

## INDICATORS OF MINERAL METABOLISM IN THE ORAL FLUID IN PATIENTS WITH GASTROESOPHAGEAL REFLUX DISEASE

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**Abstract.** Disruption of the digestive system in the gastrointestinal tract, namely in gastroesophageal reflux disease, leads to the development of pathological processes in the oral cavity, changing the homeostasis of the viscoelastic gel layer of the esophageal mucosa. Thus, it has been proven that there are reflex connections between the receptor apparatus of the esophageal mucosa and the efferent nerve fibers of the salivary glands, which can be disrupted in GERD. Therefore, saliva is involved in providing effective protection of the esophagus. As a result, the content of mineral components changes significantly: in particular, the level of calcium and enzyme composition.

Aim to study the indicators of mineral metabolism: the content of calcium, alkaline, and acid phosphatases in mixed saliva in patients with gastroesophageal reflux disease.

Methods 60 patients of various ages who underwent inpatient treatment at the IFNMU University Clinic were examined, where pH-metry was performed to determine acidity. The main group consisted of patients diagnosed with GERD, with decreased and increased acidity. The content of indicators of mineral metabolism in saliva was determined as follows: calcium (Ca) - photometric method with arsenase -111; acid phosphatase (AC) was determined by the Hillman method, alkaline phosphatase (AL) by hydrolysis of p-nitrophenyl phosphate at pH -10.4, release of p-nitrophenol and phosphate. The norm of indicators of mineral metabolism was established on 30 practically healthy volunteers. Statistical processing of data was carried out using the Microsoft Excel program by calculating the arithmetic mean.

Conclusions thus, the results obtained indicate that in GERD there is a violation of mineral metabolism in the oral fluid. The oral fluid is the first to come into contact with the reflux agent. This leads to a violation of saliva neutralization, so the study of saliva mineral composition can be considered as an early diagnostic marker for gastroesophageal reflux disease.

**Key words:** *oral fluid, gastroesophageal reflux disease; calcium; alkaline phosphatase; acid phosphatase.*

**Introduction.** For many years, changes in the oral mucosa in diseases of the gastrointestinal tract have been one of the most pressing problems in dentistry. This is due to the high prevalence of pathological conditions, the nature of the course, the complex damage to the body, and the difficulty of treating gastrointestinal pathology, namely gastroesophageal reflux disease (GERD). [2,3,4,5,6].

Many foreign and local authors testify that diseases of the oral mucosa are multifactorial and occur as concomitant diseases in the pathology of digestive organs and systems and most often in GERD [1,7,9]. Saliva is a complex biological fluid produced by specialized glands (parotid, submandibular, and sublingual ones). It is well known that oral fluid is an important component of the functional system of the oral cavity. The state of this system is carried out due to the balance of the qualitative and quantitative composition of saliva, the content of mineral enzymes, and components [8]. The composition and amount of saliva depend on the time of day and the food taken. Saliva itself performs digestive, mineralizing, protective, regulatory, and buffering functions. Saliva contains components of buffer systems that can **neutralize acids and alkalis**. [10].

Disruption of the digestive system in the gastrointestinal tract, namely in gastroesophageal reflux disease, leads to the development of pathological processes in the oral cavity, changing the homeostasis of the viscoelastic gel layer of the esophageal mucosa. Thus, it has been proven that there are reflex connections between the receptor apparatus of the esophageal mucosa and the efferent nerve fibers of the salivary glands, which can be disrupted in

GERD [3]. Therefore, saliva is involved in providing effective protection of the esophagus. As a result, the content of mineral components changes significantly: in particular, the level of calcium and enzyme composition. Therefore, the composition of saliva in patients with GERD is important.

**Objective.** To study the indicators of mineral metabolism: the content of calcium, alkaline, and acid phosphatases in mixed saliva in patients with gastroesophageal reflux disease.

### Materials and methods of the study

We examined 60 patients of various ages who underwent inpatient treatment at the IFNMU University Clinic and who underwent pH-metry, which was used to determine the acidity of gastric juice (Table 1). The main group consisted of 30 patients diagnosed with GERD, at the same time, 15 people had low acidity of gastric juice and 15 patients with high acidity. The control group included 30 practically healthy people. In the future, the study was conducted in patients with the aim of including other somatic diseases.

For the study, we took unstimulated saliva collected 30 minutes after brushing the teeth and thoroughly rinsing the mouth with distilled water. Saliva for analysis was taken at the same time on an empty stomach. The results of the study are presented in Table 2.

The content of mineral metabolism indicators in saliva was determined as follows: calcium (Ca) by photometric method with arsenase III; acid phosphatase (AP) was determined with the method of Hillmann, alkaline phos-

phatase (ALP) by hydrolysis of p-Nitrophenyl Phosphate at pH - 10.4 to release p-nitrophenol and phosphate.

**Table 1. Characteristics of the study population**

Age of the examined patients/ group	Main group		Control group	
	Females n /%	Males n /%	Females n /%	Males n /%
25-35 y/o	7 (23%)	5 (16%)	8 (26%)	4 (13%)
36- 44 y/o	6 (20%)	6 (20%)	5 (16%)	10 (33%)
45- 55 y/o	2 (6%)	4 (13%)	6 (6%)	1 (3%)
Total	15	15	19	15

The norm of mineral metabolism was established on 30 practically healthy volunteers.

Statistical data processing was performed using Microsoft Excel by calculating the arithmetic mean.

### Results and discussion

The results of the study are presented in Table 2.

**Table 2. Indicators of mineral metabolism in oral fluid in the study groups**

Study groups	Calcium (mmol/L)		Acid phosphatase (U/L)		Alkaline phosphatase (U/L)	
	High acidity (n=15)	Low acidity (n=15)	High acidity (n=15)	Low acidity (n=15)	High acidity (n=15)	Low acidity (n=15)
Main group n =30	1,26±0,1	1,87±0,11	9,5±0,3	6,1±0,6	6,7 ±1,8	6,9±1,4
Control group n =30	2,4±0,06	2,1±0,09	4,8±0,03	4,5±0,03	114±14,1	122±13,2
Total	15	15	15	15	15	15

Note \*: **n** is the number of examinees.

According to the table, the average value of calcium in the experimental group with increased gastric acidity was 1.26±0.1 mmol and in the one with decreased acidity 1.87±0.11 mmol/L, while in the control group with high acidity this figure was 2.4±0.06 mmol/L, and with low acidity it was 2.1±0.09 mmol/L. This indicates a decrease in the calcium content in saliva in patients with GERD with high acidity, which can lead to a decrease in the contractility of the lower sphincter, which plays a role in the development of GERD.

Acid phosphatase in the main group with high acidity was 9,5±0.3 U/L, in the one with low acidity 6,1±0.6 U/L, while in the control group with high acidity it was 4,8±0.03 U/L, and with low acidity it was 4.5±0.03 U/L.

In the study, the concentration of alkaline phosphatase in the oral fluid of the main group at high gastric juice acidity was 6.7±1.8 U/L, and at low acidity 6.9±1.4 U/L. Accordingly, this indicator in the control group with high acidity it was 114±14.1 U/L, and with low acidity it was 122±13.2 U/L.

Against the background of a shift in the hydrogen index to the acidic side, a decrease in the alkaline phosphatase levels, and increased concentration of acid phosphatase were observed.

Acid and alkaline phosphatases are involved in the digestion of food, starting in the mouth. Therefore, it is important to study the activity of these enzymes in the oral fluid, which can affect the state of taste sensitivity and inflammatory processes in the oral cavity.

A comparative analysis of data from scientific literature with data from our own research showed that the number of mineral indicators leads to changes in the mineralization and remineralization of enamel.

### Conclusion

Thus, the results obtained indicate that in GERD there is a violation of mineral metabolism in the oral fluid. The oral fluid is the first to come into contact with the reflux agent. This leads to a violation of saliva neutralization, so the study of saliva mineral composition can be considered as an early diagnostic marker for gastroesophageal reflux disease.

**Ethical standards:** All procedures performed in studies involving human participants, were in accordance with the ethical standards of the institutional ethics committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent:** The written informed consent was obtained from each patient before the treatment.

**Conflict of interest:** No conflicts.

**Financial Disclosure:** No funding was received for this study

**Data Availability Statement:** The data that support the findings of this study, are available from the corresponding author upon reasonable request.

### References

1. Main diseases of the mucous membrane of the oral cavity 07/28/2020 Available from: <https://www.galsi-dental.com.ua>
2. Schneider S. A.; Saleh A. Yu. Dental diseases in patients with pathology of the gastrointestinal tract: review of the literature «Bulletin of the National Medical University», 2023, Vol. 27, No. 2. Available from: DOI: 10.31393/reports-vnmedical-2023-27(2)-25
3. The state of the oral cavity in chronic stomach diseases in children November 8, 2018. Available from: [www.bsmu.edu.ua](http://www.bsmu.edu.ua)
4. Labush Y.Z., Markov A.V. RELATIONSHIP BETWEEN DISEASES OF THE MUCOUS MEMBRANE OF THE ORAL CAVITY AND PATHOLOGY OF THE GASTROINTESTINAL TRACT. Actual problems of modern medicine. Volume 23, Issue 2. Available from: DOI 10.31718/2077-1096.23.2.2.14

5. Kyrylenko II, Paliychuk IV, Rozhko MM. Zakhvoryuvannya slyzovoyi obolonky rotovoyi porozhnyny: Navch. possible dlya stud., likariv-interniv i likariv-slukhachiv zakladiv pislyadyplomnoyi osvity [Diseases of the mucous membrane of the oral cavity: Educational guide for students, intern doctors and trainee doctors of postgraduate education institutions]. Kyiv: «Medytsyna», 2016. 352 p. (Ukrainian)
6. Daley TD, Armstrong JE. Oral manifestations of gastrointestinal diseases. *Can J Gastroenterol.* 2017; 21(4): 241–244.
7. Postman VM. Pathohenetychni aspekty likuvannya khvorykh z bahatoformnoyu eksudatyvnoyu erytemoyu slyzovoyi obolonky porozhnyny rota [Pathogenetic aspects of treatment of patients with multiform exudative erythema of the mucous membrane of the oral cavity]. Odesa; 2017. 36p. (Ukrainian)
8. Schneider S. A.; Saleh A. Yu. Biochemical indicators of oral fluid as a criterion for assessing the state of antioxidant-prooxidant systems in children with GERD manifestations. Available from: <https://repo.odmu.edu.ua:443/xmlui/handle/123456789/9831>
9. Lebedyk, S. V., & Konovalenko, S. O. (2021). Early childhood caries - a modern social problem [Early childhood caries- a modern social problem]. *Nursing - Nursing*, (4), 50-54. Available from: <https://doi.org/10.11603/2411-1597.2020.4.11875>
10. Shevchenko K. V., Yeroshenko G. A., Pronina O. M., Kramarenko D. R., Kudynov M. V. MODERN IDEAS ABOUT THE STRUCTURAL AND FUNCTIONAL ORGANIZATION OF THE SALIVARY GLANDS. ISSN 2077-4214. *Bulletin of problems of biology and medicine - 2018 - Issue 3 (145)*. Available from: DOI 10.29254/2077-4214-2018-3-145-50-58

Received: 21.11.2023

Revised: 17.12.2023

Accepted: 26.12.2023