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PECULIARITIES OF DYNAMICS OF ZINC AND SELENIUM CONTENT IN BLOOD IN PATIENTS WITH SALMONELOSIS

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Abstract. The aim of the study was to study the characteristics of the content of zinc and selenium in serum and blood cells in case of Salmonella infection. The Objective of the study: to identify patterns of relationship with the course of Salmonella infection and the content of selenium and zinc in the blood in patients during the formation of a protracted course of Salmonella infection.

Material and Methods: a neutron-activation method was used to determine the content of selenium and zinc in serum and blood cells in 40 persons of the control group (relatively healthy) and 230 patients with acute salmonellosis with different outcomes of the disease in the dynamics of the disease.

Research results: It was revealed that for the implementation of the immune response in the acute course of Salmonella infection, there is a redistribution of the trace element zinc from the blood serum into the blood corpuscles. In patients with acute salmonellosis with different outcomes of the disease at different periods of the course of the disease, there is a sharp decrease in the content of the microelement selenium in the uniform elements, while the increase in its level in the serum is not so intense, which apparently indicates the use of this microelement to ensure activity in this pathological process of intracellular enzyme systems.

Keywords: salmonellosis, microelements, zinc, selenium

In the study of the pathogenesis of various variants of the clinical course of salmonellosis, researchers were increasingly interested in the dynamics of changes in the content of trace elements in various biological substrates (1,4). This interest was generated by the high biological activity of microelements that are part of the metalloproteins and are involved in various types of metabolism, tissue respiration, in the processes of growth, reproduction, hematopoiesis, and immunogenesis. A number of trace elements in combination with other biologically active substances are included in the arsenal of drugs for the treatment of various diseases and are widely used in their prevention (2).

Essential trace elements Zn, Se and others show their effect at the level of regulatory intracellular systems, induce the production or potentiate the action of a number of cellular cytokines that stimulate immune mechanisms (2).

They are involved in the functioning of various enzyme systems, maintaining the stability of protein molecules and their functional activity. It is the study of their role in the development of certain pathological processes that currently seems relevant (1,2,4).

According to Ziegler E.E. for the optimal course of metabolic processes in humans, at least nine ME (iron, cobalt, copper, manganese, iodine, zinc, chromium,

selenium, molybdenum) are required. These MEs perform catalytic, structural, and regulatory functions in the body. In the process of performing these functions, they interact with macromolecules - enzymes, prohormones, as well as with presecretory granules and biological membranes (10).

In the literature there are few, already "typhoid -paratyphoid diseases," zinc metabolism is disturbed - its content in whole blood decreases, and the more severe the disease, the more disturbed it is. So, on the one hand, the defeat of the intestinal mucosa in patients with typhoid-paratyphoid diseases cannot but be accompanied by a decrease in the absorption of the microelement received with food. On the other hand, low blood zinc levels are probably due to depletion of zinc depots in the liver and other organs (7,8).

Its presence in the body, along with other trace elements, is necessary to maintain the normal functioning of the body (9,10).

Purpose of the study. Based on the above, the aim of the study was to identify patterns in the relationship between the characteristics of immunogenesis and the content of trace elements selenium and zinc in the blood of patients during the formation of a protracted course of Salmonella infection.

To achieve this goal, the following tasks were defined: to study the content of trace elements Zn and Se in the blood of healthy individuals; to study the features of the dynamics of indicators of trace elements Zn and Se in the blood of patients with salmonellosis in the dynamics of the disease; to study the peculiarities of the dynamics of indicators of trace elements Zn and Se in the blood of patients with salmonellosis with the transition to the chronic course of the disease.

The solution of the tasks set before the study required a comparative analysis of the dynamics of the studied parameters in patients with salmonellosis in the dynamics of the disease and with different outcomes of the disease. Studies of previous years have established that in salmonellosis, the expression of an adequate and pronounced immune response is the outcome of the disease in recovery, and the expression of an inadequate and weak immune response is the outcome of the disease in the formation of a protracted course of the disease [7,10].

Material and methods. To achieve this goal, in all 230 patients with salmonellosis, the parameters of trace elements zinc and selenium, the neutron-activation method for determination was studied during the height and late convalescence of the acute course of Salmonella infection with the outcome of recovery and the formation of a protracted course of the disease.

The study of the content of trace elements in 40 relatively healthy individuals showed that the content of zinc in the uniform elements was 26.67 ± 1.15 μg / g dry. weight, and in blood serum - 18.52 ± 0.52 μg / g dry. weight. According to the results obtained in healthy individuals, the zinc content in the blood corpuscles was almost 1.44 times higher than its content in the blood serum.

Results of our own research. The study of the dynamics of changes in the zinc content in patients with an acute course of salmonellosis with the outcome of recovery showed that at the height of the disease, the dynamics of changes in zinc indicators was characterized by an increase in its content in the blood cells to 29,0 ± 1,4 μg / g dry. weight (versus 26,67 ± 1,15 μg / g dry weight in the control group),

where the degree of increase was ↑ 1,09 times (Table 1). In contrast to the blood cells, the dynamics of the zinc content in the blood serum was characterized by a decrease in the indicator to 11,0 ± 0,15 μg / g dry. weight (versus 18,52 ± 0,52 μg / g dry weight in the control group, P> 0,05), and the degree of decrease in the indicator was ↓ 1,68 times. Due to the different direction of changes in indicators in patients of this group, there was a sharp shift in the ratio of zinc in serum to its content in blood cells by 2,64 times (Table 1, Fig. 1). This indicated that during the height of the pathological process, there was a significant redistribution of the trace element zinc from the blood serum to the blood corpuscles.

Table 1

Features of the dynamics of zinc content in blood cells and blood serum of patients in the process of formation of various outcomes of salmonellosis

Biosubstrates	**Control (healthy) n-40**	**high**		**late convalescence**		
	M±m (μg / g dry weights)	M±m (μg / g dry weights)	↑II **or** ↓IS	M±m (μg / g dry weights)	↑II **or** ↓IS$_1$	↑II **or** ↓IS
Salmonellosis with outcome to recovery (n =)						
Blood serum	**16,35±0,48**	**11±0,15***	↓1,5	**9,08±0,16*•**	↓1,21	↓1,80
Shaped elements	**23,97±0,79**	**29±1,4***	↑1,2	**29,33±1,03***	↑1,00	↑1,22
Salmonellosis with the outcome of the formation of a protracted course						
Blood serum	**16,35±0,48**	**10±0,23***	↓1,6	**8,93±0,17*•**	↓1,12	↓1,83
Shaped elements	**23,97±0,79**	**29±1,2***	↑1,2	**31,50±0,64***	↑1,09	↑1,1

Note: ↑ II - the induction index - the rate of increase and ↓ IS - the suppression index - the rate of decrease in the indicator relative to healthy subjects; ↑ II1 or ↓ IS1 - the rate of increase or decrease in indicators relative to the previous period;

During the period of late convalescence in patients with an outcome in recovery, the zinc content in the corpuscles and blood serum had the same dynamics. Compared with the indicators in the previous study period (29,0 ± 1,4 μg / g dry weight), the zinc content in blood corpuscles practically did not change and amounted to 29,33 ± 1,03 μg / g dry weight. weight, where the multiplicity of the increase was only ↓ 1.00 times. The zinc content in the period of late convalescence was ↑ 1,10 times higher than in healthy individuals (Table 1). At the same time, during this period of the course of the disease, the content of zinc in the blood serum continues to decrease (by a factor of ↑ 1,21) to 9,08 ± 0,16 μg / g dry. weight (versus 11,0 ± 0,15 μg / g dry), its content remains at a level of ↓ 2,03 times lower than in healthy individuals. The continuing trend in the dynamics of the zinc content in the blood cells and serum during the late convalescence period indicates the ongoing redistribution of the trace element zinc from the blood serum to the blood cells. A more pronounced decrease in the level of zinc in the blood serum may indicate that during the implementation of the immune response, the redistribution of the trace

element zinc from the blood serum occurs not only in the formed elements, but also in other actively functioning immune cells (Table 1, Fig. 1)

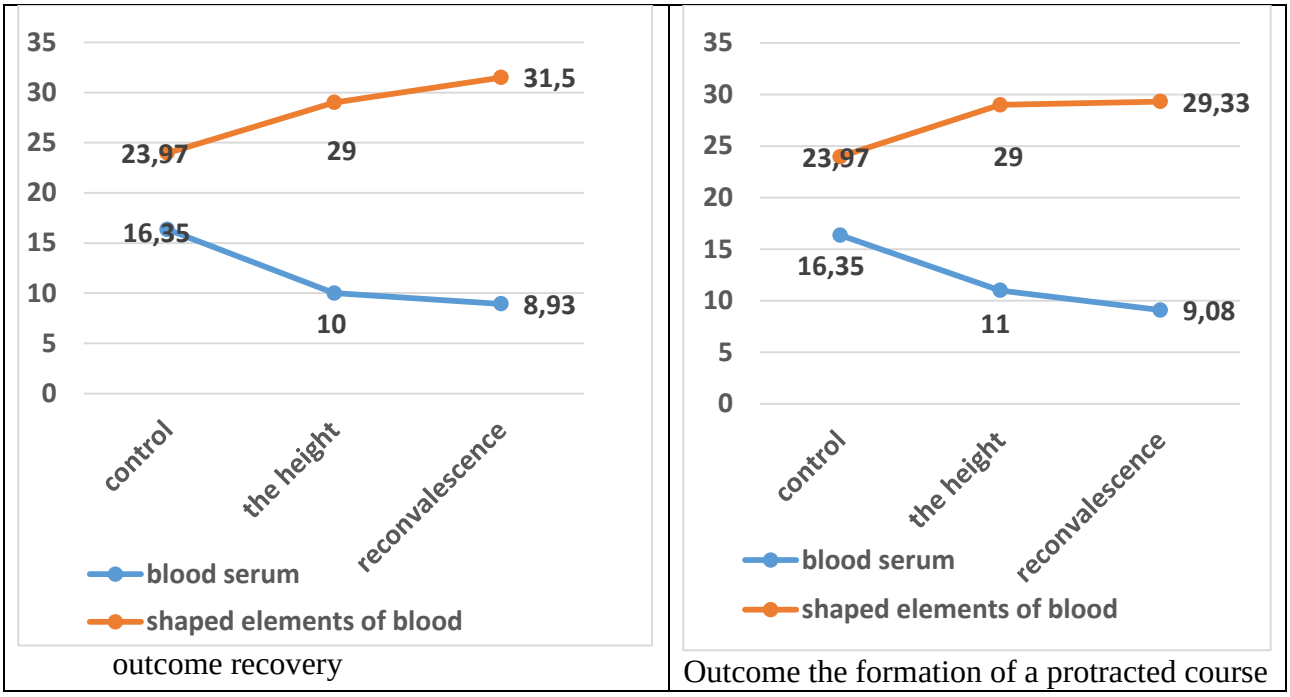

Fig. 1. The content of zinc in blood serum and blood cells in patients with acute salmonellosis with the outcome of recovery

Analysis of the dynamics of the zinc content in patients with the outcome of the formation of a protracted course of the disease showed that, in contrast to patients with an acute form of salmonellosis with an outcome of recovery, there is a more pronounced decrease in the zinc content in the serum as during the peak period (11,0 ± 0,15 μg / g dry weight and 10,0 ± 0,15 μg / g dry weight, respectively) and during late recovery (9,08 ± 0,16 μg / g dry weight, 8,93 ± 0,17 μg / g dry weight), which is significantly (2,07 times) lower than its content in the control group (18,52 ± 0,52 μg / g dry weight).

Accordingly, its increase is observed in the blood cells, and if during the peak period the indicators do not differ from those in patients with salmonellosis with the outcome of recovery, then in the period of late convalescence its significant increase is observed (31,50 ± 0,64 μg / g dry weight) as relative to the values in the previous period (29,0 ± 1,2 μg / g dry weight), and relative to the indicators in the control group (26,67 ± 1,15 μg / g dry weight).

So, this may indirectly indicate that during the formation of a protracted course of the disease, the absorption of zinc by the corpuscular elements from the blood serum to ensure the activity of intracellular enzyme systems has a more pronounced intensity than with the outcome of the disease in recovery.

The concentration of the microelement selenium in the group of relatively healthy individuals is significantly lower than the content of zinc, as in the uniform elements (2,86 ± 0,27 μg / g dry weight and 23,97 ± 0,79 μg / g dry weight, respectively) and in blood serum (0,57 ± 0,06 μg / g dry weight and 16,35 ± 0,48 μg / g dry weight, respectively). Thus, the content of zinc in blood serum is 28,7 times and

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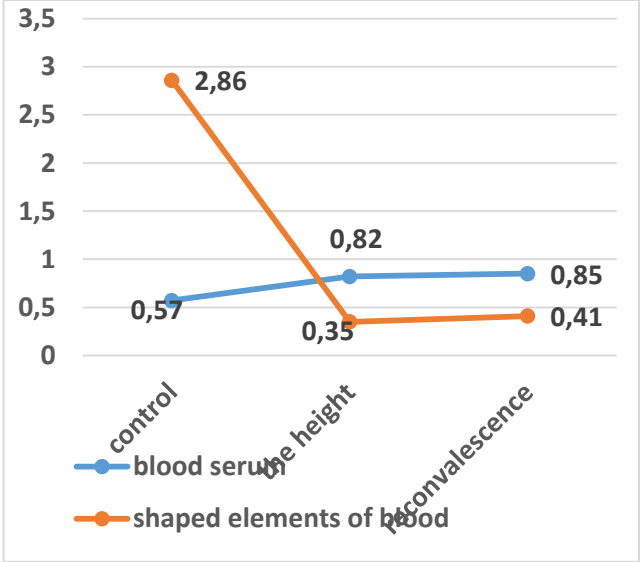
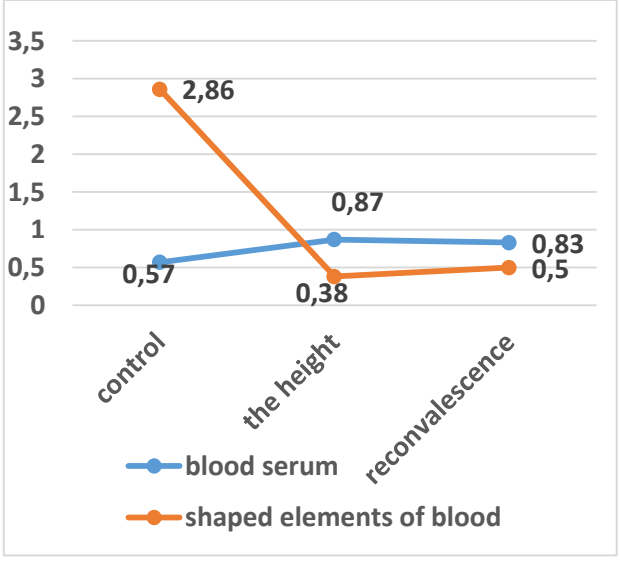
in blood corpuscles is 8.38 times higher than the concentration of selenium (Table 2, Fig. 2).

However, the role of selenium in the body is unambiguously high. Selenium is a biologically active trace element that is part of a number of hormones and enzymes and is thus associated with the activity of all organs, tissues and systems. Its presence in the body along with other trace elements is necessary to maintain the normal functioning of the body.



outcome recovery



Outcome the formation of a protracted course

Fig. 2 The content of selenium in blood serum and blood cells in patients with acute salmonellosis with the outcome of recovery

The study of the dynamics of the selenium content in our studies showed that at the height of the disease in the group of patients with the outcome of recovery, in the blood serum there is an increase of 1,4 times (0,82 ± 0,02 μg / g dry weight) relative to its level in the control group (0,57 ± 0,06 μg / g dry weight), and in the blood cells (0,35 ± 0,03 μg / g dry weight) there is a significant (8,17 times) decrease in comparison with the control group values (2,86 ± 0,27 μg / g dry weight). During the period of convalescence in this group of patients, there is a slight increase in the level of selenium indices relative to the previous period, both in blood serum (0,85 ± 0,01 μg / g dry weight versus 0,82 ± 0,02 μg / g dry weight), so in uniform elements (0,41 ± 0,02 μg / g dry weight versus 0,35 ± 0,03 μg / g dry weight), significantly differing from their content relative to the control values (0,57 ± 0,06 μg / g dry weight and 2,86 ± 0,27 μg / g dry weight, respectively, P> 0,05) (Table 2, Fig. 2).

Table 2

Features of the dynamics of selenium content in blood cells and serum of patients during the formation of various outcomes of salmonellosis

Biosubstrates	**Control (healthy) n-40**	**high**		**late convalescence**		
	M±m (μg / g dry weights)	M±m (μg / g dry weights)	↑II **or** ↓IS	M±m (μg / g dry weights)	↑II **or** ↓IS [1]	↑II **or** ↓IS

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Salmonellosis with outcome to recovery (n =)						
Blood serum	**0,57±0,06**	**0,82±0,023***	↓1,49	**0,85±0,01***	↑1,0	↑1,49
Shaped elements	**2,86±0,27**	**0,35±0,027***	↑1,21	**0,41±0,02***	↓1,17	↓6,98
Salmonellosis with the outcome of the formation of a protracted course						
Blood serum	0,57±0,06	0,87±0,040*	↑1.5	0,83±0,02*	↓1,0	↓1,46
Shaped elements	2,86±0,27	0,38±0,013*	↓7.5	0,50±0,02* •	↓1,31	↓5,72

Note: ↑ II - the induction index - the rate of increase and ↓ IS - the suppression index - the rate of decrease in the indicator relative to healthy subjects; ↑ II1 or ↓ IS1 - the rate of increase or decrease in indicators relative to the previous period

A statistical analysis of the studies carried out on the contents of the microelement selenium in patients with acute salmonellosis in the group with the outcome of the formation of a protracted course of the disease showed similar dynamics to the group of patients with the outcome of recovery, except that during the period of late convalescence, there is a slight decrease in the content of selenium in the blood serum relative to the heat indicators. while in the comparison group there is a further increase.

So, during the peak period in patients with the outcome of the formation of a protracted course of the disease, the blood serum level rises to 0,87 ± 0,04 μg / g dry. weight, in the group with the outcome of recovery increases by 1.4 times relative to the control values and is 0,82 ± 0,02 μg / g dry. weight. In the blood cells in the group with the outcome of the formation of a protracted course of the disease, it is also noted, as in the group with the outcome of recovery, a sharp decrease in the selenium content during the height of the disease (by 7,53 and 8,17 times, respectively) to 0,38 ± 0,01 μg / g dry weight and 0,35 ± 0,03 μg / g dry. weight, respectively, P> 0,05.

In the period of late convalescence, the selenium content in the blood serum in the group of patients with the outcome of the formation of a protracted course decreases to 0,83 ± 0,02 μg / g dry. weight relative to the peak period 0,87 ± 0,04 μg / g dry. weight, remaining significantly high relative to the control values (1,46 times, P> 0,05). В форменных элементах крови в данный период заболевания у больных острым сальмонеллезом с формированием затяжного течения заболевания отмечается достоверное увеличение значений содержания селена до 0,50±0,02 мкг/г сух. веса относительно периода разгара 0,38±0,01 мкг/г сух. веса, оставаясь значительно (в 5,72 раза) ниже контрольных значений (2,86±0,27 мкг/г сух. веса) (P>0,05)

Conclusions.

1. For the implementation of the immune response in the acute course of Salmonella infection, there is a redistribution of the trace element zinc from the blood serum to the formed elements, blood.

2. In patients with acute salmonellosis with different outcomes of the disease at different periods of the course of the disease, there is a sharp decrease in the content of the microelement selenium in the uniform elements, while the increase in its serum level is not so intense, which apparently indicates the use of this microelement to ensure activity in this pathological the process of intracellular enzyme systems.

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