

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Comparative Evaluation of Salivary Electrolytes in Male and Female Children in Deciduous Dentition.

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ABSTRACT

As we enter the era of genomic medicine, sialo chemistry will play an increasingly important role in the early detection, the monitoring and progression of the systemic and oral diseases and serve as a tearless diagnostic tool. For saliva to play a role as a diagnostic aid it is necessary to examine the consequences of preanalytical physiologic variations with respect to age and sex, Thus the aim of this study was to detect the physiologic levels of different electrolytes with the use of newer biochemical methods like atomic absorption spectroscopy and also to do a Comparative evaluation of salivary electrolytes in male and female children in deciduous dentition. For this study un stimulated saliva was collected from healthy individuals and were equally divided amongst the gender. The samples were evaluated for the levels of electrolytes by inductively coupled plasma emission spectrometer. Sodium, Potassium, Chloride and Calcium levels showed mild variations in concentration in gender in the said group. An overview of this study showed a mild increase in salivary electrolyte concentration in male deciduous dentition age group but did not show statistical significance.

Keywords: Saliva, Electrolytes, Deciduous dentition.

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INTRODUCTION

The ancient Greeks were among the first to recognize the medicinal value of saliva over 2000 years ago when they placed nonvenomous snake saliva on wounds to aid in healing. Saliva is a complex fluid, which influences oral health through specific and non-specific physical and chemical properties [1].

Saliva consists primarily of water accounting for 99% water or more of saliva. Inorganic ions, secretory proteins, glycoproteins of serum constituents and other substances typically accounting for 1% or less. The main electrolytes of saliva are Na, K, Ca, Cl, HCO₃ and HPO₄ [2]. High concentration of these electrolytes ensures ionic exchange with the tooth surface is directed to the tooth. This exchange begins as soon as the tooth erupts because, although the crown is fully formed morphologically when it erupts its crystalline structure is figureically incomplete. Interaction with saliva results in post-eruptive maturation through diffusion of such ions as calcium, phosphorus, magnesium and chloride into the surface apatite enamel crystals. This maturation increases hardness and decreases permeability and heightens the resistance of enamel to caries [3].

Saliva is not one of the popular bodily fluids. It lacks the drama of blood, the sincerity of sweat and the emotional appeal of tears. Despite the absence of charisma, a growing number of internists, paediatricians, pharmacologists, clinical and forensic pathologists, endocrinologists, immunologists, psychologists and dentists are finding that saliva provides an easily available, non-invasive diagnostic medium for a rapidly widening range of diseases and clinical situations [5].

Whole saliva can be collected non-invasively, and by individuals with limited training. No special equipment is needed for collection of the fluid. Diagnosis of disease via the analysis of saliva is potentially valuable for children and adults, since collection of the fluid is associated with fewer compliance problems as compared with the collection of blood. Further, analysis of saliva may provide a cost-effective approach for the screening of large populations for saliva to play a role as a diagnostic aid it is necessary to examine the consequences of pre analytical physiologic variations with respect to age and sex as the physiologic levels of different analysis in blood are established as a function of age before it can be used in detection of pathologies. Thus, the aim of this study is to evaluate and compare salivary electrolytes in male and female children in deciduous dentition.

MATERIAL AND METHODS

Criteria for patient selection:

In the present study, 5 normal healthy male children and 5 normal healthy female children ranging from 1 to 5 years were selected from housing societies in and around Pimpri-Chinchwad area of Pune district who were free from any systemic or local diseases which affect salivary secretions and totally caries free with ft score of 0 [5]. After assessing and confirming their caries status these children were stratified equally into two groups - Male (5 children ranging from 1-5 years), Female (5 children, ranging from 1-5 years). Exclusion criteria included patients who were physically or mentally compromised, having developmental delay, auditory or visual dysfunction, known neurological diseases, history of drug intake and patients with arrested carious lesions [6]. Informed consent forms were obtained from the custodial parent or guardian of the subject after explaining the procedure to the parent or guardian.

Method of saliva collection:

To minimize the effect of circadian rhythms, all whole saliva samples were collected one hour after lunch for the unstimulated condition [7]. The child was seated in a well-ventilated and well-lit room. The head was kept at 45 degrees flexion with one hand holding onto a 4ml cryo precipitation vial with a funnel inserted into it, in a calm atmosphere to simulate unstimulated conditions. The saliva was allowed to drip into the funnel held to the lower lip. For each trial, the collection continued for 2 minutes but if the saliva sample was insufficient within 2 minutes, the collection was continued until 2 ml of saliva per subject was obtained [8].

Methods of laboratory analysis:

For detection of trace elements in saliva, the saliva samples obtained from each subject were diluted with distilled water in a proportion of 1:4. This diluted saliva sample was then subjected to inductively coupled plasma emission spectroscopy. The basic aim of analytical atomic spectroscopy is to identify elements and quantify their concentrations in various media [8]. The instrument used was Varian Vista Pro with detection limits of 1 pm for each element

RESULTS

Results were tabulated and statically analysed with DESCRIPTIVE & UNPAIRED-‘t’ TEST.

DECIDUOUS DENTITION SALIVARY ELECTROLYTE CONCENTRATION IN SAMPLES					
	NO	SODIUM	POTASSIUM	CHLORIDE	CALCIUM
Male	1	7.9	18.72	5.62	5.6
	2	8.1	19.33	6.00	6.5
	3	7.6	18.83	5.54	9.1
	4	9.2	18.53	7.40	4.56
	5	9.00	17.54	6.21	5.0
Female	1	9.0	16.20	6.56	4.0
	2	7.3	15.80	5.20	6.31
	3	7.8	17.19	5.82	5.0
	4	7.6	18.21	5.54	4.1
	5	9.1	17.88	6.59	9.7

Table1: Salivary electrolytes in male and female deciduous dentition.

DISCUSSION

Human saliva contains a plethora of compounds that can be informative in monitoring overall health and well-being. Saliva reflects the body's state of well-being. The organic and inorganic contents of whole saliva were analysed in this study. Physio-chemical properties of human saliva can vary because of variable environmental factors. Un stimulated saliva was collected. The time of saliva collection is also important. In this study saliva was collected during acrophase as salivary flow rate peaks during afternoon time [7].

The electrolytes detected in this study were Sodium, Potassium, Chloride and Calcium. These ions form the main buffering system and help maintain the tooth integrity [12].

Salivary secretion increases up to the age of 3 to 5 years, but then sharply declines, reaching a steady state by the age of 8 years. Properties of saliva are age and gender dependent. In adult females, the flow rate of saliva is somewhat lower than in males [13].

In this study, sodium concentration in 5 males and 5 females was evaluated in which it was seen that 3 females and 2 male samples had more concentration of sodium (Figure-1). Sodium is a major cation in fluids outside cells. It regulates the total amount of water in the body. The movement of sodium is essential of generation of electrical signals in our body. Ben Aryeh et al found that the high salivary sodium concentration in newborns might be due to the leakage via the immature junctions between cells. Salivary sodium level also changes with the degree of stimulation. Benghasheer et al and Hussain et al in 2013 postulated that, level of Sodium were significantly higher in children with dental caries and had a positive correlation with dental caries [16].

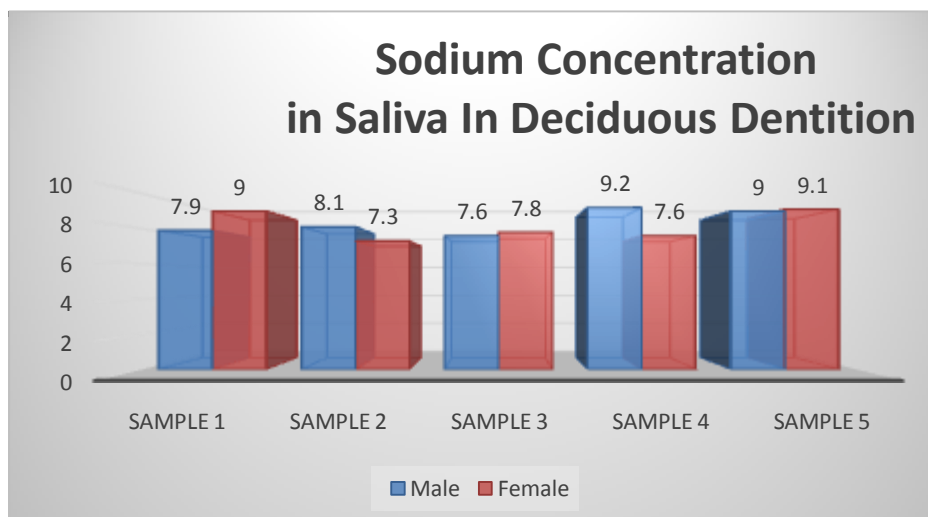


Figure 1: Sodium concentration in Saliva in male and female deciduous dentition

In this study a mild increase in Potassium in male deciduous dentition age group but did not show statistical significance. In this study, potassium concentration in 5 males and 5 females was evaluated in which it was seen that 1 female and 4 males samples had more concentration of Potassium.(Figure-2)Potassium is the major cation found inside cells. It is essential for regulation of heartbeat and functioning of muscles. Bengha sheer et al and Hussain et al in 2013 postulated that, level of Potassium were significantly higher in children with dental caries free and had a negative correlation with dental caries.[17] The salivary sodium-potassium concentration can be used for detecting functioning of aldosterone hormone in the body along with detection of kidney disorders [9].

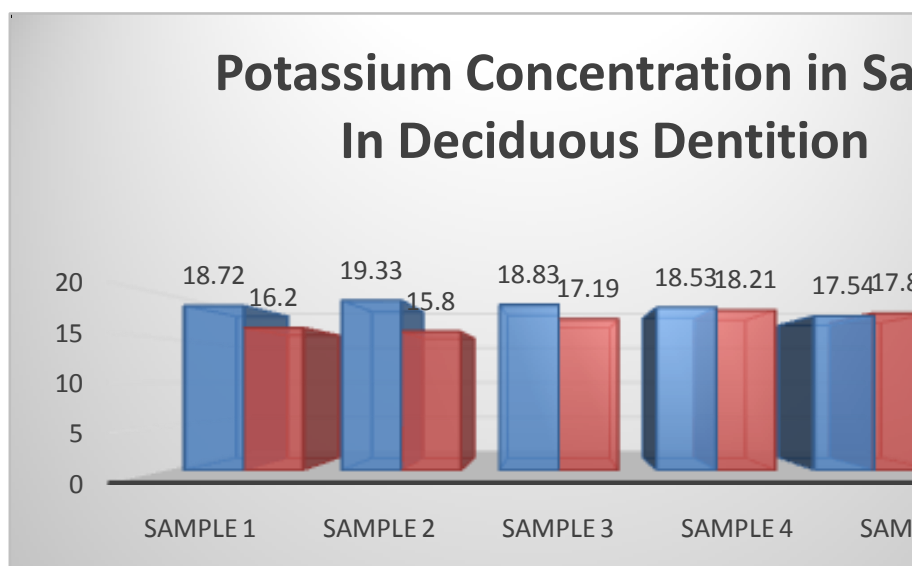


Figure 2: Potassium concentration in Saliva in male and female deciduous dentition

A mild increase in Chloride in male deciduous dentition age group was seen in this study but did not show statistical significance. In this study, Chloride concentration in 5 males and 5 females was evaluated in which it was seen that 3 females and 2 males samples had more concentration of Chloride (Figure -3).In the ducts of the salivary glands, sodium and chloride are reabsorbed, but potassium and bicarbonate are secreted and hence the electrolyte balance is altered depending upon the rate of flow of saliva [13].Saliva consists of approximately 99% water and is isotonic in the acinar cells, but becomes hypotonic as Na⁺ and Cl⁻ are reabsorbed as it passes through the ductal system[14]. Resultant bicarbonate serves as a buffering agent and calcium and phosphate neutralize acids that would otherwise compromise tooth mineral integrity[15].

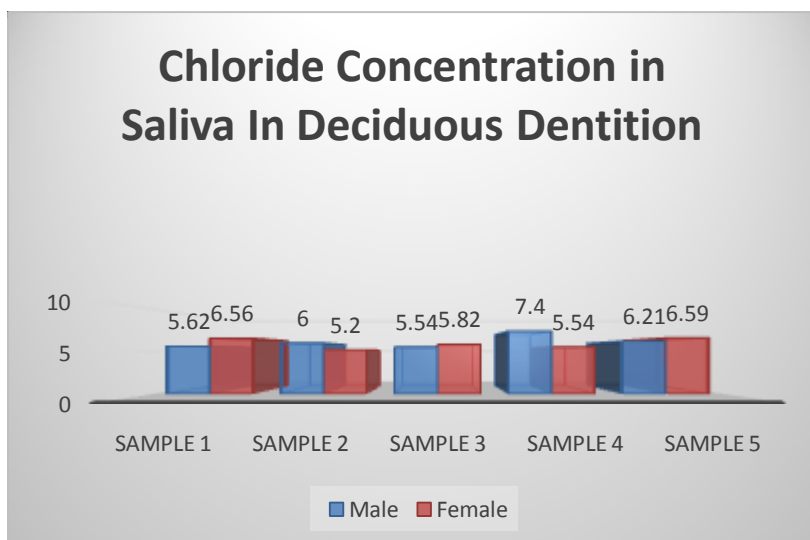


Figure 3: Chloride Concentration in Saliva in male and female deciduous dentition

It has been proved that an inverse relationship exists between salivary calcium concentration and dental caries. The results of this study of values showed a mild increase in calcium in male deciduous dentition age group but did not show statistical significance, thus this highlights one aspect of increased caries susceptibility in deciduous dentition. In this study, Calcium concentration in 5 males and 5 females was evaluated in which it was seen that 2 females and 3 males samples had more concentration of calcium. (Figure-4) Kavanagh and Svelha (1998) postulated that a key salivary parameter to consider in terms of remineralisation is the extent of variations in calcium concentration. Large fluctuations in calcium concentrations occur in one individual. A lower calcium concentration results in a lower thermodynamic driving force for hydroxy apatite precipitation at normal oral pH, a higher driving force for hydroxy apatite dissolution at low pH, and a higher critical pH than normal value of 5-5.3[10]. Salivary calcium concentrations are lower in children than adults, but in male children it is higher than female children. The critical pH is significantly higher for children than for adults in saliva. Therefore, when compared to adults, children have a greater thermodynamic driving force for demineralization at low oral pH, and a lower force for remineralisations at normal oral pH[11]. This is one contributor to the increased risk of demineralization in children.

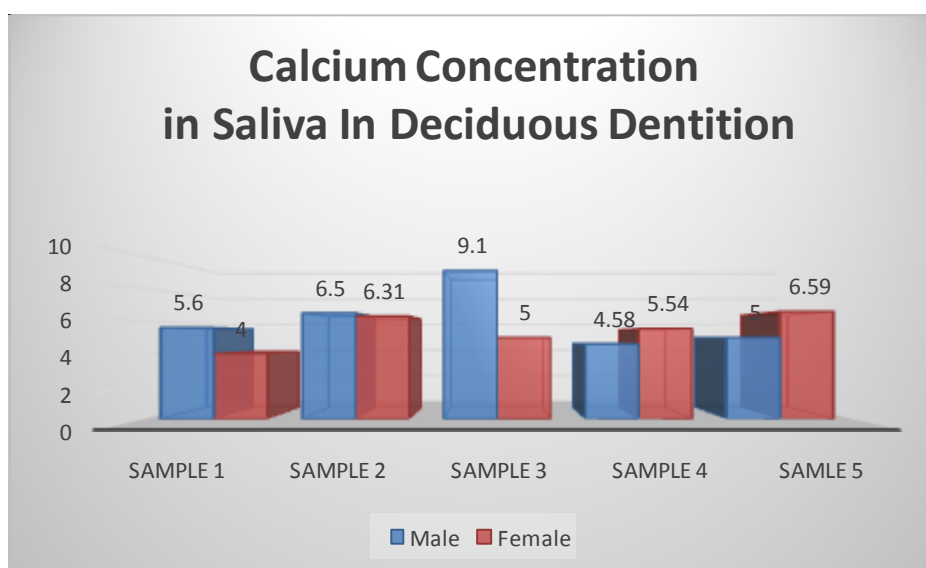


Figure 4: Calcium concentration in Saliva in male and female deciduous dentition

On studying all this data, we found that there is high concentration of sodium, potassium, chloride and calcium in saliva of male in deciduous dentition that of compared to females. (Figure-5)

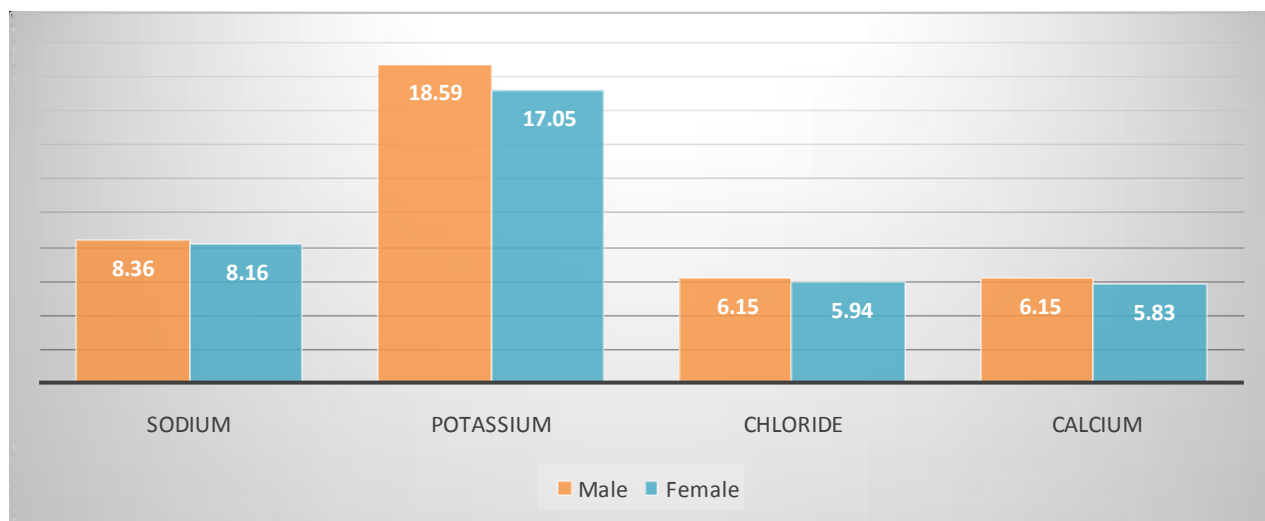


Figure 5: Salivary electrolytes in Saliva in male and female deciduous dentition

The major limitation of this study is its small sample size. The data obtained in this study is preliminary and expansion of the subjects is needed to obtain improved valid results.

CONCLUSION

Biological factors that are present within the saliva are essential for the lifelong preservation of the dentition. It has long been recognized that saliva serves as a mirror of body's health as it contains proteins, hormones, antibodies, electrolytes and other molecules that are frequently measured in standard blood tests to monitor health and disease[17]. There is a necessity for constructing a comprehensive catalogue which is physiologic for salivary electrolytes in deciduous dentition in male and female. Thus this study lays a foothold and may serve as a reference value for growing interest in saliva as a diagnostic tool.

ACKNOWLEDGEMENT

This research project was carried out by Vaishnavi Kotwal , then, final year BDS student and was funded by ICMR.

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