

## ORIGINAL ARTICLE

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# FEATURES OF HUMORAL IMMUNITY IN PREGNANT WOMEN WITH OR WITHOUT SOME DENTAL DISEASE AND IRON DEFICIENCY ANEMIA



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**Key words:** humoral immunity, pregnant women, dental diseases, iron deficiency anemia.

**Introduction.** Established in 2000, the US National Anemia Action Council (NAAC) defines it as a health problem that requires universal attention and action – approximately one billion people in the world have iron deficiency. Among the various pathological conditions that occur in women during pregnancy, iron deficiency takes the first place among all complications of gestational process [1, 4, 7]. This disease is a primary cause or a significant predisposing factor in the pathogenesis of various pathological processes and increased severity of chronic diseases [5, 9, 10, 12]. According to some authors, serious violations of the immune system occurs in pregnant women on the background of iron deficiency anemia [8, 13, 14]. There is a direct relationship between the state of activation of the immune system and normal growth and opportunistic oral microflora. The violation of local and systemic inflammatory protection mechanisms leads to inflammatory diseases [3, 2, 15]. The presence of pathology of pregnancy intensifies the course of periodontal diseases. Gestosis burdens the course and the frequency of exacerbations of gingivitis in the pregnant [6, 11].

**Objective:** the purpose of this study was to identify the features of humoral immunity in pregnant women with or without some dental diseases and iron deficiency anemia.

**Materials and methods:** The study was conducted on two groups of pregnant women. The first group included 50 pregnant women with IDA and periodontal diseases and oral mucosa, while the second group consisted of 30 pregnant women with IDA without dental diseases. The control group consisted of 30 pregnant women with physiological pregnancy of dental diseases and the same amount without symptomatic lesions of periodontal and oral mucosa.

In order to determine the presence of periodontal disease and oral mucosa were generally conducted clinical studies, including index assessment of periodontal tissues and

clinical samples. In the research group were selected women with generalized periodontitis of initial-I, I -II severity, chronic and sometimes with symptomatic gingivitis. Angular cheilitis was among the diseases of the oral mucosa. All data were recorded in a specially-developed “map of detailed anamnesis.” Radial immunodiffusion in gel by Mancini et al. (1965) was used to determine the number of immunoglobulins G, A, M. Determining the level of circulating immune complexes (CIC) was performed according to Diegon, Lawer, Bach (1977).

### The research results

The study of the functional activity of B-lymphocytes (Table. 1) in terms of production of major classes of Ig G, A and M has showed that the serum concentration of IgG and IgA in pregnant women with iron deficiency anemia (IDA) both in the presence and in the absence of cheilitis corresponds to the level in healthy persons ( $p > 0.1$ ). There has been an increase in serum IgM concentration by 24.8% ( $p < 0.05$ ) in group II (patients with concomitant cheilitis) compared with healthy individuals and by 16.67% ( $p < 0.05$ ) compared to pregnant women without cheilitis.

Studying the content of circulating immune complexes (CIC) in blood serum of the patients in both groups has showed unilateral changes without probable differences between groups that reflect changes in the immune system with IDA.

There has been a decrease in the concentration of large-sized CIC in both groups of the pregnant compared to healthy individuals, respectively, by 38.74% ( $p < 0.05$ ) and 33.06% ( $P < 0.05$ ). Simultaneously, there has been an increase in the concentration of medium-sized CIC, respectively by 40.62% ( $p < 0.05$ ) and 54.25% ( $P < 0.05$ ).

In blood serum of the pregnant women of both groups it was found the increased level of small-sized CIC – by 2.12 times in the first group and by 2.01 times ( $p < 0.001$ ) in the second one.

Deeper disturbance of synthesis of B-lymphocytes major classes of immunoglobulins compared to the pregnant women with IDA and concomitant cheilitis was found in pregnant women with IDA, concomitant cheilitis and generalized periodontitis (Table. 2). The concentration of IgA in blood serum in group I was reduced by 43.07% ( $p < 0.001$ ) compared to the control group and by 47.96% ( $p < 0.001$ ) to group II of pregnant women. The concentration of IgG in blood serum in both groups of pregnant women had no probable difference between them ( $p > 0.05$ ) and amounted to respectively  $11,37 \pm 0,58$  and  $10,27 \pm 0,51$  g/l. There were no significant ( $p > 0.05$ ) differences from the figures of the control group –  $13,80 \pm 1,45$  g/l as well. The level of IgM in blood serum in the comparison group of the pregnant had no significant difference from the data of the control group ( $p > 0.05$ ).

The revealed changes of the level of the major classes of immunoglobulins in blood serum are a reflection of pathological changes in the pregnant with IDA and concomitant dental diseases. The reduction of IgA and thus sIgA leads to manifestations of immunodeficiency on the mucous membrane of the mouth (mucous membrane). This is evident in their lack of protection against microbial and viral agents, the tendency to multiply. The high level of IgM is a classic manifestation of the inflammatory process, in which the synthesis of Ig occurs through the hyperproduction of IgM at the early stages with following switching on the synthesis of IgG.

In blood serum in both groups of pregnant women was found a significant violation of the ratio of the CIC's concentration value of various sizes, which had a much

deeper character in the second group of pregnant women with combined dental lesions.

In group II (pregnant with IDA) was revealed a decrease in the content of large-sized CIC by 33.06% ( $p < 0.05$ ) in comparison with the patients in the control group; an increase of the concentrations of average-sized CIC by 54.26% ( $p < 0.001$ ) and an increase of the content of small-sized CIC by 100.82% ( $p < 0.001$ ). In main group I there was an even more marked deficit of large-sized physiological CIC – by 52.07% ( $p < 0.001$ ) less in comparison with the control group. The excess of CIC appeared in the overproduction of medium-sized CIC – 88.39% ( $p < 0.001$ ) and small-sized – by 3.41 times ( $p < 0.001$ ).

So, in pregnant women with IDA that combined with dental disease as cheilitis and generalized periodontitis (GP) was found a deeper breach of the immune system compared to pregnant women with IDA as well as with cheilitis. They consisted in the significant increase of the concentration of pathogens CIC of medium and small size against the background of the low level of physiological CIC.

The revealed disorders of the immune system certainly require a combined approach to the treatment of this group of pregnant women. This is very important, because despite minimal clinical manifestations and absence of life-threatening complications, they can cause premature termination of pregnancy.

The concentration of IgG in blood serum of both groups of pregnant women with IDA had no statistically significant differences from the figures in the healthy and amounted respectively  $33 \pm 0,62\%$  and  $10,27 \pm 0,51\%$  (Table. 3).

The level of IgA in blood serum in group I of the pregnant was significantly ( $p < 0.001$ ) lower than data of the control group

Table 1.

**State of humoral immunity in pregnant women with IDA in the presence (group I) and absence (II group) associated cheilitis (M ± m)**

Immunological parameters	I group (n= 29)	II group (n= 20)	Control group (n= 20)
Ig G, g/l	$13,49 \pm 0,68$	$10,27 \pm 0,51$	$13,80 \pm 1,45$
Ig A, g/l	$1,56 \pm 0,09$	$2,21 \pm 0,12$	$2,02 \pm 0,24$
Ig M, g/l	$1,61 \pm 0,07^*$	$1,38 \pm 0,07$	$1,29 \pm 0,13$
Large-sized CIC (>19 S), c.u.	$31,67 \pm 1,86^*$	$34,61 \pm 1,72^*$	$51,70 \pm 3,17$
Medium-sized CIC (11-19 S), c.u.	$48,57 \pm 2,57^*$	$53,28 \pm 2,67^*$	$34,54 \pm 2,02$
Small-sized CIC (<11 S), c.u.	$23,16 \pm 1,18^*$	$21,97 \pm 1,12^*$	$10,94 \pm 1,13$

Notes:

\* – Significant difference in the relative data of the control group ( $P < 0.05$ );

\*\* – Significant difference in performance between groups of patients ( $P < 0.05$ );

n – amount of patients.

Table 2.

**State of humoral immunity in pregnant women with IDA in the presence (group I) and absence (II group) associated cheilitis and GP (M ± m)**

Immunological parameters	I group (n=50)	II group (n=30)	Control group (n= 30)
Ig G, g / l	$11,37 \pm 0,58$	$10,27 \pm 0,51$	$13,80 \pm 1,45$
Ig A, g / l	$1,15 \pm 0,06^*$	$2,21 \pm 0,12^{**}$	$2,02 \pm 0,24$
Ig M, g / l	$1,58 \pm 0,09^*$	$1,38 \pm 0,07$	$1,29 \pm 0,13$
Large-sized CIC (>19 S), c.u.	$24,78 \pm 1,25^*$	$34,61 \pm 1,72^* **$	$51,70 \pm 3,17$
Medium-sized CIC (11-19 S), c.u.	$65,14 \pm 3,28^*$	$53,28 \pm 2,67^* **$	$34,54 \pm 2,02$
Small-sized CIC (<11 S), c.u.	$37,29 \pm 1,85^*$	$21,97 \pm 1,12^* **$	$10,94 \pm 1,13$

Notes:

\* – Significant difference in the relative data of the control group ( $P < 0.05$ );

\*\* – Significant difference in performance between groups of patients ( $P < 0.05$ );

n – amount of patients.

by 40.09% and by 45.25% than in the second group. Low content of IgA as well as its form s IgA can be both a cause and a consequence of existing generalized periodontitis (GP).

The level of IgM in blood serum in group I of the pregnant significantly exceeded the figures of the control group by 25.58% ( $p < 0.05$ ) and group II – by 17.39% ( $p < 0.05$ ).

In pregnant women with IDA and periodontal diseases was revealed the significant imbalance of CIC: the concentration of large-sized physiological CIC was below the control figures by 2.94 times ( $p < 0.001$ ), and below the figures of the comparison group by 49.26% ( $p < 0.05$ ). The concentration of pathogenic medium molecular CIC exceeded the level in the healthy by 1.97 times ( $p < 0.001$ ) as well as in the comparison group by 27.48% ( $p < 0.05$ ). The concentration of small-sized CIC exceeded the figures of the control group by 3.78 times ( $p < 0.001$ ) and the figures of group II by 1.88 times ( $p < 0.001$ ).

Thus, the imbalance of CIC as well as general changes in the form of over production of IgM was revealed in pregnant women with IDA and concomitant diseases of periodontal tissues.

The research of serum immunoglobulins' level in women with physiological pregnancy (Table 4) showed that the concentration of IgG, both in the absence and in the presence of concomitant dental diseases had no significant ( $p > 0.05$ ) differences from the control group and was  $12,33 \pm 0,62$  g/l,  $11,43 \pm 0,59$  g/l and  $13,80 \pm 1,45$  g/l. In women with physiological pregnancy and concomitant dental disease serum IgA was less by 45.57% ( $p < 0.05$ ). The level of IgM had no probable differences between the groups surveyed and the figures in the control group.

The large-sized CIC's concentration in both groups of women with physiological pregnancy did not differ

significantly among themselves ( $p > 0.1$ ) and was  $40,31 \pm 2,05$  and  $41,93 \pm 2,18$  standard units. At the same time, it was probably ( $p < 0.05$ ) by 22.03% lower in group I and by 18.90% ( $p < 0.05$ ) lower in group II compared with the control one.

Along with the reduction of the concentration of physiological CIC was found a growth of medium-sized CIC: by 76.90% in group I ( $p < 0.001$ ) and by 35.12% ( $P < 0.05$ ) in group II. It was established a trustworthy ( $p < 0.05$ ) increase in the average-sized CIC's concentration by 30.92% in women with physiological pregnancy and concomitant dental diseases.

A similar trend was noted for small-sized pathogenic CIC. In women with physiological pregnancy without concomitant dental diseases their concentration was  $20,46 \pm 1,029$  standard units that by 2.69 times ( $p < 0.001$ ) higher than in the control group. In the second group of pregnant the concentration of small-sized CIC exceeded the figures in the healthy by 1.87 ( $p < 0.05$ ) times.

This research established that the physiological course of pregnancy in women without concomitant dental complications is characterized by the following changes in the immune system: increased spontaneous proliferative activity of lymphocytes, the imbalance of CIC.

In women with the physiological course of pregnancy and concomitant dental diseases was detected the imbalance of CIC with the prevalence of pathogenic medium and small-sized CIC, the decreased concentration of serum IgA.

#### Conclusions:

1. Inflammatory periodontal lesions in pregnant women with iron deficiency anemia and concomitant cheilitis cause the presence of B-lymphocytosis hyperfunction of IgM and decreased synthesis of IgA as well as the imbalance of

Table 3.

#### State of humoral immunity in pregnant women with IDA in the presence of periodontal diseases (I group) and absence related dental disease (II groupe) (M±m)

Immunological parameters	I group (n=50)	II group (n=30)	Control group (n=30)
Ig G, g/l	12,33±0,62	10,27±0,51	13,80±1,45
Ig A, g/l	1,21±0,06*	2,21±0,12**	2,02±0,24
Ig M, g/l	1,62±0,08*	1,38±0,07**	1,29±0,13
Large-sized CIC (>19 S), c.u.	17,56±0,89*	34,61±1,72* **	51,70±3,17
Medium sized CIC (11–19 S), c.u.	67,92±3,41*	53,28±2,67* **	34,54±2,02
Small-sized CIC (<11 S), c.u.	41,35±2,07*	21,97±1,12* **	10,94±1,13

Notes:

\* – Significant difference in the relative data of the control group ( $P < 0.05$ );

\*\* – Significant difference in performance between groups of patients ( $P < 0.05$ );

n – amount of patients.

Table 4.

#### State of humoral immunity in women with physiological pregnancy in the presence (group I) and absence (II group) related dental disease (M ± m)

Immunological parameters	I group (n=50)	II group (n=30)	Control group (n=30)
Ig G, g/l	12,33±0,62	11,43±0,59	13,80±1,45
Ig A, g/l	1,16±0,07*	1,22±0,064	2,02±0,24
Ig M, g/l	1,37±0,08	1,45±0,075	1,29±0,13
Large-sized CIC (>19 S), c.u.	40,31±2,05*	41,93±2,18*	51,70±3,17
Medium-sized CIC (11-19 S), c.u.	61,10±3,19*	46,67±2,35* **	34,54±2,02
Small-sized CIC (<11 S), c.u.	29,15±1,57*	20,46±1,029* **	10,94±1,13

Notes:

\* – Significant difference in the relative data of the control group ( $P < 0.05$ );

\*\* – Significant difference in performance between groups of patients ( $P < 0.05$ );

n – amount of patients.

circulating immune complexes in the direction of increasing concentration of pathogenic fractions of circulating immune complexes that may develop autoimmune manifestations.

2. The physiological complication of pregnancy caused by dental disease leads to the deepening imbalance of circulating immune complexes with the significant prevalence of pathogenic small- and medium-sized molecular fractions and a reduction in the concentration of serum IgA.

3. The revealed changes of major classes of immunoglobulins in blood serum are a reflection of pathological changes in the body of pregnant women with iron deficiency anemia and concomitant dental diseases. All these manifestations are unfavorable for pregnancy. They reflect the presence of iron deficiency anemia and create conditions for the threat of early termination of pregnancy.

Reviewer: professor V.P. Nespiadko

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## ОСОБЛИВОСТІ ГУМОРАЛЬНОГО ІМУНІТЕТУ У ВАГІТНИХ ЖІНОК ІЗ НАЯВНІСТЮ ЧИ ВІДСУТНІСТЮ ДЕЯКИХ СТОМАТОЛОГІЧНИХ ЗАХВОРЮВАНЬ ТА ЗАЛІЗОДЕФІЦИТНОЇ АНЕМІЇ

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**Резюме.** Вивчення особливостей гуморального імунітету у вагітних із наявністю чи відсутністю деяких стоматологічних захворювань та залізодефіцитної анемією показало, що у вагітних із залізодефіцитною анемією та супутніми стоматологічними захворюваннями спостерігається наявність В-лімфоцитозу із гіперфункцією IgM та зниженням синтезу IgA та дисбаланс ЦІК в сторону зростання концентрації патогенних фракцій ЦІК, за рахунок чого може відбуватись розвиток аутоімунних проявів; ускладнення фізіологічного перебігу вагітності супутніми стоматологічними захворюваннями призводить до поглиблення дисбалансу циркулюючих імунних комплексів із значним переважанням вмісту патогенних дрібно- і середньомолекулярних їх фракцій та зниженням концентрації сироваткового IgA.

**Ключові слова:** гуморальний імунітет, вагітні жінки, стоматологічні захворювання, залізодефіцитна анемія.

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## ОСОБЕННОСТИ ГУМОРАЛЬНОГО ИММУНИТЕТА У БЕРЕМЕННЫХ ЖЕНЩИН С НАЛИЧИЕМ ИЛИ ОТСУТСТВИЕМ НЕКОТОРЫХ СТОМАТОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ И ЖЕЛЕЗОДЕФИЦИТНОЙ АНЕМИЕЙ

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**Резюме.** Изучение особенностей гуморального иммунитета у беременных с наличием или отсутствием некоторых стоматологических заболеваний и железодефицитной анемией показало, что у беременных с железодефицитной анемией и сопутствующими стоматологическими заболеваниями наблюдается наличие В-лимфоцитоза с гиперфункцией IgM и снижением синтеза IgA и дисбаланс ЦИК в сторону роста концентрации патогенных фракций ЦИК, за счет чего может происходить развитие аутоиммунных проявлений; осложнения физиологического течения беременности сопутствующими стоматологическими заболеваниями приводит к углублению дисбаланса циркулирующих иммунных комплексов со значительным преобладанием содержания патогенных мелко- и средньомолекулярных их фракций и снижением концентрации сывороточного IgA.

**Ключевые слова:** гуморальный иммунитет, беременные женщины, стоматологические заболевания, железодефицитная анемия.