The Peculiarity of the Functional Specificity of Mixed Saliva against the Background of Motor Activity of Children of Different Age Groups

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A B S T R A C T

It is known that both lack and excess of motor activity are a pathogenetic factor leading to diseases. The body must choose the path of adaptation and glucocorticoid hormones help it in this, which includes cortisol, which is the main compound that ensures the development of a general adaptation syndrome. The article describes the possibility of using a non-invasive, accessible and informative rapid analysis of oral fluid, conducted according to a minimum number of indicators (ionized calcium, salivation volume, arterial pulse and respiratory rate), which makes it possible to assess the degree of physical activity of the child, to choose the optimal motor mode and, if necessary, to correct it.

A R T I C L E I N F O

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As is known, salivary glands react subtly to any changesin the internal organs and systems of the body, whether it is a pathological process or a physiological state. Any severe exposure, mental or physical, to which the body is exposed, is accompanied by a change in the secretory activity of the adrenal cortex. Physical activity is known to be a stress for the body, accompanied by the development of a general non-specific reaction, an adaptive syndrome, which is also reflected in changes in saliva composition and its structural properties. It should be noted that only optimal amount and duration of the motor loads have a positive effect on the organism. At the same time, both lack of motor activity and excess motor activity are pathogenic factors that lead to disease. Therefore, organism must choose the path of adaptation and this is assisted by glucocorticoid hormones including cortisol, which is the main compound that ensures the development of the general adaptation syndrome.Recent investigations haveproved that saliva is a convenient subject for cortisol research, as it is stable and represented as a free fraction. Most researchers who studied the hormonal composition of saliva believe that the determination of cortisol in saliva may have a diagnostic value, although it is necessary to consider its lower concentration compared to its content in plasma [1.2.3]. It has been reported that the dynamics of calcium concentration in the blood and, consequently, in saliva are associated with cortisol secretion. In individuals with a high cortisol content, due to continuous stress, calcium loss is often observed, since this inhibits the absorption of calcium in the intestinal wall and its reabsorption in the kidney tubules. It is well known that calcium is a vital mineral that takes part in biologically important reactions such as bone formation, dentin, tooth enamel, muscle contraction processes, nerve and muscle conduction and other processes. Calcium deficiency in childhood results in growth retardation, posture disorders, decreased muscle tone, as well as various somatic pathologies, therefore, timely diagnosis of hypocalcemia is important, especially in pediatrics.

The aim of research is to study the composition of saliva in children with different motor activity and to identify their relationship.

To achieve our goals, we were faced with the following tasks:

- To study the mineral composition of oral fluid in children in groups with different levels of activity;
- To study the gender characteristics of the mineral composition of oral fluid in children in groups with different degrees of activity;
- To study the correlation of the mineral composition of oral fluid in children in terms of gender, age and motor load.

Materials and research design.

The studies were carried out in 120 apparently healthy senior grade students of the school. The age range of children was from 15 to 17 years old. Among the children who took part in the study, 58 were boys, which corresponded to 48%, and 62 girlsor 52%. All children were divided into three groups according to the level of physical activity: Group I - children not engaged in sports and not attending regular physical education classes at school; Group II - children with average physical activity, attending physical education classes at school and receiving physical activity additionally 1-2 times a week in sport clubs and sections; III group - children - athletes (5-7 years of experience in athletics). All studies were conducted with the mutual consent of the participants and in compliance with ethical standards.

In each group, unstimulated oral fluid was collected using a Lashley-Krasnogorsky capsule in polypropylene tubes in the morning on an empty stomach for 5-15 minutes, after hygienic treatment of the oral cavity with boiled water. For calcium testing, each portion was centrifuged at 3000 rpm for 15 minutes. In further studies, the supernatant was used. To determine the concentration of calcium in saliva, a photometric method with o-cresolphthaleincomplexone was used using a set of reagents from the "Human" company on Humalyzer Junior apparatus (Germany). Each portion of the oral fluid was tested for its response with standard test strips. The arterial pulse and respiratory rate were calculated for each student.

All the results obtained were statistically processed using computer program “6-Statistics”, and the validity of differences of matched values was determined using “t-criterion of Student”.

Results of the research

Analysis of our results showed that the oral fluid parameters vary quite widely, both in terms of gender and in terms of available physical activity. For example, in the first (I) group, where there were children who did not go in for sports and who did not regularly attend physical education classes at school, it was found that the calcium content in the oral fluid did not have any special gender differences.The amount of excreted oral fluid per unit time differed almost insignificantly. Arterial pulse and respiratory rate also did not differ much between girls and boys and corresponded to their ages (Table 1).

Table 1. The content of ionized calcium and other oral fluid parameters in healthy children of group I

Oralfluidparameters	Girls	Boys	Note
Oral fluid amount (for 15 min.)	8 ml	10 ml	
Calciumamountmmol / l	0,57±0,01	0,59±0,01	
pH of the oral fluid	5,8	5,9	In mixed diet
Arterialpulseperminute	88 beats	86 beats	
Respiratoryrateperminute	20	18	

Analysis of the results of the second group of children suggests that with average physical activity in children, the range of changes in the volume of salivation decreased insignificantly in both female and male population of children. The amount of salivation in both sexes was almost equal. Similar changes were related to the results of the reaction of the oral fluid. However, the calcium composition of the oral fluid had a general tendency to increase. The absolute indicators of this parameter and a large percentage of the increase were noted in boys of this group. The increase in the readings of the calcium content in the oral fluid averaged 0.8 times.

The indicators of the functional state of the cardiovascular system and the respiratory system tended to decrease, both in girls and boys. This tendency to decrease in arterial pulse averaged 1.2 times, and the

decrease in respiratory rate was 1.2 times in girls and 1.3 times in boys. But the absolute indicators of these systems in boys and girls of this group visually seem to be significant (Table 2).

The content of ionized calcium and other parameters of oral fluid in healthy children of the group II.

Table 2.

Oralfluidparameters	Girls	Boys	Note
Oral fluid amount (for 15 min.)	6ml	6.5ml	
Calciumamountmmol / l	0,65±0,01	0,78±0,01	
pH of the oral fluid	6.0	6,3	In mixed diet
Arterialpulseperminute	73 beats	69 beats	
Respiratoryrateperminute	17	14	

Analysis of the indicators of the results of the third group of children suggests that with high physical exertion in children, the range of changes in the volume of salivation remains unchanged compared to the indicators of the previous group. However, there is a slight difference in both female and male population of children. The amount of salivation of both sexes was almost equal. Similar changes were made to the effects of the oral fluid reaction. With regard to the calcium content of the oral fluid, a marked downward trend should be noted. Again, the reactivity of the changes in this parameter in absolute terms and a high percentage of the decrease was observed in boys of this group. The average reduction in the calcium content of the oral fluid was 0.9 times.

Indicators of the functional state of the cardiovascular system and the respiratory system tended to decrease, both in girls and boys. This tendency to decrease in arterial pulse averaged 1.2 times, and the decrease in respiratory rate was 1.2 times in girls and 1.3 times in boys. But the absolute indicators of these systems in boys and girls of this group visually seem to be significant (Table 3).

Discussion of the results

When analyzing the results obtained, we came to the following: in children with low physical activity, there is a decrease in the level of calcium, which is possibly associated with increased level of emotional and hormonal status, which corrects the absorption of calcium in the intestinal wall and its reabsorption in the tubules of the kidneys. Plastic processes occurring in bone tissue and muscles need a sufficiently large amount of calcium, and therefore the level of calcium in the blood decreases and, accordingly, decrease in calcium in the oral fluid is observed. These indicators once again prove the effect of cortisol on calcium and require timely diagnosis and correction of this condition. Indicators of calcium levels in saliva in the third group indicate the presence of mechanisms for adapting the body to regular physical activity, which corresponds to low levels of hormone cortisol in young athletes.

Table 3. The content of ionized calcium and other parameters of oral fluid in healthy children of group III.

Oralfluidparameters	Girls	Boys	Note
Oral fluid amount (for 15 min.)	6.1ml	6.3 ml	
Calciumamountmmol / l	0,60±0,01	0,72±0,01	
pH of the oral fluid	6.1	6,2	In mixed diet
Arterialpulseperminute	70beats	68beats	
Respiratoryrateperminute	17	14	

The optimal figures, as can be seen from the tables, were in the second group of schoolchildren with average motor activity, attending physical education classes at school and receiving physical activity additionally 1-2 times a week in sports clubs and sections, since high levels of ionized calcium was found in saliva. This result confirms the so-called optimal law of "average loads".

Thus, studies have shown that a non-invasive, accessible and informative express analysis of the oral fluid, carried out according to the minimum number of indicators (ionized calcium, salivation volume, arterial pulse and respiratory rate) makes it possible to assess the degree of physical activity of the child,

select the optimal motor mode and, if necessary, to perform a correction thereof.

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