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The Relationship between Thyroid Stimulating Hormone (TSH) and Semen Parameters in Infertile Sudanese Cigarette Smokers

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Abstract:

This is a descriptive cross-sectional and case control study. The study included 150 apparently infertile cigarette smoker volunteers (as a test group) and 150 apparently infertile non cigarette smoker volunteers (as a control group). All study subjects were selected randomly from Dr. Alsir Abualhassan fertility centre .The test group and the control group, were matched in terms of age, socioeconomic status and sex (all were males). Semen parameters (volume/ml, count x 106, motility % and morphology %) and TSH mlU/L hormones levels compared in the two groups.

The sperm count, motility, morphology and TSH hormone levels were significantly reduced, while semen volume was not significantly changed in the test group compared to the control group. Mean ± SD for infertile smokers versus controls show sperm count (10.1 + 2.9) versus (11.8 + 3.0) x 106, (P = 0.029), motility (30.0 +

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5.3) versus (31.5 + 5.7) %, (P = 0.031), abnormal sperm morphology (91.6±3.1) versus (89.1±4.3)%, (P = 0.001),TSH (2.3 + 0.64) versus (3.1 + 0.79) mlU/L, (P = 0.047) and semen volume (2.3±0.55) versus (2.4±0.62) ml, (P = 0.183).

From this study, it is concluded that; cigarette smoking is associated with reduced sperm count, motility, TSH hormone level and raised number of sperms with abnormal morphology while insignificant change occurred on semen volume. TSH hormone level correlate negatively with both the duration of smoking and the number of cigarettes smoked per day.

Key words: TSH hormone, Semen parameters, Infertile Sudanese cigarette smokers.

INTRODUCTION

A man is responsible in about 20% of infertility among couples, and contributes 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 [1,2]. Men with secondary infertility, in general, have better chance of future fertility. 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 [3,4,5].

Cigarette smoking may be associated with sub-fertility in males and may result in decreased sperm concentration, lower sperm motility, reduced percentage of morphologically normal sperm respectively and decreased of TSH level which lead to hypothyroidism [6].

Thyroid stimulating hormone binds to the receptor on the thyroid cells, this causes these cells to produce thyroxin and triiodothyronine and release them into the bloodstream. These

hormones have a negative effect on the pituitary gland and stop the production of thyroid stimulating hormone if the levels of thyroxin and triiodothyronine are too high [7]. A simple blood test can measure thyroid stimulating hormone in the circulation. If a person has too much, this may indicate that their thyroid gland is not making enough thyroid hormone, ie, they have an underactive thyroid gland or hypothyroidism. TSH level can indicate if your thyroid gland is working properly [8]. While a TSH test is usually used as the initial blood test to detect hypothyroidism, the doctor may need to order additional tests to diagnose hypothyroidism. It's important to know that blood tests are not the only way the doctor determines your hypothyroidism diagnosis. Asking how you're feeling is just as important. Reviewing your TSH results and discussing all your symptoms helps the doctor see the bigger picture [9,10].

Nineteen studies evaluating the influence of smoking on TSH level and 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 [11,12].

Therefore, this study aimed at determining the effect of smoking in infertility in Sudanese males, based on clinical and laboratory findings in order to promote the involvement of males in reproductive health issues and in the prevention of infertility in particular. As a large number of men smoke worldwide, and the fact that cigarette smoke contains known mutagens and carcinogens, there has been much concern that smoking may have unfavourable effects on male reproduction [13,14]. Several studies from different parts of the world have

observed that cigarette smoking has an effect on the semen quality, especially in those who are heavy smokers or who have been smoking for many years [15,16,17]. The aim of our study determines the effect of cigarette smoking on TSH level and related with quality of seminal fluid parameters.

MATERIALS AND METHODS

This is a descriptive cross-sectional, and analytical case-control study. The study was done in, Dr. Alsir Abualhassan fertility centre, Khartoum State, the target population was infertile Sudanese smokers diagnosis by consultant, aged 20-59 years. Long standing cigarette smokers 5 years and more were included as a test group in this study. 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 were excluded. A total of 300 Sudanese men were included in this study, 150 infertile smokers and 150 infertile non smokers. 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).

Venous blood sample 5 ml was drawn by a well trained medical technologist into plain vacationer tubes from smokers and non smokers. The Blood was left for a while allowed to clot. Then serum samples were obtained by centrifugation at room temperature at 3000 rpm/10 minutes then used for TSH hormone analysis.

Finally the result were analyzed by SPSS version 19 . The mean and SD were obtained and "t" test used for comparison. Linear regression was also use 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 300 Sudanese males were recruited to participate in this study, 150 infertile smokers and 150 infertile non smokers. The mean age of participants was 36.8 ± 7.6 year for range 20 – 59 year the infertile smokers and 37.0 ± 7.3 year range 20 – 59 year for the infertile non-smokers. However the variation in the age between the smokers and non-smokers was not statistically significant, P value = 0.31.

The percentage of sperm motility, sperm count and TSH level were found to be statistically decreased compared to the infertile non-smokers (P values 0.031, 0.029 and 0.047 respectively). On the other hand the percentage of sperm with abnormal morphology was significantly raised in the group of infertile smokers (P values 0.001). However there was statistically insignificant differences between the two groups regarding the mean semen volume (P values 0.183). (Table.1). From this study observed increased the numbers of infertile smokers compared to the age of infertile smokers and the severity of infertility in infertile cigarette smokers (Table 2, Figure 1).Also this study showed strong relationship between the semen parameters and TSH level according to the number of infertile smokers and non smokers and the severity of infertility (Figure 2,3,4). In infertile smokers negative correlation was observed between the TSH hormone with both; the duration of cigarette smoking / years and the number of cigarettes smoked / day (Figure 5, 6).

Table (1) Comparison the means of semen parameters and TSH between the infertile smokers and non smokers groups:

Variable	(Infertile smokers) (mean + SD) n = 150	(Infertile non smokers) (mean + SD) n = 150	P. value
TSH	(2.3 + 0.64)	(3.1 + 0.79)	0.047
Sperm count x 10 6	(10.1 + 2.9)	(11.8 + 3.0)	0.029
Sperm motility %	(30.0 + 5.3)	(31.5 + 5.7)	0.031
Abnormal sperm morphology %	(91.6 + 3.1)	(89.1 + 4.3)	0.001
Semen volume ml	(2.3 + 0.55)	(2.4 + 0.62)	0.183

Table shows the mean + SD, range in brackets ( ) and probability (P) .
Independent T-test was used for comparison.

Table (2) Shows the severity of infertility according to the age of infertile smokers:

Age of infertile smokers	20 - 29		30 – 39		40 – 49		50 - 59		Total	
Number & % of infertile smokers	N	%	N	%	N	%	N	%	N	%
Oligozoospermia	18	6	27	9	45	15	51	17	141	47
Sever oligozoospermia	15	5	24	8	36	12	45	15	120	40
Azoospermia	6	2	3	1	12	4	18	6	39	13

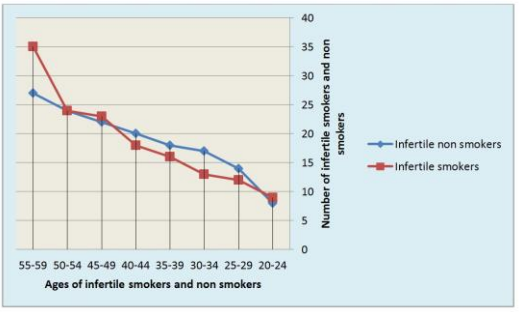

FIGURE (1) Distribution of the age according to the number of infertile smokers.

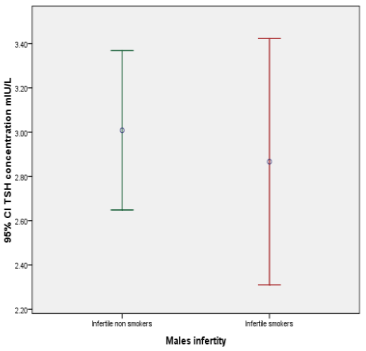

FIGURE (2) Relationship between TSH and Infertile smokers and non smokers.

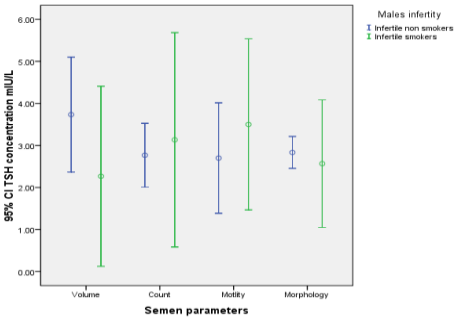

FIGURE (3) Relationship between TSH and semen parameters.

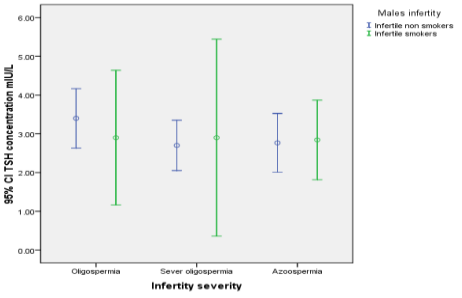

FIGURE (4) Relationship between TSH and the severity of infertility.

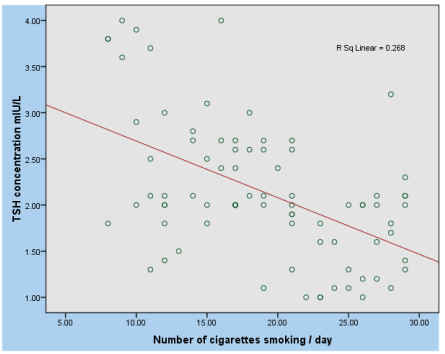

FIGURE (5) Shows negative correlation between the level of TSH and the number of cigarette smoking / day in the infertile smokers (r = -0.268 , P = 0. 037).

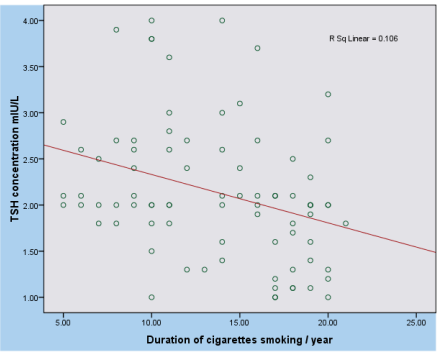

FIGURE (6) Shows negative correlation between the level of TSH and the duration of cigarette smoking / years in the infertile smokers (r = -0.106 , P = 0.049).

DISCUSSION

Cigarette smoking is an important modifier of hormones. The direct toxic effect of environmental toxins present in cigarette smoking which contains a lot of known toxins that may have detrimental effects on fertility in both sexes [8,18].Some of chemicals in cigarette's smoke generate a large number of free radicals, which may be related to aetiology of cancer and various diseases [10,19]. Several studies have examined the

relationship between thyroid stimulating hormone and the semen parameters in infertile males cigarette smokers. The results of this studies showed slightly reduced of TSH level lead to a negative effect on sperm count, motility and morphology with no change occurred on the semen volume. This results indicated that cigarette smoking affects on TSH level sperm count, motility and morphology, causing decreased of TSH level lead to reduced of the sperm count, motility and increased abnormal sperm morphology and these findings confirm the earlier studies examining the relationship between TSH level and sperm count, motility and abnormal sperm morphology in infertile male cigarette smoking [13,20,21] . The findings were consistent with the results reported by Kunzle et al 2003 who reported that there were significant differences among smokers and non-smokers in the TSH level and semen parameters and Rajender 2011 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 [16,22].

The seminal volume was compared between the two groups and they showed no significant changes. This is in agreement with the results of the study done by Kunzle 2003 who reported that there were insignificant differences in seminal volume between smokers and non smokers [15,23] .

The study observed that sperm count and motility were significantly decreased where the levels of abnormal sperm morphology and TSH level were markedly increased in the smokers compared to the non smokers. These findings are in agreement with that documented by Wong and Hussein 2001[12,22]. The exact mechanism of increased abnormal sperm morphology and decrease of sperm and motility is not well understood but the possible explanations are 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 [24,25].

The recent study showed a significant decrease in the TSH level with increasing the number of cigarettes smoked /day and the duration of cigarettes smoking in years. Similar findings were reported by Zhang et al who found inversely proportional correlation between TSH level and increasing number of cigarettes smoked /day and the duration of cigarettes smoking in years [14.17,26,27].

CONCLUSION

Cigarette smoking affects fertility by its main negative impact on semen parameters and TSH level was significantly reduced in cigarette smokers, and negatively correlated with both: the duration of cigarettes smoking in years and the number of cigarettes smoked / day.

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