

# THE INFLUENCE OF WATER AND RESPIRATORY TRAINING ON HORMONAL AND SERUM ANTIOXIDANT STATUSES IN PREGNANT WOMEN

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**Introduction.** The issue of promotion of maternal and child health, disease prevention among pregnant women is still in the center of researchers' attention [5, 3]. Child's sickness rate is mainly related to the risk factors in the perinatal period [1].

Hormonal status is one of the main indicators of female health during pregnancy. Hormones control almost all body systems, their change can indicate to development of disorders or, on the contrary, resetting of physiological functions [4].

The health complex made of consistent execution of respiratory and aquagymnastics exercises during the whole gestational period is one of the ways to enhance the treatment of fetal hypoxia, decrease maternal incidence and rate of prenatal and birth complications [6, 2].

**The purpose of the study** was to examine the influence of the water and respiratory training for pregnant women on the hormones and serum antioxidant statuses.

**Materials and methods.** The first (control) group consisted of 35 (17.7%) healthy pregnant women aged 20 to 42 years who did not participate in recreational activities (C). Their mean age was  $22 \pm 5$  years. The second (comparison group) was made of 40 (20,2%) pregnant women aged 18 to 40 years with somatopathies, who did not participate in the complex of recreational activities (CG). The average age of the group was  $23 \pm 4$  years. The third (main group) included 123 (62,1%) pregnant women aged 19 to 43 years with somatopathies, who made a complex of recreational activities (M). Their mean age was  $23 \pm 5$  years.

Hormones in the blood serum were determined using the enzyme-linked immunosorbent assay (ELISA). The content of somatotropin (STT), testosterone and estradiol was measured. The study was performed using an automated analyzer ELISA on the apparatus "AXSYM" produced by Abbott. Using a two-step immunoenzyme method based on the principle of reverse titration malondialdehyde (MDA) was measured using the color reaction with thiobarbituric acid. Mass concentration of vitamin E in the blood serum was defined by the bioliquid analyzer FLUORAT ABLF-02.

The results of the study were statistically processed using the statistical software package STATISTICA 6.0. The Kolmogorov-Smirnov's test was used to check the normal distribution. The reliability of differences of unrelated samples was estimated using Student's t-criterion (for parameters with normal distribution) and the Mann-Whitney U test (for parameters not subject to the normal distribution law).

A set of exercises was performed four times a week under the methodist's supervision and 3 times a week on one's own. The duration of the class of respiratory gymnastics was 15-20 minutes and aquagymnastics - 45 minutes [2].

The respiratory gymnastics exercise set was made of 6 exercises performed in the half-sitting position in a relaxed state. The aquagymnastics exercise set included:

- Active exercises at the nosing of the pool
- Exercises, hanging with one's back to the nosing
- Exercises, hanging on the nosing with one's face to it
- Breast exercises
- Water exercises
- Breathing exercises
- Breath-holding exercises

Exercises were performed at each lesson. 50 % of the time was dedicated to active exercises with stretching, 50 % - breathing and breath-holding exercises.

**Results and discussion.** Proceeding from the general analysis of the investigated hormonal parameters in general, women with different forms of somatic diseases and risk factors in the prenatal period in the I trimester of pregnancy were characterized by lower indices of the content of thyroid hormones of T3, T4 and thyrotropic hormone (TTH) in the groups being analyzed relative to control one ( $p < 0.001$ ) (Tab. 1).

**Table 1.** The content of thyroid hormones in peripheral blood of pregnant women in the compared groups,  $X + m$

Hormones	Trimester	Compared groups		
		Control group, n=35	Comparison group, n=40	Main group, n=123
TTH, mIU/L	I	2,84±0,04 p3<0,001	2,04±0,03 p1<0,001 p3<0,001	2,09±0,03 p1<0,001 p3<0,001
	III	3,25±0,05	2,51±0,05 p1<0,001	3,20±0,04 p1>0,05 p2<0,001
T3, nm/l	I	2,51±0,04 p3<0,01	2,03±0,02 p1<0,001 p3<0,001	2,10±0,03 p1<0,001 p3<0,001
	III	2,74±0,04	2,30±0,04 p1<0,001	2,63±0,04 p1>0,05 p2<0,001
T4, nm/l	I	121,52±4,02 p3<0,05	106,52±3,42 p1<0,001 p3<0,001	107,52±4,59 p1<0,001 p3<0,001
	III	139,36±2,04	124,43±2,67 p1<0,001	135,13±3,13 p1>0,05 p2<0,001

*Note.* Here and in Tab. 2, 3: p1 – level of reliability of indices compared with the control group, p2 – level of reliability of indices compared with the comparison group, p3 – level of reliability of indices compared with the relevant groups in dynamics (I and III trimesters).

The given picture of the hormonal blood spectrum suggests that in the formation of its features in pregnant women with various forms of somatopathies the suppression of the thyroid functional status could have a pathogenetic importance, which arose probably under the influence of continuous action of risk factors (stress, frequent exacerbations of somatic pathology, etc.). Such a condition in pregnant women is caused by the long-term tension of the pituitary-thyroid system, which can lead not only to a gradual reduction of adaptive mechanisms, but also to

metabolic disturbances in the glandula thyroidea. The noted decrease in the level of thyroxine and triiodothyronine can also be considered as a nonspecific reaction of the organism in the somatic pathology.

According to our data, the inhibition of glucosteroidogenesis was also observed in pregnant women with somatopathies, as indicated by reduced cortisol in comparison groups and in the main group of the I trimester. Prolonged tension of pituitary-adrenal system can lead to a slow deterioration of the adrenal cortex. Nevertheless, some researchers stress that pregnant women, suffering from diseases such as bronchial asthma, chronic bronchitis for a long time, have not the depression of their function of the adrenal cortex, but intensification of glucocorticoid effects by increasing the free cortisol concentration and the histaminase activity. This fact enables to consider low cortisol level in women with somatopathies as an indicator of disruption of the normal immunogenesis regulation and associated changes in the immunological reactivity. The insulin indices in the I trimester of pregnancy must be related with the hypofunction of maternal endocrine glands which could lead to precocity and functional prematurity of relevant fetal glands, meant for liquidation of hormonal deficiency in the mother's organism, which is proved by the increased indices of the pituitary-thyroid system in pregnant women on the background of active physical and breathing classes.

In the III trimester of pregnancy the indices T3, T4, TTH of women of the main group (on the background of water and respiratory training) did not differ significantly from the ones of women of the control group. The women of the comparison group had low indices of thyroid hormones throughout pregnancy and they did not have significant differences depending on the gestational term.

During the 20<sup>th</sup> week of pregnancy the risk of developing gestational diabetes increases. On the background of active physical and breathing classes women of the main group had an increase in the insulin level within the reference values, whereas in the comparison group the insulin level significantly decreased ( $p < 0.05$ ), but remained within the control values (Tab. 2).

**Table 2.** *Cortisol and insulin content in peripheral blood of pregnant women in compared groups,  $X \pm m$*

Hormones	Trimester	Compared groups		
		Control group, n=35	Comparison group, n=40	Main group, n=123

Cortisol, nm/l	I	494,44±5,48 p3<0,001	401,18±4,88 p1<0,001 p3<0,001	405,36±2,84 p1<0,001 p3<0,001
	III	751,64±12,43	511,73±21,75 p1<0,001	665,69±12,14 p1<0,001 p2<0,001
Insulin, mcU/ml	I	14,60±0,16 p3<0,001	16,21±3,24 p1<0,001 p3<0,001	16,50±3,24 p1<0,001 p3<0,001
	III	23,28±0,19	22,03±3,42	22,09±3,22 p1>0,05

Such a dynamics provokes the positive influence of the complex physiological exposure of recreational activities on the hormonal status of pregnant women with a somatic pathology. In this regard, the course of adaptive processes in the body is largely dependent on the adrenal function and the pituitary-adrenal system against thyroid gestation.

Thus, different somatopathies and risk factors in the prenatal period during pregnancy can affect the functional activity of the endocrine system of pregnant woman, which is accompanied by reduced indices of thyroid hormones and adrenal glands.

Given the key role of lipid peroxidation processes in the pathogenesis of pregnancy complications, we have identified the indices of malondialdehyde (MDA) and antioxidant status (Vitamin E) in the blood serum. The results of the study of the indices of lipid peroxidation and antioxidant activity of blood in pregnant women are presented in Table 3. Comparing the examined index of malondialdehyde in pregnant women with somatopathies with the control group (2,88 nm/l), an increase in its content was observed in the I trimester of pregnancy (comparison group - 3,85 nm/l; main group - 3,84 nm/l). The analysis of blood antioxidant status (vitamin E) in women with somatopathies in the first trimester of pregnancy showed a slight decrease in vitamin E (9,89 mmol/ml) compared with the uncomplicated pregnancy of healthy women (10,63 mmol/ml). In this regard, some researchers emphasize that pregnant women, suffering from diseases such as bronchitis, bronchial asthma for a long time, have an increase of radical oxidation process and reduction of the blood antioxidant status.

**Table 3.** *Indices of lipid peroxidation - antioxidant defense in pregnant women in the compared groups,  $X \pm m$*

Index	mes	Compared groups
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		<b>Control group, n=35</b>	<b>Comparison group, n=40</b>	<b>Main group, n=123</b>
MDA, nm/l	I	2,88±0,03 p3>0,05	3,85±0,04 p1<0,001	3,84±0,05 p1<0,001
	III	2,80±0,04	3,58±0,12 p1<0,001	2,87±0,05 p1>0,05 p2<0,001
Vit. E, mmol/ml	I	10,63±0,07 p3>0,05	9,89±0,09	10,19±0,11 p1>0,05
	III	10,96±0,07	11,26±0,34	15,61±0,21 p1<0,001 p2<0,001

Thus, the onset of pregnancy on the background of somatopathies and gestational complications (threat of an early miscarriage, hypertension, etc.) in the I trimester of pregnancy is characterized by the MDA increase and low vitamin E.

The data on the decline in the activity of malondialdehyde in the III trimester of pregnancy are of practical significance on the background of water and respiratory training in women of the main group relative to the comparison group ( $p < 0.001$ ). But the index of blood antioxidant status - Vitamin E - increased significantly compared with that in the group of women not engaged in gymnastics, respiratory and aqua gymnastics (15.61 and 11.26 mmol/ml respectively,  $p < 0.001$ ) It can be assumed that pregnancy of women with somatopathies and risk factors in the prenatal period proceeded against the background of the oxidative stress and depletion of antioxidant defense systems. To prevent the development of the oxidative stress women of the main group performed water-respiratory training complexes. The prolonged exposure of recreational activities was followed by the reduction of malondialdehyde and the increase of vitamin E in the blood serum in the organism of pregnant women in the III trimester of pregnancy. As shown by the results of the study, physical exercises, respiratory and aqua gymnastics have a stimulating effect on metabolism, thereby normalizing the level of enzymatic antioxidants.

Thus, as shown by the results of the studies, pregnancy associated with an extragenital pathology is accompanied by the decreased blood antioxidant status (vitamin E) since early pregnancy - 10-12 weeks. The end products of the lipid peroxidation - MDA reaction were proved to be the most marked.

The timely introduction in the prenatal period of a set of physical and breathing exercises and aquagymnastics facilitates restoration of enzymatic redox processes in tissues, resulting in enhancement of the fetal oxygen uptake.

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