

## 1. Introduction

Harmonious and stable psycho-emotional state of pregnant women and women in childbirth is an important condition of successful pregnancy follow-up, fetal development and physiological childbirth. People are facing various problems related to mental health that vary from psycho-emotional stress and mental disorders during and after force majeure situations [1, 2]. Among the consequences of severe stress during pregnancy is dizziness, tachycardia, trembling of limbs, elevated arterial pressure, unmotivated increase in nervousness and anxiety, sleep disorder, depression that lead to worsening of general condition of a future mother.

Some researchers tie the decrease in capability for work, worsening of appetite, flabbiness, apathy, sleep disorder of pregnant women to a long-term negative impact of chronic stress [2]. Therefore, the issue of learning of psycho-emotional state of pregnant women, especially those who are staying in the zone of the military aggression, is the primary concern for scientists [3, 4]. Undoubtedly, perinatal stress makes negative impact on nervous system of a fetal and a newborn that can be identified by clinical signs in the form of low birth weight and low estimate by Apgar scale during the first minutes after birth. Later on, these children encounter difficulties during adaptation in a collective, they are hyperactive and prone to various phobias [5, 6].

The issue of perinatal stress is a matter of particular importance today. Military aggression stipulates the birth of so-called «children of war», whose typical features are lack of self-confidence, low self-esteem and mental disorders [7]. The specifics of psycho-emotional state of these children have been studied by German and American psychoanalysts and psychiatrists [7], who confirmed the negative impact of chronic stress conditioned by military regime on formation of personality of future children.

## POSTTRAUMATIC SYNDROME DURING PREGNANCY: EXPECTATIONS AND REALITY

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**Abstract:** **Aim of the research** is to study identification of peculiar issues associated with psycho-emotional state and the related stress-associated hormones and micronutrients in pregnant-displace individuals for further improvement of programmes for antenatal research.

**Materials and methods.** In order to reach the research objective, a dynamic prospective clinical-paraclinical examination of 96 pregnant women (experimental group) – temporary displaced individuals with gestation period of more than 22 weeks who have been treated and gave birth to their children in the Central Municipal Hospital in Rubizhne and Perinatal Centre in Severodonetsk, Lugansk region. The control group consists of 39 randomly selected pregnant women for the purposes of prospective research that are living in the areas under the control of Ukraine government.

All pregnant women were examined (clinical-laboratory and special midwifery examinations), the evaluation of psycho-emotional state of examined pregnant women was conducted with the help of screening by performing clinical interviews together with routine questioning. The questionnaires that contained the questions of Spielberg's tests in the modification of Khanin were composed in advance. Concentration of stress-associated hormones in the blood serum, Ca and Mg was identified using the method of solid-phase immuno-ferment analysis.

**Results.** According to the Spielberg's test, the average score of reactive anxiety in the experimental group exceeded the analogous indicator in the control group by 1.6 times. The indicators of personal anxiety exceeded the normal indicator in the control group by 2.2 times. Of the pregnant women in the experimental group had the concentration of cortisol in the blood serum exceeded the upper physiological standard by 5.5 % and exceeded the analogous indicator in the control group by 43.4 %. The increase concentration of prolactin was yet observed in the II trimester of pregnancy if compared to the upper level of physiological standard by 13.3 %; if compared to the average indicator of this hormone in the control group – by 20.3 %. In the III trimester – concentration in both groups was within normal ranges, but in the experimental group this indicator was higher by 10.5 %. In the experimental group of pregnant women the concentration of Ca in the blood serum in comparison to the physiological standard was higher by 19.2 % and by 9.6 % higher if compared to the analogous indicator in the control group of pregnant women. At the same time, the pregnant women in the experimental group have low concentration of Mg.

**Conclusions.** Taking into account the identified patterns, it is useful to categorise the pregnant women from among the internally displaced individuals as the group of high risk with respect to the development of obstetric and perinatal complications.

**Keywords:** pregnancy, labors, stress, psychodiagnostics, pregnant women-displaced persons, cortisol, prolactin, micronutritional imbalance, perinatal complications.

Presently, one of the features of Ukrainian reality is the presence of new layer of society – internally displaced individuals from Donbass and Crimea. According to the data of the Ministry of Social Policy of Ukraine, total number of internally displaced citizens reached 1,489,659 as of 5 March 2018 [8]. These people were exposed to the direct military aggression in one way or another. However, overcoming force majeure situations related to the occupation and military activity in the East of Ukraine results in pathologic reactions to everyday life routines, which is identified as a posttraumatic syndrome (PTS).

According to the data presented by modern researchers, PTS is characterized by frequent changes in mood and behavior that, in the most cases, continues to disturb individuals during many years and leads to destruction of the system of personal protectors [9].

Pregnant women and children are the most sensitive to this destruction caused by PTS. It is clear that there is the connection between psycho-emotional and physical state of pregnant women and fetal development. Negative emotions, mental strain, fatigue, fear, anxiety and depression increase the risk of midwifery complications [2, 10], including preeclampsia (46.3 %), placental dysfunction (56.65 %), nulliparity (10.9 %) and prematurity of pregnancy (16.6 %). In addition, these factors contribute to the increase in the share of newborns (76.0 %) with different types of asphyxia [7, 10].

**Aim of the research:** identification of peculiar issues associated with psycho-emotional state and the related stress-associated hormones and micronutrients in pregnant-displace individuals for further improvement of programmes for antenatal research.

## 2. Materials and methods

In order to reach the research objective, a dynamic prospective clinical-paraclinical examination of 96 pregnant women (experimental group) – temporary displaced individuals (TDI) with

gestation period of more than 22 weeks who have been treated and gave birth to their children in the Central Municipal Multidisciplinary Hospital (CMMH) in Rubizhne and Perinatal Centre in Severodonetsk, Lugansk region. The control group consists of 39 randomly selected pregnant women for the purposes of prospective research that are living in the areas under the control of Ukraine government.

All pregnant women were examined (clinical-laboratory and special midwifery examinations) according to the requirements of the quality standards according to the Order of the Healthcare Ministry (HM) of Ukraine № 417 of 15.07.2011 [11]. The evaluation of psycho-emotional state of examined pregnant women was conducted with the help of screening by performing clinical interviews together with routine questioning. The questionnaires that contained the questions of Spielberg's tests in the modification by Khanin were composed in advance. Concentration of stress-associated hormones in the blood serum (cortisol (C) and prolactin (PRL)) was identified using the method of solid-phase immuno-ferment analysis with the help of test-systems Cortisol – EIA, Prolactin – EIA (produced by XEMA, Russia) and the device "Lazurite" with SD DS Matrix 1.23 (Dynex Technologies, USA), concentration of Ca and Mg was identified with the help of the device Chem-7 (Erba Mannheim, Germany) and the set of reagents – Magnesium (Mg) – SpL, Calcium (Ca) – SpL [«SpineLab» Ltd, Ukraine] colorimetric method. Statistical processing of the results was performed with the help of methods of descriptive and variation statistics using Student's criterion and Fisher's method of angular transformation. The comparison of the research results was conducted with the help of multiple correlation analysis with computation of Pearson's (r) coefficient of linear correlation. The computation of the obtained results was performed with the help of PC using programs Statistica for Windows and Microsoft Excel 7.0. The level of significance is  $p < 0.05$ .

### 3. Research results

The characteristics of pregnant women from experimental groups, including age, family and social status, childbirth parity, were homogeneous to provide insights regarding the divergences linked to the state of an internally displaced individual. Thus, according to the Spielberg's test, the average score of reactive anxiety (RA) in the experimental group exceeded the analogous indicator in the control group (29) by 1.6 times scoring 47. At the same time, 29 (30.2 %) pregnant women in the experimental group had low level of RA, 48 (50.0 %) of them had moderate level of RA and 19 (19.8 %) had high level of RA. The majority of pregnant women in the control group had low level of RA (25–64.1 %;  $p < 0.05$ ), the share of pregnant women with moderate and high level of RA made up 30.8 % (12 cases) and 5.1 % (2 cases) respectively ( $p < 0.05$ ). The indicators of personal anxiety (PA) were different as well and made up 45 and 33 scores respectively. Every third of pregnant woman in the experimental group had low level of PA (31.3 %; in the control group – 66.7 %;  $p < 0.05$ ), every second pregnant woman had the moderate level of PA (45.8 %; in the control group – 23.1 %;  $p < 0.05$ ), that is nearly twice the level of PA in the experimental group. The frequency of the high level of PA in the experimental group exceeded the normal indicator in the control group by 2.2 times and made up 22.9 % (the control group – 10.2 %;  $p < 0.05$ ). Hence, according to the Spielberg's test, the state of the pregnant woman in the experimental group is characterized by the moderate and high levels of RA and PA that is the result of activation of the hippocampus-hypothalamus-hypophysis-adrenal gland based on persistent chronic stress. According

to the results of this research, in the dynamics of pregnancy (22–23 weeks;  $229.46 \pm 15.93$  ng/ml) of the pregnant women in the experimental group had the concentration of cortisol (C) in the blood serum exceeded the upper physiological standard by 5.5 % and exceeded the analogous indicator in the control group by 43.4 % ( $160.0 \pm 14.99$  ng/ml;  $p < 0.05$ ). Taking into account the fact that the concentration C in the uterine muscle increases by nine times when its concentration in the blood plasma increases by three times [12], emerging of the majority of complications during pregnancy based on chronic stress is tight to disorder of biosynthesis of this hormone. The concentration C in the blood serum of pregnant women in the experimental group grew progressively in the dynamics of pregnancy and made up  $233.19 \pm 7.26$  ng/ml during 32–33 weeks of pregnancy that exceeds the upper physiological level by 7.3 % and by 17.9 % of the average indicator in the control group ( $197.86 \pm 612.14$  ng/ml;  $p < 0.05$ ). In this way, the results of the research verify that the gestation flow in the experimental group of pregnant women based on significant increase in the concentration C is influenced by the permanent stress.

High concentration C in the case of the long-term stress of pregnant women contributes to the development of functional changes in the hippocampus-hypothalamus-hypophysis-adrenal gland, which is the reason of the increase in arterial pressure, and formation of insulin resistance of fetal. According to the data of modern researchers [13], there is a system of «fetal programming» which is the manifestation of the deferred consequences in the adult age, functional disorders and changes in the fetal development. The increase in concentration C contributes to the changes in the number of steroid receptors in the neuroendocrine system of a fetal. This results in the increase in secretion of the hormone as the response to any external agent in the future. In other words, a vicious circle is formed thus creating a basis for persistent increase in basal and stress-inductive concentration of glucocorticoids in the bodies of adult individuals. From our perspective, there are rather interesting results of the correlation analysis between the concentration of cortisol and personal anxiety of the pregnant women in the experimental group according to the Spielberg's test: the presence of strong direct relation ( $r = 0.8601$ ) is an evidence of the significant impact of cortisol. Biosynthesis of cortisol is increasing during stress that provokes bad state of health, anxiety, sleep disorder, irritability and depression of pregnant women-displaced individuals who participated in the research.

The tendency to the excessive concentration of prolactin is observed in the blood serum of the examined women in the experimental group. The increase in these indicators was yet observed in the II trimester of pregnancy ( $326.31 \pm 11.29$  ng/ml) if compared to the upper level of physiological standard by 13.3 %; if compared to the average indicator of this hormone in the control group ( $271.16 \pm 7.13$  ng/ml,  $p < 0.05$ ) – by 20.3 %. In the III trimester of pregnancy, the concentration of PRL in both groups was within normal ranges, but in the experimental group, this indicator was higher by 10.5 %. The indicators made up  $400.42 \pm 5.35$  ng/ml and  $362.28 \pm 6.28$  ng/ml;  $p < 0.05$  respectively. Thus, it is clear that the pregnant women from among TDI are under the impact of permanent long-term stress and have the increased concentration of PRL and C in blood. At the same time, it is clear that hyperprolactinemia plays a significant role in the pathogenesis of insufficiency of the corpus luteum in the early gestation terms and the related threat of pregnancy termination. In the II and III trimesters of pregnancy hyperprolactinemia leads to progress of placental dysfunction which is accompanied by imbalance of placental hormones, blood

circulation disorder in the uteroplacental and placental-fetal channels, and pathological changes in placenta [14, 15], that stimulates the development of placental-associated gestation complications.

#### 4. Discussion

One of the factors of physiological follow-up of pregnancy is an optimal proportion of Ca and Mg content in the body of a future mother. The proportion of Mg and Ca in the state of physical and psychological calmness is 1:2 [16]. The research results present evidence of essential changes in the Ca-Mg proportion which increases in the experimental group of pregnant women till 1:3.7 (in the control group – 1:2.8), that means that the pregnant women-displaced individuals are in the state of the permanent stress. The disorders revealed are the micro-nutritional basis for prolongation of the state of tension with increased content of intracellular Ca and deficit of Mg. In the experimental group of pregnant women the concentration of Ca in the blood serum ( $2.98 \pm 0.04$  mmol/l) in comparison to the physiological standard was higher by 19.2 % and by 9.6 % higher if compared to the analogous indicator in the control group of pregnant women ( $2.72 \pm 0.11$  mmol/l;  $p < 0.05$ ). Hence, the increased level of Ca in the blood serum is confirmed. At the same time, the pregnant women in the experimental group have low concentration of ionized Mg in the blood serum making  $0.8 \pm 0.02$  mmol/l, which is certainly lower than the analogous indicator in the control group ( $0.98 \pm 0.02$  mmol/l;  $p < 0.05$ ) by 18.4 %. According to the data presented by Dikke G.B. (2016), the concentration of Mg in the blood serum within 0.5–0.84 mmol/l is considered as a moderate insufficiency [17] and is typical for the state of chronic stress. In the case of deficit of magnesium the disorder of Ca utilization by cells takes place that leads to accumulation of Ca in the joints, gall bladder, kidneys and sometimes may lead to brain calcification or calcification of other organs that is manifested as arthritis, cholelithiasis and urolithiasis, etc. [18, 19]. One of the most important roles of Mg is its natural anti-stress features. In particular, ionized Mg hinders the processes of nervous system excitation and decreases sensitivity of a body to the external negative factors. Usually, deficit of Mg contributes to the decrease in elasticity of red blood cells that complicates its passing through capillaries, disrupts microcirculation and shortens life of red blood cells that clinically manifests as an iron-deficiency anemia [20]. Hypocalcaemia is one of the signs of undifferentiated connective tissue dysplasia that leads to the increase in concentration of muscular tissue of cervix. It happens when connective tissue is pathologically displaced by smooth muscle tissue that worsens intestinal capabilities of cervix and contributes to the increase in shrinking activity of uterus. [21, 22].

The speed of metabolic processes increases as a result of hormones activity, cells are leaking large quantities  $Ca^{2+}$  and  $Mg^{2+}$  into bloodstream, nervous system mobilizes heart and muscles. As a result, heart rate is speeding up, blood pressure elevates and the entire body starts working in the regime «fight or run» [16].

One of the clinical displays of Mg deficit is progressing of personal anxiety [23]. The results of the correlation analysis present evidence of strong inverse relationship ( $r = -0.7857$ ) be-

tween the concentration of Mg ions and personal anxiety of the pregnant women from the experimental group according to the Spielberg's test. In our opinion, the patterns we revealed reflect the impact of Mg on the release and metabolism of neurotransmitters and, as a result, on the clinical signs of its deficit in the form of irritability, excitability, disorders of the depressive type, sleep disorders and anxiety of examined women from the group of TDI.

Insufficient quantity of Mg, which is inherent in the pregnant women in the experimental group based on antagonism with Ca ions, can be one of the pathogenetic links of the increase in shrinking capability of smooth muscles of uterus. Based on oxidative stress and endothelial dysfunction with further development of premature shrinking activity, preeclampsia and eclampsia, metabolic syndrome, gestational diabetes, detachment of chorion or placenta, childbirth activity disorder, fetal development delay, etc.

Taking into account the speed of changes and the tension in functioning of organs and systems that take place in a woman's body during physiological gestation [24, 25], pregnancy is a kind of physiological stress. The risk of system inflammation, atherosclerotic processes and thrombolytic disorders of hemostasis significantly increases even during physiological flow of pregnancy. The risk of disorders tight to glucose tolerance increases as well that manifests in gestational diabetes and metabolic syndrome [26, 27].

#### 5. Conclusions

1. Pregnant women-displaced individuals are characterized by the following disorders:

1. 1. Anxious and neurotic state with high levels of reactive and personal anxiety that exceed normal indicators in the control group by 3.9 and 2.2 times;

1. 2. Credible exceeding in concentration of stress-implementing hormones – cortisol and prolactin;

1. 3. Strong inverse relationship ( $r = -0.7857$ ) between the concentration of Mg ions and personal anxiety; strong direct relationship ( $r = 0.8601$ ) between cortisol and level of personal anxiety according to Spielberg's test;

1. 4. Micronutritional imbalance with significant shift in calcium-magnesium balance to the side of calcium and decrease in the concentration of magnesium in the blood serum.

2. Taking into account the identified patterns, it is useful to categorise the pregnant women from among the internally displaced individuals as the group of high risk with respect to the development of obstetric and perinatal complications. In order to prevent these complications, it is necessary to carry out an integrated preconceptional preparation with participation of a psychologist and a long-term magnesium therapy during pregnancy.

3. For pathogenetic justification of prevention of placenta-associated, obstetric and perinatal complications it is useful to conduct a study of the content of placental hormones in the dynamics of pregnancy among the internally displaced pregnant women in comparison to the clinical pregnancy flow and the data derived with the help of instrumental research methods (USR, dopplerometrics, cardiotocography, etc.).

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