

# Characteristic Features of Lipid Metabolism in Patients with Chronic Generalized Periodontitis Associated Metabolic Syndrome.

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## ABSTRACT

**Background:** The purpose of this study was a comparative analysis of the oral fluid in patients with CGP associated MS. **Methods:** 72 patients with moderate CGP were examined. Of these, 24 patients without concomitant diseases; 48 patients with CGP in combination with MS. Patients with chronic hepatitis C combined MS at the age of 40-65 years were mainly contingents suffering from metabolic disorders, in particular the syndrome of insulin resistance and were outpatient observation. The presence of hypertriglyceridemia, elevated levels of OH, LDL cholesterol and reduced HDL cholesterol levels is an important component in the development of the metabolic syndrome in patients with chronic hepatitis C combined state of insulin resistance. **Results:** The level of TG in the oral fluid was increased by an average of 5 times in patients with chronic hepatitis C associated metabolic disorders compared with the group of healthy individuals with intact periodontal disease at a confidence level of  $p < 0.05$ , 3 times in comparison with the control group at a confidence level of  $p < 0.05$ . **Conclusion:** In the oral fluid of patients with CGP associated MS, significant changes in carbohydrate and lipid metabolism compared with the serum of healthy individuals with intact periodontal were revealed.

**Keywords:** lipid metabolism; metabolic syndrome; hepatitis C; generalized periodontitis.

## INTRODUCTION

A number of studies have shown that patients with metabolic syndrome have a more severe periodontal disease.<sup>[1,3]</sup> but aspects of the relationship between these diseases are not well understood. One of the proven facts is the development of a systemic inflammatory response in patients with metabolic syndrome due to an increase in the mass of visceral adipose tissue.<sup>[5,7]</sup> In this case, the likelihood of development and the severity of periodontal disease is directly related to metabolic changes in the body as a whole. The metabolic syndrome is determined by the presence of tissue insulin resistance, hyperinsulinemia, impaired glucose tolerance, primary arterial hypertension, dyslipidemia and hyperlipidemia, as well as abdominal obesity, microalbuminuria and hyperuricemia in one patient. The main characteristics of the metabolic syndrome are an increase in the mass of visceral fat, insulin

resistance, hyperinsulinemia. Persistent pathological changes in carbohydrate, lipid, and purine metabolism in combination with arterial hypertension lead to an increase in cardiovascular diseases, which are one of the main causes of disability and mortality in developed countries. According to the majority, the basis for the formation of the pathology of the cardiovascular system is metabolic syndrome. At the same time, the mechanism of the interrelation of the metabolic syndrome with the inflammatory process in periodontal tissues remains not fully studied.<sup>[2,4,6,8,9]</sup>

The purpose of this study is a comparative analysis of changes in lipid metabolism in serum and oral fluid in patients with chronic hepatitis C associated MS.

## MATERIALS AND METHODS

A comparative analysis of the biochemical parameters of blood and oral fluid was carried out in the clinical diagnostic laboratory of the clinic TGSI and in the laboratory of RNPCSM. To achieve this goal, under our supervision there were 72 patients with moderate CGP. Of these, 24 patients without concomitant diseases; 48 patients with CGP in combination with MS. Patients were

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on outpatient treatment in the clinic TSGI. Patients with chronic hepatitis C combined MS at the age of 40-65 years were mainly contingents suffering from metabolic disorders, in particular the syndrome of insulin resistance and were outpatient observation. In 86.8% of patients, concomitant arterial hypertension and obesity were noted. In working with the examined, ethical principles were observed, which were reflected in the Helsinki Declaration of the World Medical Association (1964). For an objective assessment of the condition of periodontal tissues, patients with CGP combined with MS were examined according to the following parameters: determination of papillary-marginal-alveolar index by C. Parma (1960), determination of bleeding gums when probing according to Barer, Lemetskaya (1996), test of capillary functional resistance according to Kulazhenko V.I. (1960), determination of the index of peripheral blood circulation in periodontal tissues by Dedova L.N. (1981), determination of the degree of tooth mobility, according to A.I. Evdokimov (1953), determination of the depth of periodontal pockets according to WHO (1990), determination of the periodontal index according to Russell A. (1956), determination of the hygienic index according to Green J.C., Vermilion J.R. (1960).

Blood was taken for examination in the morning, after a 12-14-hour fasting from the cubital vein. Oral fluid was collected on an empty stomach into a glass tube, without stimulation, by spitting, for 10 minutes. Next, the samples were subjected to freezing for at least 3 hours. Then it was thawed again, centrifuged for 5 minutes until a clear supernatant was formed, which was used for the study (Gilmiyarova, 2006). Oral fluid and serum were analyzed on the same day. All patients were informed about the study and expressed their

written consent to conduct it. The study of the state of carbohydrate, lipid metabolism and lipid peroxidation in the examined patients was carried out in parallel with the comparison group. In the serum, carbohydrate metabolism was studied by the level of glucose glucose oxidase method; lactate, pyruvate (Umbright method by colorimetric method. Lipid profile, including OH, TG, XC-LDL, X-HDL, was analyzed by colorimetric method using standard HUMAN test systems on the ROSH-31 biochemical analyzer. Statistical analysis was performed using program Statistica8.0.

## RESULTS & DISCUSSION

Analysis of the research results presented in Table 1 shows that in the group of practically healthy individuals the glucose level did not differ from the WHO recommendations and did not exceed the 6.1 mmol/l threshold value. According to the recommendations of the Diabetes Control Committee and its clinical complications (Diabetes Control & Complication Trial, DCCT), it is possible to assess the carbohydrate metabolism of a patient over a long period by determining the concentration of glycated hemoglobin (HbA1c) in the blood. The glycated hemoglobin content reflects the patient's glycaemia level over the preceding period. In the study, an increase in the content of glycated hemoglobin was observed in 98% of the examined patients with the combined form of the disease. The level of HbA1c was significantly elevated in 25% of patients (12 people), on average, 1.7 times as compared with the recommended level and more than 2.1 times higher than in the comparison group.

**Table 1: Dynamics of serum biochemical parameters in patients with CGP concomitant MS**

Indicators	Healthy individuals with intact periodontal n =14	Patients with chronic generalized periodontitis n= 24	Patients with chronic hepatitis C combined with MS n = 48
Glucose, mmol/l	4,51±0,48	5,57±0,48	8,79±2,20*
HbA1, %	4,50±0,44	5,58±0,44	7,81±1,55*
Lactate, mmol/l	0,81±0,22	1,34±0,12	2,36±0,28*
Pyruvate, mmol / l	0,07±0,02	0,13±0,02	0,26±0,07*
Triglycerides, mmol/l	1,04±0,23	1,68±0,13	2,38±0,63*

Note: \* - significance of differences P <0.05

Consequently, HbA1c is an important marker in the long-term control of glycemia in patients with chronic hepatitis C combined MS. From literary sources it is known that an increase in the level of lactate and pyruvate indicates the severity of hypoxia in the tissues of the body. In clinical practice, the determination of the amount of lactate

in the blood is used to monitor the level of tissue hypoxia: the utilization of pyruvate depends on the availability of oxygen and, accordingly, a decrease in the oxygen supply to the cells leads to an increase in the production of lactate and an increase in its level in the blood.

In our studies in patients with CGP concomitant MS, the level of lactate was increased in 49% (24 people) compared to the recommended value and increased 2.9 times as compared with the control group. Increasing the amount of lactate in patients with the combined form of the disease can cause a shift in acid-base balance with the development of lactic acidosis. It should be noted that in patients with CGP combined MS, there was also an increase in pyruvate by 3.7 times compared with the recommended values, which was observed in 36 patients (25%) patients. This suggests that in this study, half of the patients disrupted pyruvate utilization. In this situation, activation of the conversion of pyruvate to lactate, can lead to an increase in blood lactate. And this may adversely affect the development of tissue hypoxia.

The condition of hypertriglyceridemia is usually considered to be one of the main disorders of lipid metabolism. Therefore, measuring the concentration of TG in the blood is one of the WHO's recommendations for assessing metabolic disorders. In the course of the study, high serum TG values were detected in 73.3% of the examined patients (35 people) and significantly exceeded control values ( $2.38 \pm 0.63$ ). Significantly, elevated levels of TG were observed in 42% of patients (20 people) on average 2.5 times compared with the control group. At the same time, the triglyceride concentration averaged  $2.68 \pm 0.24$  mmol/l.

Analysis of the obtained data showed an increase in the level of total cholesterol in the blood compared with the data of the group of healthy individuals ( $p < 0.01$ ). In the group of patients with CGP associated MS, the level of total cholesterol was  $6.78 \pm 0.54$  mmol/l, which is 44% higher than the value in the control group. Hypercholesterolemia was observed in 82% of patients (39 people) and exceeded the recommended values by 1.45 times.

Determination of total cholesterol levels is used for screening studies, but a more accurate assessment of lipid metabolic disturbances requires measurements of HDL cholesterol and cholesterol LINS [Table 2].

**Table 2: Levels of LDL-C and HDL-C in LDL-C patients with concomitant MS**

Groups surveyed	ChS-LDL, mmol / l	ChS- HDL, mmol/l	CA
Healthy people with intact periodontal N = 14	$2,24 \pm 0,28$	$2,01 \pm 0,19$	1,05
Patients with chronic generalized periodontitis N = 24	$2,78 \pm 0,21^*$	$1,67 \pm 0,18^*$	3,7*

Patients with chronic hepatitis C combined with MS N = 48	$3,92 \pm 0,21^*$	$1,03 \pm 0,11^*$	5,3*
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An increase in the content of cholesterol-LDL was observed in 75% of those examined with the combined form of the disease compared with the group of healthy individuals with intact periodontal disease. On the contrary, the content of HDL cholesterol was reduced by 52% compared with healthy people. Hence, the atherogenic coefficient of the examined patients with MS was 5.3, that is, it exceeded the recommended level almost 5 times. This fact testified to the presence in patients with CGP combined with MS for the risk of atherosclerotic complications or a predisposition to them.

Thus, it can be concluded that the presence of hypertriglyceridemia, elevated levels of OH, LDL cholesterol and reduced HDL cholesterol is an important component in the development of the metabolic syndrome in patients with chronic hepatitis C combined insulin resistance.

As you know, oral fluid is a labile medium and many factors and conditions affect its quantitative and qualitative composition, but, first of all, the state of the organism. One of the main functions of saliva is to maintain homeostasis in the oral cavity. Disruption of metabolic processes in patients with chronic hepatitis C is reflected in changes in biochemical parameters, both in serum and oral fluid. The concentration of glucose in saliva in patients with the combined form of the disease was increased 3 times compared with the control group with a confidence level of  $p < 0.05$  according to the U-Mann-Whitney test. In patients with CGP concomitant MS, a significant change in the values of lactate in the oral fluid was also found. The increase in lactate in the oral fluid can be explained by the light permeability of this metabolite through the cell membranes. Observed destructive processes in patients with CGP combined with MS affect cells and their membranes and probably contribute to an increase in lactate permeability and its release into the oral cavity in the composition of the oral fluid. Considering that the oral fluid is in a dynamic relationship not only with the organs of the oral cavity, but also with the internal liquid medium of the body, the revealed dynamics of the lactate content indicates the development of tissue hypoxia in the oral mucosa. According to the assessment of the level of lactate in the oral fluid was increased on average by 78% in patients with chronic hepatitis C combined with MS when compared with a group of healthy individuals with an intact periodontal disease. Analysis of the results of studies presented in the table showed that the

level of TG in the oral fluid was increased on average 5 times in patients with chronic hepatitis C associated metabolic disorders compared with a group of healthy individuals with intact periodontal at a confidence level of  $p < 0,05$ . total cholesterol in the oral fluid showed an increase of 4.3 times in 77% of patients with chronic hepatitis C (37 patients) compared with the control group with a confidence level of  $p < 0.05$ .

**Table 3: Indicators of cholesterol and triglyceride in the saliva of the examined persons.**

Indicator	Healthy individuals with intact periodontal n = 14	Patients with chronic generalized periodontitis without MS n = 24	Patients with chronic hepatitis C combined with MS n = 48
OH, mmol/l	0,07±0,01	0,09±0,02	0,17±0,06*
TG, mmol/l	0,03±0,03	0,09±0,02*	0,15±0,05*

Note: \* significance of differences  $P < 0.05$

In 23% of patients with chronic hepatitis C, the total cholesterol content in the oral fluid was increased slightly compared with the control group and was  $0.09 \pm 0.02$  mmol/l. The observed changes in the content of OH and TG in the oral fluid suggests a violation of lipid metabolism.

## CONCLUSION

In the oral fluid of patients with CGP associated MS, significant changes in carbohydrate and lipid metabolism compared with the serum of healthy individuals with intact periodontal were revealed.

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