# Some salivary parameters in relation to dental caries - experiences

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## ABSTRACT

*Back ground: 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 الاسنان

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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) إناث و (22) من الذكور. وقد تم فحص جميع المتبرعين وتم تسجيل تسوس الأسنان باستخدام (DMFS) المؤشر العالمي لقياس نسبة تسوس الاسنان وكذلك تم جمع عينات اللعاب وتحليلها كيميائيا لتحديد تركيز كلا من الصوديوم والبوتاسيوم فيه فضلا عن قياس درجة الحموضة ومعدل تدفق اللعاب وقد تم تحليل العينات باستخدام مقياس الطيف الضوئي للامتصاص وكذلك قياس درجة الحموضة اللعابية باستخدام جهاز تحديد الرقم الهيدروجيني ، اما معدل التدفق (مل / دقيقة) فيتم قياسه بقسمة حجم اللعاب (مل) الذي تم جمعه من المتبرع على الوقت التي تم جمعه فيها والذي يكون ثابتة ( خمسة دقائق)، وقد تم تحليل جميع البيانات باستخدام SPSS النسخة 13. وأظهرت التحليلات الإحصائية للصوديوم اللعابي والبوتاسيوم في كل من مجموعة الدراسة (مع تسوس) ومجموعة التحكم (خالية من التسوس) وقد وجد انه لا يوجد فرق كبير في متوسط النتائج (0.9، 0.67) على التوالي حيث ان ال(0.05 <P) وكذلك الحال بالنسبة الى الرقم الهيدروجيني اللعابي ومعدل التدفق في كل من مجموعة الدراسة (مع تسوس) ومجموعة التحكم (خالية من التسوس) 0.98، 0.61 على التوالي.(0.05 <P)

الخلاصة: ليس هناك علاقة بين الصوديوم والبوتاسيوم اللعابي، ودرجة الحموضة، ومعدل التدفق اللعابي مع تسوس الأسنان.

**الكلمات الدالة:** تسوس الاسنان، المؤشر العالمي لقياس نسبة تسوس الاسنان، 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 ($-20\,ºC$) 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), $0.05 \geq P > 0.01$ * Significant (S), and $P \leq 0.01$ ** 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 (1):** Sample distribution according to gender

| Gender | With caries (study group) | | Free from caries (control group) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| **Total** | 22 | 55% | 18 | 45% |
| **Female** | 10 | 25% | 8 | 20% |
| **Male** | 12 | 30% | 10 | 25% |

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 ±1.04) in female and (20.32 ± 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

| Gender | No. | Na (mmol/l) | K(mmol/l) |
|---|---|---|---|
| | | Mean ± SD | Mean ± SD |
| **Total** | **40** | 6.82 ± 0.96 | 21.02 ± 3.12 |
| **Female** | **18** | 6.58  ± 0.94 | 21.87 ±1.04 |
| **Male** | **22** | 7.02 ± 0.95 | 20.32 ± 4.017 |
| **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 ± 0.3) in total,  included  female (7.33 ± 0.26) and  male (7.28 ± 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 ± 1.82) included (5.65 ± 2.33) in female and (5.3 ± 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.

| Gender | No. | pH | Flow rate (ml/min) |
|---|---|---|---|
| | | Mean ± SD | Mean ± SD |
| Total | **40** | 7.3 ± 0.3 | 5.49 ± 1.82 |
| Female | **18** | 7.33 ± 0.26 | 5.65 ± 2.33 |
| Male | **22** | 7.28 ± 0.34 | 5.3 ± 1.31 |
| 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 ± 0.93mmol/l, 21.91 ± 2.94 mmol/l, 7.32 ± 0.3, and 5.78 ± 1.63ml/min) respectively. And in control group there were (6.53 ± 1.02mmol/l, 21.82 ± 3.41mmol/l, 7.35 ± 0.32, and 5.48 ± 2.04ml/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 ± 0.55 mmol/l, 20.2 ± 3.46 mmol/l, 7.26 ± 0.32, and 5.6 ± 1.24ml/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.

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

**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

**[1]** MF. Ahmadi , P. Davoodi, M. Dalband, SS. Hendi . "*Saliva as a mirror of the body health*". DJH; 2010; 1(2):1-15.

**[2]** BKB Berkovitz, GR Holland, BJ Moxham. "*Oral anatomy, histology and embryology*". 3rd ed. New York: Mosby 2002.

**[3]** MEG Ferraris, AC Munõz. "*Histologia embriologia bucodenta*" l. 2nd ed. Rio de Janeiro: Guanabara Koogan 2006.

**[4]** I. R Maria, A. M Sandra, Elaine V B ., L. Laura, S. Rosemary. "*Salivary flow rate, pH, and concentrations of calcium, phosphate, and sIgA in Brazilian pregnant and non-pregnant women*". Head & Face Medicine, 2006; 2: 44.

**[5]** C. Llena-Puy. "*The rôle of saliva in maintaining oral health and as an aid to diagnosis*". Med Oral Patol. Oral Cir Bucal, 2006; 11: 449-455.

**[6]** H. P. Lawrence "*Salivary markers of systemic disease: noninvasive diagnosis of disease and monitoring of general health*" .J Can. Dent .Assoc, 2002; 68(3): 170-174.

**[7]** FJ. Dowd  "*Saliva and dental caries*". Dent Clin North Am; 1999; 43(4):579-97.

**[8]** Carmen Llena Puy. "*The role of saliva in maintaining oral health and as aid to diagnosis*", Med Oral POatol Oral Cir Bucal. 2006;11:E449-55.

**[9]** DP Lima, DG Garcia, SA Saliba, DH Sumida, AC Okamoto. "*Saliva: reflection of the body"*, Int J of Infect Dis. 2010; 14(3):184-8.

**[10]** LM. Lenander, V. Loimaranta .  " *Saliva and dental caries*",  Adv Dent Res. 2000; 14:40-7.

**[11]** F. Ahmadi Motamayel,P. Davoodi, M. Dalband  Hendi. "*Saliva as a Mirror of the Body Health*", DJH. 2010; Vol.1, No.2;p1-15

**[12]** J. Intesar Al-Kaysi, A. Huda abudallah "*The Effect of Salivary Zinc Concentration in Dental Caries Experience*", Tikrit Journal Of Dental Sciences. 2011; 1; 1-5

**[13]** J. Parker. "*COMBINATIONS OF PHOSPHATES AS CARIOSTATIC AGENTS*" Nutrition Reviews, 1965;V 23, Issue 10, pages 307–309.

**[14]** L. Ira Shannon. "*Salivary Sodium, Potassium, and Chloride Levels in Subjects Classified as to Dental Caries Experience*", International and American Associations for Dental Research J. 2011; 401-406.

**[15]** Batul Kargul, Aysen Yarat, llknur Tanboga. "*a study of some salivary elements with respect to sex, age, and caries in children*"; the saudi dental J. 1998; 2009; V 10; NO. 3;100-106 .

**[16]** A.M. Scheinin, KK. kinen, E. Tammisalo , M. Rekola, Turku sugar studies XVIII. "*Incidence of dental caries in relation to 1-year consumption of xylitol chewing gum*". *Acta Odont Scand*, 1975;33: 269-78

**[17]** J. Tenovuo, F. Legerlof. "*Saliva In: Thylstup A, Fejerskov O edts*". Textbook of Clinical Cariology. 2nd ed. Munksgaard. Copenhagen;1996: 17-43.

**[18]** Petra Klumb, Chritiane Hoppmann, and elanie Staats. "*Work Hours Affect Spouse's Cortisol Secretion*" —For Better *And* for Worse, Psychosomatic Medicine;2006; 68: pp 742–746.

**[19]** M. Wejdan  Al-Obaidi, A. Wesal Al-Obaidi. "*Severity of dental caries in relation to salivary parameters and inorganic compositions among a group of 22-23 years old adults in Baghdad city*", J Bagh College Dentistry; 2010; 22(2): pp 118-122.

**[20]** R. Abdul-Wahab Hamad, M. Shanaz Gaphor, G. Maissa Shawagfeh, G. T. Nazar  Al-Talabani. "*Study of Serum and Salivary Levels of Proinflammatory Cytokines, Potential Biomarkers in the Diagnosis of 4. Oral Squamous Cell Carcinoma*". Academic Journal of Cancer Research;2011; 4 (2): pp 47-55.

**[21]** WHO. Oral health surveys basic methods 4th ed world health organization. Geneva, Switzerland. 1997.

**[22]** HR. Pakshir. "*Dental reduction and denti-stry system in Iran*". *Med Princ Pract* ;2003; 12 (Suppl): 56–60.

**[23]** P. De Almeida, M. Gregio A., Machado, L. De Lima A., Azevedo. "*Saliva composition and functions: A comprehensive review*" . J Cont Dent Pract, 2008; 9(3):072-080.

**[24]** J. Nada Radhi. " *Salivary constituents in relation to caries-experience among a group of cerebral palsied adolescents*", J Bagh Coll Dentistry ;2011;23(4):141-147

**[25]** Hawraa Khalid Aziz. " *Caries experience in relation to the tea consumption and salivary parameters among the smokers and non-smokers patients*", Journal of Kerbala University; 2010; Vol. 8 No.2 Scientific:p 70-71 .

**[26]** S. Hanaa Al-Jobouri, Mohammed Al-Casey. "*Selected salivary constituents among 16-18 years patients with β thalassemia major in relation to oral disease*", J Bagh Coll Dentistry;201; 23(124-127

**[27]** NB. Pitts, C. Deery , HE. Fyffe, ZJ. Nugent. Caries prevalence surveys a multi–country comparison of caries diagnostic criteria. *Community Dent Health* 2000; 17: 196.

**[28]** O. Norman Harris, Franklin Garcia Godoy. "*Primary preventive dentistry*". 6th ed. Upper Saddle River, New Jesery: Julie Levin Alexander;2004; 337.

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