

eISSN: 09748369

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Biology and Medicine

Short Communication

БЖ

www.biolmedonline.com

Volume 6, Issue 3, Article ID: BM-050-14, 2014

Indexed by Scopus (Elsevier)

www.biolmedonline.com

Disturbance of spermatogenesis in men's population living in environmentally unwell areas of Kyzylorda region, Kazakhstan

Margulan Kinayatov, Zhandos Kenzhin, Aliya Yeshmagambetova, Berikbay Kultanov*,
Raushan Dosmagambetova

Department of Molecular Biology and Medical Genetics, Karaganda State Medical University,
38 Gogol Street, Karaganda, Kazakhstan.

*Corresponding author

Citation: Kinayatov M, Kenzhin Z, Yeshmagambetova A, Kultanov B, Dosmagambetova R (2014) Disturbance of spermatogenesis in men's population living in environmentally unwell areas of Kyzylorda region, Kazakhstan. Biol Med 6(3), Article ID: BM-050-14, 3 pages.

Received: 25th Oct 2014; Accepted: 10th Dec 2014; Published: 20th Dec 2014

Abstract

The Aral crisis is recognized as one of the global environmental problems of today. There is a profound change in the state of the environment and a catastrophic degradation of ecosystems in the region, which resulted in a change in the demographics of the population. The Aral Sea areas, especially Aral'sk and Zhusal'y settlement located at a distance of 70-150 km from the former coast, are most affected. Ecological problems in the region are reflected in the health of the population, which leads to disruption of metabolic processes in organism, causing the development of pathologies. It was revealed the abnormalities of endocrine system, immune status, but it is not explored the condition of male reproductive status in the region, which determined the relevance of the study. The results of our study show that the maximum increase of the number of mobile forms of sperm was observed in men living in zone of ecological crisis of Zhusal'y settlement, the number of fixed forms of sperm – in men in the zone of ecological disaster of Aral'sk. The analysis of clinical and laboratory studies showed the persistent abnormalities of spermatogenesis, as well as the development of pathological changes in the endocrine and immune system in men of reproductive age.

Keywords: Environmental crisis; the Aral Sea region; spermatogenesis; reproductive function.

Introduction

The consequences of environmental change were the emergence of "ecological disaster zones" of some regions of Kazakhstan, where there were profound changes in the environment, which resulted in a change in demographics of the population. One of these regions is the Aral Sea region, where the present ecological crisis erupted involving the geosphere, the change in the biogeochemical parameters of the environment, catastrophic degradation of ecosystems in the region. The Aral Sea areas, especially Aral'sk and Zhusal'y settlement located at a distance of 70-150 km from the former coast, are most affected.

The processes occurring in the Aral Sea region affected the human population: the morbidity and mortality had been increased, especially in children and the elderly age, it was increased the number of cancer and congenital malformations. There have been many other changes – the mentality of society had been transformed, the spiritual

and moral crisis aroused, which in many cases is a cause and a consequence of regional environmental disasters. All this allows us to consider what is happening as the degradation of the natural environment and the threat to human population [1].

The extreme environmental conditions in the Northern and the Southern Aral Sea regions have led to the emergence of environmental, socio-economic, and health problems, the leading from which is the negative impact of ecologically unfavorable factors on the health of people, living in this region. The immune system is a dynamic, constantly updated, with complex mechanisms of regulation and interaction with many systems of organism [2].

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It was carried out the molecular and genetic study of physiological changes in sperm for the assessment of the condition of reproductive function in men.

The aim of this study was to investigate the physiological changes in sperm of men living in ecological disaster zone of Kyzylorda region.

Materials and Methods

We examined 133 young men at the ages of 20-30 yrs, living in the Kyzylorda region, of which 82 men – in zone of ecological disaster of Aralsk and 51 men in the area of environmental crisis Zhusalı settlement.

The analysis of ejaculate was carried out by standard methods [3,4]. It was used light microscope “Micmed 5” with 400-fold magnification for microscopic examination and Goryaev camera.

During the microscopy, it was used 10-fold ejaculate dilution. It was determined the following parameters: the number of active and inactive forms of spermatozoa (with fast and slow forward motion, with nonforward motion, fixed spermatozoa); the concentration of spermatozoa in 1 ml of ejaculate; and the total number of spermatozoa in ejaculate. For the qualitative and quantitative characteristics of ejaculate sperm, the criteria fertile ejaculate were used, offered by WHO [5].

Results and Discussion

During the analysis of physiological characteristics of spermatogenesis in the surveyed group of men, it was revealed that the complex influence

of toxicants (dusty salt aerosol, heavy metals, pesticides, etc.) led to decrease in reproductive function. According to the literature data, at the influence of toxicants on the reproductive function of inhabitants of environmentally disadvantaged regions of Central Kazakhstan, it is known the violation of morphological and biochemical indices of spermatogenesis in men of reproductive age. The complex influence of toxicants reduces the actively motile sperm forms and increases the number of fixed forms of spermatozoa. Also, it was revealed the violation of the physiological characteristics of sperm closely interconnected with the change of products PL – AOP [6]. The data on the number of spermatozoa in 1 ml of sperm in the examinees are presented in Table 1.

The number of fertile semen in men living in Aralsk in the comparison with WHO data was 35.8%, the reduced fertility was 44.2%, and non-fertile ejaculate of spermatozoa was observed in 20% of cases. In Zhusalı settlement, the prolific amount of ejaculate was 49.3%, the reduced fertility was 36.7%, and significantly reduced fertility of sperm was 14%.

The analysis of the research results revealed that the maximum increase of number of mobile sperm forms was observed in men living in the zone of ecological crisis of Zhusalı settlement, the number of fixed forms of sperm in men – in the area of environmental catastrophe of Aralsk.

Thus, all the examined men living in areas of Kyzylorda region have the deviations from the WHO guidelines on physiological characteristics of sperm, which explains the negative impact of toxicants on the processes of spermatogenesis and leads to the development of the pathological process. Our findings are supported by the literature data [7]. The analysis of clinical and laboratory studies showed the persistent abnormalities in sperm: decrease of the number of mobile forms and, consequently, an increase in the number of fixed forms of

Table 1: Number of spermatozoa in 1 ml of ejaculate in the surveyed men, M ± m.

Sperm count, %	Control according WHO	Zhusaly settlement	Aralsk
70 and higher	100	–	–
60-69	–	49.3	35.8
40-59	–	36.7	44.2
20-39	–	14	–
Less than 20	–	–	20

spermatozoa in young men living in the Aralsk city. Based on the research results, we can assume that the combined effect of launches from cosmodrome “Baikonur”, the development of radioactive ores in the surrounding areas and the presence of a number of toxicants: salt aerosols, organochlorine pesticides, heavy metals, and other agents [1] adversely affects the processes of spermatogenesis and leads to the development of pathological processes in male of reproductive age.

Acknowledgment

Also mention the name of the funding agency: Ministry of Health and Social Development, Republic of Kazakhstan. Research work has been done under the scientific funding program “Complex ways in controlling of population health in Aral Sea region”.

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