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CONDITION OF DENTAL HEALTH AMONG POPULATION LIVING UNDER INFLUENCE OF HEAVY METAL SALTS

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Epidemiological study of dental condition of people at the age of 35-44, living on territories polluted by heavy metals salts of low intensity, was conducted. The author has found that these people have higher prevalence of parodontal pathology, dentofacial anomalies, dental retention; caries intensity and number of non-erupted teeth enlarge.

Keywords: heavy metals salts, parodontitis, caries, dentofacial anomalies, disease prevalence, epidemiological study.

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Foreword. Ecological crisis is a stress condition between society and nature, characterized by disharmony (redundancy) of anthropogenic load on environment to ecological resources of biosphere. Ecological crisis is characterized not only reinforcement of human's influence on nature, but also heavy increase of transformed nature influence on people's health and social development [4].

Many chemical substances to a greater or lesser degree have negative effect on people's health, moreover their concentration in environment is important. Ecological factors, even if their level is not high, due to long exposure time can lead to serious decay of health. It is generally recognized that heavy metals are the most dangerous substances among other chemical pollutant for human's health. Dental health is an essential part of somatic health. Children are most vulnerable to heavy metal effect. That is why there are many scientific papers devoted to study of heavy metals influence on dental condition of children [1, 2, 10]. But this question concerning adults is little-studied.

Goal of research was to study prevalence of dental diseases among adults living on the territory polluted with heavy metal salts of law intensity.

Materials and Methods. Epidemiological study of 263 adults was conducted. All examined people were divided in 2 groups. The 1 group consisted of 91 adults living on hypothetically "polluted" territory where there was excessive content of Cr, Mn, Fe, Cu, Zn, Pb salts (territory "A"). The 2 group consisted of 172 adults living on hypothetically "clear" territory (territory "B"). "Card of epidemiological study" was filed for every person. Parodontium tissues were estimated according to CPITN index. Caries intensity was estimated according to CFE index (C – tooth with caries, F – filled tooth, E – extracted tooth). Dentofacial anomalies were differentiated according to intensity: low, middle or heavy [5]. Moreover non-erupted teeth were also taken to attention.

Prevalence of indicated pathology was calculated as P (95 % CL), where P is proportion of people with studied signs (%), 95% CL – confidential interval at 95% level of confidence probability of this proportion in people of general totality. Confidential interval for proportion was calculated according to Klopper-Pirson. Intensity of disease was expressed as mean (M) and its mistake (m). Update values of dichotomous scale in two groups of examined people was made according to one-sided accurate Fisher test and non-parametric tests (Mann-Whitney U-test, W-Wilcoxon, Sevige and Van der Waerden).

Age 35-44 years is standard monitoring group while examination of adults' dental health and also one of the "key" group while epidemiological study, thus in this report we made data analyses just in this group of people.

Study Findings and Discussion. Prevalence of parodontal diseases in this age group on both territories was 85.1%. In spite of close advantage of parodontal diseases in women over men, it is significant ($p<0.001$). Table 1 shows that citizen of territory "A" have higher index of pathology prevalency, than in the region. Women feel ill more often than men ($p>0.05$). Citizens of territory "B" have pathological signs less frequently than average value in the region. Men have parodontal diseases more often than women ($p>0.05$).

Comparative analyses of received data showed significant difference in prevalence of parodontal diseases among citizens of two territories. Thus, examined people from regions of ecological risk have signs of parodontal diseases more often ($p<0.05$). Moreover, it is true not for all examined together, but for men ($p<0.001$) and women ($p<0.05$) separately.

Table 1

Prevalence of parodontal diseases among population of 35-44 years

Sex	Prevalence on territory "A"		Prevalence on territory "B"		P
	n	% (95% CL)	n	% (95% CL)	
M	29	86.21 (68.34; 96.11) n=25	84	84.52 (74.99; 91.49) n=71	<0,001
F	62	93.55 (84.30; 98.21) n=58	88	79.55 (69.61; 87.40) n=70	<0,05
M+F	91	91.21 (83.41; 96.13) n=83	172	81.98 (75.40; 87.41) n=141	<0,05

Dental caries prevalence among population of two regions is equal, 100% of population have caries. Table 2 data shows that CFE of adults living on territory "A" amounted to 18.38±0.52 per examined person, that is 40% higher (p=3E-12) than have adults living on territory "B" (13.08±0.44), while average-Russian value is 13.14 [3]. Level of dental caries intensity among population living on territory "A" is characterized (according to recommendations of Health Protection Department) as "very high", but among population living on territory "B" it is characterized as "high". Comparative analysis showed that the rate of persons with different level of intensity on studied territories has substantial differences. Thus, "very low" level is not registered in any examined person from territory "A" and in 0.58% (95% CL: 0.01; 3.18) of persons from territory "B". "Low" level is registered 15 times rare on ecologically polluted territory 1.10% (95% CL: 0.03; 5.97) of population, when on the territory "B" it is 15.03% (95% ДСL: 10.06; 21.24). "Average" and "high" intensity level of caries on the territory "A" occur in equal proportion 14.29% (95% CL: 7.83; 23.19) of population and almost twice less frequently on the territory "B", where "average" level has 30.06% (95% CL: 23.33; 37.48), and "high" – 24.28% (95% CL: 18.09; 31.37) of examined population. "Very high" level has the most illustrative statistical differences. In "A" region it is found in 70.33% (95% CL: 59.84; 79.45) of citizens, and in "B" region – in 30.06% (95% CL: 23.33; 37.48). As in other groups for this age group from territory "A" higher statistically significant values of CFE components are typical: "C" for 1.7 times (p=3.33E-08), "F" for 1.3 (p=0.0002), "E" for 1.5 (p = 4.31E-05) times.

Among population of age 35-44 years living on the territory "A" prevalence of dentofacial anomalies amounts to 38.46% (95% CL: 28.45; 49.25) and 32.56% (95% CL: 25.62; 39.90), p>0.05 in citizens of territory "B". Rate of persons with non-erupted teeth is also higher on the territory "A" 12.09% (95% CL: 6.19; 20.60) in comparison with the territory "B" 10.98% (95% CL: 6.74; 16.62), p>0.05. The number of non-erupted teeth per examined person is increased on the polluted territory – 0.31±0.10 in comparison with 0.24±0.06 in not polluted territory (p<0.05).

According to the results a high intensity of parodontal diseases on polluted territories can be stipulated by negative effect of heavy metals on different elements of parodontitis pathogenesis. Bone tissue [6], immune and hematopoietic systems [9], endocrine organs [8] and others are very sensitive to the influence of xenobiotics. Organic disorders of these systems and organs can have cascade character in pathogenesis of parodontal diseases.

High level of caries intensity among population living on the polluted territory also can testify the influence of heavy metals on the development of curiosity. While examination of teeth microelement composition, it was determined higher concentrations of some metals in carious tooth in comparison with healthy tooth [10].

Besides generally known facts of caries development risk, its prevalence and intensity among children depends also on microelements composition of potable water [2]. It is expected that inclusion of metals in apatite of enamel microcrystals can change their chemical properties, especially solvability, consequently raising their sensibility to organic acids with further enamel degradation [7]. In the context of the foregoing, there is ground to consider that long-term effect of heavy metals is a risk factor of dental caries development.

Formation of dental arch, jaw relationships directly depends on condition of alveolar bone. Alveolar bone is one of the main structures of parodontium tissues complex. Its chemical composition is similar with teeth enamel; it consists of the same apatite crystals. Calcium ion substitution in apatite scale on metals or ion insertion of metals on vacant positions in crystals can lead to defect of bone functional status and change of its strength properties. This, in return, conduces to development of destruction in alveolar bone, development of parodontal pathology and formation of postprimary dentofacial anomalies.

Summary. Thus, on polluted with heavy metals territories among adults it is registered high prevalence of parodontal pathology, dentofacial anomalies, dental retention; caries intensity and number of non-erupted teeth enlarges.

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Table 2

Intensity of dental caries among population of 35-44 years (M+m)

Territory	n	CFE	C	F	E
"A"	91	18,38 ± 0,52	4,18 ± 0,25	9,31 ± 3,60	4,88 ± 0,39
"B"	173	13,08 ± 0,44	2,53 ± 0,16	7,30 ± 0,40	3,25 ± 0,27
P		3E-12	3E-08	0,0002	4E-05

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