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THE EFFECT OF OCCUPATIONAL GROUPS AND USE OF ALCOHOL AND SMOKING IN THRACE ON SEMEN PARAMETERS

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ABSTRACT

Aims: Research of the effect of alcohol and smoking of the male spouses of infertile couples and their occupational groups on sperm quality.

Methods: 686 male cases who have applied to Trakya University, Faculty of Medicine, Department of Assisted Reproductive Techniques, Infertility Polyclinic were included in the assessment. As a result of the spermiogram test, every patient's sperm count, motility and morphology were assessed. Occupational groups, usage of alcohol and smoking were enquired to each case. Mann Whitney U, Willcoxon Test was employed in the statistical analyses and the risk ratios were calculated.

Results: Out of the 686 people, 353 were smokers (51.4%) and 333 were non-smokers (48.6%). The number of people who smoked and also consumed alcohol was 59 (8.6%). In terms of occupation, 132 people were unemployed (%19.2), 23 were being exposed to heat (%3.3), 256 had to stand while working (%37.3), 31 were being exposed to radiation and chemicals (%4.5), 199 had to be both stand and sitting while working (%29) and 45 had to sit while working (%6.5). As a result of our study, while no correlation between smoking and the sperm count and morphology could be observed, the sperm motility of the smoking group has been observed to be lower. However, no significant difference in terms of semen analysis could be observed between, just drinkers, both drinker and smokers and non-smokers and drinkers groups. Smokers and those who both smoke and have a job where they have to be sitting have a significantly lower sperm motility. When the sperm quality is observed amongst occupational groups in terms of alcohol, the sperm motility of the people who were only exposed to radiation and chemicals have significantly increased in the alcohol consumers.

Conclusion: Semen quality is affected by numerous genetic and environmental factors. Smoking, alcohol consumption and being employed in certain occupational groups are just a few of many risk factors.

Key Words: Infertility, semen quality, smoking, alcohol, occupations

INTRODUCTION

Infertility is defined as no pregnancy after a period of one year of unprotected sexual intercourse. It can be classified as primary infertility if there were no pregnancy previously and as secondary infertility if there had been at least one pregnancy whether it resulted with live birth or not. 10-15% of infertility can be observed with couples in fertility age. 30-40% of the reason for infertility is due to male dependent and 40-50% of reason for infertility is female dependent. Unexplained infertility is a situation which cannot be explained with the available standard examination tests and it can be observed at the rate of 10-15% (1). Although the underlying reason of 40-60% of male infertility is known, the factor can't be presented in many cases and this is accepted as idiopathic infertility. The known reasons for male infertility are hormonal disorder, hereditary diseases and chromosomal abnormalities, gonadotoxins (medicine, insecticides, radiation, magnetic fields, alcohol, smoking and drugs, food additives), abnormal spermatogenesis and various metabolic diseases.

Spermatogenesis is defined as the formation of sperm cells by germ cells after going through various stages. The testicle tissue is inside a surrounding structure (scrotum) that contains inside the blood vessels, nerve fibers and muscle cells. Spermatogenesis takes place inside the seminiferous tubules (2,3,4). Spermatogenesis starts at the age of 13 and continuous throughout one's life while decreasing prominently. Sperm activity prominently increases with temperature rise, but under these conditions, increase in the metabolism rate seriously

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decreases the life span of the sperms and may prevent spermatogenesis by degenerating the seminiferous tubule cells (5).

The Relation of Infertility and Smoking

There are about 4000 materials inside a cigarette which are produced by the burning of tobacco and which are considered to be mutagen and carcinogen. Nicotine is a toxic material which is highly responsible for the addiction but when compared with the DDT, acetone, arsenic and cadmium in the cigarette, it is quite innocent (6).

There are numerous studies that show the adverse effects of smoking on spermatogenesis. In all of the studies, it is shown that these parameters have more or less been effected. In the study of Gaur et al. (2007), infertile males who smoke and don't smoke have been compared and it has been observed that the normospermia was 39% in non-smokers, yet this rate was 3% in smokers (7). In many studies to show the relation of sperm parameters and smoking, it shows that sperm amount and concentration of especially heavy smokers who smoke more than 20 a day are effected (8,9,10). Apart from conditions where concentration is effected, the deterioration of motility and morphology also stands out.

The Relation of Ethanol and Infertility

Ethanol is a material which is regarded as a reproductive toxin (11). Chronic use of ethanol by men causes atrophy in testicles, reduction in sperm production and drop in testosterone levels (12). In histological studies, the reduction in diameter of seminiferous tubules and loss in germ cells are reported. Chronic use of ethanol causes gonadal dysfunction; suppresses spermatogenic cases; reduces the proliferative activation of the spermatogoniums in every level of seminiferous tubule cycles (13,14).

The Relation of Occupational Groups and Infertility

Various occupational factors affect the cells in the seminiferous tubules in some cases and directly damage the spermatogenesis or indirectly have an effect on the spermatogenesis by interacting with the hormones. Some factors, which decrease libido, cause reproductive disorders as well. Heavy metals such as lead and manganese have reducing effects on libido. Those working in the production of oral contraceptives are exposed to estrogenic hormones. Since polychlorinated biphenyls and some pesticides display similar effects to estrogen, they also lead to hormonal disorders. Lead is the primary substance with spermatotoxic effect. Apart from lead, elements such as heat, ionizing radiation, mercury, DBCP and carbon sulphur have spermatotoxic effect as well (Table1) (15).

Physical Factors	Chemical Factors	Biological Factors	Ergonomic Factors
*temperature *radiation *Heavy work load	*Heavy metals(lead, mercury, cadmium, manganese) *solvents (benzene, hexane) *pesticides *Oral contraceptives * ethylene oxide *cytotoxic medicine *Anesthetic gases	*rubella * cytomegalovirus *Toxoplasma *Hepatitis B *HIV *Parvovirus B19	*Unseated working *heavy blue-collar labor *Job with shifts *Lifting heavy load

Table 1: Some occupational factors that affect male reproduction system

MATERIAL AND METHODS

The study has been carried out with the data obtained at the Trakya University, Faculty of Medicine, Assisted Reproductive Techniques Center, Andrology Laboratory. 688 male patients who have applied the infertility clinic have been included in the assessment. The age average was 32,41 ±6,668 SD and the youngest was 15 and the oldest was 57. Oral and written information has been conveyed to the patients with regard to conduction of semen analysis. Individual's name, date of birth, number of days of the sexual abstinence, the time and date the sample was obtained, the part of the sampling that was completed, difficulties that occurred during sampling, the time elapsed between the sampling and the analysis, use of alcohol and smoking and the occupational information were recorded in the report.

The sample was obtained after at least 3 days of sexual abstinence. The sample was obtained through masturbation and the ejaculate was placed in a clean, wide, glass or plastic cup that is non-toxic for the sperm. The name or the number of the individual and the time and date the sample was taken was inscribed on the cup. In the macroscopic examination, the semen was assessed on liquefaction, appearance, volume and pH characteristics. The examination was conducted after the ejaculate was liquefied within5-30 minutes of sampling. Color, viscosity and the odor was determined and recorded. In the semen analysis, phase-contrast attachment

light microscopic was used for microscopic examination and the assessments were carried out in 10x20 zoom. For the sperm count (concentration), the number was determined as million/ml in 10 squares of a 100 square area by using Makler counting chamber. For an effective result, 10 squares counts were carried out more than once (at least four) and the average was taken.

If no sperm was observed in the ejaculate, it was centrifuged at 2000 rpm for 10 minutes and it was examined on a palette. If no sperm was observed even after the centrifuge, it was called an "azoospermic sample". Motility was assessed in four different groups as rapid linear forward movement, slow and non-linear but forward movement, in-situ movement and as immobile. The semen sample dripped according to the sperm concentration on the lame which was recently cleaned with 70% ethanol before the morphological examination, was spread and dried with an angle of 45 degrees. The percentage of normal morphology sperm rate was determined by examining 100-200 sperms under immersion oil in a 100x objective glass after being dyed with Spermac paint. The sperms were classified according to their head, tail and acrosome structures. The data was input in the SPSS 11.0 statistic software by using Mann Whitney U. and Willcoxin test as P≤ 0.05 sensitive.

RESULTS

Out of the 686 people, 353 were smokers (51.4%) and 333 were non-smokers (48.6%). 585 of them didn't consume alcohol (85.2%) whereas 101 consumed alcohol (14.8%). The number of people who smoked and also consumed alcohol was 59 (8.6%).

Occupation	*Number (%)*
Unemployed	132 (%19.2)
Exposed to high temperatures	23 (%3.3)
Unseated labor	256 (%37.3)
Exposed to radiation and chemicals	31 (%4.5)
Both seated and unseated labor	199 (%29)
Seated labor	45 (6.5)

Table 2: Number of cases according to occupations

		YES	*NO*	*P*
Smoking	Sperm count	29 (0 – 520)	33 (0 – 1020)	0.619
	Motility	53 (0 - 94)	54 (0 – 100)	0.040*
	Morphology	3 (0 – 24)	3 (0 – 22)	0.538
Alcohol	Sperm count	30 (0 – 520)	37 (0 – 1020)	0.601
	Motility	53 (0 - 100)	57 (0 – 100)	0.336
	Morphology	3 (0 – 24)	4 (0 – 22)	0.485
Smoking Alcohol	Sperm count	31 (0 – 520)	38 (0 – 1020)	0.475
	Motility	53 (0 - 100)	58 (0 – 100)	0.167
	Morphology	3 (0 – 24)	4 (0 – 22)	0.586

(Sperm count = million /ml; motility %; morphology %) *p<0.05

Table 3: Spermiogram results according to smoking and alcohol consumption

As a result of our study, while no correlation between smoking and the sperm count and morphology could be observed, the sperm motility of the smoking group has been observed to be lower. However, no significant difference in terms of semen analysis could be observed between, just drinkers, both drinker and smokers and non-smokers and drinkers groups.

Smoking		*YES*	*NO*	*P*
Unemployed	Sperm count	46 (0 – 240)	42 (0 – 270)	0.721
	Motility	54 (0 - 85)	53 (0 – 91)	0.494
	Morphology	3 (0 – 10)	4 (0 – 9)	0.963
Exposed to high temperatures	Sperm count	19.5 (0 – 160)	28 (2 – 220)	0.622
	Motility	63.5 (0 - 75)	53 (16 – 100)	0.355
	Morphology	4 (0 – 6)	3 (0 – 8)	0.393
Unseated labor	Sperm count	21 (0 – 340)	30 (0 – 340)	0.227
	Motility	54 (0 - 94)	54 (0 – 100)	0.260
	Morphology	2 (0 – 21)	3 (0 – 22)	0.362
Exposed to radiation and chemicals	Sperm count	21 (0 – 520)	36.5 (0 – 120)	0.152
	Motility	56 (0 - 91)	62.5 (0 – 81)	0.264
	Morphology	3 (0 – 18)	3 (0 – 5)	0.685
Both seated and unseated labor	Sperm count	27 (0 – 250)	33 (0 – 1020)	0.836
	Motility	52,5 (0 - 85)	53 (0 – 100)	0.104
	Morphology	3 (0 – 24)	3 (0 – 16)	0.737
Seated labor	Sperm count	42 (1 – 210)	37 (4 – 180)	0.216
	Motility	46,5 (0 - 71)	65 (11 – 90)	*0.008
	Morphology	3 (0 – 15)	3 (0 – 9)	0.871

(Sperm count = million /ml; motility %; morphology %) *p<0.0

Table 4: Spermiogram results of smokers according to their occupations

When the relation of smoking on semen quality is considered, only the sperm motility have significantly increased in the non-smoking group.

Alcohol		*YES*	*NO*	*P*
Unemployed	Sperm count	43.5 (0 – 270)	48,5 (0 – 106)	0.976
	Motility	50 (0 - 91)	56.5 (0 – 79)	0.441
	Morphology	3 (0 – 10)	4 (0 – 6)	0.222
Exposed to high temperatures	Sperm count	24 (0 – 220)		
	Motility	54 (0 - 100)		
	Morphology	3 (0 – 8)		
Unseated labor	Sperm count	25 (0 – 340)	38 (0 – 220)	0.410
	Motility	54 (0 - 100)	60 (0 - 100)	0.369
	Morphology	3 (0 – 21)	3 (0 – 22)	0.829
Exposed to radiation and chemicals	Sperm count	28 (0 – 520)	0 (0 – 65)	0.098
	Motility	61 (0 - 91)	0 (0 – 57)	*0.019
	Morphology	3 (0 – 18)	0 (0 – 4)	0.087
Both seated and unseated labor	Sperm count	28 (0 – 290)	33 (0 – 1020)	0.738
	Motility	52 (0 - 100)	55.5 (0 – 82)	0.412
	Morphology	3 (0 – 24)	3,5 (0 – 17)	0.857
Seated labor	Sperm count	37 (1 – 210)	41 (2,6 – 72)	1
	Motility	50 (0 - 90)	57 (35 – 82)	0.515
	Morphology	3 (0 – 15)	4,5 (1 – 9)	0.200

(Sperm count = million /ml; motility %; morphology %) *p<0.05

Table 5: Spermiogram results of drinkers according to their occupations

When the sperm quality is observed amongst occupational groups in terms of alcohol, the sperm motility of the people who were only exposed to radiation and chemicals have significantly increased in the alcohol consumers.

Smoking and Alcohol		*YES*	*NO*	*P*
Unemployed	Sperm count	43.5 (0 – 270)	50 (0 – 105)	0.874
	Motility	51 (0 - 91)	56.5 (0 – 79)	0.556
	Morphology	3.50 (0 – 10)	4 (0 – 6)	0.475
Exposed to high temperatures	Sperm count	24 (0 – 220)		
	Motility	54 (0 - 100)		
	Morphology	3 (0 – 8)		
Unseated labor	Sperm count	26 (0 – 340)	30 (0 – 220)	0.616
	Motility	54 (0 - 100)	60 (0 – 100)	0.195
	Morphology	3 (0 – 21)	3 (0 – 22)	0.861
Exposed to radiation and chemicals	Sperm count	27 (0 – 520)		
	Motility	60 (0 - 91)		
	Morphology	3 (0 – 18)		
Both seated and unseated labor	Sperm count	28.5 (0 – 290)	37 (0 – 1020)	0.621
	Motility	53 (0 - 100)	50 (0 – 82)	0.813
	Morphology	3 (0 – 24)	3 (0 – 12)	0.594
Seated Labor	Sperm count	37.5 (1 – 210)	38 (2.6 – 62)	0.733
	Motility	51 (0 - 90)	73 (42 – 82)	0.265
	Morphology	3 (0 – 15)	5 (1 – 9)	0.328

(Sperm count = million /ml; motility %; morphology %) *p<0.05

Table 6: Spermiogram results of smokers and drinkers according to their occupations

There has been no significant difference of semen parameters between smokers and drinkers in al occupational groups.

Occupation	*Spermiogram*	
Unemployed	Sperm count	45.5 (0 – 270)
	Motility	53,5 (0 - 91)
	Morphology	4 (0 – 10)
Exposed to high temperatures	Sperm count	24 (0 – 220)
	Motility	54 (0 - 100)
	Morphology	3 (0 – 8)
Unseated labor	Sperm count	26 (0 – 340)
	Motility	54 (0 - 100)
	Morphology	3 (0 – 22)
Exposed to radiation and chemicals	Sperm count	27 (0 – 520)
	Motility	60 (0 - 91)
	Morphology	3 (0 – 18)
Both seated and unseated labor	Sperm count	31 (0 – 1020)
	Motility	53 (0 - 100)
	Morphology	3 (0 – 24)
Seated Labor	Sperm count	38 (1 – 210)
	Motility	52 (0 - 90)
	Morphology	3 (0 – 15)

(Sperm count = million /ml; motility %; morphology %)

Table 7: Spermiogram results of cases according to their occupations

When the semen parameters were assessed in terms of occupational groups, the sperm count and sperm morphology has been determined to be high in the unemployed group when compared with the other groups. The sperm motility has been observed to be high in the occupational group who were exposed to radiation and chemicals.

DISCUSSION

Spermiogram analysis is the first and the simplest test for the diagnosis of male infertility (2,3). The lowest reference values for the sperm analysis which the World Health Organization has set are given in Table 8 below (16).

Parameters	Lowest reference values
Semen volume (ml)	1.5 (1.4-1.7)
Total sperm count (106)	39 (33-46)
Sperm concentration (106/ml)	15(12-16)
Total motility (PR + NP %)	40 (38-42)
Progressive motility (PR %)	32(31-34)
Vitality (living sperms %)	58(55-63)
Sperm morphology (normal forms %)	4 (3.0-4.0)
pH	>7.2
Peroxidase-positive leucocyte (106 per ml)	<1.0
MAR test (%)	<50
Immunobead test (%)	<50
Seminal zinc (µmol/ejaculate)	>2.4
Seminal fructose (µmol/ejaculate)	>13
Seminal neutral glucosidase (mU/ejaculate)	>20

Table 8: The lowest reference values for semen analysis (5 Percentile and %95 confidence interval)

There may be various reasons for the abnormal results in the spermiogram. One of them is considered to be smoking. However, there are inconsistent results regarding the negative effect of smoking on infertility. Although there are studies defending the negative effects of smoking, there are publications stating that there is no effect. But this inconsistency may be due to the study designs. The reason for not being able to find a relation when assessing cases who smoke and don't smoke, just like our study, may be that the information regarding the frequency of the exposure to the toxic agent, the duration of the exposure and the density of the exposure is not available and that the grouping is insufficient. There has been no result parallel to the studies which indicate a relation as the amount of alcohol consumed and the amount of smoking and their frequencies have not been inquired when gathering data (12,13,14). The acquisition of different results from studies on the relation of smoking on fertility is noteworthy. The differences of period of smoking, the number of cigarettes, inhalation depth and duration can explain this. Moreover, the differences in the amount and the variety of the toxic matters inhaled in the blood and the target organ can be responsible for this. The difference of the surrounding environmental pollution is yet another factor that must be taken into consideration likewise. With these findings, the adverse effect of smoking on fer-

tility is acknowledged. It can be said that, solely smoking is not a reason for infertility but it must be regarded as a risk factor. It is thought that this risk factor can cause infertility together with other risk factors such as environmental and genetic factors.

Environmental factors such as working at high temperatures, constantly being seated, and inhaling chemical substances are considered to be the reasons of infertility at men. However the rate of people who work at high temperatures was 3% in our study and this made it impossible to make an assessment. In addition, the stress load of the people wasn't inquired in our study. For these reasons, our study needs to be expanded with a wider range of cases and a more detailed interrogation. Nevertheless, advising people who don't have a child to initially stay away from the negative factors, to quit their bad habits and to lead a healthy life, may help approaching one step closer to the goal wherein this equation with multiple variables although it may be hypothetical. One must quit smoking and stay away from alcohol.

Ethics Committee Approval: This study was approved by Trakya University Faculty of Medicine Scientific Researches Ethics Committee.
Informed Consent: Written informed consent was obtained from the participants of this study.
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