SCIENCE IN THE MODERN WORLD: INNOVATIONS AND CHALLENGES

Proceedings of VI International Scientific and Practical Conference

Toronto, Canada

20-22 February 2025

Toronto, Canada

2025

TABLE OF CONTENTS

AGRICULTURAL SCIENCES

BIOLOGICAL SCIENCES

MEDICAL SCIENCES

УДК 616.697:616.699-072(477.64-25)

CHANGE OF SEMEN ANALYSIS PARAMETERS UNDER THE INFLUENCE OF PSYCHO-EMOTIONAL STRESS

Vorontsova Lolita Leonidivna,
Doctor of Medical Sciences, professor,
Head of the Department
Kovalenko Victoria Anatoliivna,
Candidate of Biological Sciences, Associate Professor
Department of Laboratory Medicine
Zaporizhzhia State Medical and Pharmaceutical University
Zaporizhzhia, Ukraine

Abstract. The article assesses spermogram of 904 clinically healthy men of reproductive age, who are living in the industrial city of Zaporizhzhia (over a ten-year period).

As a result of the study, only in 2022 – 2023 a number of pathological changes in spermograms (dyskinesis, teratozoospermia, decrease in the percentage of motile spermatozoa in the dynamic kinesisgram) were revealed, which is evidence of the deterioration of the fertility of the ejaculate and caused by the presence of additional psycho-emotional stress factors in these years.

Thus, psychoemotional factors play a leading role in the development of reproductive disorders in men living in an industrial city, while the negative influence of environmental factors is secondary and manifests itself only with sufficiently powerful cumulative effects.

Key words: spermogram, regional indicators, male infertility, fertility.

Recently, reproductive impairment in men has acquired a special medical and social significance [1, p. 8-17; 2, p. 227-230].

The most pressing issue is the change in semen indicators, as the causes of male infertility, in conditions of pollution of a large industrial city, as evidenced by a significant amount of scientific research, it is proved that the level of male fertility

varies depending on the level of pollution in the region [3, p. 114-121].

At the same time, many authors emphasize the effect of pronounced stress (including psychological), as one of the leading factors that inhibit spermatogenesis, which, apparently, is mediated by a number of hormonal changes [4, p. 284-291; 5, p. 134-137].

Socio-political and economic events of recent years in Ukraine are taking place against the backdrop of a protracted armed conflict, and as a result, the vast majority of both the participants in armed conflicts and civilians in the South-Eastern part of Ukraine (including Zaporizhzhya region) are under the psychotraumatic influence of stress, that leads to the so-called post-traumatic stress disorders [6, p. 173-177]. These violations are accompanied not only by social and psychological maladaptation but also lead to the development of a few borderline disorders and psychosomatic diseases. To date, the problems of disrupting the health of participants in wars and local conflicts in the form of borderline disorders and psychosomatic diseases have been studied sufficiently, while the influence of psycho-emotional stress on the male reproductive system remains poorly studied [7, p. 84-86].

In this regard, the study was aimed at identifying changes in the main indicators of ejaculate in clinically healthy men of reproductive age living in the conditions of the Zaporizhzhya region and analyze the severity of these changes over 10 years.

Materials and methods

The analysis of the main indicators of the ejaculate was carried out over a 10-year period (from 2014 to 2023). 904 men aged 21 to 42 years who did not complain about the dysfunction of the reproductive system were examined and were examined in connection with the planning of childbirth.

Semen analysis was performed over standard technique recommended by WHO [8].

During this ten-year period, statistical processing of the main indicators of the spermogram for each year and a statistical analysis of the comparative indicators in relation to the previous year were carried out.

Results of the study

As a result of the study, regional indicators of male spermograms in the Zaporizhzhya region over a ten-year period were studied, based on which one can judge the dynamics of changes in the fertile properties of the ejaculate.

When analyzing the dynamics of changes in the volume, the pH and of the ejaculate viscosity no statistically significant changes over the indicated years were revealed.

Analysis of sperm motility and the changes in the percentage of active spermatozoa showed that the fluctuations of this indicator from 2014 to 2021 ranged from 65-70%, which corresponded to the standards recommended by WHO. In 2021 – 2022 there was a slight decrease in the number of actively mobile forms (on average by 5,5 % and 7,7 % compared to the previous year and 2014). In 2023, the number of active spermatozoa sharply decreased: relative to 2022, on average – by 26,5 % ($P<0,01$), compared to 2014 – on average by 41,5 % ($P <0,01$).

Determination of the percentage of immobile sperm showed a statistically significant increase, starting from 2015. At the same time, general motility (the sum of active and not mobile forms) complied with WHO standards. The study showed that from 2014 to 2023 the number of immobile spermatozoa ranged from 10,5 to 13 %. In 2023, there was a statistically significant ($P<0,01$) increase in the number of fixed spermatozoa by 1,5 times compared with 2021 and 1,9 times compared with 2014.

The study of changes in the number of spermatozoa, both in 1 ml of ejaculate and in the total spermatozoa amount in ejaculate, showed that throughout the entire study period, these indicators were stably at a high level, significantly exceeding the standards recommended by WHO experts.

Determination of the percentage of morphologically normal spermatozoa in stained preparations showed that from 2014 to 2015 their number ranged from 77,5 to 80 %, averaging 79,2 %. In 2022 – 2023 morphologically normal spermatozoa averaged 63,7 %, which was 20 % lower than in the period 2014 – 2021, but corresponded to the standards recommended by WHO experts. Evaluation of

morphologically altered spermatozoa, respectively, showed that from 2014 to 2021 their percentage ranged from 20 to 22,5 %. While in 2022 - 2023 there was a statistically significant increase in the number of morphologically modified spermatozoa.

Analysis of the percentage of sperm with multiple defects showed that from 2014 to 2020 isolated forms in rare fields of view were identified. In 2022 – 2023 the number of spermatozoa with multiple defects ranged from 2 % to 7 %. The index of teratozoospermia was 1,1 – 1,27, which indicates the deterioration of the fertile properties of the ejaculate.

The tendency to a decrease in the fertile properties of the ejaculate of men of reproductive age in the Zaporizhzhya region, observed in 2022–2023, manifested as a decrease in the number of spermatozoa, an increase in the number of morphologically changed, against the background of a decrease in morphologically normal spermatozoa and a tendency to a decrease in the percentage of motility forms. This is apparently due to the fact that, starting from 2022, in addition to the negative influence of environmental factors, emotional stress has joined, lenny the existence of an armed conflict in the Ukraine.

Thus, given the identified quantitative changes in semen parameters in men who do not have a dysfunction of the reproductive system at the time of the survey, only in the years mentioned above, it can be assumed that emotional factors play a key role in the development of disorders of the male reproductive function [9, p. 126-140; 10, p. 373-382].

Conclusions

1. During the study, changes were identified in a number of spermogram indices, which are different in variability and indicate a tendency to a decrease in the fertile properties of the ejaculate.

2. A number of pathological changes in spermograms (dyskinesis, teratozoospermia, decrease in the percentage of motile spermatozoa in the dynamic kinesisgram) were determined in 2022-2013, which indicated a deterioration in the fertile properties of the ejaculate and, obviously, caused by the action of negative

emotional factors.

3. The data obtained are recommended for use as reference values in the analysis of fertility rates in men of Zaporizhzhya region in diagnostic centers and family planning centers.

LITERATURE

1. Horpynchenko I., Romanyuk M. (2016) Choloviche bezpliddya: etiolohiya, patohenez, diahnostyka ta suchasni metody likuvannya [Male infertility: etiology, pathogenesis, diagnosis and modern methods of treatment]. Zdorov`e muzhchyny, vol. 1, no 56, pp. 8 – 17. (in Ukrainian).

2. Szkodziak P., Wozniak S., Czuczwar P. (2016) Infertility in the light of new scientific reports – focus on male factor. Ann. Agric. Environ. Med., vol. 23, no 2, pp. 227 – 230.

3. Lomeiko O., Kolesnyk Yu., Avramenko N. (2018) Cholovicha infertil'nist' v umovakh velykogo promyslovogo mista: rol' khimichnykh, fizychnykh ta emotsiynykh faktoriv [Male infertility in a large industrial city: the role of chemical, physical and emotional factors]. Pathologia, vol. 15, no 1, pp. 114 – 121. (in Ukrainian).

4. Juarez-Rojas L., Vigueras-Villasenor R.M., Casillas F., Retana-Marquez S. (2017) Gradual decrease in spermatogenesis caused by chronic stress. Acta Histochem, vol. 119, no 3, pp. 284 – 291.

5. Zolotareva T., Nasibullin B., Yaroshenko N., Zmievskiy A. (2011) Suchasni uyavlennia pro stres-indukovani zminy aktyvnosti spermatogenezu [Modern concepts of stress-inducted changes of spermatogenesis' activity]. Svit medytsyny ta biologii, no 4, pp. 134 – 137. (in Ukrainian).

6. Troshin V., Pogodina T., Ryzhakov V. (2011) Rasstroystva tsentral'noy nervnoy sistemy, tipichnye dlia uchastnikov sovremennykh boevykh deystviy [Frustrations of the central nervous system, typical for participants of modern military operations]. Medical al'manakh, vol. 1, no 14, pp. 173 – 177. (in Russian).

7. Shadrina I., Dedova N., Pugachev A. (2011) Neyrofiziologicheskie osobennosti raboty golovnogo mozga (po rezul'tatam analiza pokazateley EEG) i ikh

vliyanie na psikhicheskie kharakteristiki u patsientov s posttravmaticheskim stressovym rasstroystvom [Neurophysiological features of the brain (according to the results of the analysis of EEG indicators) and their impact on mental characteristics in patients with post-traumatic stress disorder]. Vestnik YurGU, no 7, pp. 84 – 86. (in Russian).

8. World Health Organization (WHO) (2010) Laboratory manual for the examination and progressing of human semen [5th ed.]. New York: Cambridge University Press, 234.

9. Jenardhanan P., Panneerseivam M., Mathur P. (2016) Effect of environmental contaminants on spermatogenesis. Semin. Cell. Dev. Biol., vol. 59, p. 126 – 140.

10. Nargund V. (2015) Effects of psychological stress on male fertility. Nat. Rev. Urol., vol. 12, no 7, pp. 373 – 382.