

EVALUATION OF SOME SALIVARY PARAMETERS IN A GROUP OF CHILDREN SUFFERING FROM RAMPANT CARIES IN ISMAILIA CITY

Eman Abo El-Liel¹, Ghada A Elbaz², Nagwan A M.Sabek³, Asmaa A Abo Elsoud⁴

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• E-mail address:
emanaboelliel@yahoo.com

1. Post Graduate student in Department of Pediatric, Preventive, Dentistry and Dental Public, Health Faculty of Dentistry Suez, Canal University.
2. Prof. of Pediatric, Preventive Dentistry and Dental Public Health Faculty of Dentistry Suez Canal University.
3. Prof. of Biochemistry Faculty of Medicine Suez Canal University.
4. Lecturer in Pediatric, Preventive Dentistry and Dental Public Health Faculty of Dentistry Suez Canal University.

ABSTRACT

Introduction: Rampant caries (RC) is a severe form of dental decay with multifactorial origin. RC poses a challenging management problem for dentists and patients. **Aim:** the aim of the study was to evaluate and compare between some salivary parameters: pH, buffering capacity, total protein, flow rate and zinc concentration in a group of children suffering from rampant caries and others with normal caries activity in Ismailia city. **Material and methods:** sixty apparently healthy children aged from 3-5 years of both sexes. According to dmfs index the selected children were divided into three groups. Saliva samples were examined for salivary pH changes, measured by pH meter, Buffering capacity by titratable acidity, Total protein by colorimetric method, Flow rate by drooling method and Zinc concentration using an atomic absorption spectrophotometer. **Results:** there was no statistically significant difference between mean salivary pH values in three groups. Salivary buffering capacity results showed, group I had a statistically significantly highest mean buffering capacity, There was no statistically significant difference between group II and group III, salivary total proteins showed no statically significant difference between group I and group II; both showed the statistically significant highest mean total protein, but group III showed the statistically significant lowest mean salivary total protein. There was no statistically significant difference between the three groups in salivary flow rate and Zn concentration. **Conclusion:** salivary pH, flow rate and Zn conc. can't be used as an indicator for occurrence of rampant caries but salivary total protein and salivary buffering capacity may be used.

INTRODUCTION

Rampant Caries has prompted numerous definitions and synonyms within dentistry. Although there is little universal agreement on a definition of rampant caries, it may be described as a lesion of acute onset involving many or all of the erupted teeth, rapidly destroying coronal tissue, leading the early involvement of the dental pulp⁽¹⁾. The etiology of rampant disease is very complex; it is multifactorial and has a close relationship with a number of risk factors⁽²⁾.

“Rampant caries” which signifies advanced or severe decay on multiple surfaces of many teeth may be seen in individuals with xerostomia, poor oral hygiene methamphetamine use (due to drug

induced dry mouth), and/or large sugar intake. If rampant caries is a result from previous radiation to the head and neck, it may be described as radiation induced caries. Problems can also be caused by the self-destruction of roots and whole tooth resorption when new teeth erupt or later from unknown causes⁽³⁾.

The distinguishing character of rampant caries is the involvement of the proximal surfaces of the lower anterior teeth and the development of cervical type of caries⁽¹⁾. Pulpal involvement is early leading to multiple abscesses and pathological fracture of weakened tooth structure. The disease usually proceeds in the following pattern: first to be involved is the labial surface of maxillary anterior teeth followed by first molars: Maxillary slightly before the Mandibular. This is followed by rapid involvement of the canines and the mandibular incisors⁽¹⁾.

Rampant caries is of the following three types: Nursing bottle rampant caries, Adolescent rampant caries and Xerostomia-induced rampant caries. Nursing bottle rampant caries is very common in infants⁽⁴⁾.

Saliva is armed with immunological and enzymatic defense systems and has the ability to protect the mucosa against mechanical insults and promote its healing⁽⁵⁾. Various components of saliva play individual roles in the total properties of saliva. Salivary flow, pH and buffering capacity play an important role in the initiation and progression of dental caries⁽⁶⁾. The aim of the study was to evaluate and compare between some salivary parameters: pH, Buffering capacity, Total protein, Flow rate and Zinc concentration, in a group of children suffering from rampant caries and others with normal caries activity in Ismailia city.

MATERIALS AND METHODS

This study was approved by the ethical committee of Faculty of Dentistry Suez Canal University. The procedures and steps of the experiment were fully explained to parents or guardians of the children and informed written consents for treatment were obtained prior to clinical procedures.

All patients who participated in the experimental investigation and subjects should be able to freely withdraw from the investigation any time.

Sixty apparently healthy children aged from 3-5 years of both sexes were included in this study. All selected children were examined clinically and radiographically (bitewing radiograph) for caries activity using dmfs index following World Health Organization (WHO) criteria⁽⁷⁾.

According to dmfs index children were divided into three groups:

Group I: (control group) 20 children with no caries (zero dmfs). **Group II:** (low caries group) 20 children with dmfs equal or less than 3. **Group III:** (Rampant caries group) 20 children suffering from rampant caries (RC). For all children 5ml of fresh whole un-stimulated saliva was collected from 9:00 am to 11:00 am, children were asked not eat nor drink for at least two hours⁽⁸⁾. Children were asked to rinse their mouth with clear water before collection of saliva samples. Un-stimulated whole saliva was collected while child was seated at a low table, swallowed residual saliva present in the mouth before the beginning of the collection and with the head down and mouth slightly open, saliva was allowed to drip from the lower lip into 50 ml falcon™ tube and placed in ice⁽⁹⁾. Saliva accumulated in the mouth was spat out. No other conscious movements of the oral musculature were made during the collection⁽¹⁰⁾.

Analysis of saliva samples:

1. pH and buffering capacity determination were done at a centre of excellence in Molecular and Cellular medicine faculty of Medicine, Suez Canal University. pH was measured at the same time of the day immediately after collection of saliva samples⁽¹¹⁾.
2. Buffering capacity was measured by calculating the amount of citric acid of pH 2.5 required to lower the initial pH of saliva down to 3⁽¹²⁾.
3. Total protein measuring was done in the Biochemistry department of Faculty of Medicine, Suez Canal University. Salivary total protein was assayed by colorimetric method using Biuret Reagent according to the manufacturer's protocol.

Protein estimation of all the samples was done according to the spectrophotometric method suggested by **Layne E** ⁽¹³⁾.

4. Flow rate was measured by dividing the volume of the saliva collected (5ml) on the time needed for collection ml/m⁽¹¹⁾.
5. Zinc concentration was done at the central lab, Faculty of Science, Suez Canal University. Fresh unstimulated whole saliva was collected in the graduate plastic tube. Samples were placed in a thermo flask with ice and were sent to a laboratory to measure the zinc concentration immediately in these saliva samples using an atomic absorption spectrophotometer ⁽¹⁴⁾.

RESULTS

Salivary pH: There was no statistically significant difference between mean pH values in the three groups Significant at $P \leq 0.05$.

Salivary buffering capacity (ml): Group I showed the statistically significantly highest mean buffering capacity. There was no statistically significant difference between group III and group II; both showed statistically significantly lower mean buffering capacity than group I, Significant at $P \leq 0.05$, Different superscripts indicate statistically significant difference .Fig (1)

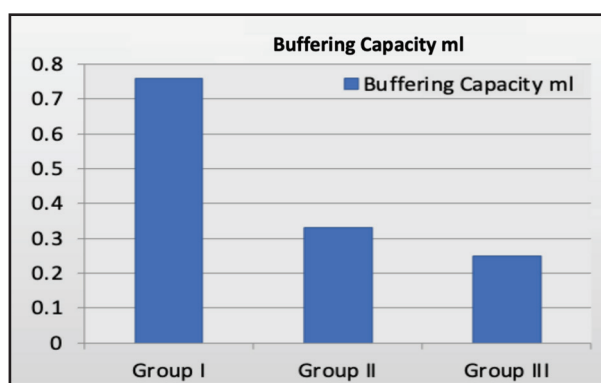


Fig. (1) Bar chart representing comparison between mean buffering capacities in the three groups.

Salivary total Protein (g/dL): There was no statistically significant difference between group II and group III; both showed the statistically significantly highest mean total protein, but group I showed the statistically significantly lowest mean total protein. Significant at $P \leq 0.05$, Different superscripts indicate a statistically significant difference.

Salivary flow rate (ml/min) and zinc conc.: There was no statistically significant difference between the three groups for both. Significant at $P \leq 0.05$.

Correlation between dmfs and different variables: According to correlation between dmfs and different variables, the results showed that, there was an appositve correlation between dmfs and salivary total protiens while there was a

negative correlation between dmfs and salivary buffering capacity. Salivary pH, salivary flow rate and salivary Zn conc. showed no correlation with dmfs. Table (1)

Table (1) Results of Spearman's correlation coefficient for the correlation between dmfs scores and different variables

Variables	Correlation coefficient	P-value
dmfs and age	0.360	0.005*
dmfs and salivary pH	0.070	0.597
dmfs and salivary buffering capacity	-0.587	<0.001*
dmfs and salivary total protein	0.322	0.012*
dmfs and salivary flow rate	0.176	0.178
dmfs and salivary Zinc conc.	0.137	0.296

*: Significant at $P \leq 0.05$

DISCUSSION

The selected age included in this study was ranged from 3-5 years old, as epidemiologic surveys of caries show an increase in caries prevalence with age. Newly erupted teeth (non-mature) are more susceptible to caries, particularly at pit and fissure sites. The susceptibility of caries also seems increased by the difficulty of cleaning the teeth until they have reached the occlusal plane. Therefore, children at those selected ages are of great risk for caries as their teeth have just erupted⁽¹⁵⁾.

In this study choosing children in rampant caries group, including caries in lower anterior teeth to exclude nursing bottle caries⁽¹⁶⁾. All selected children were asked not to eat, drink or use mouth rinses for 2 hours before saliva sample collection. Samples from each subject were collected between 9.00 a.m. - 11.00 a.m. to minimize variability due to circadian rhythm effects⁽⁸⁾.

Decision was made to collect unstimulated whole saliva because this type of saliva predominates during most part of the day and is important for maintenance of oral health, reflecting the physiological status of the oral cavity and the entire body.⁽¹⁷⁾ The saliva samples were kept in icebox as soon as possible after collection to maintain the sample integrity. The collected salivary sample was centrifuged at 10000 rpm for 5min, to avoid visible precipitates⁽¹²⁾.

Saliva pH was determined immediately in the same day after collection of the saliva samples in order to avoid any time-related pH changes. It was then stored at -20° to prevent the degradation of some molecules in saliva and prevent bacterial growth⁽¹⁸⁾.

As regards the results of salivary pH, there was no statistically significant difference between the three groups. **Tulunoglu et al**⁽¹⁹⁾ found that salivary pH had a weak correlation with caries activity.

This result was in disagreement with many previous studies that showed significantly lower and more acidic salivary pH values of children in the rampant caries group (6.45 ± 0.50) when compared to caries resistant group (7.15 ± 0.30)⁽¹¹⁾.

Regarding the results of salivary buffering capacity, group I showed the statistically significant highest mean buffering capacity while group II and group III showed statistically significant lower mean salivary buffering capacity than group I.

This result was in accordance with the findings of many authors, who reported a negative correlation between salivary buffering capacity and caries activity in a population⁽²⁰⁾. Decrease in salivary buffering capacity leads to a drastic increase in caries susceptibility as the enamel dissolution by plaque acids is left uncontrolled⁽²¹⁾.

Regarding the results of salivary total protein between three groups, there was no statistically significant difference between group II and group III; both showed the statistically significant highest mean total protein. Group I showed the statistically significant lowest mean total protein.

From a survey of published trials in this field, only a few revealed statistically significant differences in the total salivary protein content between caries free and caries active individuals. Generally, the total protein content in saliva was increased with caries activity; however, no differences attributable to caries activity were confirmed in several experimental studies published to date ⁽²²⁾.

Regarding salivary flow rate, the results showed that there was no statistically significant difference between the three groups. Similarly **Kadoum et al** ⁽¹⁷⁾ found non-significant differences attributed to salivary flow rate located within normal range.

In general, higher the salivary flow rate, faster the clearance and higher the buffering capacity and thus lesser microbial attacks. Parallel results were seen in the study conducted by **Scully** ⁽²³⁾ where he showed that dental caries is probably the most common consequence of hypo salivation

Regarding the demographic results of salivary zinc concentration between the three groups; there was no statistically significant difference between them.

This result was in accordance with **Duggal et al** ⁽²⁴⁾ they observed a negative relationship between copper and fluoride in saliva and dental caries while zinc, iron and manganese in saliva have not shown any relationship with caries experience.

The relationship between salivary elements and caries activity in children remains controversial; a specific element reported as cariostatic in one study

may have no effect or even increased caries risk in others and hence further research is encouraged in this field.

Preethi et al ⁽²⁵⁾ showed that pH had a weak correlation with caries activity. Hence it can be speculated that other factors like micro flora, diet and retention of food might have dominated the buffering capacity to initiate caries, which is a multifactorial disease. On contrast, previous results of many studies showed that an inverse relationship between dmfs and pH was found ⁽²⁶⁾.

Regarding the results of demographic data between dmfs and salivary buffering capacity, there was a statistically significant inverse (negative) correlation between them. These results were in agreement with **Prabhakar** ⁽²⁷⁾ results. Also, **Preethi et al** ⁽²⁵⁾ found that salivary buffering capacity are slightly decreased in caries active children compared to caries free children, however, the difference was not found to be statistically significant.

Regarding the demographic data between salivary total protein and dmfs, there was a statistically significant direct (positive) correlation between dmfs and salivary total protein. **Tulunoglu et al** ⁽¹⁹⁾ and **Preethi et al** ⁽²⁵⁾ demonstrated that the concentration of salivary total protein was increased by caries activity in children. Similarly, **Amer et al** ⁽²⁸⁾ found that this variance increased in caries active children in comparison to caries free children. Several other investigations did not observe a statistically significant difference in the total salivary protein concentration between children with and without ECC ⁽²⁹⁾.

Regarding the demographic results between salivary flow rate and dmfs, there was no statistically significant correlation between them. This result was in agreement with the results of **Russell et al** ⁽³⁰⁾ showed no significant difference between salivary pH and salivary flow rate and mean caries score.

However, **Sakeenabi, Hiremath**⁽³¹⁾ were showed highly significant ($p < 0.01$) correlation between mean caries score, salivary buffer capacity and flow rate.

Finally the demographic data between salivary zinc concentration and dmfs, showed no statistically significant correlation between them. Previous studies showed that there was no statistically significant correlation between dmfs and salivary zinc concentration⁽³²⁾.

On contrast, **Elbaz GA et al**⁽³³⁾, **El-sherif M et al**⁽³⁴⁾ showed that the salivary zinc amount was significantly higher in caries free group than in caries active group. As high concentration of zinc leads to greater mineralization and accumulation of zinc quantities on surface enamel that becomes more caries resistance. Deficiency of micronutrient like zinc can influence the amount and composition of saliva and reduce protective effect of saliva. Increased susceptibility to dental caries in zinc deficient animals might be mediated by alterations in salivary proteins that are associated with the maintenance of tooth structure.

Conclusion: pH, flow rate and Zn can't be used as an indicator for rampant caries, but total protein and buffering capacity may be used.

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