Some salivary parameters in relation to dental caries experiences

Sulafa K. Banoosh
Collage of dentistry / Tikrit university

Sulafa.khairy@yahoo.com

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ABSTRACT

Background: The aim of this study is to estimate the relation of salivary sodium, potassium, pH, and flow rate with dental caries experiences.

Materials and Methods: In this study; 40 healthy-looking subjects were participated, their ages were (18-25) years old included (18) females and (22) males. Dental caries was recorded using DMFS (Decayed, Missed, and Filled) surfaces index teeth and. stimulated saliva was collected before clinical measurement and chemically analyzed to determine the concentrations of sodium, potassium Atomic Absorption Spectrophotometer then salivary pH estimated by using pH meter, and flow rate (ml/min) was estimated by dividing saliva volume (ml) by the fixed collected time (min). All data were analyzed using SPSS version 13.

Results: The statistical analysis for the salivary sodium, potassium in both study (with caries) and control (free from caries) groups showed no significant difference in mean 0.9, 0.67 respectively (P>0.05). This is corresponds with the salivary pH and flow rate in both study (with caries) and control (free from caries) groups 0.98, 0.61 respectively (P>0.05).

Conclusion: There are no relation between salivary sodium, potassium, pH, and flow rate with dental caries experience.

Keywords: dental caries, DMFS, saliva, salivary sodium, salivary potassium, pH, flow rate.
علاقة بعض العوامل المتغيرة في اللعاب مع تسوس الأسنان

سلافة خيرالدیه بنوش
جامعة تكريت/ كلية طب الأسنان / فرع العلوم الأساسية
Sulafa.khairy@yahoo.com
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الملخص

إن الهدف من هذه الدراسة هو تقدير علاقة الصوديوم اللعابي، والبوتاسيوم اللعابي، ودرجة الحموضة، ومعدل تدفق اللعاب مع تسوس الأسنان. شارك في هذه الدراسة (40) متبرع تتراوح أعمارهم بين (18-25) سنة منهم (18) إثاث و (22) من الذكور. وقد تم فحص جميع المتبرعين. وتم تسجيل تسوس الأسنان باستخدام المؤشر العالمي لقياس نسبة تسوس الأسنان. وكذلك تم جمع عينات اللعاب وتحليلها كيميائياً لتحديد تركيز كلاً من الصوديوم والبوتاسيوم فيه. وتم قياس درجة الحموضة ومعدل تدفق اللعاب. وقد تم تحميل كل من الصوديوم والبوتاسيوم في كل من مجموعة الدراسة (مع تسوس) و مجموعة التحكم (بدون تسوس).

وقد وجدت الدراسة أن هناك علاقة غير موجودة بين الصوديوم والبوتاسيوم اللعابيين، ومعدل التدفق في كل من مجموعة الدراسة (مع تسوس) ومجموعة التحكم (بدون تسوس).

الخلاصة: ليس هناك علاقة بين الصوديوم والبوتاسيوم اللعابيين، ومعدل التدفق في كل من مجموعة الدراسة (مع تسوس) ومجموعة التحكم (بدون تسوس).

الكلمات الدالة: تسوس الأسنان، المؤشر العالمي، نسب تسوس الأسنان، اللعاب، الصوديوم، والبوتاسيوم اللعابي، درجة الحموضة، معدل التدفق.
1. INTRODUCTION

Salivary fluid is an exocrine secretion consisting of approximately 99% water and the other 1% is complex of organic and inorganic molecules[1], it containing a variety of electrolytes (calcium, magnesium, potassium, sodium, chloride, bicarbonate and phosphate) [2,3], which play an important role in the oral cavity and in establishing oral health and function[4,5,6] by providing oral self protective mechanisms through its constituents[7].

In the last few decades, there have been a focus on the utilization of saliva for bacteriological tests that give an indication of dental caries and periodontal diseases risk[8,9,10,11].

Trace elements in saliva either directly or indirectly influence the susceptibility of the teeth to dental caries. Investigations suggested that, some trace elements are cariogenic, mildly cariostatic, and some are strongly cariostatic[12]. Sodium and potassium were considered to be a cariostatic element among trace elements that decreases the caries development[13]. But some study found that these elements have no effect on dental caries[14,15], other authors found that there is slightly increasing in Na and K with increasing dental caries[15].

The pH of dental plaque is a key factor in the balance between acid demineralization of the teeth and the remineralisation of the initial caries lesion[16]. Plaque pH falls each time acids accumulate in the plaque due to bacterial acid production following the consumption of fermentable carbohydrates – mainly sugars – in foods and drinks. On the other hand, the plaque pH rises when the acids are washed out and neutralised by saliva, which contains the important buffer, bicarbonate. The pH also rises when the plaque bacteria either metabolise the acids, or produce alkali, such as ammonia, from nitrogenous compounds found in foods and saliva. Stimulation of saliva flow results in an increase in the washing out of acids (and sugars), and also an increase in the amount and concentration of bicarbonate buffers and of remineralising ions[16].

The aim of this study is to investigate the relation of salivary sodium, potassium, pH, and flow rate with dental caries – experiences with respect to gender.
2. MATERIAL AND METHODS

The Sample population

The study was conducted on students of College of Dentistry / Tikrit University, Iraq. Sample population consists of (40) male and female, age ranged from 18-25 years, all volunteers were free from any medication (acute illness or chronic diseases as well as medication should be considered) and smoking. the work was started from December 2011 till April 2012.

Saliva Analysis

Saliva Collection

The collection of stimulated salivary samples were performed under standard condition following instruction cited by Tenovuo and Lagerlof [17]. All participants were instructed not to eat or drink (except water) at least 1 hour prior to donation of saliva, the subject should sit in a relaxed position and the subjects should not undergo heavy physical stress before collection, and samples containing blood should be discarded. Saliva was collected between 9-12 am. After the subject rinse his mouth several times by sterilized water and then wait for 1-2 minutes for water clearance, they asked to chew a piece of Arabic gum (0.5-0.7 gm) for one minute, all saliva was removed by expectoration, chewing was continued for five minutes with the same piece of gum then saliva was collected in a sterile screw capped bottle, then the salivary pH was measured using an electronic pH meter and flow rate (ml/min) was estimated by dividing saliva volume (ml) by the fixed collected time (min) at the time of collection. The samples were stored at (-20°C) in a deep freeze till the time of biochemical analysis[18]

Biochemical analysis

Freezing samples allowed to thawing at room temperature, then centrifuge 3000 r.p.m (revolution per minute) for 10 minutes[19,20], then the clear supernatant was separated by micropipette. The Atomic Absorption Spectrophotometer was used to determine sodium and potassium concentration.

Clinical examinations

Clinical examinations were conducted using plane mouth mirror and dental explorer. Examinations and oral health assessments were performed according to the basic method proposed by WHO (1997) [21].
Statistical analysis

1. Descriptive Statistics; included:
   - mean
   - standard deviation (SD)

2. Inferential Statistics; included
   ● Student t-test.
   ● Coefficient of correlation (r).

In the statistical evaluation, the following levels of significance are used:
P > 0.05 Non-significant (NS), 0.05 ≥ P > 0.01 * Significant (S), and P≤ 0.01 ** Highly significant (HS).

3. RESULTS

In this study; 40 healthy-looking subjects were participated their ages were (18-25) years old included (18) females and (22) males.

This study divided the total sample (40) dental students to two groups: with caries (study group), they were 22 subjects represented 55% and free from caries (control group), they were 18 subjects represented 45% from the total sample. According to gender the females in caries group were (10) represented 25%, while the males in the same group (12) represented 30% from the total sample. In the control group the females were (8) represented 20% while the males were (10) represented 25%. as shown in Table (1).

<table>
<thead>
<tr>
<th>Gender</th>
<th>With caries (study group)</th>
<th>Free from caries (control group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>55%</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>25%</td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>30%</td>
</tr>
</tbody>
</table>

In this study the mean and standard deviation of the concentrations of salivary sodium (mmol/l) in total was (6.82 ± 0.96) so in female was (6.58 ± 0.94) and in male was (7.02 ± 0.95) statistically there was no significant differences between both sex. Also the mean and standard deviation of the concentrations of salivary potassium(mmol/l) in total was (21.02 ±
3.12) included \((21.87 \pm 1.04)\) in female and \((20.32 \pm 4.017)\) in males, so no significant differences between both sex as were recorded. As shown in Table (2).

**Table (2): the concentration of the salivary sodium, potassium according to gender**

<table>
<thead>
<tr>
<th>Gender</th>
<th>No.</th>
<th>Na (mmol/l)</th>
<th>K(mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>6.82 ± 0.96</td>
<td>21.02 ± 3.12</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>6.58 ± 0.94</td>
<td>21.87 ±1.04</td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>7.02 ± 0.95</td>
<td>20.32 ± 4.017</td>
</tr>
</tbody>
</table>

p-value 0.54 0.93

P<0.05

This study show the mean and standard deviation of the salivary pH which was \((7.3 \pm 0.3)\) in total, included female \((7.33 \pm 0.26)\) and male \((7.28 \pm 0.34)\) so statistically there was no significant differences between both sex. While the mean and standard deviation of salivary flow rate (ml/min) in total was \((5.49 \pm 1.82)\) included \((5.65 \pm 2.33)\) in female and \((5.3 \pm 1.31)\) in males, no significant differences between both sex. As shown in Table (3).

**Table (3): the mean and standard deviation of the salivary pH and flow rate according to gender.**

<table>
<thead>
<tr>
<th>Gender</th>
<th>No.</th>
<th>pH</th>
<th>Flow rate (ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>7.3 ± 0.3</td>
<td>5.49 ± 1.82</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>7.33 ± 0.26</td>
<td>5.65 ± 2.33</td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>7.28 ± 0.34</td>
<td>5.3 ± 1.31</td>
</tr>
</tbody>
</table>

p-value 0.26 0.97

P<0.05

Table (4) illustrated the mean and standard deviation of the salivary sodium, potassium, pH and flow rate in females within the study group which were \((6.62 \pm 0.93)\text{mmol/l}, \ 21.91 \pm 2.94 \text{ mmol/l}, \ 7.32 \pm 0.3,\ and \ 5.78 \pm 1.63\text{ml/min})\ respectively. And in control group there were \((6.53 \pm 1.02)\text{mmol/l}, \ 21.82 \pm 3.41\text{mmol/l}, \ 7.35 \pm 0.32,\ and \ 5.48 \pm 2.04\text{ml/min})\ respectively, statistically there were appositive correlation between both groups but not significant (p>0.05). In males the salivary sodium, potassium, pH and flow rate in the study group were \((6.85 \pm 0.55)\text{mmol/l}, \ 20.2 \pm 3.46 \text{ mmol/l}, \ 7.26 \pm 0.32,\ and \ 5.6 \pm 1.24\text{ml/min})
respectively. And in control group there were (7.09 ± 1.21 mmol/l, 20.82 ± 4.13mmol/l, 7.28 ± 0.32, and 5.57 ± 2.07 ml/min), statistically there were positive correlation between both groups but not significant (p>0.05).

Table (4): the mean and standard deviation of the salivary sodium, potassium, pH and flow rate in both groups according to gender and the correlation between them.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Salivary parameters</th>
<th>With caries</th>
<th>Free from caries</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Na(mmol/l)</td>
<td>6.62 ± 0.93</td>
<td>6.53 ± 1.02</td>
<td>0.69</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td>K(mmol/l)</td>
<td>21.91 ± 2.94</td>
<td>21.82 ± 3.41</td>
<td>0.27</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>7.32 ± 0.3</td>
<td>7.35 ± 0.32</td>
<td>0.46</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Flow rate</td>
<td>5.78 ± 1.63</td>
<td>5.48 ± 2.04</td>
<td>0.29</td>
<td>0.48</td>
</tr>
<tr>
<td>Male</td>
<td>Na(mmol/l)</td>
<td>6.85 ± 0.55</td>
<td>7.09 ± 1.21</td>
<td>0.07</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>K(mmol/l)</td>
<td>20.2 ± 3.46</td>
<td>20.82 ± 4.13</td>
<td>0.1</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>7.26 ± 0.32</td>
<td>7.28 ± 0.32</td>
<td>0.08</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Flow rate</td>
<td>5.6 ± 1.24</td>
<td>5.57 ± 2.07</td>
<td>0.26</td>
<td>0.46</td>
</tr>
<tr>
<td>Total</td>
<td>Na(mmol/l)</td>
<td>6.77 ± 0.93</td>
<td>6.89 ± 1.02</td>
<td>0.03</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>K(mmol/l)</td>
<td>20.89 ± 2.94</td>
<td>21.17 ± 3.41</td>
<td>0.1</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>7.29 ± 0.3</td>
<td>7.31 ± 0.32</td>
<td>0.005</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Flow rate</td>
<td>5.71 ± 1.63</td>
<td>5.23 ± 2.04</td>
<td>0.12</td>
<td>0.61</td>
</tr>
</tbody>
</table>

P<0.05

4. DISCUSSION

Dental caries is a highly prevalent chronic sugar dependent infectious disease, affecting calcified tissue of the teeth and causing demineralization of the inorganic portion with subsequent destruction of the organic substance. The carious tooth never returns to its original state, even if it is treated[22].

Electrolytes in saliva are necessary to maintain the integrity of teeth and considered to be an important variable explaining the difference in caries – experience[23].

In this study there were no relation for salivary sodium and potassium with dental caries-experiences this result agree with (Kargul, et al. 2009: and Shannon, 2011) [14,15] and
disagree with (Radhi, 2011) [24] who recorded that there was a negative significant relation with dental caries.

The role of sodium and potassium in relation to dental caries is not well substantiated. However, more studies are necessary to determine if there is an error in the sodium/potassium pump.

Also this study found that there were no relation for salivary pH, and flow rate with dental caries this finding agree with (Aziz, 2010) [25], and disagree with (Al-Jobouri. et al, 2011) [26] who found a negative significant relation between salivary pH and flow rate with dental caries.

Dental caries has a worldwide distribution, regardless of sex, age, race and socioeconomic level[27]. There are still individuals who appear to be more susceptible to caries and those who are extremely resistant, regardless of the environmental risk factors to which they are exposed. Like many medical and dental diseases, it depends on a complex interaction between the genetic structure of an individual and the superimposed environmental factors, a combination of nature and nurture. Although there is clear evidence that dental caries is a multifactorial, infectious disease, with many contributory environmental factors, there is also strong evidence for a genetic component in the etiology of this disease[28].

5. CONCLUSION

There are no relation between salivary sodium, potassium, pH, and flow rate with dental caries experience

REFERENCES


AUTHOR

Sulafa K. Banoosh: is born in 1979 in Baghdad city, Iraq. She received her bachelor degree in dentistry in 2001 from College of Dentistry, Baghdad University, Iraq. her Higher Diploma degree is received in dental operative in 2006 from College of Dentistry, Baghdad University, and M.Sc. degree is received in medical physiology in 2012 from physiological department, College of medicine, Tikrit University. During 2001-2002 she worked in A specialized medical center, in Ministry of Health, Iraq, and from 2002-2006 as a Teaching Assistant in College of Dentistry, in mustanseria University. From 2012 till now as Assistant lecturer in College of Dentistry, Tikrit University.