Analysis of immune status assessment results of pregnant and breastfeeding women permanently residing in rural districts

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Abstract. The purpose of the study was to determine the immune status of healthy, pathologically observed pregnant and lactating women living in rural areas. It was found that the trend and intensity of IgA, IgG, IgM, IgE changes in blood serum of pregnant and lactating women were practically the same. 1.27 times according to IL-1b, 1.40 times according to IL-4, 1.25 times according to IL-6, 1.31 times according to IL-10 were reliably higher in women with observed pathology compared to healthy pregnant women. Differences in the trend and intensity of changes among lactating women were similar to the parameters of pregnant women. S3S, lactoferrin and procalcitonin indicators in the blood serum of pregnant women and lactating women were recommended as differential diagnostic criteria for evaluating immune status and prognostic criteria for evaluating the end of pregnancy.

1 Introduction

In the following years, as a result of the development of clinical immunology, the mechanisms of many pathologies and pathological conditions were revealed, and the unresolved issues related to the formation and development of various infectious and somatic diseases were clarified. At the same time, despite the results of many scientific studies on reproductive immunology, regional issues related to this problem remain unsolved. For this reason, studying the state of the immune system of pregnant and lactating women, interpreting the obtained results and making the main conclusions in the analyzed state, introducing them into health care practice is the demand of the times [1, 7, 10].

In recent decades, attention to humoral immunity has increased, its role in the pathogenesis of many pathological entities has been shown, and their quantitative indicators have been proven to be of diagnostic and prognostic value in various pathological conditions [2, 4, 8, 11].

Non-specific resistance factors mainly provide local immunity, in addition to being the first defense barrier against antigen invasion and stimulation, it should be noted that their main functions are actually different. It is noteworthy that in addition to its main function, it has been proven to perform a protective function in the body [3, 5, 6, 9].

The purpose of the study was to determine and assess the immune status of healthy, pathologically observed pregnant and lactating women living in rural areas.

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2 Material and methods

92 women involved in scientific research were of fertile age (19-49 years old) and permanently resided in Kuchak, Shibirgoni, O'glan, Bog'imusa, Saraycha, Sadir neighborhoods of Peshko district of Bukhara region.

Their immune status was studied 2 times - during the III trimester of pregnancy and during breastfeeding. They studied the immune system at 38-40 weeks of pregnancy and 40-45 days after giving birth during breastfeeding. These studies were divided into healthy women (n=20) and women with autoimmune thyroiditis (n=36) and those with anemia of I-II degree (n=36).

Concentrations of IgA, IgM, IgG, IgE in blood serum were determined using IFA. The test kits of "Vector Best" LLC (Novosibirsk, RF) were used. Tests were carried out based on the instructions in the test systems. The IFA method is based on a "sandwich option" on a solid phase carrier.

S3 component of complement, lactoferrin, to determine the concentration of procalcitonin in blood serum. Vector Best® (Novosibirsk, RF) used.

For this, women's blood serum was taken and studies were conducted using IFA. The test systems produced by "Cytokin" LLC (SPb, RF) were used. With their help, the concentrations of interleukin-1 b (IL-1 b), interleukin-6 (IL-6), interleukin-10 (IL-10) in blood serum were determined. The IFA method is based on a "sandwich option" on a solid phase carrier.

Statistical processing of the obtained materials was carried out using traditional variational statistics methods. For this purpose, arithmetic mean size (M), arithmetic mean error of size (m), reliability of differences was determined according to the Fisher-Student test (R). Statistical analysis was performed on a personal computer based on a Pentium IV processor using a software package for medical and biological research. The principles of evidence-based medicine were used in the organization and conduct of research.

3 Results and Discussion

During the research, the quantitative indicators of these immunoglobulins were studied and analyzed in pregnant and lactating women.

The obtained results showed (Table 1) that the amount of IgA in healthy women was 1.76 ± 0.77 g/l, while in the general group, this indicator was 1.70 ± 0.08 g/l, no practically convincing difference was observed between the groups. A similar trend of changes was also determined for IgG (R>0.05).

<table>
<thead>
<tr>
<th>Indicators</th>
<th>IgA, g/l</th>
<th>IgG, g/l</th>
<th>IgM, g/l</th>
<th>IgE, XB/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy pregnant women, n=20</td>
<td>1.76±0.07</td>
<td>20,35±0,18</td>
<td>2.10±0.08</td>
<td>138.82±0.89</td>
</tr>
<tr>
<td>Total group, n=72</td>
<td>1.70±0.08↑</td>
<td>19.85±0.26 ↔</td>
<td>2.48±0.14*↑</td>
<td>162.65±0.68*↑</td>
</tr>
</tbody>
</table>

Note: * - sign of a reliable difference in relation to pregnant women; ↑ - direction of changes; ↔ - no reliable difference.
In contrast to previously analyzed immunoglobulins, IgM was observed to be significantly increased in the general group compared to healthy pregnant women (P<0.05). A similar result was also observed for IgE (R<0.05). If the difference between the compared groups in terms of IgM increased by 1.18 times in favor of the general group, the increase in IgE increased by 1.17 times. In our opinion, the tendency of IgM, IgE to increase in healthy pregnant women with autoimmune thyroiditis and various levels of anemia (general group) is an antigen shown to the body. It was explained by the presence of stimulation, the effect of the pathological state on the humoral joint of the body's immune system, and the increase in the synthesis of immunoglobulins due to the stress of the immune system. If we look at the analysis of the tasks performed by these immunoglobulins, it becomes clear that an increase in the primary immune response and allergic background is observed.

A convincing difference in the parameters of lactating women was also observed for IgM and IgE, if these immunoglobulins in healthy lactating women were 2.25±0.07 g/l and 67.39±0.56 XB/ml, respectively, the total it is noteworthy that the difference of 1.23 (R<0.05) and 2.43 (R<0.001) times was observed in the women included in the group, respectively. If we look at the amount of IgA and IgG, no reliable difference was observed between the compared groups (R>0.05). The intergroup difference according to the contingent of the studied subjects was determined by IgM and IgE, IgA and IgG were expressed by the absence of a reliable difference in women belonging to both contingents of women. Therefore, the absence of a reliable difference in the indicators of pregnant and lactating women indicates the effect of pregnancy and lactating period on their concentrations in blood serum.

As it can be seen, although there was no significant difference in IgA and IgG, a convincing difference was found in IgM (R<0.05), there was no difference in healthy subjects, which means that in the pathological condition IgM changed quantitatively. Similar changes were observed in IgE. A convincing level of difference was found in these parameters. In pregnant women, due to the allergic background, the amount of IgE increased, but in lactating women, this amount was reliably reduced. The status of pregnant and lactating women was not significant in women with a pathological process.

In the course of the research, the concentrations of complement S3 component (S3S), lactoferrin and procalcitonin from the non-specific resistance factors in the blood serum of pregnant and lactating women were comparatively studied (Table 2).

**Table 2.** Comparative indicators of non-specific resistance factors in healthy and pathologically observed pregnant women

<table>
<thead>
<tr>
<th>Groups</th>
<th>S3S, μg/ml</th>
<th>Lactoferrin, μg/ml</th>
<th>Procalcitonin, ng/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy pregnant women, n= 20</td>
<td>1.42±0.04</td>
<td>247.15±0.88</td>
<td>0.06±0.01</td>
</tr>
<tr>
<td>Total group, n= 72</td>
<td>1.75±0.08*↑</td>
<td>189.10±0.48*↓</td>
<td>0.16±0.03*↑</td>
</tr>
</tbody>
</table>

Note: * - sign of a reliable difference compared to the indicators of healthy pregnant women; ↑,↓ - directions of changes

A comparative study of the quantitative indicators of non-specific resistance factors in the blood serum of healthy and pathologically observed (general group) pregnant women showed that all three indicators (S3S, lactoferrin, procalcitonin) in pathologically observed (autoimmune thyroiditis, anemias of I-II) pregnant women compared to healthy pregnant women increased relatively reliably (R<0.05 - R<0.001). This increase was 1.23 times for S3S, 1.31 times for...
lactoferrin, and 2.67 times for procalcitonin. Such a situation is explained by the presence of stress in the activity of the immune system under the influence of pathology, the increase of antigen stimulation as a result of bacterial translocation, and the development of a pre-pathological state as a result of inflammatory symptoms. For this reason, pregnant women are recommended to always measure S3S lactoferrin and procalcitonin in blood serum (as immunological monitoring). The parameters themselves are recommended as a differential diagnostic criterion for evaluating the immune status of pregnant women and as a prognostic criterion for evaluating the end of pregnancy.

Taking into account the activity of the immune system of cytokines, the relationship between immunocomponent cells, the application of the inflammatory process and ensuring its timely fight against it, a comparative study of the cytokine status of healthy and pregnant women with various pathologies (autoimmune thyroiditis and various degrees of anemia) was conducted. For this, 2 pro-inflammatory (IL-1β, IL-6) and 2 anti-inflammatory (IL-4, IL-10) cytokines were identified (Table 3).

### Table 3 Results of determination of cytokine status of healthy and general pregnant women, ng/ml

<table>
<thead>
<tr>
<th>Groups</th>
<th>Applicator of inflammation</th>
<th>Anti-inflammatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IL-1β</td>
<td>IL-6</td>
</tr>
<tr>
<td>Healthy pregnant women, n = 20</td>
<td>18.39±0.15</td>
<td>155.95±0.66</td>
</tr>
<tr>
<td>General guru h, n = 72</td>
<td>23.27±0.36*↑</td>
<td>194.35±0.28*↑</td>
</tr>
</tbody>
</table>

Note: * - sign of reliable difference compared to the indicators of healthy pregnant women; ↑ - directions of changes

A comparative study of the concentration of cytokines in the blood serum of healthy and sick (autoimmune thyroiditis, anemias of various degrees) pregnant women showed that all 4 identified cytokines were reliably higher in women with pathology compared to healthy pregnant women (R<0.05-R<0.001). The increase in IL-1β was 1.27 times, IL-4 was 1.40 times, IL-6 was 1.25 times, and IL-10 was 1.31 times. In all cases, there was a statistically significant difference in cytokine status, indicating that pro-inflammatory (IL-1β) and anti-inflammatory (IL-4, IL-6, IL-10) cytokines were equally expressed. The quantitative increase of cytokines, in turn, is a sign of increased stimulation of immunocompetent cells, tension in the immune system, and the fact that the inflammatory process is still in an active phase. Such clear differences in the cytokine status allow to use them as additional diagnostic and prognostic criteria for monitoring the course of pregnancy in pregnant women, for identifying pre-pathological conditions related to inflammation.

At the next stage of the work, the amount of cytokines (IL-1b, IL-4, IL-6 and IL-10) in the blood serum of lactating women was studied, and their cytokine status was compared. For the purpose of comparison, healthy and lactating women belonging to the general group were taken (Table 4).

### Table 4. Description of quantitative indices of cytokines in blood serum of healthy and general group of lactating women, ng/ml

<table>
<thead>
<tr>
<th>Groups</th>
<th>IL-1b</th>
<th>IL-4</th>
<th>IL-6</th>
<th>IL-10</th>
</tr>
</thead>
</table>


Healthy lactating women, n = 20
13.22±0.16 5.14±0.08 91.55±0.60 47.22±0.28

General guru h , n = 72
18.53±0.44↑ 7.29±0.23↑ 111.07±0.84↑ 64.10±0.56↑

Note: * - sign of reliable difference from healthy lactating women; ↑ - the direction of changes.

The obtained results show that the tendency and intensity of the quantitative increase of all studied cytokines was preserved even in lactating women, it was found that pro-inflammatory (IL-1β) and anti-inflammatory (IL-4, IL-6, IL-10) cytokines were practically the same. Determining the concentration of cytokines in the blood serum of healthy and general groups of lactating women showed that there were convincing differences between healthy and patients, which were 1.40 times higher for IL-1β, 1.42 times higher for IL-4, and 1.42 times higher for IL-6. 1.21 times, IL-10 was 1.36 times (R<0.05 - R<0.001). Differences in trend and intensity of changes were similar to the parameters of pregnant women. It should be noted that the indicators of pregnant women belonging to the healthy and normal group were significantly lower (R<0.05) than those of lactating women belonging to the healthy and general group. A similar situation was observed in breast-feeding women with pathology included in the general group.

Therefore, in the groups of pregnant and lactating women, healthy and pathological conditions were studied in comparison with each other of the parameters of the groups of diagnosed pregnant women (Table 5). The main reason for this was to identify and evaluate the level of change among this contingent.

Table 5. Comparative indicators of cytokine status in healthy and pathological pregnant and lactating women, times

<table>
<thead>
<tr>
<th>Groups</th>
<th>IL-1b</th>
<th>IL-4</th>
<th>IL-6</th>
<th>IL-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy pregnant women, n = 20</td>
<td>1.40↑</td>
<td>1.42↑</td>
<td>1.21↑</td>
<td>1.36↑</td>
</tr>
<tr>
<td>General guru h , n = 72</td>
<td>1.27↑</td>
<td>1.40↑</td>
<td>1.25↑</td>
<td>1.31↑</td>
</tr>
</tbody>
</table>

Note: * - sign of reliable difference compared to healthy pregnant or lactating women; ↑ - the direction of changes.

As can be seen from Table 5, the concentrations of cytokines detected in the blood serum of pregnant lactating women with pathology in all cases were reliably higher than those of healthy pregnant and lactating women (R<0.05-R<0.001).

4 Conclusions

IgA, IgG, IgM, IgE indicators in the blood serum of pregnant and lactating women were practically the same, and the absence of significant differences in them showed that pregnancy and lactating periods have little effect on serum concentrations. All 4 cytokines detected in blood serum of healthy and sick pregnant women were significantly higher in women with pathology compared to healthy pregnant women (R<0.05-R<0.001). The increase in the amount of IL-1β was 1.27 times, IL-4 was 1.40 times, IL-6 was 1.25 times, and IL-10 was 1.31 times. Believable differences were also observed between
healthy and breastfeeding women belonging to the general group, which were 1.40 times for IL-1b, 1.42 times for IL-4, 1.21 times for IL-6, and 1.36 times for IL-10. became (R<0.05-R<0.001). Differences in the tendency and intensity of changes were similar to the parameters of pregnant women. It was found that the indicators of pregnant women belonging to the healthy and general group were significantly lower than those of lactating women belonging to the healthy and general group (R<0.05).

The amount of S3S in the blood serum of pregnant women with a pathological condition was significantly higher by 1.23 times compared to healthy pregnant women (R<0.05). The difference of lactoferrin was 1.31 times in favor of healthy pregnant women (R<0.05). In pregnant women with somatic diseases, the amount of procalcitonin in blood serum significantly increased by 2.67 times compared to healthy pregnant women (R<0.001). Quantitative indicators of S3S, lactoferrin and procalcitonin in the blood serum of pregnant women were recommended as a differential-diagnostic criterion for evaluating the immune status of pregnant women and as a prognostic criterion for evaluating the end of pregnancy.

In healthy and breast-feeding women diagnosed with pathologies, reliable differences were found for all three studied indicators of non-specific resistance factors (R<0.05 - R<0.001). If S3S and procalcitonin were reliably detected 1.31 and 1.88 times higher in the general group, respectively, compared to healthy people, the lactoferrin indicator was statistically significantly lower by 1.24 times. The imbalance of non-specific resistance factors in healthy and pathological lactating women was explained by the presence of pathological conditions in the body. Taking this into account, all three indicators (S3S, procalcitonin, lactoferrin) were recommended as immunological diagnostic and prognostic criteria to evaluate the condition of lactating women.

References
