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

Rahul R Deshpande^{1,2}, Vishwas Patil¹, Komal K Bagde¹, Pranav Dungarwal^{1*}, Ladusingh Rajpurohit¹, Mayuri Mutha¹, Snehal Shep¹, and Vaishnavi Kotwal¹.

¹Dr. D.Y. Patil Dental College and Hospital, Pimpri, Pune-411018, Maharashtra, India.

²Deenanath Mangeshkar Hospital, Pune-411004, Maharashtra, India.

ABSTRACT

Human saliva harbors few electrolytes of clinical relevance and they are also present in blood. This highlights that saliva can be used for clinical applications just as urine or blood. Road block to the advancement of saliva as a diagnostic tool is the lack of information with regard to the baseline levels (reference ranges) of electrolytes in saliva within a healthy control group to discriminate the molecular composition and levels during a disease stage. The aim of this study was to do comparative evaluation of salivary electrolytes in male and female children in permanent dentition. Unstimulated whole saliva sample was collected from 5 normal healthy male children and 5 normal healthy female children ranging from above 14 years. Diluted saliva sample was then subjected to inductively coupled plasma emission spectroscopy. Out of 5 male and female children 4 females showed comparatively high concentration of sodium than in males, 4 males showed comparatively high concentration of potassium than females, 3 females showed high concentration of chloride that compared to males, & 3 males showed high concentration of calcium compared to females. Results were tabulated and statically analysed with Descriptive and unpaired 't'test. From this study we conclude that males showed comparatively high concentration of sodium and calcium electrolytes than compared to females, also females showed high concentration of potassium and chloride electrolytes that compared to males in permanent dentition age group but did not show statistical significance.

Keywords: Saliva, Electrolytes, Permanent dentition.

*Corresponding author

INTRODUCTION

Saliva offers several benefits over traditional blood-based biochemical analyses for clinical diagnosis- it is non-invasive, tearless stress free sample collection, easy and multiple sampling opportunities, reduced need for pre-sampling procedures and it is an ideal biofluid for developing countries due to the relatively low costs associated with sample collection and processing. Saliva contains multiple electrolytes, proteins, hormones, enzymes, antioxidants etc., Saliva being esoteric fluid thus, current clinical biological data is scarce. A pre-analytical physiologic data is necessary to be obtained with respect to age and gender. Our research team is trying to find baseline values of electrolyte concentration in saliva according to age and gender in Indian population as electrolytes play vital role in maintaining oral health integrity. The aim of this study was to do comparative evaluation of salivary electrolytes in male and female children in permanent dentition age group.

MATERIAL AND METHODS

Criteria for patient selection: In the present study, 5 normal healthy male children and 5 normal healthy female children ranging from 6 to 14 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 dmft score of 0 [1]. After assessing and confirming their caries status these children were stratified equally into two groups - Male (5 children ranging from 6-14 years), Female (5 children, ranging from 6-14years). 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 [2].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 [3]. 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 cryoprecipitation 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 [4].

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 [4]. The instrument used was Varian Vista Pro with detection limits of 1 ppm for each element.

RESULTS

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

Conc of Sodium in Saliva in Permanent Dentition age group

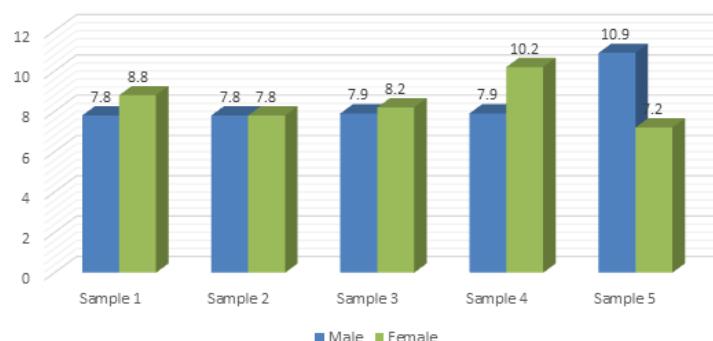
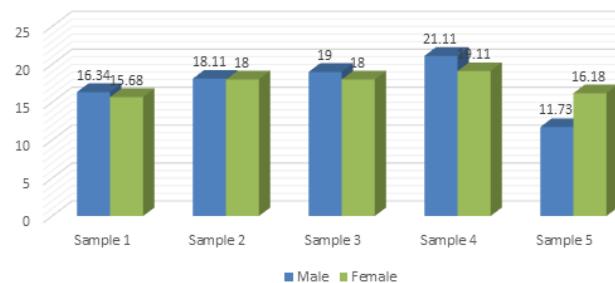


Figure 1: Sodium concentration in Saliva in male and female permanent dentition

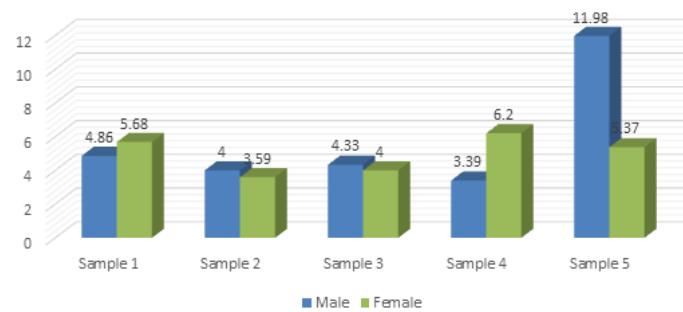
Table 1: Salivary electrolytes in male and female Permanent dentition.

		PERMANENT DENTITION SALIVARY ELECTROLYTE CONCENTRATION IN SAMPLES			
	NO	SODIUM	POTASSIUM	CHLORIDE	CALCIUM
Male	1	7.80	16.34	5.65	4.86
	2	7.80	18.11	5.73	4.00
	3	7.90	19.00	5.72	4.33
	4	7.90	21.11	5.80	3.39
	5	10.9	11.73	8.40	11.98
Female	1	8.8	15.68	6.23	5.68
	2	7.8	18.00	5.62	3.59
	3	8.2	18.00	6.10	4.00
	4	10.2	19.11	8.82	6.20
	5	7.2	16.18	5.10	5.57

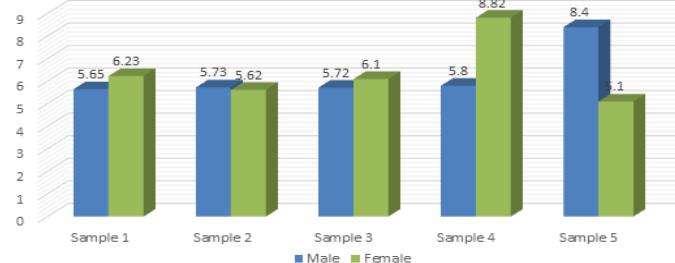
Conc of Potassium in Saliva in Permanent Dentition age group


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

Conc of Calcium in Saliva in Permanent Dentition age group


Figure 3: Calcium concentration in Saliva in male and female permanent dentition

Conc of Chloride in Saliva in Permanent Dentition age group


Figure 4: Chloride concentration in Saliva in male and female permanent dentition

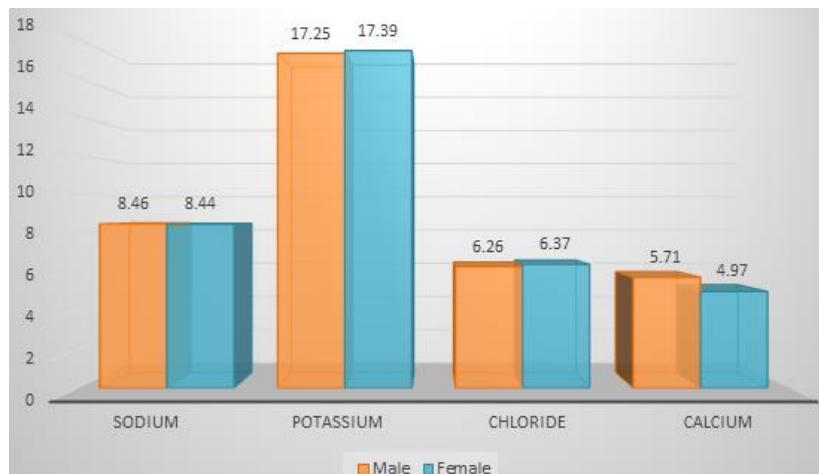


Figure 5: Salivary electrolytes in Saliva in male and female permanent dentition

DISCUSSION

Saliva has a great potential for clinical disease diagnostics. 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. [5] The electrolyte contents of whole saliva were analysed in this study group. Physio-chemical properties of human saliva can vary because of variable environmental factors such as age , gender , diseases and drugs etc., Unstimulated flow rate is more important than stimulated flow rate since only as small fraction of the day is spent eating. The flow rate increases, pH & concentrations of protein, sodium, chloride, bicarbonate rises, while magnesium and phosphate concentration falls.[6]In this study, unstimulated saliva was collected during acrophase as salivary flow rate peaks during afternoon time.

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.

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 [7].

In this study, sodium concentration in 5 males and 5 females was evaluated in which it was seen that 4 females and 1 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. Changes in the concentration of sodium can be due to a decrease in the volume of water or due to inflammation [8].

In this study a mild increase in Potassium in male permanent dentition age group was observed 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 all 4 male samples had more concentration of Potassium. (Figure-2) Potassium is essential for regulation of heartbeat and functioning of muscles. The salivary sodium-potassium concentration can be used for detecting functioning of aldosterone hormone in the body along with detection of kidney disorders [9].

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).Chloride transport is a key to Fluid secretion. Chlorides are known to enhance amylase activity. 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. [10] 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 [11]. Resultant bicarbonate serves as a buffering agent and calcium and phosphate neutralize acids that would otherwise compromise tooth mineral integrity [12].

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 permanent dentition age group but did not show statistical significance, thus .In this study, Calcium concentration in 5 males and 5 females was evaluated in which it was seen that 3 males and 2 female 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 hydroxyapatite precipitation at normal oral pH, a higher driving force for hydroxyapatite dissolution at low pH, and a higher critical pH than normal value of 5-5.3. [13] 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. [14] This is one contributor to the increased risk of demineralization in children.

In this study, males showed comparatively high concentration of sodium and calcium electrolytes than compared to females, also females showed high concentration of potassium and chloride electrolytes that compared to males in permanent dentition age group but did not show statistical significance.

A change in the hormonal level in pubescence may also be strong enough to cause changes in the salivary composition [15].

CONCLUSION

From this study we conclude that males showed comparatively high concentration of sodium and calcium electrolytes than compared to females, also females showed high concentration of potassium and chloride electrolytes that compared to males in permanent dentition age group but did not show statistical significance. Salivary electrolytes play a pivotal role in the overall maintenance of a healthy homeostatic condition in the oral cavity, which from the dental perspective usually considered to be related to protection of the teeth and mucosal surfaces. Since, several factors can influence salivary secretion and composition there is a necessity of precise pre-analytical range of salivary electrolytes in permanent dentition in male & female children.

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