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Investigation Of Saliva Of Patients With Periodontal Disease Using NAA

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Abstract. In this study the non-stimulated whole saliva of 26 healthy subjects (mean age 33.9 ± 11.0 years, range: 26 to 49 years) and 11 patients with periodontal disease (mean age 41.7 ± 11.5 years; range 29 to 55 years) was investigated using Neutron Activation Analysis (NAA) technique. The samples were obtained from donors at São Paulo city (Brazil). The analyses were performed in the nuclear reactor IEA-R1 (3.5-4.5MW, pool type) at IPEN/CNEN-SP (Brazil). Considerable changes in Ca and S saliva's level were identified in patients with periodontal disease suggesting they can be used as monitors of periodontal diseases.

Keywords: NAA; whole saliva; periodontal disease; element concentrations; diagnostics. NAA
PACS: 82.80 Jp

INTRODUCTION

In the last years investigations in saliva have increased as a way of diagnosing diseases in the oral cavity. Investigations of flow rates, pH, molecular components, hormones and proteins have presented significant improvements for clinical tests. Inorganic elements also have shown important correlations that can be used for diagnosis, but these salivary components are still poorly investigated [1-2]. In Brazil there is also a lack of such data for human saliva. The major advantage for using saliva in diagnosis is the easy access and collection (non-invasive).

Saliva consists mainly of water (~98%) in addition to electrolytes and enzymes. It performs several functions in the oral mucosa: keeps the mouth acidity, prevents dental caries, participates in the digestion process and helps in the maintenance of water balance (body fluids excretion) [3].

The main goal of this investigation was to determine Br, Ca, Cl, I, K, Mg, Na and S concentrations in whole saliva of patients with periodontal disease using the Neutron Activation Analysis technique.

EXPERIMENTAL PROCEDURE

The samples of non-stimulated whole saliva were collected from 37 female adults, which 26 healthy subjects (mean age 33.9 ± 11.0 years, range: 26 to 49 years) and 11 patients with periodontal disease (mean age 40.7 ± 11.5 years; range 29 to 55 years).

All participants were inhabitants of São Paulo city. The collection was performed the same way was described in previous work [4]. Samples and standard solutions were irradiated in a pneumatic station in the nuclear reactor (IEA-R1, 3.5-4.5MW, pool type) at IPEN. The thermal neutron flux utilized ranged from $6.67 \cdot 10^{12}$ to $8.42 \cdot 10^{12}$ n $\text{cm}^{-2} \text{s}^{-1}$. The neutron irradiation condition was optimized for simultaneous determination of the Br, Ca, Cl, I, K, Mg, Na and S. Irradiation time of 60s (using 400 μL of saliva) was used and the activated materials were gamma-counted by adequate times: 120s for Na and Cl, 900s for Br, Ca, Mg, K, S and 1200s for I.

A γ -spectrometer system with a semiconductor detector (GEM-60195 ORTEC) and an amplifier (ORTEC 671), in pile up rejection mode, connected to an ADCAM multichannel analyzer (919E-ORTEC) and to a PC computer were used to measure the induced gamma-ray activity. Reference material (IAEA-A13) was analyzed to verify the quality of analytical results and the Z-score values (standardized differences) obtained indicated that our results are satisfactory and are within the range of certified data at 95 % confidence level.

RESULTS AND DISCUSSION

In Figure 1 the concentrations (mean value) of Br, Ca, Cl, I, K, Mg, Na and S in saliva samples of healthy subjects and patients with periodontal disease are presented. According to the Student's t-test for Cl, K, Br, Mg, Na and I contents there is an agreement between the control and disease groups ($p > 0.05$), but for S and Ca there are significant increase ($p < 0.05$). To see in more details these alterations, the concentrations of Ca and S in saliva of patients with periodontal disease are shown in Table 1 and the effects of $C_{\text{Ca}}/C_{\text{S}}$ (closed circles) ratio in these patients in comparison to ratio for the control group (dashed line) are shown in figure 2.

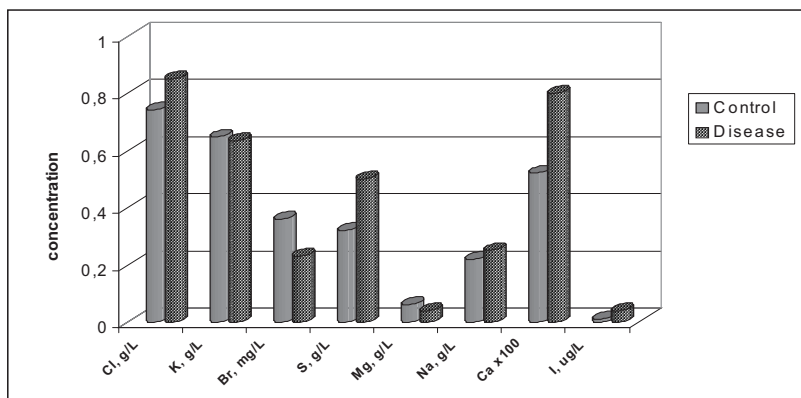


FIGURE 1. Concentration's of Br, Ca, Cl, I, K, Mg, Na and S in saliva samples of patients with periodontal disease. The control group was also included for comparison.

TABLE 1. The concentration, standard deviation (SD) and range of Ca and S in whole saliva of patients with periodontal disease.

Ca, gL ⁻¹		S, gL ⁻¹	
MV	± 1SD	MV	± 1SD
0.083	0.008	0.62	0.11
0.097	0.008	0.43	0.11
0.076	0.006	0.44	0.11
0.095	0.007	0.35	0.11
0.105	0.010	0.71	0.21
0.051	0.003	0.30	0.06
0.075	0.003	0.40	0.06
0.066	0.002	0.27	0.05
0.147	0.002	0.54	0.05
0.090	0.002	0.49	0.05
0.089	0.002	0.52	0.05
Range, 95%		Range, 95%	
[0.022 - 0.082]		[0.20 - 0.44]	

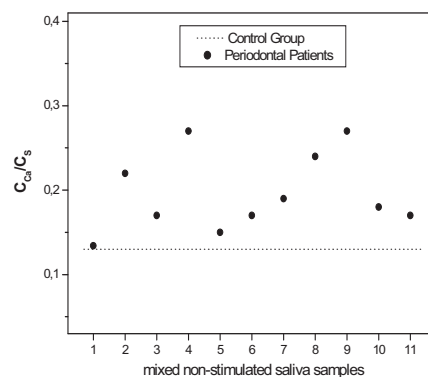


FIGURE 2. Concentration ratio comparison between C_{Ca}/C_S for control and periodontal disease groups

According to Figure 2, the effects of the periodontal disease in C_{Ca}/C_S concentration ratio are high in 91% of the cases comparatively to healthy group. These results are consistent with other studies [1-2,5], which have also suggested that high Ca (mainly) and S levels in whole saliva can be associated with periodontal disease.

CONCLUSION

Investigations performed in whole saliva of periodontal patients indicate that abnormal concentrations of Ca and S can be used as monitors of periodontal diseases. These data provide a scientific basis for biomedical research of oral diseases using Neutron Activation Analysis (NAA).

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