


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

Y. Lakhtin, PhD of Medicine, Associate Professor
Kharkiv Post-graduate Medical Academy, Ukraine

Epidemiological study of the dental health status among population at the age of 35-44, living in the territories polluted with heavy metals salts of low intensity, was conducted. It was established that these people have higher prevalence of parodontal pathologies, dentofacial anomalies and dental retentions. Caries intensity and number of non-erupted teeth is higher.

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

Conference participant,
National championship in scientific analytics,
Open European and Asian research analytics championship

 Digital Object Identification: <http://dx.doi.org/10.18007/gisap.msp.v0i6.1048>

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

Many chemical substances to a greater or lesser extent negatively affect people's health. Moreover their concentration in environment is important. Ecological factors, even if their level is not high, can lead to serious decay of health due to the lasting exposure time. It is generally recognized that heavy metals are the most dangerous substances for human's health among other chemical pollutants. Dental health is an essential part of somatic health. Children are most vulnerable to heavy metals effect. That is why there are many scientific papers devoted to the study of heavy metals influence on dental status of children [1, 2, 10]. But this same question is poorly studied in relation to adults.

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

Materials and Methods. Epidemiological study of 263 adults was con-

ducted. All the examined people were divided into 2 groups. The I group consisted of 91 adults living in the hypothetically "polluted" territory with excessive content of Cr, Mn, Fe, Cu, Zn, Pb salts (territory "A"). The II group consisted of 172 adults living in hypothetically "clear" territory (territory "B"). "Card of epidemiological study" was filled for every person. Parodontium tissues were assessed according to CPITN index. Caries intensity was assessed 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 into consideration.

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

Age from 35 to 44 is a standard monitoring group at examination of adults' dental health and also one of the "key" groups at epidemiological studies. Therefore 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 citizens of territory "A" have higher index of pathology prevalence, than in the region. Women feel ill more often than men ($p > 0.05$). Citizens of the territory "B" have pathological signs less frequently than the mean value in the region indicates. Men have parodontal diseases more often than women ($p > 0.05$).

Comparative analyses of the received data has shown 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 the examined altogether, but for men ($p < 0.001$) and women ($p < 0.05$) separately.

Dental caries prevalence among population of two regions is equal, 100% of population have caries. Table 2 data shows that CFE of adults living in territory "A" amounted up

Tab. 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

to 18.38±0.52 per examined person, which is 40% higher ($p=3E-12$) than the index of adults living in territory "B" (13.08±0.44), while average-Russian value is 13.14 [3]. Level of dental caries intensity among population living in the territory "A" is characterized (according to recommendations of Health Protection Department) as "very high", but among population living in territory "B" it is characterized as "high". Comparative analysis showed that the rate of persons with different levels of intensity on the 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 more rare in the ecologically polluted territory - 1.10% (95% CL: 0.03; 5.97) of population, when in the territory "B" it is 15.03% (95% CL: 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 is 30.06% (95% CL: 23.33; 37.48), and "high" - 24.28% (95% CL: 18.09; 31.37) of the 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, higher statistically significant values of CFE components are typical for this age group from territory "A": "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 the age from 35 to 44 living in the territory "A" prevalence of dentofacial anomalies amounts up 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 in 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, high intensity of parodontal diseases in the 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 [8] and organs are very sensitive to the influence of xenobiotics. Organic disorders of these systems and organs can have cascade nature in pathogenesis of parodontal diseases.

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

In addition to the generally known facts of caries development risk, its prevalence and intensity among children also depends 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 and jaw relationships directly depend on the condition of alveolar bone. Alveolar bone is one of the main structures of

the parodontium tissues complex. Its chemical composition is similar to the 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 defects of bone functional status and changes of its strength properties. This, in return, conduces to development of destruction of alveolar bone, development of parodontal pathology and formation of postprimary dentofacial anomalies.

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

References:


1. Bezvushko E.V. Vpliv zabrudnennya navkolishn'ogo seredovishcha na stomatologichnu zakhvoryuvanist' ditei [The impact of environmental pollution on the children's dental morbidity rate]., E.V. Bezvushko, M.A. Klimchuk, Dovkillya ta zdorov'ya [Environment and Health]., 2008., Vol. 44, No. 1., pp. 65-68.
2. Den'ga O.V. Mikroelementi ta stomatologichne zdorov'ya dityachogo naseleennya [Microelements and dental health of the child population], O.V. Den'ga, O.M. Svitlichna, Yu.M. Vorokhta, Dovkillya ta zdorov'ya [Environment and Health]. - 2008., Vol. 44, No. 1., pp. 53-56.
3. Kuz'mina E.M. Stomatologicheskaya zaboлеваemost' naseleniya Rossii [Dental morbidity of population of Russia]., E.M. Kuz'mina. - Moscow., MSMSU, 1999. - 227 p.
4. Prokhorov B.B. Ekologiya cheloveka. Ponyatiino-terminologicheskii slovar' [Human Ecology. Conceptually-terminological dictionary]. - Rostov on Don., Feniks, 2005. - 476 p.

Tab. 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


5. Stomatologicheskoe obsledovanie: osnovnye metody [Dental examination: basic methods], translated from English by A.G. Kolesnika. - [3rd ed.]. – Geneva., WHO, 1989. - 62 p.

6. Bone manganese as a biomarker of manganese exposure: A feasibility study, A. Pejovic-Milic, D.R. Chettle, J. Oudyk [et al.], Am. J. Ind. Med. - 2009., Vol. 52, No. 10., pp. 742-750.  <http://dx.doi.org/10.1002/ajim.20737>


7. Davies B.E. The epidemiology of dental caries in relation to environmental trace elements, B.E. Davies, R.J. Anderson, Cellular and Molecular Life Sciences. - 1987., Vol. 43., No. 1.,

pp. 87-92.

8. Endocrine-disrupting chemicals: an Endocrine Society scientific statement, E. Diamanti-Kandarakis, J.P. Bourguignon, L.C. Giudice [et.al.], Endocr. Rev. - 2009., Vol. 30, No. 4., pp. 293-342.  <http://dx.doi.org/10.1210/er.2009-0002>

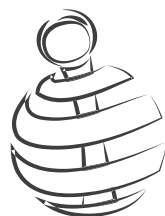
9. Immunosuppressive effect of subchronic exposure to a mixture of eight heavy metals, found as groundwater contaminants in different areas of India, through drinking water in male rats, S.H. Jadhav, S.N. Sarkar, G.C. Ram, H.C. Tripathi, Arch. Environ. Contam. Toxicol. - 2007., Vol. 53, No. 3., pp. 450-458.  <http://dx.doi.org/10.1007/s00244-006-0177-1>

org/10.1007/s00244-006-0177-1

10. Tvinnereimn H.M. Heavy metals in human primary teeth: some factors influencing the metal concentrations, H. M. Tvinnereimn, R. Eide, T. Riiset, Science of the total environment. - 2000., Vol. 255, No. 1-3., pp. 21-27.  [http://dx.doi.org/10.1016/S0048-9697\(00\)00436-8](http://dx.doi.org/10.1016/S0048-9697(00)00436-8)

Information about author:

Yuriy Lakhtin – Ph.D. of Medicine, Associate Professor, Kharkiv Post-graduate Medical Academy; address: Ukraine, Kharkiv city; e-mail: sumystom@yandex.ru



INTERNATIONAL ACADEMY OF INTELLECT AND QUALITATIVE PROGRESS

CERTIFICATION «ICSQ-775»

- ◆ Standart certification
- ◆ Operative certification



PATENTING IOSCEAAD-775

- ◆ Standart patenting
- ◆ Operative patenting



ACCREDITATION

- ◆ Authoritative accreditation
- ◆ Procedural accreditation
- ◆ Status accreditation
- ◆ Membership accreditation
- ◆ Expert accreditation



<http://academy.iuci.eu>