Original Article

Effect of smoking on reproductive hormones and semen parameters of infertile Saudi Arabians

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Abstract

Objective: The purpose of this retrospective study is to look into the effect of smoking on semen and hormonal profile of Saudi Arabians attending infertility clinics.

Materials and Methods: Medical record numbers of patients who attended infertility clinics and who underwent full assessment were identified rom Quadramed system and out-patient log books between January 2010 and December 2012. The standard protocol of the patients include full history, age, number of years of marriage personal habits of smoking, alcohol consumption, primary or secondary infertility. Standard laboratory tests which were performed, included, complete blood picture, random blood sugar, testosterone, follicle stimulation hormone, luteinizing hormone, prolactin level and semen analysis; volume, count, progressive motility and morphology. The data was entered in the database and analyzed.

Results: During the study period, 279 patients attended and infertility clinic and only 258 gave the sample for analysis. The average age of patients in the smoking group was 34.23 ± 7.66 and in the nonsmokers 34.07 ± 7.92 years. Primary infertility was more common in smokers versus nonsmokers $P < 0.001$ confidence interval (CI)< −44.0705, total serum testosterone level was lower 383.8 ± 239.5 versus 422.5 ± 139.2 ng/dL (0.009 CI< −9.9415), serum prolactin level was higher 18.68 ± 13.28 versus 12.85 ± 12.34 ng/mL (0.001 CI < 8.3794). The average volume of the semen among the smokers was 2.8 ± 1.35 mL and in nonsmokers it was 3.08 ± 0.76 mL ($P < 0.008$ CI< −0.123). The mean progressive motility in smokers was 31.5 ± 23.1 compared to nonsmokers 40.05 ± 25.43% (0.002 CI< −3.2962) and total sperm count was 119.52 ± 114.12 and 139.71 ± 104.82 million/mL (0.07 CI < 1.4657).

Conclusions: This study shows that the effect of smoking is dramatic reduction in the hormonal levels and semen parameters. It is recommended that smoking men undergoing fertility treatment should stop smoking to increase their chances of having offspring.

Key Words: Hormonal levels, Saudi Arabians, semen parameters, smoking

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INTRODUCTION

There are many factors which effect semen parameters such as environmental issues, tight under garments which raises the local temperature, life-styles, occupational hazards and sleep deprivation adversely effect semen parameters.[1-4] Added to these smoking, which causes harmful effects to probably every tissue of the human body[5] effects semen parameters as well. There is conflicting findings on the effect of smoking on the

quality of semen. Reports indicate severe effect on semen parameters in smokers,[6-10] while some studies have reported few changes in the semen parameters such as motility and volume.[11,12]

Studies have shown the deleterious effect of nicotine and its products on the levels of sex hormones which influence semen parameters but its clinical relevance is still under investigation.[13,14] Even with proactive anti-smoking campaigns, the incidence of smoking does not look like coming down. It is estimated that 19% of all adults over the age of 18 years in the United States smoke cigarettes[15] and in Saudi Arabia the overall prevalence of tobacco use was reported to be 26.3%.[16]

There is no data available on the effect of smoking on semen parameters and the sex hormones which ultimately play a major role on the fertility among the Saudi Arabian population. This retrospective study was done to find out the effect of smoking in our infertile population.

MATERIALS AND METHODS

After due approval of the Institutional Review Board, medical record numbers of patients who attended infertility clinics and who underwent full assessment were identified rom Quadramed system and out-patient log books between January 2010 and December 2012. As a standard protocol of all patients infertility clinics data on full history, age, number of years of marriage personal habits of smoking, alcohol consumption, primary or secondary infertility was available and recorded. Standard laboratory tests which were performed, included, complete blood picture, testosterone, follicle stimulation hormone (FSH), luteinizing hormone (LH), prolactin level and semen analysis; count, motility and morphology. The mean semen parameters was compared with the normal reference values as described by the World Health Organization.[17]

The data was entered in the database and analyzed using a *t*-test to compare means between the different levels of number and morphology of the sperms. The data was analyzed using Statistical Package for the Social Sciences, version 15.0, Chicago, Illinois. $P < 0.05$ was considered to be statistical significant.

RESULTS

During the study period, the semen and blood samples of 258 patients was available for analysis. The average age of all the patients was 34.12 ± 7.8 years. Ninety (34.8%) were smokers and the rest were nonsmokers. The average age of patients in the smoking group was 34.23 ± 7.66 and in the nonsmokers 34.07 ± 7.92 years. Table 1 gives the demographic and the hormonal data of all patients. Primary infertility was more common in smokers versus nonsmokers $P < 0.001$ confidence interval (CI) < −44.0705, total serum testosterone level was lower 383.8 ± 239.5 versus 422.5 ± 139.2 ng/dL (0.009 CI< −9.9415), serum prolactin level was higher 18.68 ± 13.28 versus 12.85 ± 12.34 ng/mL (0.001 CI < 8.3794).

Table 2 gives the semen parameters of smokers and nonsmokers. This shows the average volume of the semen among the smokers was 2.8 ± 1.35 mL and in nonsmokers it was 3.08 ± 0.76 mL ($P < 0.008$ CI< −0.123). The mean progressive motility was 31.5 ± 23.1 compared to nonsmokers 40.05 ± 25.43% (0.002 CI< −3.2962) and total sperm count was 119.52 ± 114.12 and 139.71 ± 104.82 million/mL (0.07 CI < 1.4657).

DISCUSSION

In this study, we found that 34.8% of men who attended infertility clinics and gave samples of semen and blood for investigations were smokers and had significantly low semen parameters in comparison to the nonsmokers. The results were similar to world literature of the deleterious effects of smoking on the semen parameters.[6-9] The cause of these effects on semen changes is causing the increased prevalence of primary infertility among the couples. In this study among the smokers

Table 1: Demographic data and hormonal profile of 258 patients

Variable	Smokers	Non-smokers	*P* value
Number of patients	90	168	
Age	34.23±7.66	34.07±7.92	0.8
Number of months of marriage	63.93±37.24	68.39±64.02	0.5
Primary infertility	75	126	0.001; CI <−44.0705
Secondary infertility	15	42	0.001; CI <−20.0705
Random blood sugar	128.52±132	106.43±48.24	0.001
Testosterone level	383.8±239.5	422.5±139.2	0.009; CI <−9.9415
Follicle stimulation hormone	5.39±5.32	5.98±5.93	0.34; CI<0.6351
Leutinizing hormone	4.07±4.35	4.77±3.27	0.04; CI <−0.0244
Prolactin level	18.68±13.28	12.85±12.34	0.001; CI <8.3794

CI: Confidence interval

Table 2: Comparison of the semen analysis between smokers and non-smokers

Parameter	Smokers	Non-smokers	*P* value
Number of patients	90	168	
Volume (mL)	2.8±1.35	3.08±0.76	0.008; CI <−0.123
pH	7.43±0.3	7.37±0.34	0.09; CI <0.1302
Progressive motility (%)	31.5±23.1	40.05±25.43	0.002; CI <−3.2962
Sperm count/ ejaculate (million)	42.15±29.6	49.86±39.94	0.07; CI <0.5416
Total sperm count (million/mL)	119.52±114.12	139.71±104.82	0.07; CI <1.4657

CI: Confidence interval

the primary infertility was significantly higher on comparison with nonsmokers. The overall incidence of primary infertility in the African region was reported to between 3% and 6%.[18] The reported data of relationship between smoking and male sex hormones has been a roller coaster. Recently Tweed *et al*.[13] did not find any relationship between testosterone, FSH and LH, but another report suggested total and free testosterone levels to be higher in smokers.[19] In our study, we found actually the total serum testosterone level to be lower in infertile smokers when compared to the infertile nonsmokers. The significantly higher levels of prolactin in our patients with smoking is similar to what is reported by other researchers.[20,21]

The effect of smoking an extensive review of over 25 studies by Vine[22] raised concerns that cigarette smoking reduces the quality and quantity of semen. Recent reports does suggest the adverse effects of smoking on semen parameters[6,7,23] and our results are in this direction. We observed that there was significant negative changes in the semen parameters of the smokers, from volume to the sperm motility and count. The study of Axelsson *et al*.[24] further emphasizes the effect of smoking as they found the effect of cigarette smoking not only effected the semen parameters of the smokers themselves but also reduced total sperm count in men whose father smoked at the time of the pregnancy.

The incidence of international primary infertility in 2010 was reported as 1.9% and 10.5% for secondary infertility and this indicated that rates on infertility has remained unchanged for the last decade.[25] The estimated total fertility in Saudi Arabia has dropped from 7.30 in 1970-1975 to 3.03 in 2005-2010[26] and recently a senior obstetrician and gynecologist from Saudi Arabia puts a figure of male and female infertility to be around 20%.[27] This higher incidence of infertility could not be substantiated. If this high figure is true and the falling total fertility rate, then we believe much work needed to be done. One of the most important steps will be to educate the young Saudi Arabians to stop smoking so that they could improve the fertility rates.

The retrospective nature of the study in itself is one of the limitations of this study, secondly our records did not show the duration and the amount of cigarettes the study population smoked, which could have suggested the importance of duration and number of packs smoked. The strength of the study is we were able to analyze complete data and report on a subject, which was not touched before.

CONCLUSIONS

Our study found that up to 38% of the infertile males were smokers and the reproductive hormones and semen parameters were much lower in the smokers than nonsmokers. We believe health care givers to be more proactive with the government and other agencies to repeatedly inform the young about the affect of smoking on infertility and lastly we have undertaken a prospective study to undermine the limitations in this study.

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