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SMOKING AS ETHIOLOGICAL FACTOR IN  
DEVELOPING INFERTILITY IN MEN

PUŠENJE KAO ETIOLOŠKI FAKTOR U  
RAZVOJU INFERTILITETA  
KOD MUŠKARACA

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*Abstract*

*Key words*

infertility in men, smoking, ejaculates  
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zooids

*Ključne reči*

infertilitet muškaraca, pušenje, volumen  
ejakulata, karakteristike spermatozoida.

**Introduction:** Infertility is defined as absence of pregnancy in couples who are having regular sexual intercourses over a period of one year without using any contraception. Smoking, as numerous studies confirm, can be related to lower fertility in men, which is a result of decreasing the number of spermatozooids, decreasing of their motility as well as lowering of the level of morphologically normal sperm.

**Aim of the paper:** Establishing a relation between infertility in men and smoking.

**Methodology:** The specimen was subjects who have been treated from infertility at the Clinic for Urology at the Clinical Center in Podgorica. According to their smoking status, they were divided into an examined and a control group. What was analyzed was the form, smell, the form and biochemical composition of ejaculates, whereby a particular attention was paid to the volume of ejaculates, the number and motility of spermatozooids and to the presence of possible abnormality in them.

**Results:** The analysis of obtained data from smokers and non-smokers ejaculates established that there is statistically significant difference in ejaculates volume, total and progressive motility of spermatozooids and the presence of abnormal spermatozooids, in the favor of non-smokers. Namely, it is evident that in non-smokers, the ejaculate volume is larger, there is a higher motility of spermatozooids and there is smaller number of abnormal spermatozooids. At the same time, it has been established that there is no statistically significant difference in number of spermatozooids between smokers and non-smokers.

**Discussion:** Tobacco smoke is highly dangerous for entire human organism. Chemical substances contained in tobacco smoke affect male reproductive organs directly affecting testis and their capacity to produce spermatozooids in a process of spermatogenesis. Studies have proved that those men who are smokers have 17% less spermatozooids than non-smokers. Smoking not only reduces the number of spermatozooids, but it also affects its quality. Some researches have proved that the quantity of sperm has increased eight times in men who stop smoking.

**Conclusion:** Results of the research on relation of smoking to infertility in men have shown that the ejaculate volume is larger in non-smokers than in smokers, the total motility of spermatozooids is better as well as the progressive motility of spermatozooids. Apart from that, it has been established that smoking disease causes higher percentage of abnormal forms of spermatozooids.

Therefore, each smoker should be encouraged to stop smoking, especially if pregnancy is planned.

1. INTRODUCTION

Infertility is defined as absence of pregnancy in couples who are having regular sexual intercourses over a period of one year without using any contraception.<sup>(1)</sup> Statistical methods calculated that there is a monthly pregnancy probability of 23% in completely healthy fertile couples and the total pregnancy probability for a period of one year is some 93%.

Over the period of three years this percentage increases to 97% - 99%, so that there is no statistically significant difference related to these two observed periods.<sup>(2)</sup>

Today, some 10% - 15% of couples encounters with the problem of infertility and from that percentage we come to the data that in 85% - 90% the cause of infertility will be identified and that 10% - 15% of couples will have no explanation and that particular group forms a group of

unidentified causes of infertility. Today, the male factor in infertile couples has been identified in 30% - 50% of cases and female factor in 40% - 70%, and in some 20 % of couples there is a joint, male-female factor.

Causes for occurring of male infertility are quite diverse. Pre-testicular factors are: hypogonadism ( decreased level of male sex hormones), smoking, consumption of alcohol or drugs. Testicular factors are: sperm characteristics (teratospermia i.e. abnormal morphology), oligospermia (decreased volume), azospermia ( absence of sperm) and genetic mutations of Y chromosomes. Post-testicular factors are: obstruction or lack of Vas deference (the duct that carries sperm), infections and retrograde ejaculation (advancement of the ejaculate towards the urinary bladder) (3).

Experience of numerous authors confirms that smoking could be a significant factor for incidence of infertility. Namely, smoking as the most widespread preventable addiction disease led to significant increase in number of men who have problems with infertility (4). Experimental studies show that in rats that have been exposed to tobacco smoke and in which the nicotine and cotinine level was increased, negative effect on spermatogenesis and fertility was identified (5). Smoking, which many studies confirm, can be related to lower fertility in men as a result of decreased number of spermatozooids and lower motility of spermatozooids as well as of decreased level of morphologically normal sperm. (6). Also, some of these researches confirmed that there is a connection between smoking disease in men and the quality of their semen, whereby the quality was of significantly better quality in non-smokers (7).

Normal morphology and motility of spermatozooids are only some of the criteria that should be met, so that a successful fertilization occurs. They have to be capable of capacitation, acrosomic reaction, and nuclear decondensation. They have to have the capacity of penetration through the cervical mucous plug, cumulus oophorus, ZP (zone pellucida) and VM (vitellina membrane) and the capacity to bind to the ovum. For all these reasons the research of ejaculates does not only include determining of number of spermatozooids, its motility and evaluation of morphological irregularities, but it is also about determining physical properties of semen liquid, establishing biochemical composition of semen and morphological analysis of ejaculates (8).

## 2. AIM OF THE PAPER

Establishing relation between smoking and infertility in men.

## 3. MATERIALS AND METHODS

The specimen in this research was all patients who have been treated from infertility at Andrology out-patient department at the Urology and Nephrology Clinic of the Clinical Center of Montenegro. Their age ranged from 20 to 49 years. In total, the research included 150 patients and all of them were divided into the group of examinees, which was composed of smokers, and the control group, which was composed of non-smokers.

The instrument of the research was examination of spermogramme. The sample for testing is obtained by masturbating into a container 20 min. to one hour before examining its

quality. Before masturbation, the patient is given instructions on sexual abstinence, which must not be shorter than two days and not longer than 5 days, and the recommendable period is 3 – 4 days. If the patient is not capable to produce the semen in the laboratory, he is advised to do it at home under condition that he delivers the semen within one hour. He has to make sure that the semen does not get cold or that it is not exposed to large temperature variations. After measuring the period of liquefaction, the organoleptic properties were determined. They include the volume, acidity (Ph), color and consistency of the examined sperm. What was analyzed was the ejaculate volume, the number of spermatozooids, their motility – total and progressive, as well as the presence of possible abnormalities on the spermatozooids.

The ejaculates analysis was performed according to the WHO criteria. While examining infertile subjects we used the following scheme of differentiation:

- General anamnesis
- Andrological anamnesis
- Phimosi and paraphimosi
- General examination
- Clinical examination
- Andrological examination( outer genitalia, internal genitalia, ejaculate volume – it should range from 2 – 6 ml. , ejaculate acidity, microscopic examination, biochemical examination, prostate exprimate)

According to the aim of the paper, we collected the information on examinees focusing on the separate group they belonged to and we observed the characteristics of a particular phenomenon. Depending on the type of the feature, we applied parametric and non-parametric statistical methods when analyzing our data.

## 4. RESULTS

The research included 150 examinees that have been treating their male infertility. The examined group consisted of 88 and the control group of 62 examinees.

In most cases the age of examinees ranged from 30 – 35 years.

By comparing the ejaculate volume in infertile examinees that belonged to the group of smokers ( 4.22 ml.) to the group of infertile examinees that did not have smoking habit ( their ejaculate volume was 4.39), shown in table no.1, a statistically significant difference was obtained in ejaculate volume of infertile patients according to their smoking habit (T = 394, p< 0.05).

By comparing the number of spermatozooids in 1 ml. of ejaculate ( Chart 1) in infertile examinees that belonged to the group of smokers 10.47x10<sup>6</sup> ml. to the same number in infertile non-smokers , no statistically significant difference was obtained ( T=243, p>0.05) .

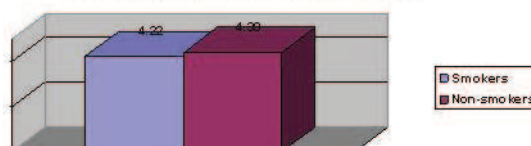
Table no.1: Distribution of ejaculate volume in infertile examinees according to smoking habit

Ejaculate volume	Statistical parameters					
	N	Average value	SD	MED	Min	Max
Smokers	88	3.23	0.74	3.2	1.4	4.8
Non-smokers	62	3.24	0.95	3.1	1.4	4.9

p<0.05

\*Values of statistical parameters are expressed in %

Fig 1. Number of spermatozooids in 1 ml of ejaculate in smokers and non-smokers



The next parameter to be compared was total motility of spermatozooids in those examinees who belonged to the group of smokers ( 37.13%) to the group of infertile examinees without smoking habit (43.57%) (table no. 2). Here there is statistically significant difference in total motility of spermatozooids in favor of non-smokers (  $p<0.05$ ). It is evident that the total motility of spermatozooids was significantly lower in infertile examinees that had smoking habit.

Table no.2: Distribution of total motility of spermatozooids in infertile examinees according to smoking

Total motility of spermatozooids	Statistical parameters					
	n	Average value	SD	MED	Min	Max
Smokers	88	37.13	10.21	40	18	50
Non-smokers	62	43.57	5.76	44	28	49

$p<0.05$  \* Values of statistical parameters are expressed in %

Table no.3: Distribution of progressive motility of spermatozooids in relation to smoking

Percentage of abnormal forms of spermatozooids	Statistical parameters					
	N	Average value	SD	MED	Min	Max
Smokers	88	46.45	9.72	48.5	24	64
Non-smokers	62	42.82	9.34	44.5	25	58

$p<0.05$  \* Values of statistical parameters are expressed in %

Table no 4. Participation of abnormal spermatozooids in total structure of spermatozooids

Percentage of abnormal forms of spermatozooids	Statistical parameters					
	N	Average value	SD	MED	Min	Max
Smokers	88	46.45	9.72	48.5	24	64
Non-smokers	62	42.82	9.34	44.5	25	58

$p<0.05$  \* Values of statistical parameters are expressed in %

The research included monitoring of progressive motility of spermatozooids. In the examined group of smokers, the progressive motility of spermatozooids was 8.03%, whereas at the same time, in non-smokers it was 9.05 (table no. 4). Table 3 shows that there is statistically significant difference in progressive motility of spermatozooids between the examined infertile smokers and non-smokers patients (T=381,  $p<0.05$ ). It is evident that smoking habit reduces progressive motility of spermatozooids.

By comparing percentages of abnormal forms of spermatozooids in infertile examinees belonging to groups of smokers and non-smokers, the value was 46.45% in smokers whereas in group of infertile examinees that did not have smoking habit it was 42.82% ( table 4). It was evident that there is statistically significant difference in relation to presence of abnormal spermatozooids in both smokers and non-smokers as to the total structure of spermatozooids ( T= 386,  $p<0.05$ ).

The obtained data show that in examinees that were smokers there is significantly higher percentage of abnormal forms of spermatozooids.

## 5. DISCUSSION

Today, smoking has all features of a pandemic and it has been estimated that worldwide there is 1.3 billion smokers, out of which 70% falls to developing countries. This disease represents the leading factor of mortality in mid-age period in 54% men and 32% women and the trend is increasing. In 2002, 4 million deaths have been recorded due to smoking and it has been estimated that in 2020 there is going to be 10 million. The intensity and duration of smoking as well as the degree of nicotine addiction are directly related to deterioration of health (8).

Some four thousand various chemical substances have been identified in tobacco smoke, and some of them poisonous by themselves. Therefore, it is obvious why tobacco smoke affects all cells and tissues of a human organism. Chemical substances affect male reproductive organs directly thus affecting testis and their capacity to produce spermatozooids in a process of spermatogenesis. (9; 10). These mechanisms can affect hormonal control of spermatogenesis or they can directly affect the germinal epithelium, and Sertoli's cells in seminiferous tubules(11). Studies have proved that men smokers have 17 percent less spermatozooids than non-smokers. Smoking not only reduces the number of spermatozooids but also its good quality. Researches have proved that in men who stop smoking, the quantity of sperm has increased up to eight times (12).

Five out of six men in which no increase of number or quality of spermatozooids occurred are long-term chronic smokers, whereas three men in whom an improvement occurred were only temporary smokers (13, 14, 15).

Apart from this, there are numerous pieces of evidence on increase of abnormal forms of spermatozooids as well as on decrease of motility and number of spermatozooids in men that have smoking habit (16).

## 6. CONCLUSION

- Results of the research on relation of smoking to infertility in men have proved that:
- Ejaculate volume is significantly larger in non-smokers than in smokers.
- In non-smokers, there is statistically significant higher total motility of spermatozooids.
- It is evident that smoking disease decreases progressive motility of spermatozooids.
- Smoking disease causes higher percentage of abnormal forms of spermatozooids.
- Therefore, every smoker should be encouraged to stop smoking, particularly if pregnancy is planned.

## Apstrakt

**Uvod:** Infertilitet se definiše kao izostanak trudnoće nakon jedne godine, kod parova koji imaju redovne seksualne odnose, a bez upotrebe kontracepcije. Pušenje, kako je potvrđeno brojnim studijama, može biti povezano sa slabijim fertilitetom kod muškaraca, kao posljedica smanjenja broja i slabljenja pokretljivosti spermatozoida, kao i sniženja nivoa morfološki normalne sperme.

**Cilj:** utvrđivanje povezanosti infertiliteta kod muškaraca i pušenja.

**Metodologija:** Uzorak su činili ispitanici koji su liječeni od infertiliteta na Urološkoj klinici Kliničkog centra u Podgorici, koji su podijeljeni na ispitivanu i kontrolnu grupu prema pušačkom statusu. Analiziran je miris, izgled i biohemijski sastav ejakulata, sa posebnim osvrtom na volumen ejakulata, broj i pokretljivost spermatozoida i postojanje eventualne abnormalnosti na njima.

**Rezultati:** Analiza dobijenih podataka ejakulata pušača i nepušača, pokazala je da postoji statistički značajna razlika u volumenu ejakulata, ukupnoj i progresivnoj pokretljivosti spermatozoida i postojanju abnormalnih spermatozoida, na račun nepušača. Naime, evidentno je da je kod nepušača veći volumen ejakulata, bolja pokretljivost i manji broj abnormalnih spermatozoida. Istovremeno je pokazano da ne postoji statistički značajna razlika u broju spermatozoida pušača i nepušača.

**Diskusija:** Duvanski dim predstavlja veliku opasnost za cijeli organizam. Hemijske supstance iz duvanskog dima pogađaju muške reproduktivne organe direktno utičući na testise i njihovu sposobnost da proizvode spermatozoide kroz proces poznat kao spermatogeneza. Studije su dokazale da muškarci pušači imaju 17 posto manje spermatozoida od nepušača. Pušenje ne smanjuje samo broj spermatozoida, već i njihov kvalitet. Istraživanja su pokazala da se muškarcima koji prestanu pušiti količina sperme povećala za 8 puta.

**Zaključak:** Rezultati istraživanja povezanosti pušenja i infertiliteta kod muškarca su pokazali da je volumen ejakulata značajno veći kod nepušača, bolja ukupna pokretljivost spermatozoida, kao i progresivna pokretljivost spermatozoida. Osim toga, pokazano je da bolest pušenja ima veći procenat abnormalnih formi spermatozoida.

Stoga, svakog pušača bi trebalo ohrabrivati da prestane da puši, pogotovo ako se planira trudnoća.

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