Several studies have examined the effect of cigarette smoking on male fertility and showed a negative effect on sperm motility and morphology. The results of this study indicated that cigarette smoking affects sperm motility and sperm morphology, causing reduced motility and increased abnormal sperm morphology and these findings confirm the earlier studies examining the relationship between cigarette smoking and sperm motility and abnormal sperm morphology (9,16) . The findings were consistent with the results reported by Pasqualotto who reported that there were significant differences among smokers and non-smokers in the semen parameters and Collodel who reported significant difference in sperm motility between smokers and non-smokers, also the study showed that sperm morphology is negatively affected by cigarette smoking which confirms the results of Kunzle (11,13,15).

The seminal volume and sperm count values were compared between the two groups showed no significant changes, and this is in agreement with the results of the study done by Carlsen and Kunzle they reported that there were insignificant differences in seminal volume and sperm count between smokers and non smokers (9,13).

The study observed that sperm motility was significantly decreased where the levels of abnormal sperm morphology was markedly increased in cases compared to controls. These findings are in agreement with that documented by Okonofua and Rantala (8,10) . The exact mechanism of increased abnormal sperm morphology and decreased of sperm motility is not well understood but the possible explanations suggested were that nicotine in tobacco and metabolite cotinine may lead to decreased sperm motility and increased abnormal sperm morphology, also carbon monoxide may affect male reproduction via direct effect on the testicular function and spermatogenesis (11).

The recent study showed a significant decrease in the sperm motility and significant increase in abnormal sperm morphology with increasing number of cigarettes smoking /day and the duration of cigarettes smoking / years ^[41, 78].

The study showed significant correlation between the sperm motility and abnormal sperm morphology with increasing the number of cigarettes smoked /day and the duration of cigarettes smoking / years. Similar reported by Collodel who pointed that significant correlation between the s sperm motility and abnormal sperm morphology with increasing the number of cigarettes smoking /day and the duration of cigarettes smoking / years (12).

Conclusion

Reduced of perms motility, and negatively correlated with both: the duration of cigarettes smoking / years and the number of cigarettes smoked / day. While abnormal sperms morphology were significantly increased in cigarette smokers and positively correlated with both: the duration of cigarettes smoking / years and the number of cigarettes smoked / day.

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