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INDICATORS OF HORMONAL STATUS OF THE MILITARY SERVICEMEN IN THE MODERN TYPE OF MILITARY TECHNOGENESIS

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Abstract

The paper presents the results of the evaluation of the testosterone level in the military servicemen. The work at the military enterprises is characterized by storage and disposal of chemical weapons and the presence of a number of harmful factors. The effect of carcinogens and reproductive hazards in the operation environment on the hormonal system changes the levels of hormones responsible for the reproductive function of the body. It is known that the reduction in the concentration of testosterone leads to male infertility, and its increase with age can trigger the development of prostate cancer. Testosterone indicators in our study were distributed subject to the contingent, age, length of service and a type of troops. Determination of hormone was conducted by enzyme-linked immunosorbent assay (ELISA) of blood. The study revealed hormonal disorders in all contingents examined. A high-risk group involves retired and former military servicemen (high levels of testosterone were found in 52.1% of the surveyed of this contingent), persons over 70 years old (high levels of testosterone were found in 61.5% of the surveyed in this age group), the workers with length of service of 30-39 years (high levels of testosterone were found in 55.2% of the surveyed with this length of service). Low levels of testosterone were found in private soldiers (3.6% of the surveyed of this contingent), in persons aged 18-29 years (3.3% of the surveyed in this age group), and in those with length of service of 1-2 years (3.6% of the surveyed with this length of service).

Keywords: hormonal status, military technogenesis, testosterone

Introduction: The concept of "technogenesis" was proposed by A.E. Fersmann in 1924 and is defined as the process of changing the natural systems under the influence of human production activities. Technogenesis is the transformation of the biosphere, caused by a set of processes associated with the technical and technological activities of people [1, 10].

The growth of global industrial production has led to the fact that at the beginning of the 21st century about 4 million toxic substances were circulating in the environment. Over 100 thousand xenobiotics can get into the human body, more than 1,000 of which are toxic.

We have conducted a study to assess the hormonal status of military servicemen working on the territory of military technogenesis.

Military technogenesis is characterized by the presence of arsenal of chemical and other weapons, and its recycling companies on its territory [2]. Work at the enterprises of the military technogenesis is associated with the impact of a number of hazardous factors, such as exposure to chemicals, heat radiation, noise, vibration. The priority environmental pollutants are heavy metals (lead, cadmium, copper, zinc, manganese), benzopyrene, arsenic, formaldehyde, sulfur dioxide, nitrogen dioxide, [1, 8]. The impact of harmful factors on the human body leads to dysfunction of a number of systems, including the endocrine one.

The endocrine system, along with nervous and immune ones relates to essential regulatory systems of the body, which state predetermines the adaptation to different environmental conditions and development of responses to stress factors, including the production ones [3]. The effect of carcinogens and reproductive hazards of the work environment on the hormonal system changes the levels of hormones responsible for the reproductive function of the body [3, 9]. A particular attention is paid to a variety of compounds with estrogenic effects, or to ligands of androgenic receptors. These substances, indirectly acting on the reproductive system, can disrupt the endocrine regulation of spermatogenesis and steroidogenesis in the male body [4].

There are studies showing that the induced activity of enzyme systems in men, carrying out the process of detoxification of the majority of xenobiotics entering the body, is considerably weaker than that in women. An adaptive capacity of the male body becomes exhausted much faster, especially in case of prolonged intake of ecotoxicants [4]. The paper presents the results of the evaluation of the hormonal status of military servicemen, in particular, the indicators of testosterone level.

Testosterone is the primary male sex hormone responsible for the development of male sexual organs, regulation of spermatogenesis, and sexual behavior. It is known that the reduction in the concentration of testosterone leads to male infertility, and its increase with age can trigger the development of prostate cancer.

Due to this fact, the study of the impact of harmful factors on the health of workers and their hygienic assessment is promising and important for the further development of medical and preventive measures [4].

Objective of the research was the evaluation of blood hormonal status in the military servicemen. The following tasks have been solved: the selection of the contingent for the study, blood sampling, biochemical blood tests for testosterone concentration, and the analysis of data obtained.

Materials and Research Methods

The study involved both active and retired military servicemen and private soldiers. The control group included people not related to military activity.

We also determined the significance of possible risk factors such as age, occupation, length of service, and a type of troops. Considering these factors, the indicators of testosterone levels in the surveyed were distributed.

Hormones were identified by enzyme-linked immunosorbent assay (ELISA) of blood with the use of a reagent kit "Testosterone ELISA". The principle of the method is based on the competitive enzyme immunoassay. The monoclonal testosterone antibodies were immobilized on the inner surface of the microtiter well. The sample testosterone competes with the conjugated testosterone for the binding to antibodies on the wells' surface. As a result, a peroxidase-containing plastic "sandwich" is formed. During incubation with a solution of tetramethylbenzidine (TMB) substrate the solutions in the wells are stained. The color intensity is inversely proportional to the concentration of testosterone in the sample. The concentration of testosterone in the samples is determined based on the calibration curve of the optical density to the testosterone content in the calibration samples [5, 6, 7].

Course of Study

1. Put a required number of strips - for test samples of calibration samples and for control serum - into the frame.

2. Add 25 µl of calibration sample and control serum in each corresponding well. Add 25 µl of test samples of blood (plasma) serum in each of the rest wells. Both calibration samples, control serum and test samples should be added within 5-10 minutes.

3. Add 100 µl of a conjugate to each of all wells.

4. Seal the plate with the plate sealing paper and incubate for 120 minutes at +37 °C.

5. After incubation, remove the content from the wells and wash the wells 5 times. Upon each washing add 250 µl of washing solution to each well, then shake the plate is shaken in circular motions on a horizontal surface with its

further aspiration or decantation. A delay upon washing (wells soaking) is not required. During each decanting carefully remove the remaining fluid from the wells by tapping the plate in upside down position on the filter paper.

6. Add 100 µl of tetramethylbenzidine substrate solution in each well. Tetramethylbenzidine substrate solution should be added in the wells within 2-3 minutes. Incubate the plate in the dark at room temperature (+18 ... +25°C) for 10-20 minutes depending on the extent of blue staining development.

7. Add 100 µl of stop reagent in the same wells within the same time limits and in the same sequence, to make the content of the wells turn bright yellow.

8. Further, measure the optical density (OP) value of the content of the microtiter wells with the photometer. The well content OP should be measured within 15 minutes after the introduction of a stop reagent.

Then, the obtained results were processed by statistical research methods.

Results

At the beginning of the study the military servicemen were divided into contingent groups: private soldiers, active military servicemen, retired and former military servicemen.

The distribution of testosterone level indicators by contingent showed the reduced level only in private soldiers - 3.6% of the surveyed in this group.

High testosterone levels have been detected in all the contingents: private soldiers - 37.3%, active military servicemen - 27.5%. The risk group by contingent included the retired and former military servicemen: high testosterone levels were detected in 52.1% of the surveyed in this group.

In the control group, a high testosterone level was in 48.3% of the surveyed.

A high testosterone level is observed in all age groups: 60-69 years - 56%, 50-59 years - 50%, 40-49 years - 40%, 18-29 years - 37.4%. The risk group by age factor includes persons over 70 years old: an increased level of testosterone was detected in 61.5% of the surveyed in this age group.

Low level was detected in persons aged 18-29 years – 3.3% of the surveyed.

Analysis of the distribution of testosterone level indicators by age showed that the older the age contingent is, the more often there is a high testosterone level in the blood.

A high testosterone level is observed in all groups based on length of service: 3-9 years - 42.9%, 1-2 years - 36.9%, 20-29 years - 31%, 18-29 years - 37.4%. The risk group by length of service includes persons with more than 30-39 year experience: an increased level of testosterone was detected in 55.2% of the surveyed in this group.

During the service period of 1-2 years there is an increase in testosterone level in 3.6% of the surveyed.

The distribution of indicators by professional experience showed that the increase in professional experience leads to increase in testosterone levels in the military servicemen.

Analysis of testosterone level in the military servicemen subject to the type of troops showed high testosterone levels in the missile troops (in 90.2% of the surveyed in this group), naval forces (55.6%), and ground forces (43.8%).

Low testosterone levels were identified in 1.3% of the surveyed of the ground forces.

The distribution of indicators by the type of troops showed that the risk group involves military servicemen of missile troops, naval and ground forces.

The conducted correlation analysis established a strong correlation between the indicators of testosterone level and a contingent, labor conditions, and a type of troops.

Summary

The study revealed hormonal disorders in all contingents examined.

A high-risk group involves retired and former military servicemen (high levels of testosterone were found in 52.1% of the surveyed of this contingent).

The age-related risk group involves persons over 70 years old (high levels of testosterone were found in 61.5% of the surveyed in this age group).

The risk group based on length of service involves the workers with length of service of 30-39 years (high levels of testosterone were found in 55.2% of the surveyed with this length of service).

The following interrelation was revealed: with an increase in age and professional experience in the military servicemen there is an increase in testosterone levels, which can increase the risk of cancer of the prostate gland.

Low levels of testosterone were found in private soldiers (3.6% of the surveyed of this contingent), in persons aged 18-29 years (3.3% of the surveyed in this age group), and in those with length of service of 1-2 years (3.6% of the surveyed with this length of service).

The conducted correlation analysis established a strong correlation between the indicators of testosterone level and a contingent, labor conditions, and a type of troops.

Conclusion

The conducted study reveals the acute problems of carcinogenic and mutagenic hazards emerging in terms of production and non-production spheres of activity of an able-bodied person. Hormonal status is one of such criterion.

Data show that almost all age, experience, or occupational contingents have deviations from the standard testosterone levels. An attention is drawn to two groups of surveyed - the group of private soldiers and the group of retired military servicemen. Significantly high discrepancy with the standard values were revealed in these groups. The private soldier, starting the military service, already have disorders of hormonal status. Further professional activities (military soldiers, in the context of this study) contributes to further hormonal imbalance in the form of sharply inflated reliable indicators of this hormone, which may indicate a potentiation of the harmful effects of reprotoxic substances and factors of physical etiology (sound pressure levels, various category vibrations, radio- and electromagnetic radiation, etc.).

Considering the problem of hormonal imbalance in men there arises a need for primary prevention as a system of measures aimed at preventing the occurrence of disorders in the male genital area by eliminating or weakening environmental factors. Also, a comprehensive in-depth study will provide a preventive scheme for men of reproductive age.

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