9. Методы микробиологического контроля почвы: Методические рекомендации. - М., 2004. - 12 с.

10. Системный подход при анализе эпидемического процесса: труды / ред. И.Х. Шуратов. НИИ эпидемиологии, микробиологии и инфекц. болезней. – Алма-Ата, 1987. – 121 с.

Тұжырым

Арал маңы елді мекені топырағының биологиялық факторлармен ластануын электрондық картаға түсіру, Жосалы кенті және Әйтеке-би кентінде олардың ең көп қарқындылығын және Шиелі кентінде кең таралуын анықтауға мүмкіндік берді.

Түйінді сөздер: биологиялық ластану, картаға түсіру, «тұқымданудың жиынтығы», ЖІТ, топырақ, Арал маңы

Summary

Visualization of soil contamination of the settlements of the Aral Sea biological factors on electronic maps allowed to reveal their greatest intensity in Zhosaly v. and Aiteke-bi v., and the prevalence of Shieli v.

Key words: biological contamination, mapping, "cumulative density", OKI, soil, Aral Sea region

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EVALUATION OF THE CYTOGENETIC STATUS OF THE POPULATION LIVING IN THE AREA BEFORE THE ENVIRONMENTAL CRISIS

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According to the world health organization (WHO) every fourth disease in the world has a direct link with the impact of environmental pollution in the pathogenesis of virtually every disease has a negative influence of ecological factors. In Kazakhstan remains a difficult environmental situation in the Aral sea, the legally recognized zone of ecological disaster. The problem of the dying Aral sea has caused an environmental catastrophe of nature the vast region of Central Asia. This environmental situation has a negative impact on public health, including genotoxic and can manifest as chromosomal aberration (CA).

Key words: DNA, chromosomal aberrations, heavy metals, genotoxic, structural anomalies, the Aral sea area

Relevance. The negative impact of adverse environmental factors on population health have acquired a special significance for the world in General, and for Kazakhstan. The tragedy of the dying Aral sea has caused an environmental catastrophe of nature the vast region of Central Asia and of the population living in this territory. Numerous epidemiological, laboratory and clinical observations indicate the presence of causal relationships between environmental pollution and damage to the genetic material of the human body. These observations were carried out as in harmful conditions of production activities and in terms of settlements, atmosphere, water sources and soil contaminated with mutagens [1-6].

As many chemical pollutants can cause mutations, then one of the problems of hygienic importance is the issue of the genetic consequences, manifested at the chromosomal level, and underlying malignant transformation of cells, to increase the incidence and reduce the body's resistance to the action of environmental factors. The estimation of the effect of mutagens on humans in real conditions (prolonged combined effects of mutagens) is performed mainly by cytogenetic examination of people exposed to the harmful effects of chemical and radiation factors.

The objective of cytogenetic studies was to evaluate the frequency and quality of the spectrum of chromosomal abnormalities in peripheral blood lymphocytes of people of reproductive age living in the zone of ecological crisis of Aral sea.

Materials and methods. The Genotoxic effects were studied using a modified polymicrobial cultivation of peripheral blood lymphocytes Hungerford D.A. et al., to take account of the frequency and types of chromosomal aberrations [7-8]. The main advantages of this technique are: availability of taking material (blood), circulation of lymphocytes in the blood in all tissues, a well-developed technique of lymphocytes, their fixation and preparation of metaphase chromosomes [9] and the sensitivity of the method, sufficient for anomaly detection in a small population of cells [10].

We have analyzed 7253 metaphase plates have 40 people in the main group of surveyed individuals residing in the zone of the ecological pre (Arys) and 7020 metaphases with 40 persons in the control group were persons residing in the zone of ecological well-being (p. Atasu). Each group presented a homogenous cohorts, with the formation of which, by selecting for each group a pair of individuals was taken into account the matching parameters, such as: gender, age, duration of residence, social status, education, profession, and household conditions. Each group represented the same number of persons, male and female. The main group was divided into subgroups, the difference between the subgroups was the General practitioner on the presence or absence gastrological, obstructive, hemorrhagic, neurological and splenomegalic syndromes. Persons with the syndrome amounted to a subgroup 2, those not having the syndrome – a subgroup 1.

All patients carried out the determination of metals in blood. Blood testing for metals was performed on atomic absorption spectrometer MGA – 915 (Russia) with electrothermal atomization [11].

Data analysis was performed using software package Statistica 10. Statistical data processing included calculation of arithmetic mean values (M), standard error of average arithmetic (m), confidence intervals and standard deviation for variables with normal distribution. The normality of distribution was tested by evaluating the Shapiro-Wilk test and Kolmogorov-Smirnov test. Differences between groups were identified by methods of nonparametric statistics using the Mann-Whitney test for two unrelated groups. To identify the linear relationship used correlation coefficient Spearman.

Results and discussion. When carrying out cytogenetic studies have examined the population living in the zone of ecological pre was studied 7253 metaphase plate. The identified chromosomal aberrations were divided into 2 main groups: chromosome and chromatid type. The overall frequency of aberrations in the surveyed population amounted to 101 case and was at 1.392±0.137% which is 27% higher than that in the control group of 1.011±0.119%. Mean values of aberrations of the chromatid and chromosome type among respondents living in the area of ecological pre was at 1.047±0.119%, 0.344±0.068%, respectively. The frequency of chromatid type aberrations (1.047±0.119%) also exceeded the corresponding values in the control group (0.655±0.096%) 37%. Between aberrations of chromosomal type is significantly important to distinguish between the detection was not (table 1).

Table 1 - Frequency and types of chromosomal aberrations in the examined individuals living in the area of the ecological pre (M±m%; 95% CI, SD)

Indicators	Control	MSD	The main group	MSD
The overall frequency of aberrations	1.011±0.119 (1.008-1.014)	0.018	1.392±0.137* (1.389-1.395)	0.014
Chromosome type	0.356±0.071 (0.354-0.357)	0.068	0.344±0.068 (0.343-0.346)	0.009
Chromatid-type	0.655±0.096 (0.652-0.657)	0.014	1.047±0.119* (1.045-1.050)	0.005

Note - * - significant discriminating about benchmarks on St'yudent $p<0.05$

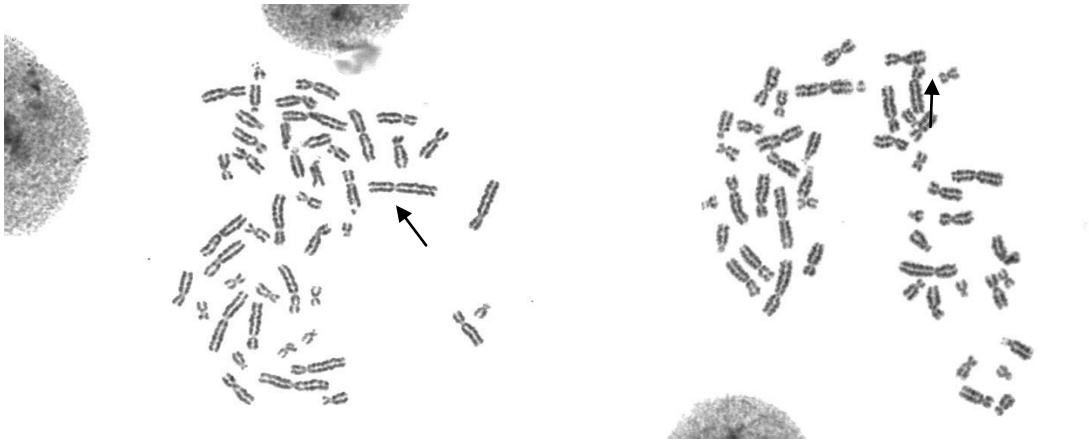
When you study the types of chromosomal aberrations of the chromatid and chromosome type in peripheral blood lymphocytes of the surveyed population, it can be noted that the identified aberrations were represented by single fragments, whose share in the total number of aberrations was 58.42% (59 cases), paired fragments (19.80% (20 cases), chromatid breaks – of 14.85% (15 cases), breaks on the centromere – of 2.97% (3 cases), deletions of 1.98% (2 cases) and translocations – is 1.98% (2 cases). Cytogenetic aberrations in the control group, mainly represented by the same classes of types of chromosomal aberrations.

Analyzing obtained data on the types of chromosomal aberrations may be noted that the level of chromatid-type CA 67% was higher than the CA chromosome type. As we know from the literature, the manifestations of aberrations chromatid type characteristic of chemical mutagenesis (table 2) [12-16].

Table 2 - the Frequency and types of chromosomal aberrations in the examined individuals living in the area of the ecological pre (M±m%; 95% CI, SD)

Indicators	M±m	95% CI	MSD	P
Chromatid-type	1.047±0.119	1.045-1.050	0.014	0.001
Chromosome type	0.344±0.06	0.343-0.346	0.068	

The total number of aberrations of chromosomal and chromatid types were divided as follows: 75% of aberrations of the chromatid type and 25% of aberrations of chromosome type (figure 1).



a single fragment pair fragment

Figure 1 – Chromosomal aberrations in peripheral blood lymphocytes of persons living in the area of environmental pre-crisis

Aberrations chromatid type among the surveyed were represented by single fragments, chromatid gaps and deletions. Among the aberrations of chromatid type were dominated by single fragments, whose contribution to the total number of chromatid type aberrations was 77%. Chromosome type aberrations, mainly paired fragments and made up 80% of the total CA of the chromosome type, identified in the group surveyed, the remaining 20% are breaks on the centromere and chromosomal the translocation (table 3).

Table 3 – Types of chromosomal aberrations in the examined individuals living in the area of the ecological pre-crisis (m±m %)

Indicator		The studied group		p
		control	the main group	
Aberrations of chromosomal type	Paired fragments	0.285±0.063	0.275±0.061	-
	Tears by focus degree	0.057±0.028	0.041±0.023	-
	Mikrovalna translocation	0.014±0.014	0.027±0.019	-
	Total	0.356±0.071	0.344±0.068	-
Aberrations chromatid type	Chromatid breaks	0.099±0.037	0.206±0.053	-
	Single fragments	0.498±0.084	0.813±0.105	0.02
	Deletions	0.057±0.028	0.027±0.019	-
	Total	0.655±0.096	1.047±0.119	0.01

When compared according to gender were examined, it can be noted that the level of chromosomal aberrations in women (1.645±0.224%) living in the area of the pre-crisis, though, and was not significantly significant differ compared to the level of chromosomal aberrations in men (1.190±0.170), but was higher than that by 27.65% (table 4).

Table 4 - Frequency of chromosomal aberrations in the examined individuals living in the area of environmental pre depending on gender (M±m%; 95% CI, SD)

Indicator	M±m	95% CI	MSD	p
Women	1.645±0.224	1.638-1.653	0.050	-
Man	1.190±0.170	1.184-1.95	0.029	

Considering the level of chromosomal aberrations among persons living in the area of environmental pre, between sub 5 and sub 6 is possible to note that significant differences have been identified.

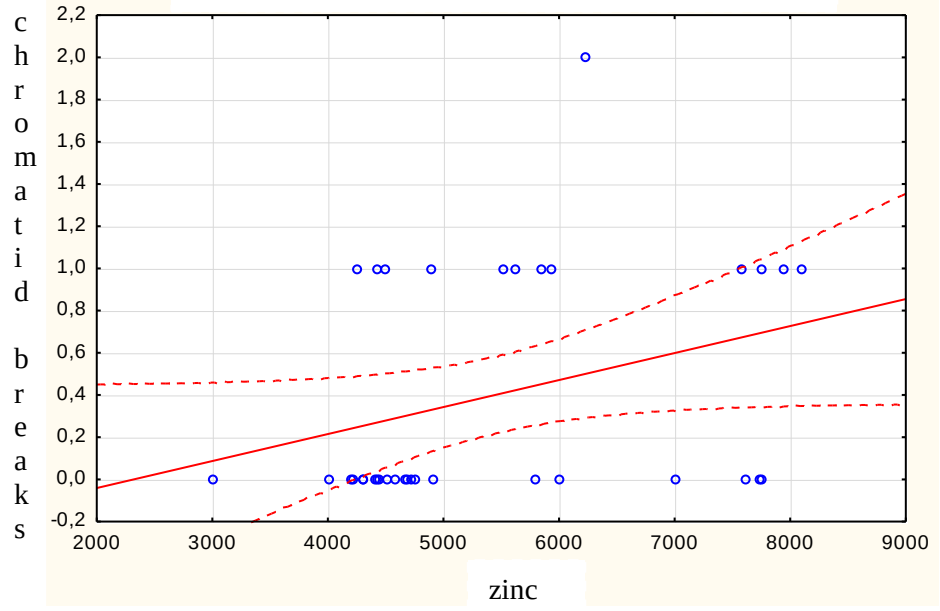
To assess the effect of genotoxic action of chemical agents in environment, which include heavy metals in the hereditary structure was performed correlation analysis between the level of chromosomal aberrations and the content of micro-elements in the blood because the intake of toxicants, the response of the body and repair capabilities, certain individuals may be different.

The analysis of blood content of trace elements in individuals living in a zone of ecological disaster showed that the concentration of heavy metals in the blood, able to exert toxic effects, such as lead, Nickel, and manganese were exceeded benchmarks by 40%, 41% and 32%, respectively. While the level of essential trace elements has been significantly reduced: selenium is 38%, zinc 40% iodine and 30% (table 5).

Table 5 - Content of metals in the blood (M±m; 95% CI)

Indicator	Physiological parameters	Control	95% CI	The main group	95% CI	p
Copper	800-1300	966.33± 23.21	919.35-1013.31	973.28± 22.19	1294.05-1439.14	-
Zinc	4000-8600	5859.15± 183.45	5250.13-5822.88	5447.07± 137.14	4965.13-5929.00	-
Lead	до 25	2.38±0.34	1.69-3.07	3.98±0.44	3.08-4.88	0.01
Iron	309-521	382.55± 11.11	360.07-405.03	392.79± 9.76	372.94-412.64	-
Cadmium	0.3-0.9	0.38±0.02	0.53-0.65	0.58±0.03	0.50-0.66	-
Selenium	58-234	85.62±5.17	75.15-96.08	83.98± 3.46	76.94-91.03	-
Arsenic	0.002-3	1.50±0.14	1.21-1.79	1.17±0.16	0.85-1.50	-
Nickel	1-50	2.45±0.21	2.03-2.87	4.16±0.49	3.15-5.15	0.01
Chromium	0.7-2.8	1.52±0.09	1.32-1.72	1.76±0.09	1.56-1.95	-
Manganese	1.6-75	3.78±0.37	3.02-4.54	5.58±0.50	4.56-6.60	0.01
Mercuey	0.05-5.0	1.71±0.17	1.37-2.05	1.21±0.17	0.85-1.56	0.04
Iodine	5-12	7.03±0.28	6.45-7.60	6.76±0.30	6.13-7.38	-

A) Pre-crisis area
Scatterogams:zink vs chromatid breaks
Correlation: r= ,32443



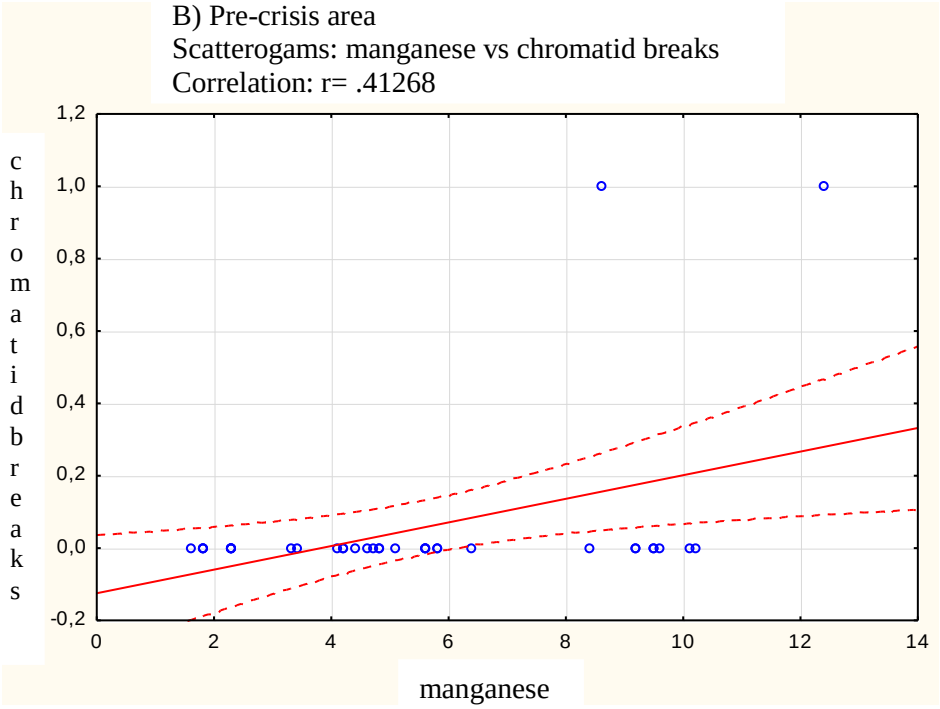


Figure 2 – Link between the level CA and the content of microelements in blood of persons residing in the area of environmental pre:
A) chromatid breaks and zinc; B) the gaps at the centromere and manganese

Persons living in the area of environmental pre revealed significantly significant relationships between chromatid breaks and zinc content in blood (r=0.38), and between the gaps at the centromere and manganese (r=0.41), at a significance level of $p<0.05$ (figure 2).

Thus, the conducted study, analysis and interpretation of results allow to draw the following conclusions:

1. The identified level of chromosomal aberrations 27% higher than in the control group and amounted to 1.392±0.137%.

2. The frequency of chromatid type aberrations (1.047±0.119%) of subjects living in the area of environmental pre exceeded the corresponding values in the control group (0.655±0.096%) 37%.

3. Elevated levels of mutagenic load in the study group relative to the control, is due to chemical mutagenesis, which is confirmed by the identified aberrations chromatid type and correlation analysis.

References

1. The law of the Republic of Kazakhstan dated 30 June 1992 "On social protection of citizens affected by the consequences of the ecological disaster in the Aral sea". – 1992.

2. Rakhmanin Yu.A., Zhurkov V.S., Revazova Y.A., Sycheva L.P. The Role of genetic studies in assessing the influence of environmental factors on human health // Gigiena i sanitariya [Hygiene and sanitation]. - 2005. - N6. - P.59-62.

3. Revazova Yu.A., Gorkov V.S. Genetic approaches to the evaluation of safety factors in the human environment // Vesti RAMN [News RAMN]. – 2001. - №10. – P.77-80.

4. Ivanov S.I., Zhurkov V.S., Belyaeva N.N., Sycheva L.P., Kovalenko M.A., Antsiferov B.M. Cytogenetic status of children living near pulp and paper mill // Gigiena i sanitariya [Hygiene and sanitation]. - 2010. - N1. - P.7-10.

5. Yurov Y.B., Demidova I.A., Beresheva A.K., Vorsanova S.G., Kolotii A.D., Kravets V.S., Yurov I.Yu., Kurinnaya O.S. Cytogenetic and molecular cytogenetic studies in the diagnosis of mosaic forms of chromosomal abnormalities in children // Rossiyskiy vestnik perinatologii i pediatrii [The Russian Bulletin of Perinatology and Pediatrics]. - 2011. - N2. - P.23-29.

6. Novikova I.V., Golovataya E.I., Lishtvan L.M., Pribylina O.V. Disconcordance of karyotypes in prenatal diagnosis of patau syndrome in the first trimester of pregnancy // Prenatalnaya diagnostika [Prenatal diagnosis]. - 2010. - N3. - P.253-259.

7. Moorhead P.S., Nowell P.S., Mellman W.J. Chromosome preparation of leokocytes cyltured from human periferal blood // Exp.Cell.Res. - 1960. - Vol.20. - P.613.

8. Hungerford D.A. Leikocytes cultured from small inocula od whole blood and the preparation of metafase chromosomes by treatment with hypotonic KCl // Stain Technology. - 1965. - Vol.40, №6. - P.333-338.

9. Svyatov G.S., Abildinova G.J., Berezina G.P. Medical genetic testing in ecologically adverse regions: guidelines. - Almaty, 1998. - 27 p.

10. Standards for the analysis of chromosome in neoplasia hematopoiesis: Methodical recommendations. – Kiev, 2007. – 43 p.

11. Namazbayeva Z.I., Mukasheva M.A., Pudov A.M. et. al. Determination of heavy metals content in environmental objects and biomaterials on atomic absorption spectrometer MGA-915 MR. – Astana, 2007. - 19 p.

12. Sabirov J.B., Namazbayeva Z.I. Evaluation of the cytogenetic status of the population living in urban areas // All-Russian scientific – practical conference with international participation “Innovative technologies in occupational medicine and rehabilitation in Belokurikha”. - Altai Krai, 2013. - P.131-132.

13. Sabirov J.B. Way of the emergence of structural mutations in the chemical nature of mutagenesis // Gigiena truda i medicinskaya ecologiya [Hygiene of labour and medicine ecolog]. - 2015. - №2(47). – P.26-31.

14. Sabirov J.B. Evaluation of the cytogenetic status of persons living in conditions of industrial region // Materials of scientific-practical. Conf. "Buketov read - 2015". – Karaganda, 2015. – P.243-245.

15. Dubinin N.P. Shared genetics. - M.: Science, 1986. - P.291-324.

16. Goloshchapov A.P. Genetic and biochemical aspects of human adaptation to the conditions of the city with developed chemical industry. – M.: Association of scientific publications KMK, 2012. – 103 p.

Тұжырым

Дүниежүзілік денсаулық сақтау ұйымының мәліметтеріне сәйкес, әлемдегі әрбір төртінші ауру қоршаған ортаның лас болуымен тікелей байланысты, іс жүзінде экологиялық факторлар әрбір аурудың патогенезіне теріс әсерін тигізеді. Елімізде Арал маңының экологиялық жағдайы әлі де күрделі болып қалуда және заң жүзінде экологиялық апатты аймақ болып саналады. Құрып бара жатқан Арал теңізінің мәселесі Орталық Азия аумағындағы орасан зор табиғаттың экологиялық апатты аймаққа айналуына себепші болуда. Мұндай экологиялық жағдай тұрғындардың денсаулық жағдайына теріс әсер етеді, және хромосомдық аберрациялар (ХА) ретінде көрініс табуы мүмкін.

Түйінді сөздер: ДНҚ, хромосомдық аберрациялар, ауыр металдар, генотоксикалық, құрылымдық ауытқулар, Арал маңы

Резюме

По данным Всемирной организации здравоохранения (ВОЗ) каждое четвертое заболевание в мире имеет прямую связь с воздействием загрязнения окружающей среды, в патогенезе практически каждого заболевания имеет место отрицательное влияние экологических факторов. В Казахстане продолжает оставаться сложной экологическая ситуация в Приаралье, законодательно признанной зоной экологического бедствия. Проблема умирающего Аральского моря обусловила экологическую катастрофу природы огромного региона Центральной Азии. Такая экологическая ситуации оказывает негативное влияние на здоровье населения, в том числе и генотоксическое и может проявляться как хромосомные аберрации (ХА).

Ключевые слова: ДНК, хромосомные аберрации, тяжелые металлы, генотоксические, структурные аномалии, Приаралье