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Evaluation of Oxidative Stress in Men Living in the Zone of Ecological Catastrophe

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Abstract

The aim of our study is to examine the state of oxidative stress of the body by determining the concentration of malondialdehyde (MDA) in blood plasma of the male population of Aktobe (n. Yrgyz, Mr. Shalkar), South Kazakhstan (Arys city), and Karaganda (n. Ulytau, p. Atasu) regions. The quantitative content of MDA in blood plasma of men living in the regions studied were measured by the modified method EN Korobeinikova [7] and high-performance liquid chromatography. The most commonly used marker, MDA, is the most informative. MDA is formed during lipid peroxidation free radicals at break molecules of polyunsaturated fatty acids. Increased concentration of MDA in serum serves as a marker of endogenous degree of intoxication and oxidative stress.

Keywords

Oxidative stress; Malondialdehyde; Zone of ecological disaster; Blood plasma

Introduction

As known, oxidative stress is a process of free-radical damage to various cells and organs. It occurs when the formation of free radicals in the system exceeds the system's ability to neutralize and eliminate them. Imbalance may be due to the lack of an antioxidant-defense system, caused by impaired production or distribution of antioxidants or excess free radicals.

The vast majority of the known theories of aging is based on the theory of the development of oxidative stress. Numerous scientific publications suggest that oxidative stress leads to the development of the most dangerous and socially significant diseases, such as cardiovascular diseases, cancer, diabetes, stroke, inflammation, rheumatoid, neurodegenerative (Parkinson's disease and Alzheimer's disease) and some others [1-5].

In our view, the impact of exogenous and endogenous factors on the body lead to the development of oxidative stress, the effects of which are serious violations of cellular metabolism, as in the development of all the pathologies characterized by intensification of free-radical processes and reduction in the activity of AOP [6].

Therefore, the aim of our research is to study the state of oxidative stress of the body by determining the concentration of MDA in the blood plasma of the male population of Aktobe (village Yrgyz, city Shalkar), South Kazakhstan (Arys city), and Karaganda (village Ulytau, village Atasu) regions.

Materials and Methods

The studies were conducted on the basis of shared laboratories (SL) KSMU involving employees of the Research Center, Department of Molecular Biology and Medical Genetics.

Clinical and laboratory studies were carried out in the male population of Aktobe (village Yrgyz, city Shalkar), South Kazakhstan (Arys City), and Karaganda regions (village Ulytau, village Atasu) aged 18-49 years. The criterion for inclusion in the study was the stay of an adult in the Aral Sea area being not less than five years and employment in occupations with the hazard of no more than two class.

The quantitative content of MDA in blood plasma of men living in the regions studied was measured by the modified method of E. Korobeinikova [7] and high-performance liquid chromatography (HPLC) [8].

Results and Discussion

When the content of reactive-oxygen species and free radicals in the body fluids and cells of the redundant human antioxidant system cannot neutralize them, they start the oxidation process vital to DNA molecules, proteins, lipids, and carbohydrates. As a result of oxidation of these molecules appear connections—markers of oxidativillage. The greater degree of free radicals is susceptible to the unsaturated bonds of fatty acids in the membranes. Markers of lipid—aldehydes, dialdehydes, methylglyoxal, hexenal derivatives, nonenal, and isoprostane.

The most commonly used marker, MDA, is the most informative. MDA is formed during lipid peroxidation free radicals at break molecules of polyunsaturated fatty acids. Increased concentration of MDA in serum serves as a marker of endogenous degree of intoxication and oxidative stress [9-13]. MDA forms a Schiff base with amino groups of the protein, thus creating insoluble lipid-protein complexes (pigments wear). MDA concentration in the serum of healthy persons (normal) is less than 1 mmol/l [14].

In view of the above, we conducted a quantification of MDA in the plasma of males residing in the regions studied as an additional criterion for the development of oxidative stress and a marker of lipid peroxidation, using a spectrometric method and HPLC; the results are presented in Table 1.

Analysis of the data set showed that regardless of the method used, in samples taken, the oscillation values of MDA concentration were in

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Area	Age	MDA content in the plasma in men, mmol/l	
		Spektrofometriya	HPLC
South Kazakhstan region			
Village Aris, n = 150	18-29 years, n = 50	0.84 ± 0.08**	0.82 ± 0.05**
	30-39 years, n = 50	0.70 ± 0.09	0.71 ± 0.04
	40-49 years, n = 50	0.73 ± 0.03	0.70 ± 0.02
Aktobe region			
Village Yrgyz, n = 150	18-29 years, n = 50	0.84 ± 0.05***	0.85 ± 0.05***
	30-39 years, n = 50	1.58 ± 0.61	1.55 ± 0.09
	40-49 years, n = 50	0.71 ± 0.04	0.73 ± 0.05
City Shalkar, n = 225	18-29 years, n = 75	0.60 ± 0.02	0.59 ± 0.01
	30-39 years, n = 75	0.91 ± 0.14	0.87 ± 0.09
	40-49 years, n = 75	0.70 ± 0.04	0.72 ± 0.05
Karaganda region			
Village Ulytau, n = 150	18-29 years, n = 50	0.94 ± 0.09***	0.96 ± 0.07***
	30-39 years, n = 50	0.97 ± 0.08	0.95 ± 0.05
	40-49 years, n = 50	0.96 ± 0.06***	0.97 ± 0.04***
Village Atasu, n = 225	18-29 years, n = 75	0.81 ± 0.05	0.84 ± 0.05
	30-39 years, n = 75	0.70 ± 0.04	0.74 ± 0.05
	40-49 years, n = 75	0.70 ± 0.04	0.72 ± 0.03

The accuracy of between age groups: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 1: Malonic dialdehyde (MDA mmol/l) in blood plasma of males (M ± m)

the range of 0, 60-1.58 mmol/l; the concentration of MDA is practically independent of the age of the subjects. We found an increased content of MDA level (1.58 mmol/l) in men in the age group of 30-39 years old, living in village Yrgyz, compared with MDA (0.60-0.97 mmol/l) in men living in village Atasu, city Aris, village Ulytau, and city Shalkar.

Conclusion

Thus, the study of the complex influence of negative environmental factors and dust-salt aerosols in the Aral region on the body at the molecular and cellular level, was done to evaluate the state of oxidative stress of the body on the male population of Aktobe (village Yrgyz, city Shalkar), South Kazakhstan (city Aris), and Karaganda (village Ulytau, p. Atasu) regions, which found an increased content of MDA level in men in the age group of 30-39 years, living in the village Yrgyz, compared with MDA in men living in village Atasu, city Aris, village Ulytau, and city Shalkar, caused by endogenous and exogenous

intoxication and man-made pollution, leading to violations of free-radical oxidation in the cells, accompanied by changes in the enzyme level of antioxidant protection and product lipid peroxide stage.

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