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Original Scientific Paper

SMOKING EFFECT ON OXIDATIVE STRESS AND ANTIOXIDANT CAPACITY OF CERVICAL MUCUS IN WOMEN WITH PRIMARY IDIOPATHIC STERILITY – OBSERVATIONAL CASE-CONTROL STUDY

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SUMMARY – The aim of the study was to determine the effects of smoking on cervical mucus in women with primary idiopathic sterility. A prospective, case-control, observational, quantitative, and analytical study was carried out over a five-year period through ambulatory care. The first part of the study involved 140 healthy women (85 smokers and 55 non-smokers). The second part included 90 women (58 healthy, 32 suffering from sterility), grouped according to their smoking status. Concentrations of total proteins in cervical mucus solutions and homogenates of cervical surface cells and their mitochondria, thiocyanate and ascorbic acid, rhodanese activity, concentrations of cytochrome P-450 (mitochondria), lipid peroxidation and the total antioxidant capacity in homogenates of cervical surface cells, concentrations of superoxide O2, reduced gluthatione (GSH), advanced oxidation protein products (AOPP), and ferric reducing ability of plasma (FRAP) were measured. The measurements showed higher concentrations of thiocyanate, cytochrome P-450 and lipid peroxidation values, and lower concentrations of ascorbic acid, cytochrome P-450 activity and FRAP in smokers. Higher concentrations of superoxide O2, GSH, AOPP, and lower FRAP were found among smokers and women suffering from sterility. In conclusion, changes in oxidative stress and antioxidant capacity caused by smoking indicate that the quality of cervical mucus among patients suffering from sterility is lower compared to healthy women.

Keywords: *Smoking; Cervical mucus; Primary idiopathic sterility; Oxidative stress; antioxidant capacity*

Introduction

Tobacco smoke is a heterogeneous mixture of approximately 4,000 inorganic and organic, simple, and complex compounds, 42 of which directly cause cancer as shown in studies in animals (1, 2). In addition, it contains substances that can decrease the oxidative capacity of the human body by increasing the concentration of free radicals that damage proteins, lipids, carbohydrates, and DNA. Smoking also decreases the level of antioxidants in the body (3).

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It is not known if smoking causes a decrease in the antioxidant capacity of cervical mucus and whether such a change has any impact on the quality of cervical mucus and fertility.

Reduced L-gluthatione (GSH) is the primary cellular and tissue antioxidant, directly involved in neutralizing free radicals and maintaining external antioxidants in their reduced (active) form. Its prime role is the protection of cellular components from damage caused by hydroxy peroxides during normal metabolism (4).

Ascorbic acid is a potent natural antioxidant, which rapidly decomposes free radicals from cigarette tobacco smoke (5), and its concentration is 40% lower in the blood, plasma, and leukocytes of active smokers compared to non-smokers (6).

The mainstream smoke from one packet of cigarettes contains approximately 4.2 g of cyanide (CN-). However, this cyanide poses no threat to smoker's life because the enzyme rhodanese rapidly converts it into the less harmful compound thiocyanate (SCN) through sulfuration (7).

Thiocyanate (also known as rhodanide) is the product of the enzyme rhodanese, which also has antioxidant properties. It is the preferred substrate for lactoperoxidase, an enzyme that catalyzes the production of hydrogen peroxide and hypothiocyanite (8).

Tobacco smoke decreases the activity of the cellular cytochrome P-450, consequently slowing down cellular detoxification processes (9). The chromoprotein cytochrome P-450 participates in the detoxification, i.e. in the oxidation of many compounds alien to the human organism. Research has shown a high concentration of cytochrome P-450 in the liver and the placenta of women who smoke cigarettes (10).

The ferric reducing ability of plasma (FRAP) assay measures the reductive capacity of antioxidant substances through a colorimetric reaction. Results strongly depend on the type of radicals used (11). This method allows for the assessment of the antioxidant capacity of cervical mucus.

Advanced oxidation protein products (AOPP) are indicators of oxidative stress. Their levels increase in the presence of a large number of free radicals. They behave as real mediators of inflammation and have the capacity to synthesize inflammatory cytokines in neutrophils and monocytes (12).

The aim of this study was to determine the concentrations of smoking-specific markers in cervical mucus and to compare the findings between participants with and those without primary idiopathic sterility.

Participants and methods

Participants

This was a prospective, case-control, applicative, observational, quantitative, and analytical study that was conducted at University Hospital "Merkur", Zagreb, Croatia, from January 1, 2013 to December 31, 2018. The study was divided into two parts. The first part involved 140 women (85 smokers and 55 non-smokers) who presented for a routine gynecological examination, had normal gynecological findings, no chronic diseases, were not on medication and did not suffer from sterility (at least one pregnancy). A cervical mucus sample was taken from all consecutive participants visiting the outpatient clinic and meeting the inclusion criteria. Smokers were divided into two subgroups: participants who consumed <10 cigarettes per day (n=45) and those who consumed ≥10 cigarettes per day (n=40). The first part of the study involved determining total proteins in the cervical mucus solution, the homogenate of cervical surface cells and their mitochondria. In the cervical mucus, the concentrations of thiocyanate and ascorbic acid were measured, while rhodanese activity, cytochrome P-450 concentration (also in mitochondria), lipid peroxidation value, and total antioxidant capacity were measured in the homogenate of cervical surface cells. In the second part of the study, which included comparisons in relation to sterility and involved 90 participants, of whom 58 had normal fertility (at least one pregnancy) and 32 had primary idiopathic sterility, the concentrations of superoxide O_2, GSH, AOPP, and FRAP were measured. Participants were also divided into subgroups according to their smoking status. The abnormal Pap test result and partner's pathological spermiogram were exclusion criteria. There was no selection bias as participants meeting study criteria were included consecutively. The incidence of smoking and sterility did not change during the study, so there was no need to adjust the data with respect to time elapsed.

After obtaining ethical approval (UH "Merkur" Ethics Committee) all participants signed informed consent.

Methods

All biochemical tests were performed at the Institute of Biology, School of Medicine, University of Zagreb.

Cervical smear samples were taken with a spatula from all participants and placed in corresponding plastic test tubes. This procedure was performed only in women who, upon vaginal examination, were found to be in the pre-ovulatory phase of the menstrual cycle, which is the most favorable time for collecting biological material (13). The mucus samples were transported to the laboratory for analysis on the same day.

The samples, obtained from all parts of the cervical canal of participants, were dissolved in a 0.1 M phosphate buffer with a pH of 7.5 and prepared according to the method proposed by Sasson et al (13) and Schiffman et al (14).

Biochemical tests were performed on the supernatant of cervical mucus and, in part, on the cellular organelles obtained from cervical smear samples. All tests on frozen samples were carried out within one month of sample collection.

The concentration of proteins was determined (15), as well as the level of thiocyanate in the cervical mucus (16). The level of ascorbic acid (vitamin C) (17), cytochrome P-450 (18) concentration, and the rhodanese activity (7) were also measured. The enzyme complex cytochrome oxidase (ferricytochrome c oxidoreductase, EC 1.1.3.1.) in the mitochondrial fraction of cervical cells (9), the activity of the enzyme complex cytochrome oxidase (19), and lipid peroxidation (20, 21) were also determined . The total antioxidant capacity, i.e., total antioxidants in cervical mucus, was determined by measuring the reduction of ferric ion (FRAP) (11), the superoxide (22), GSH (23), and AOPP (14). Spectrophotometric measurements were performed on Ultrospec 1000E (Pharmacia Biotech, Great Britain).

Statistical analysis

The number of participants needed was calculated based on the results of the first 17 participants (power of 80%, α=0.05; β=0.20). Categorical data are presented as absolute and relative frequencies, numerical data as mean values with standard deviations in case of normal distribution, and as median and interquartile range in other cases; normality of distribution was tested using the Shapiro-Wilk test. Differences in normally distributed numerical variables between two independent groups were tested using Student's t-test (alternatively, the Mann-Whitney U test) and among more than two independent groups using analysis of variance (alternatively, Kruskal-Wallis test). Differences in categorical variables were tested using chi-squared (χ^2) test and, when necessary, Fisher's exact test. The correlation between numerical variables with distribution deviating from normal was assessed with Spearman's correlation coefficient ρ (rho). A ROC analysis was carried out and sensitivity and specificity for each variable were determined as a diagnostic test for sterility. The data obtained through the ROC analysis were used to calculate the odds ratio (OR) for sterility in the case of a finding higher than the critical concentration of a parameter. All P-values are two-sided. The level of significance was set at α=0.05. Due to repetition of measurements on the sample in case of failure of the first measurement, we had no participants with missing data. The data were analyzed using MedCalc statistical software program, version 14.8.1.

This study is presented in accordance with guidelines for observational studies (STROBE) (24).

Results

Of 140 women included in the first part of the study, aged between 19 and 46 (median, 30), 85 were smokers (45 women smoked <10 cigarettes per day and 40 women smoked ≥10 cigarettes per day) and 55 non-smokers, with no age difference among them (Z=1.011; P=0.314). Total proteins in the cervical mucus solution, the homogenate of cervical surface cells, and their mitochondria showed minor differences that were not statistically significant (Table 1).

The level of thiocyanate in participants who smoked ≥10 cigarettes per day was as much as 17.3 times higher than that in non-smokers and 7.5 times higher than that in participants who smoked <10 cigarettes per day (Table 2). Compared to non-smokers, participants who smoked up to 10 cigarettes per day and

Table 1. Total proteins in the cervical mucus solution, the homogenate of cervical surface cells, and their mitochondria

		Cervical mucus (mg/mL)	Homogenate (mg/mL)	Mitochondria (mg/mL)
Non-smokers (n=55)		6.94±1.59	5.43±1.05	3.62±0.87
Smokers	<10 cig/day (n=45)	7.16±1.68	5.64±1.01	3.77±0.84
	≥10 cig/day (n=40)	7.28±1.82	5.59±1.17	3.49±0.86
ANOVA. Cervical mucus: F=2.494, P=0.088; homogenate: F=0.845, P=0.919; mitochondria: F=0.096, P=0.909				

F – test value; P – statistical probability; descriptive statistics – mean and standard deviation.

Table 2. Values of thiocyanate, ascorbic acid, rhodanese, cytochrome P-450, lipid peroxidation, and total antioxidant capacity of the cervical mucus of fertile participants in relation to smoking

	Non-smokers	Smokers		Statistics	
		<10 cig/day	≥10 cig/day	ANOVA	*post hoc* (Bonferroni)
Thiocyanate (nm/mL)[1]	7.26±1.36	16.87±3.25	25.70±2.33	F=34.905; P<0.001	P<0.001 for all
Ascorbic acid (μ/mL)[1]	42.08±3.81	16.73±2.28	10.16±1.22	F=27.421; P<0.001	P<0.001 for all
Rhodanese (μM/min/mg of protein)[1]	11.63±2.23	12.21±2.56	12.04±3.43	F=0.673; P=0.513	
Cytochrome P-450 (nm/mg of protein)[1]	0.09±0.04	0.24±0.12	1.04±0.22	F=21.123; P<0.001	P<0.001 for all
Cytochrome P-450 activity (nm/mg of protein)[2]	14.34±4.45	1.37±6.97	0.14±0.07	F=20.150; P<0.001	P<0.001 for all
Lipid peroxidation (nm of malondialdehyde/mg of protein)[1]	1.12±0.01	1.26±0.03	1.15±0.03	F=2.398; P=0.109	
Lipid peroxidation (nm of malondialdehyde/mg of protein)[3]	36.23±1.48	42.56±1.62	55.82±2.21	F=29.547; P<0.001	P<0.001 for all
Total antioxidant capacity (FRAP) (μM/L)[3]	7,080±532	5,997±628	4,761±491	F=29.547; P<0.001	P<0.001 for all

[1]homogenate, [2]mitochondria, [3]cervical mucus; descriptive statistics–mean and standard deviation; FRAP – ferric reducing ability of plasma.

those who smoked >10 cigarettes per day had 2.5 and 4 times lower levels of vitamin C, respectively. Cigarette smoking did not alter the activity of the enzyme rhodanese, i.e., the level of cyanide. Non-smokers had a lower concentration of cytochrome P-450 by about 22 times compared to participants who smoked ≥10 cigarettes per day. The concentration of cytochrome P-450 in participants who smoked was 4.3 times higher.

Cytochrome showed a significantly lower activity in participants who smoked. The cytochrome results differed by approximately hundredfold between participants who did not smoke and those who smoked ≥10 cigarettes per day. The activity of cytochrome oxidase in the mitochondria of the samples taken from participants who smoked <10 cigarettes per day was by 29% lower compared to that of non-smokers.

There were no significant differences in lipid peroxidation among the observed groups, while all samples were mutually different at the level of 10%. Assuming that all lipid peroxide diffused into cervical mucus from the bloodstream or from decomposed epithelial cells of the cervical surface, we measured lipid peroxidation in the homogenate of cervical surface cells. Significant differences were observed, and the highest value was measured in participants who smoked ≥10 cigarettes per day.

The highest FRAP value was found in the cervical mucus of participants who did not smoke, while the lowest value was recorded in participants who smoked ≥10 cigarettes per day (Table 2).

A positive correlation was found between thiocyanate and cytochrome P-450 (r_s=0.47, P=0.030), a negative correlation between thiocyanate and ascorbic acid (r_s =-0.45, P=0.001), and a negative correlation between thiocyanate and the activity of the enzyme cytochrome oxidase (r_s=-0.72, P=0.001).

The second part of the study involved 90 participants whose median age was 29 years (range from 18 to 35). Of these 90 participants, 58 had normal gynecological findings and 32 had primary idiopathic sterility. Twenty-nine participants were smokers, with 19 of them smoking <10 cigarettes per day and 10 smoking

Table 3. Concentrations of superoxide O_2, reduced glutathione (GSH), advanced oxidation protein products (AOPP), and ferric reducing ability of plasma (FRAP) in participants in relation to sterility and smoking

Sterility	Smoking	Superoxide O_2 (μM/min/mL)	GSH (μM/mL)	AOPP (μM/L)	FRAP (μMFESO$_4$/L)
No	No	2.44 (1.85-4.22)	14.21 (13.02-15.85)	3.57 (1.98-4.08)	396.05 (389.00-416.80)
	<10 cig/day	6.48 (5.68-7.75)	26.35 (24.38-28.64)	9.20 (8.50-11.20)	284.20 (274.60-294.10)
	≥10 cig/day	8.08 (7.39-8.72)	33.38 (31.98-35.90)	11.88 (10.01-13.08)	247.60 (235.40-264.10)
Yes	No	4.26 (3.98-5.47)	24.85 (22.38-30.12)	18.00 (15.20-22.30)	282.10 (265.80-295.90)
	<10 cig/day	10.12 (9.43-11.25)	54.41 (44.00-57.44)	29.53 (22.94-35.14)	200.50 (177.80-212.00)
	≥10 cig/day	13.22 (12.57-14.21)	82.73 (77.12-86.92)	37.75 (34.60-38.72)	162.40 (127.30-176.90)
Statistical values[1]		χ^2=57.843, P<0.001	χ^2=74.635, P<0.001	χ^2=76.420, P<0.001	χ^2=70.602, P<0.001

[1]Kruskal-Wallis test, *post hoc* Mann-Whitney, all P<0.05; descriptive statistics – median and interquartile range.

Table 4. Coefficients of correlation between the concentrations of superoxide O_2, reduced glutathione (GSH), advanced oxidation protein products (AOPP), and ferric reducing ability of plasma (FRAP), and sterility and cigarette smoking, and a comparison of correlation coefficient values

		Sterility	Smoking	Difference	
				Z	P
Superoxide O_2 (μM/min/mL)	r_s	0.465	0.693	-2.309	0.021
	P	<0.001	<0.001		
	N	90	90		
GSH (μM/mL)	r_s	0.651	0.679	-0.331	0.741
	P	<0.001	<0.001		
	N	90	90		
AOPP (μM/L)	r_s	-0.815	-0.521	3.720	<0.001
	P	<0.001	<0.001		
	N	90	90		
FRAP (μMFESO$_4$/L)	r_s	-0.739	-0.498	2.649	0.008
	P	<0.001	<0.001		
	N	90	90		

r_s – value of Spearman's correlation coefficient; P – statistical probability; Z – value of the correlation coefficient comparison test.

≥10 cigarettes per day. Among 32 participants with diagnosed sterility, 13 were smokers, while among those without sterility there were 16 smokers, which did not represent a statistically significant difference (χ^2=1.605, P=0.205). Most women had a normal body mass index (BMI). No age difference was found between participants without sterility (median 29 years, interquartile range 18-35) and those with sterility (median 30 years, interquartile range 18-35) (Z=-1.249, P=0.212). The median BMI was 22.2 kg/m^2 (interquartile range 20.2-24.9) in participants without sterility and 23.3 kg/m^2 (interquartile range 21.71-27.02) in participants with sterility, showing no difference between the two groups (Z=-1.859; P=0.063). No difference between smokers and non-smokers was found in age (Z =-0.143, P=0.886) or BMI (Z=-0.445, P=0.657).

For all tested variables (superoxide O_2, GSH, AOPP and FRAP), significant statistical differences in concentrations and activities in relation to fertility and smoking were observed (Table 3). There was a correlation between superoxide O_2 and sterility, and a higher correlation in relation to cigarette smoking (Table 4). Participants who had a higher concentration of superoxide O_2 also had a higher incidence of sterility. Likewise, participants who smoked more cigarettes had a higher concentration of superoxide O_2. A correlation was found between smoking and sterility, and the concentration of GSH, with no difference in coefficient values. The correlation coefficient between AOPP and sterility was higher than that between AOPP and cigarette smoking. Likewise, the correlation between FRAP concentration and sterility was higher than that between FRAP concentration and smoking, although all correlation coefficients were statistically significant.

For sterility, ROC analysis was used to evaluate the diagnostic potential of variable concentrations (Table 5), identifying those at which the relationship between sensitivity and specificity was optimal. The odds ratio was calculated for each variable, indicating the degree of probability that a participant with a critical concentration would have sterility issues (Table 6).

Table 5. Results of the ROC-analysis of the concentrations of superoxide O_2, reduced glutathione (GSH), advanced oxidation protein products (AOPP), and ferric reducing ability of plasma (FRAP) in relation to sterility

	AUC	Sensitivity	Specificity	+LR	-LR	Z	P
Superoxide O_2 (μM/min/mL) >3.41	0.780	93.75%	55.17%	2.09	0.11	5.805	<0.001
GSH (μM/mL) >17.25	0.893	100%	72.41%	3.62	0.00	12.315	<0.001
AOPP (μM/L) <13.41	0.991	93.75%	100%		0.063	65.583	<0.001
FRAP ($\mu MFESO_4$/L) <223.4	0.946	93.75%	89.66%	9.06	0.07	18.926	<0.001

Classification variable – sterility; AUC – area under the curve; +LR – positive predictive value; -LR – negative predictive value; Z – test value; P – statistical probability.

Table 6. Calculated odds ratios for the concentrations of superoxide O_2, reduced glutathione (GSH), advanced oxidation protein products (AOPP) and ferric reducing ability of plasma (FRAP) showing the most useful ratio of sensitivity and specificity in relation to sterility

Sterility	Odds ratio (95% CI)	Z	P
Superoxide O_2 (μM/min/mL) >3.41	16.071 (3.511-73.572)	3.578	<0.001
GSH (μM/mL) >17.25	154.143 (8.930-2,660.579)	3.467	0.001
AOPP (μM/L) <13.41	855.000 (74.458-9,817.995)	5.421	<0.001
FRAP ($\mu MFESO_4$/L) <223.4	109.286 (21.307-560.534)	5.627	<0.001

CI – confidence interval; Z – test value; P – statistical probability.

Discussion

Our results demonstrate that cigarette smoking does not significantly alter the synthesis of total proteins in the body, but there are no similar data published to make the comparison. However, this does not mean that the activity of enzymes did not change. By acting at the level of genes, free radicals accelerate the process of transformation of normal cells into cancerous ones (25, 26), alter the structure of certain amino acids and proteins (27), and decompose cellular lipids through the process of lipid peroxidation (5).

Westley (28) found two enzymes in the body that are active in the detoxification of cyanide to thiocyanate: rhodanese and mercaptopyruvate sulfurtransferase. Reactions of rhodanese with cyanide are rapid, almost instantaneous (29), unlike those of the other enzyme (30).

Participants who smoked >10 cigarettes per day had as much as a 12 times higher level of thiocyanate in the secretion of cervical cells compared to non-smokers. Participants who smoked <10 cigarettes per day also showed a higher concentration, which correlates with previously published results by other researchers (16, 29, 30). We were unable to compare thiocyanate levels in our study with those of other researchers because, to our knowledge, this was the first study that determined the concentration of thiocyanate in cervical smears.

Some of the thiocyanate measured in cervical cell secretion may have been produced elsewhere in the body and transported to the cervical area via the bloodstream. As the activity of rhodanese was measured in the cells of various human organs (31), we believe that this enzyme is also active in the cervical cells. The activity of rhodanese in the tested samples of non-smokers and of both groups of smokers was identical, as was in human plasma and some organs (28). This shows that cigarette tobacco smoke does not contain any components that would alter the activity of this enzyme. Based on these results, we concluded that cervical cells, and likely the entire uterus, have an enzyme system for cyanide detoxification, similar to that found in many other organs (10, 28, 29).

Cyanide inhibits the activity of cytochrome oxidase (32). In our study, cigarette smoking decreased cytochrome oxidase activity in the mitochondria of cervical secretory cells. At the same time, the activity of cytochrome oxidase in the mitochondrial fraction of cervical epithelial cells of women who smoked <10 cigarettes per day was considerably higher than in women who smoked ≥10 cigarettes per day, but lower than in non-smoking participants.

To our knowledge, this is the first study that determined cytochrome oxidase activity in the mitochondrial fraction of cervical cells, indirectly confirming the assertion that ATP synthesis is decreased in smokers' cells (33). Moreover, participants who smoked may havehad a smaller amount of ATP, which in turn could have an impact on the vitality of spermatozoa.

The cellular homogenate of both groups of smokers contained a greater amount lipid peroxidation products than the homogenate of cervical cells of non-smokers, which confirms that cigarette smoking increases the degree of lipid peroxidation (5, 10, 34). These results reveal that cigarette tobacco smoke increases the level of lipid peroxidation in cervical cells, probably due to a specific activity of oxygen free radicals on the lipid structures of cells.

Decreased antioxidant capacity of plasma and increased lipid peroxidation are the most certain indicators of oxidative stress(23, 25). The antioxidant capacity of the cervical mucus of participants who smoked ≥10 cigarettes per day was by approximately 30% lower than the level of total antioxidants in non-smoking participants. The two subgroups of smokers showed little difference in the antioxidant capacity values.

Our results showed that smoking decreases the level of vitamin C in the cervical smears of smokers. These results correlate with Murata's observations (35).

Active cigarette smoking increased the concentration of thiocyanate in cervical mucus and, at the same time, decreased the activity of the enzyme cytochrome oxidase in the mitochondria of cervical epithelial cells. The number of cigarettes smoked grew almost linearly with the concentration of thiocyanate and the decrease in the activity of cytochrome oxidase. A similar relationship was found between thiocyanate and vitamin C concentrations. We cannot assert that cyanide is the component responsible for the lower concentration of vitamin C in smokers. Concentrations of both thiocyanate and cytochrome P-450 were increased in smokers. However, with an increase in the number of cigarettes smoked, the concentration of thiocyanate

increased more rapidly than that of cytochrome P-450 in the same smokers.

Similar relationship exist between vitamin C and cytochrome P-450. These parameters are inversely proportional, but the decrease in the concentration of vitamin C in smokers was greater than the increase in the concentration of cytochrome P-450 in the same participants.

We tried to meaningfully explain the results and conclude about their significance through comparisons with other research concerning pathophysiological processes related to smoking. An advantage of our study was the simplicity of sample collection to determine cervical mucus quality and clarify the role of smoking as a risk factor for primary idiopathic sterility. The shortcoming was the fact that patients classified as non-smokers could have been, and probably had been, passively exposed to tobacco smoke. The only certain way to determine the smoking status of participants is to measure the concentrations of cotinine and nicotine in urine and plasma, which was not performed in the our study. One potential limitation is the smoking status of the women, as smokers often tend to underreport the number of cigarettes they smoke.

Conclusion

The incidence of primary idiopathic sterility was associated with the concentrations of substances that indicate the level of oxidative stress. Also, the body's capacities to fight oxidative stress were lower. Additional clinical studies on larger samples are needed to shed further light on the association between nicotine and the level of nicotine-induced oxidative stress in patients' cervical mucus and the consequent sterility.

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Conflict of interest

The authors declare no conflict of interest.

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Sažetak

UČINAK PUŠENJA NA OKSIDATIVNI STRES I ANTIOKSIDANTSKA SPOSOBNOST SLUZI VRATA MATERNICE U ŽENA S PRIMARNIM IDIOPATSKIM STERILITETOM – OPSERVACIJSKO ISPITIVANJE SLUČAJEVA I KONTROLA

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Cilj rada bio je ispitati učinke pušenja na sluz vrata maternice u žena s primarnim idiopatskim sterilitetom. Provedeno je prospektivno, opservacijsko ispitivanje slučajeva i kontrola tijekom petogodišnjeg razdoblja kroz ambulantnu skrb. U prvom dijelu istraživanja sudjelovalo je 140 zdravih žena (85 pušača i 55 nepušača). Drugi dio uključio je 90 žena (58 zdravih, 32 sa sterilitetom), grupiranih prema pušačkom statusu. Izmjerene su koncentracije ukupnih proteina u otopinama cervikalne sluzi i homogenatu površinskih stanica vrata maternice i njihovih mitohondrija, tiocijanat i askorbinska kiselina, aktivnost rodaneze, koncentracije citokroma P-450 (mitohondriji), peroksidacija lipida i ukupni antioksidativni kapacitet u homogenatima površinskih stanica vrata maternice, koncentracije superoksida O_2, reduciranog glutationa (GSH), proteinskih produkata napredne oksidacije (AOOP) i sposobnost plazme za redukciju željeza (FRAP). Utvrđene su više koncentracije tiocijanata, citokroma P-450 i peroksidacije lipida, te niže koncentracije askorbinske kiseline, aktivnosti citokroma P-450 i FRAP-a u pušačica. Više koncentracije superoksida O_2, GSH, AOPP i niže FRAP pronađene su među pušačicama i ženama koje pate od steriliteta. Možemo zaključiti da promjene oksidativnog stresa i antioksidativnog kapaciteta uzrokovane pušenjem upućuju na nižu kvalitetu cervikalne sluzi kod bolesnica koje pate od steriliteta u odnosu na zdrave žene.

Ključne riječi: *Pušenje; Cervikalna sluz; Primarni idiopatski sterilitet; Oksidativni stres; Antioksidativni kapacitet*