# THE BIOCHEMICAL ANALYSIS OF SALIVARY ORGANIC COMPOUNDS TO PATIENTS SUFFERING FROM CARIES DISEASE

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**ABSTRACT: The aim of this study** was to analyze the various salivary organic compounds in 158 patients who were divided into three groups: 32 in the control group (without general diseases), 108 with general diseases (asthma, diabetes) and 18 with head and neck radiotherapy. The values of the salivary organic compounds were compared with those in the blood, in all groups studied. **Materials and methods**: The study consisted of the collection of saliva in test tubes which were maintained at a temperature of - 20 ° C. The samples were centrifuged at 10,000 rotations per minute. Laboratory analyzes were performed at an automatic analyzer, observing the protocols specific to each parameter studied. The results obtained from each component salivary considered in the study were statistically analyzed by performing comparisons between groups of patients examined and between the values of these components in the blood vs. saliva. Were obtained lower salivary amylase levels in the group of patients that followed the head and neck radiotherapy ($M_{amylase}$ = 44633.3) compared to the group of patients with general diseases ($M_{amylase}$ = 105,440.0) and control group ($M_{amylase}$ = 114,456.3). In our study we observed a high concentration of urea in the study group (30,9mmol/L) and the radiotherapy, compared to control group (27,31mmol / L). In diabetic patients examined in our study we found high levels of salivary glucose ($M_{glucose}$ = 5.35) than the control group ($M_{glucose}$ = 1.34). **Conclusions:** The results confirm previous observations showing that, through different general diseases are mainly affected parotid salivary glands, salivary source of key organic compounds (amylase, total protein, glucose). The variations of these chemical compounds in saliva have repercussions on the protective effect of saliva against cariogenic microbial agents and cause finally increase caries risk.

**Key words:** salivary amylase, urea, glucose, carious disease

## INTRODUCTION

Saliva analysis useful in the diagnosis of caries risk and caries activity monitoring has grown in recent years. They have taken a keen interest in longitudinal studies of salivary performance correlated with disease onset, severity or its remission. Quantification of salivary constituents such as epidermal growth factor, specific antibodies or autoantibodies, inflammatory modulators, or antimicrobial factors in saliva may aid in the diagnosis and management of caries disease. Longitudinal studies of saliva production or composition correlated with fluctuations in disease activity should be a goal to investigate conditions involving autoimmune salivary glands. The functions of salivary glands were analyzed in many systemic conditions. Saliva composition is influenced by a large number of physiological variables, of which the most important is salivary flow rate. Total saliva is non-sterile and contains a variety of proteolytic enzymes. Such organic compounds are susceptible to rapid catabolism, where saliva is not sterilized or

degrading enzymes are inactivated.

## OBJECTIVES

The aim of this study was to analyze the various salivary organic compounds in 158 patients who were divided into three groups: 32 in the control group (without general diseases), 108 with general diseases (asthma, diabetes) and 18 with head and neck radiotherapy. The values of the salivary organic compounds were compared with those in the blood, in all groups studied.

## MATERIAL AND METHODS

Patients included in the study had the following general diseases: asthma, diabetes, and other conditions collateral as: hypertension, obesity, heart failure and patients who have head and neck radiotherapy followed. We did a clinical examination and we collected saliva stimulated by chewing tablet paraffin. The study consisted of the collection of saliva in test tubes which were maintained at a temperature of - 20 ° C. The samples were centrifuged at 10,000 rotations per minute. Laboratory analyzes were performed at an automatic analyzer, observing the protocols specific to each parameter studied. In this research was used for statistical data processing program ANOVA, specific tests for the correlation variable for qualitative and quantitative variables Pearson. After applying these tests they were discussed the main parameters of interest and according to their values were established conclusions. Thus the calculated reference parameter p in the test is the level of significance of the test, which was compared with p = 0.05 corresponding to a 95% confidence, significant p having values <0.05.

## RESULTS AND DISCUSSIONS

The results obtained from each component salivary under study were analyzed statistically, making comparisons between groups of patients examined and between the values of these components in the blood vs. saliva.

**Urea (saliva/blood)**

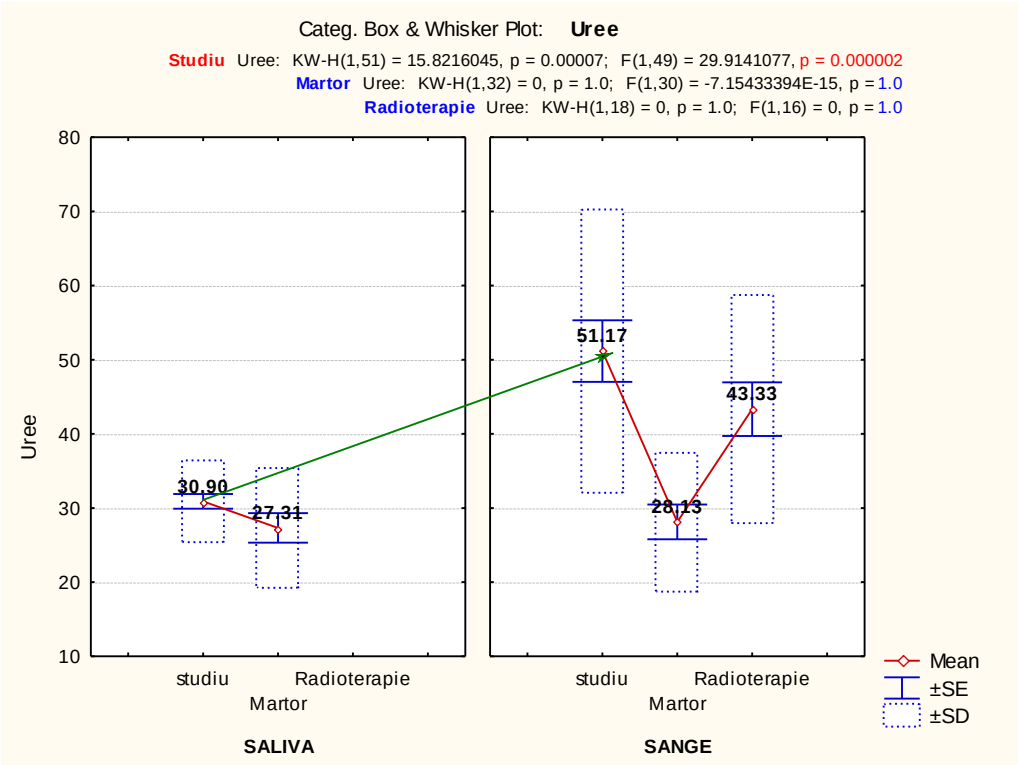


**Figure 1. Statistical indicators of urea in the groups studied**

Analysis of the results showed significantly elevated levels of urea in saliva and blood from those two studied groups compared to control group.

**Amylase [U / l] – saliva**

The correlation between amylase and studied groups is significant (p = 0.025401), the correlation coefficient indicates significant association of low amylase in patients with radiotherapy (r = -0.5329, 95% CI).

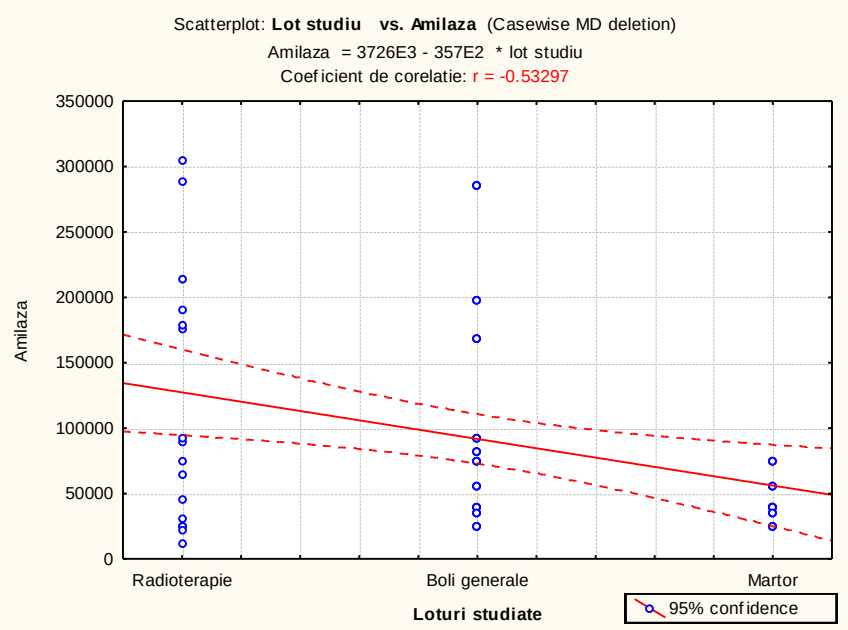


**Figure2. Right regression correlation between amylase vs. groups studied**

**Total protein saliva**

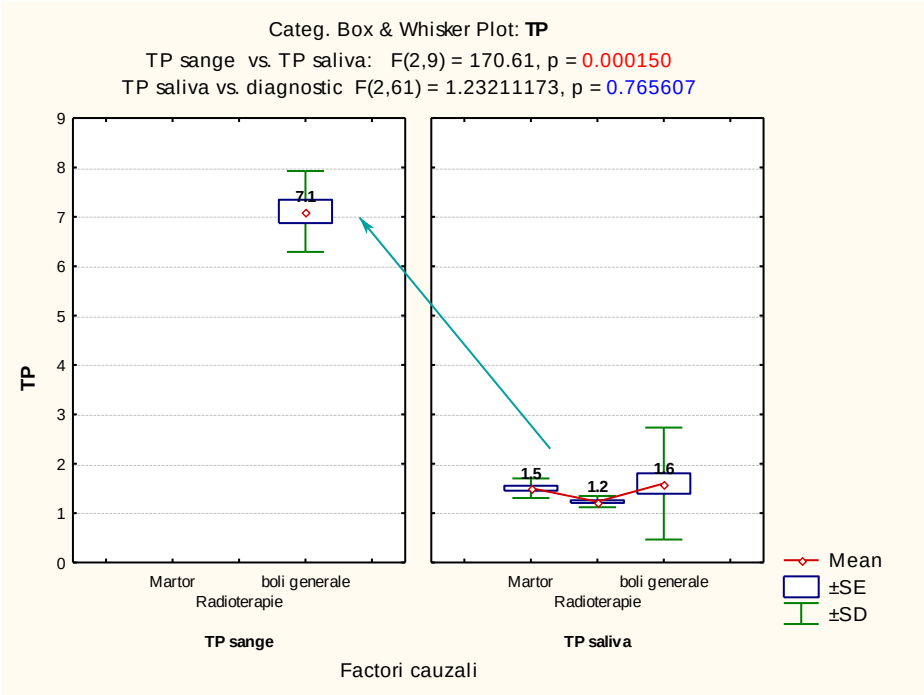


**Figure 3. Values T.P. blood / saliva in the studied**

TP values in saliva are significantly lower than (p = 0.00) in the blood in patients with general diseases.

**Glucose saliva**


**Figure 4. Glucose values / risk factors**

In patients presenting different risk factors (those with diabetes) are observed significantly higher values compared to the values registered in the control group (p = 0.000045).

In discussions about salivary diagnostics is necessary to distinguish the diagnosis of disease, susceptibility to disease diagnosis and identification of components in normal salivary constituents identify abnormal or anomalous concentrations (Anti HIV, alcohol, cocaine).

In Scandinavia, dental schools, samples of saliva tend to be usually collected from patients who are susceptible to decay. Incipient caries are difficult to diagnose by conventional methods. The use of salivary tests for the prediction of carious disease has been reviewed by Larmas (1992) [1]

Theoretically, salivary factors may influence susceptibility to caries. These include salivary flow rate, speed film formation salivary residual volume after ingestion rate of clearance down orally degree of saturation with minerals in teeth (calcium, inorganic phosphate, and fluoride), pH, buffer capacity, urea, and antimicrobial agents, the number of lactobacilli and mutans streptococci. Thus, salivary tests can be an indicator of susceptibility to caries.

Salivary amylase is synthesized primary parotid acinar cells (70-80%) and less consistent in cells interspersed proximal channel and thus is not a contribution to gingival crevicular fluid amylase, it is a way in for some salivary proteins. [2].

The smaller amount is produced and palatine glands, sublingual glands von Ebner. Production is initiated by β-adrenergic stimulation. So, salivary amylase is a good indicator of salivary gland function. In some chronic diseases such as chronic pancreatitis, insulin-dependent diabetes, kidney disorders, anorexia and bulimia nervosa, celiac disease, salivary amylase level is low. [3].

The high concentration of amylase is caused by reabsorption of water ducts and striated osmotic transport outside parotid duct. High values occur in saliva or remaining after adrenergic stimulation. [4]. The amount of amylase may decrease after irradiation in Sindr.Sjögren, poisoning β-blockers in anorexia.

In our case, salivary amylase values are lower in the group of patients that followed the head and neck radiotherapy ($M_{amylase}$ = 44633.3) due to acinar cell damage and secretory parenchyma due to radiotherapy

and are directly correlated with lower RFS. General disease patients in group mean ($M_{amylase}$ = 105,440.0) were also lower than in the control group ($M_{amylase}$ = 114,456.3) that are explained by the action of β-blockers and other drugs on acines glandular ducts and striated.

Total proteins are produced by the parotid acinar cells. Parotid saliva contains α-amylase, PRP (proline-rich protein), IgA-S, proline-rich glycoprotein, cystatine, stateine, histatine, lysozyme. Submandibular saliva contains mucins, PRP, amylase, growth factors. Total protein concentration in saliva is reduced in patients with reduced saliva flow be stimulated by administration of cardiovascular drugs, corticosteroid, or those with radiation therapy. Total protein concentration is directly related to decrease salivary amylase and buffer capacity drop.

Salivary protein secretion is controlled mainly by the sympathetic nervous system, which is exemplified by the production of amylase by acinar cells and ductal cells by secretion of lysozyme. [5].

Therefore salivary protein concentration primarily reflects sympathetic activity ductal and acinar level. Major salivary proteins, including amylase and lysozyme are synthesized and secreted by a process controlled mainly by β-adrenergic activity. In patients with asthma appear salivary composition changes (total protein and amylase) by the presence of auto-antibodies to β- adrenergic receptors that occur following administration of anti-asthmatic drugs. [6]

Wu AJ, BJ Baum, JA Ship, 1995 made a comparative study on lots of young patients (27-40 years) and elderly (60-97 years) who were not taking any medication dry mouth and noticed that no significant changes in the parotid and submandibular glands secretion stimulated in these patients. [7]

Pajukoski H. et al., 1997 [81] showed that elderly patients with chronic diseases and consumers of drugs have significant changes R.F.S. and biochemical constituents. [8]

Factors that showed negative influence on salivary flow were endocrine diseases, ophthalmic and respiratory drugs. Salivary IgA and IgM concentrations were significantly higher in these patients. Also, IgA, lysozyme, amylase concentrations were higher in patients who consume more drugs. Patients with concomitant chronic diseases urea concentrations in saliva were higher than healthy ones.

Jukka Meurman H. et al. 2002 found elevated total protein, urea and albumin salivary in elderly patients, who correlated with decreased salivary flow and medication administered for the general disease they had. [9]

In our study we observed a high concentration of urea in the study group (30,9mmol / L) and the radiotherapy compared to control group (27,31mmol/L). These values are directly correlated with low levels of RFS in both groups compared to the control subjects. However, mean values of urea salivary are lower than those in serum; the ratio between these values is less than a value of 1, which corresponds to the average values of more than 0.3 ml/min of flow rate of saliva obtained from these patients.

In patients with diabetes who do not have medication xerostomia, Paul A. Moore found a decrease in salivary flow outstanding is directly related to the increase in glycosylated haemoglobin and increased concentration of glucose in the blood. [10]

This rapid increase in the concentration of glucose in the blood is associated with hiposalivation and dewatering is explained by the fact that osmotic gradients can increase the salivary glands, thus limiting the secretion. On the other hand, elevated levels of glycosylated haemoglobin that may be associated with hiposalivation patients with diabetes, growth can indicate progression of the disease.

Increasing the concentration of salivary glucose can play an important role in the pathogenesis of dental caries. Hiposalivation may indicate low blood sugar control in diabetics. In diabetic

patients examined in our study we found high levels of salivary glucose ($M_{glucose}$ = 5.35) than the control group ($M_{glucose}$ = 1.34).

CONCLUSIONS:

1. The results confirm previous observations showing that, through different general diseases are mainly affected parotid salivary glands, salivary source of key organic compounds (amylase, total protein, glucose and urea).

2. The variation of these chemical compounds in saliva has repercussions on the protective effect of saliva against cariogenic microbial agents and causes finally increase caries risk.

REFERENCES

1. Larmas M.: Saliva and dental caries: diagnostic tests for normal dental practice. Int.Dent.J. 1992,42;199-208
2. Tenovuo J.: Nonimmunoglobulin defence factors in human saliva. In: Tenovuo J., editor. Human saliva: Clinical chemistry and microbiology.Vol.II. Boca Raton(FL):CRC Press;1989.p55-91
3. Reico F., Villamil F., Reico C., Ferrer C.: Early changes of urinary amylase isoenzyme in diabetes mellitus. Eur J Clin Chem Clin Biochem 1992; 30:657-62
4. Michels L., Manuals function salivary, version internet, 2000
5. Sreebny L.M. , Banoczy J., Baum B.J., Edgar WM.,Epstein JB,Fox PC,et al: Saliva: its role in health and disease.Int.Dent.J. 1992;42(Suppl 2):291-304
6. Iovan Gianina: Diagnosis and Management of Patients with High Caries Activity. Ed. Apollonia, Iaşi, 2002
7. Wu AJ., Baum BJ., Ship JA.: Extended stimulated parotid and submandibular secretion in a healthy young and old population. J. of Gerontology. Series A, Biol.Sciences & Medical Sciences,1995, 50A(1):45-8
8. Pajukoski H. and colab.: Prevalence of subjective dry mouth and burning mouth in hospitalized eldery patients and outpatients in relation to saliva, medication, and systemic diseases. Oral Surg.,Oral Med., Oral Pat.,2001, vol.92,nr.6:641-649
9. Jukka H. Meurman and colab.: Salivary albumin and other constituents and their relation to oral and general health in the elderly. Oral Surg.,Oral Med., Oral Pat. 2002, vol.94,nr.4:432-437
10. Murray J.J. : Trends in dental caries. In Appropriate Use of Fluorides for Human Health. J.J.Murray, Ed. WHO.Paris,1986