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Evaluation of morphophysiological indicators of sperm of a men living in ecologically unfavorable Aral sea region

This paper describes the results of the research morphological and physiological parameters in the sperm of the male population aged 18 to 49 years, conducted by the research team of Karaganda State Medical University under the STP «Integrated approach to managing the health of the population of the Aral Sea region» on the territory of the environmentally disadvantaged regions of the Republic of Kazakhstan — s. Shalkar and v. Yrgyz of Aktobe region. Clinical examination was carried out of 225 men from s. Shalkar and 150 men from v. Yrgyz and have taken the test ejaculate for macroscopic and microscopic examination. The test was divided into three age groups: 18–29 years, 30–39 years, 40–49 years. As a result, it was revealed worsening morphological and physiological parameters in men of all age groups and living areas of Aktobe region.

Key words: the Aral Sea region, spermatogenesis, the environmental crisis, DNA, nitric oxide.

Introduction

The Aral Sea crisis is the biggest environmental disaster of the planet, acquired acute. Intensive desertification and sustainable irreversible degradation of the environment, chemical pollution of the region with high doses of pesticides and herbicides, as well as a waste of heavy industry, the deterioration of living conditions and the increase in the incidence, called the new socio-economic and environmental situations that require legislative solutions and regulatory measures social protection of the population living in ecologically unfavorable areas [1]. It is known from literature data in the region of Aktobe environmental problems are very serious, because in addition to effects on the body of dust and salt aerosols Aral Sea area, in the region in the environment there are various factors of production, such as oil pollution, chromium, bromine, heavy metals and the combustion of associated gas transferring wind over large distances from the source of contamination.

In this regard, we believe that in the Aktobe region insufficiently addressed some environmental problems and issues for sanitary and public health, and others.

As we know the totality of these factors leads to increased harmful effects on the human body, which are acting for a long time may contribute to the various pathological conditions. development of methods of synthesis regulation, maintain the physiological level of concentration of endogenous nitric oxide in the cells and organs in the body as a whole, no doubt is both scientific and practical interest. The most studied antihypertensives and antiaggregant effects of the action of endogenous NO, which are the result of the launch of a number of nitric oxide biochemical processes [2–4].

In the last decade greatly increased the number of works that investigate the use of extracellular DNA as a marker for various diseases and adverse environmental effects.

Until recently it was thought that the DNA found only in the cell structures: predominantly in the nuclei of cells and a number of — in the mitochondria, where it acts as a carrier of genetic information. Have now been found that small amounts of DNA is detected and cells, especially in blood plasma in animals and humans, as well as in the sperm. [5].

The circulating DNA can appear in the bloodstream as a result of the death of nucleated cell elements, the maturation of red blood cells and platelets as well as nucleic acid active secretion into the extracellular space. development various diseases [6].

Taking into account the above stated, we felt it appropriate to define morphological and physiological indicators of sperm in the male population of Aktobe region.

Objective: To evaluate the morphological and physiological changes in the sperm of the male population aged 18 to 49 years in non-disadvantaged areas of the Republic of Kazakhstan — s. Shalkar and v. Yrgyz Aktobe region.

Materials and methods

Research conducted as part of STP, «Integrated approach to managing the health of the population of the Aral Sea region» were examined male population aged 18–49 years, the s. Shalkar and v. Yrgyz of Aktobe region. During the study examined 375 men of different age groups: 125 men in age group 18–29 years, 125 men aged 30–39 years and 125 males 40–49 years. Inclusion criteria were: time of human habitation in the Aral Sea area is not less than 5 years, employment in occupations with the hazard no more than 2 class. All men of the study area underwent clinical examination to exclude pathology of the genitourinary system, as well as laboratory studies were carried out: macroscopic and microscopic examination of sperm. Methods for producing the ejaculate almost all researchers are unified. Most often they ejaculate obtained by masturbation, at least — interrupted sexual intercourse [7].

We received ejaculate studied men after 4–5 days of abstinence. The ejaculate was placed in a warm tube with a glass stopper. On the investigation proceeded normally ejaculate within 20–30 minutes after its preparation, during which time he was subjected to liquefaction. Macroscopic and microscopic examination of the semen was performed by the method of V.V.Dolgov. Statistical analysis was performed using the package STATISTICA 6.0 (Stat-Soft, 2001) and the program BIostatistica 4.03 [8].

Results and discussion

According to the study, when metabolic processes is a violation of all the synthetic and proliferative processes which directly affect the nuclear structure of cells. An essential role in the DNA damage may play a lipid peroxidation products.

Contamination of the environment under the influence of various chemical and physical factors leading to the development of environmentally-related diseases, which are manifested in the form of clinical, immunological and pathophysiological biochemical changes, adverse environmental factors negatively affect the health of the population living in the study region of Kazakhstan [9]. Ejaculate surveyed men aged 18–49 years has a characteristic smell. In 150 men living in v.Yrgyz ejaculate has a characteristic smell of 65.8 %, the remaining missing persons smell (34.2 %).

We surveyed 225 men of s.Shalkar the characteristic smell of the ejaculate was observed in 67.0 %, the remaining 33.0 % of persons smell was absent (Tables 1–3).

Table 1

The smell of the ejaculate surveyed persons aged 18–29 (%)

The smell of the ejaculate	Norm according to WHO	v.Yrgyz	s.Shalkar
There is the smell	100	63,8	68,6
No smell	0	36,2	31,4

Table 2

The smell of the ejaculate surveyed persons aged 30–39 (%)

The smell of the ejaculate	Norm according to WHO	v.Yrgyz	s.Shalkar
There is the smell	100	65,7	69,0
No smell	0	34,3	31,0

Table 3

The smell of the ejaculate surveyed persons aged 40–49 (%)

The smell of the ejaculate	Norm according to WHO	v.Yrgyz	s.Shalkar
There is the smell	100	66,8	60,3
No smell	0	33,2	39,7

Normal color of ejaculate varies from vague and milk (pale yellow) to white. The color change is usually due to the presence of various pathological impurities. Take more or less significant number of white blood cells gives seed yellow-green and red blood cells — reddish color. Data for the study of the color of the ejaculate of the surveyed persons are presented in Table 4.

Table 4

Ejaculate color of surveyed men aged 18–49 years

Region	Age	Straw-coloured, %	Milky6 %	Transparent, %
v.Yrgyz	18–29	23,5	42,5	34
	30–39	29,3	34,7	36
	40–49	29,2	33,8	37
s.Shalkar	18–29	27,2	44,8	28
	30–39	31	34,7	34,3
	40–49	39	30	31

Comparative analysis of the survey areas showed that the number of people in their normal color of ejaculate much less. Just observe the appearance of transparent color ejaculate. According to WHO, the duration of thinning in men ejaculate normally ranges from 15 to 30 minutes, averaging 29.7 minutes.

The results of semen liquefaction time of the surveyed men are shown in Table 5.

Table 5

Ejaculate liquefaction time of surveyed men aged 18–49 years

Region	Age	Under 2 minutes, %	To 5 minutes, %	To 15 minutes, %	Average time, min
v.Yrgyz	18–29	49,4	14,6	36	8,5
	30–39	45,6	33	21,4	4
	40–49	55,6	30,2	14,2	6,7
s.Shalkar	18–29	46,3	19,7	34	8
	30–39	48,4	26,6	25	5,3
	40–49	51,1	28,2	20,7	6,1

To achieve these objectives, we conducted molecular studies on the cellular extracellular DNA, RNA, and the acid-soluble fraction (ASF) in the ejaculate of surveyed men (Table 6). Research in this area gives us the opportunity for early diagnosis and prevention measures in a number of pathological processes.

As known from literature and on results of previous our studies, oxidative modification of macromolecules play an important role in the mechanisms of regulation of protein breakdown and the formation of free radicals that leads to degradation of proteins, nucleic acids, lipids. It causes maladjustment and disturbance of the genetic apparatus of cells [10].

According to a study the reproductive health in men living in Central Kazakhstan of Kultanov B.Zh., and numerous studies have shown that the accumulation of free radicals in cells, leading to oxidative stress and turn violates the functional activity of the cells that manifests the change levels of individual fractions of chromatin proteins, DNA, RNA and ASF [11].

The study found a statistically significant increase nitric oxide metabolites in the semen of men of all age groups. These studies have provided evidence of elevated levels of nitric oxide (Table 7) in individuals living in v.Yrgyz, s.Shalkar.

Table 6

Indicators of extracellular nucleic acids in the ejaculate males (M ± m)

Region	Age	ASF	RNA	DNA
v.Yrgyz	18–29	0,49±0,06**	1,46±0,27	1,38±0,51**
	30–39	0,60±0,01*	1,47±0,62	1,39±0,67**
	40–49	0,71±0,24*	1,51±3,02**	1,67±0,94
s.Shalkar	18–29	0,49±0,15**	1,57±0,28	1,28±0,62*
	30–39	0,61±0,29	1,63±0,21	1,30±0,16
	40–49	0,69±0,04*	1,18±0,74	1,41±0,26

Note. The accuracy of between age groups p <0.01; ** p <0.05*.

Table 7

The level of nitrogen oxide (mkmol / l) in semen of men aged 18–49 years (M ± m)

Region	Age	Nitrogen oxide (NO, conventional units)
v.Yrgyz	18–29	38,7±1,12*
	30–39	37,5±1,64*
	40–49	47,3±2,01
s.Shalkar	18–29	41,06±1,54
	30–39	46,03±1,25*
	40–49	53,7±2,07*

Revealed increased circulating extracellular DNA and RNA in the semen of men can be explained by the degradation of nucleic acids under the influence of negative factors in the complex area of environmental ill-researched regions [12].

Conclusion

According to the survey of morphological parameters of sperm in the male population aged 18 to 49 years in ecologically unfavorable regions of the Aral Sea region revealed: All surveyed men living in the areas of ecological disaster of Aktobe region there are changes in the integral characteristics of the ejaculate.

Comparative analysis of the survey areas showed that the number of people in their normal color of ejaculate reduced. Just observe the appearance of transparent color ejaculate. Moreover, the surveyed persons living in v. Yrgyz, the percentage with abnormal color ejaculate higher than in s. Shalkar. One-third of surveyed men living in the Aktobe region has not the characteristic smell of the ejaculate compared with those of WHO.

We examined patients of all groups observed some increased ability to ejaculate liquefaction. Regulatory liquefaction time (15 to 30 minutes) is not registered in any of the surveyed areas. Increase of the level of nitric oxide in the semen, which is a consequence of upsetting the balance of formation and utilization of free radicals in cells. According to modern representations the most sensitive subject of attack of reactive oxygen species and nitric oxide are proteins, including a part of supramolecular structures.

From these results, the study established change in the content of extracellular nucleic acids and acid-soluble fraction in the semen of men studied regions. These disturbances depend on the effects of external environmental factors of physical and chemical nature, regardless of the age group studied individuals.

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Арал аймағының экологиялық жағымсыз жерінде тұратын ерлердің спермаларының морфофизиологиялық көрсеткішін бағалау

Мақалада Қарағанды мемлекеттік медициналық университетінің зерттеу тобымен «Арал тұрғындарының денсаулық жағдайын басқарудың кешенді жолдары» Ғылыми техникалық жобасы бойынша Қазақстан Республикасының аумағындағы Ақтөбе облысының Шалқар қаласы және Ырғыз ауылы экологиялық жағымсыз аймағының 18 бен 49 жас аралығындағы ер тұрғындардың сперматозоидтарының морфофизиологиялық көрсеткіші зерттелгені туралы жазылған. Шалқар қаласының — 225, Ырғыз ауылының 150 ерлерінен макрокопиялық және микрокопиялық зерттеулер үшін эякуляттар алынды. Зерттелушілер жас шамасы бойынша үш топқа бөлінді: 18–29 жас, 30–39, 40–49 жас. Нәтижесінде Ақтөбе облысы елді мекенінде тұратын барлық жас санатындағы ерлердің морфофизиологиялық көрсеткіші нашарлағаны анықталды.

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Оценка морфофизиологических показателей спермы мужчин, проживающих в экологически неблагоприятных регионах Приаралья

В статье описаны результаты исследований морфофизиологических показателей в сперматозоидах у мужского населения в возрасте от 18 до 49 лет, проведенные исследовательской группой Карагандинского государственного медицинского университета в рамках НТП «Комплексные подходы в управлении состоянием здоровья населения Приаралья» на территории экологически неблагоприятного региона Республики Казахстан — г. Шалкар и п. Ырғыз Актюбинской области. Был проведен клинический осмотр 225 мужчин г. Шалкар и 150 мужчин из п. Ырғыз, а также у исследуемых брали эякулят для макро- и микрокопического исследования. Исследуемые были разделены на три возрастные группы: 18–29 лет, 30–39 и 40–49 лет. В результате было выявлено ухудшение морфофизиологических показателей у мужчин всех возрастных групп, проживающих в указанных регионах.

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