# Salivary Sialic Acid Level and Oral Health Statues in Sample of Iraqi Children

**Lamia I. Sood[1], Ameena Ryhan Diajil[2]**

*[1]Assist. Prof., Department of Pop, College of Dentistry, University of Al-Anbar,*
*[2]Assist. Prof. Department of Oral Diagnosis, Oral Medicine, College of Dentistry, University of Baghdad*

## Abstract

**Background:** Saliva is the 1st defense fluid with sialic acid is a significant salivary biomarker. It is an acidic sugar with a nine-carbon backbone, able to mediate a wide variety of patho- physiological processes. the study aims at estimate salivary sialic acid in Iraqi children sample and also find out their association with oral health status.

**Method:** Unstimulated salivary samples were collected from 100 healthy child, aged 6-13 years for 5-minutes, between 9:00 - 11:00 A.M. gingival index(GI) and Plaque index were measured . According to WHO criteria,the dentition status was examined by dmfs, dmft,DMFS and DMFT. Also, flow rate and the level of salivary sialic acid were estimated.

**Results:** In the present study,a positive correlation coefficient is recorded between the salivary flow rate and age and statistically reach the level of significance**.** Sialic acid concentration increased with age, but did not reach the level of significant**.**

A male gender showed increase salivary sialic acid level by 0.2 U/L compared to female, but fail to reach the significance

GI and DMFs showed a positive association with sialic acid level (R=0.036,R= 0.0053),but it's not reach the significant. While sialic acid level observed that a significant weak inverse liner correlation with other variables like DMFS and PI,(R=- 0.082,R=-0.066)

The outcomes were exposed to t-test and Pearson's correlation coefficient, Plaque index, GI, flow rate and the dental caries status were significantly positive correlated with the sialic acid levels in saliva.

**Conclusion:** The salivary factors evaluated in this study may prove to be useful measures for gingival inflammation in children and allow pediatric dentists to target preventive measures appropriately.

***Keywords:*** *Oral health status, Salivary sialic acid, flow rate, dentition statues, children, Iraq.*

## Introduction

Sialic acid found in fluid and body tissue,it's are group of monosaccharide that normally occurs at end of sugar chains and its attached to soluble proteins and the surface of cell [(1)]. The level of Sialic acid takes part in various physiological functions, such as cell-to-cell interactions, cell migration, and proliferation[(2)]. S.A interfere between the pathogenic microorganism and host and the important function to regulate the innate immunity.[(3)]

Terminal sialic acid removed, either by enzyme of virulent bacteria (*neuraminidase*) or by inherited disorder *endogenous neuraminidase* of host from sialylated glycoprotein, its could fuse onto the developing plaque surface, playing a role in plaque formation leading to the decimation of host tissue[(4)]. It has been reported that SA is associated with several acute phase proteins that associated with periodontitis[(5)].

Till date, there is next to no information with respect to synchronous examination and measured of salivary SA level of children and oral health status.

The current investigation was along these lines attempted with a point, to not just evaluate the level of SA in saliva of children and also find out their association with oral health status.

## Material and Method

Unstimulated salivary samples were collected from 100 healthy child, aged 6-13 years for 5-minutes, between 9:00 - 11:00 A.M. a special forma "structured questionnaire" that was conveyed in Arabic language and sent to the student family.

**This forma consisted of two parts:**

**1st Part:** Demography of primary school student

**2nd Part:** Clinical oral examination which was measured by PI, GI and CI according WHO criteria.

Ethics committee of the present study was approved by collage of dentistry, university of Baghdad

Exclusion criteria were, children having limitation in opening of the mouth, children with orthodontic appliances,children with any systemic disease and who had taken drug (antibiotics)in the last month

After oral examination, unstimulated whole saliva samples from each child are collected at least one hour after breakfast between 9-11 A.M, After the collection and disappearance of salivary froth. Salivary volume is estimated with a measuring sterile test tubes under the standard conditions over 5 minutes. And the rate of secretion was expressed as millilitres per minutes (m/min)[6].

The sialic acid level measured by Using EnzyChrom™ Sialic Acid Assay Kit (USA), The kit utilizes an enzyme coupled reaction in which free sialic acid is oxidized resulting in development of the OxiRed probe to give fluorescence Ex/Em = 535/587 nm and absorbance OD = 570 nm. The sialic acid kit measures in the linear range of 0.1 - 10 nmol with a detection sensitivity ~ 1 Mm concentration

**Statistical Analysis:** The data were analysis statically by using SPSS version 19.0. Descriptive analysis, analysis of variance,student T-test, linear correlation and multiple linear regression model were used in this present study. The analysis is expected to be $p< 0.05$ as the limit of significance

## Results

One-hundred student are involved in the present study with an age ranging from 6- 13 years old, males represent 46% while 54 % were females.

The primary school student distributed in to 4 group : 6-7, 8-9, 10-11 and 12-13 years old

**Table 1: Salivary sialic acid mean**

| | Salivary Sialic Acid | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | **Mean** | **SD** | **SE** | **N** | **P** |
| **Oral hygiene status(Pl index)** | | | | | | |
| - Mild range from (0.1 -1) | (56.7-58.2) | 57.5 | 1.1 | .8 | 2 | 0.14[NS] |
| - Moderate range from (1.1- 2) | (54.9-72.4) | 62.4 | 4.9 | .6 | 59 | |
| - Severe range from(2.1- 3) | (55-69.5) | 61.1 | 4.1 | .6 | 45 | |
| **Gingival index** | | | | | | |
| - Mild (0.1 -1 | (54.9-72.4) | 61.5 | 4.8 | .8 | 36 | 0.65[NS] |
| - Moderate (1.1-2) | (55.1-72.2) | 61.9 | 4.5 | .5 | 70 | |
| **Age group (years)** | | | | | | |
| 6-7 | (56-72.2) | 62.4 | 4.9 | 1.0 | 23 | 0.81[NS] |
| 8-9 | (55.1-72.4) | 61.7 | 4.7 | .8 | 35 | |
| 10-11 | (55-70.8) | 61.8 | 4.5 | .8 | 33 | |
| 12-13 | (54.9-69.5) | 60.9 | 4.4 | 1.1 | 15 | |

| | Salivary Sialic Acid | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | **Mean** | **SD** | **SE** | **N** | **P** |
| **Flow rate - categories** | | | | | | |
| 1st (lowest) tertile (< = 1.00) | (55.1-70.2) | 62.0 | 4.2 | .6 | 50 | 0.63[NS] |
| 2nd (average) tertile (1.01 - 2.00) | (56-72.4) | 62.3 | 4.9 | 1.0 | 27 | |
| 3th (highest) tertile (2.01+) | (54.9-72.2) | 61.2 | 5.0 | 1.0 | 26 | |
| **DMFs-categories** | | | | | | |
| First (lowest) tertile (<= 2) | (54.9-71.6) | 61.1 | 4.3 | .7 | 38 | 0.47[NS] |
| Second (average) tertile (3 - 7) | (55.1-72.4) | 62.4 | 5.0 | .8 | 36 | |
| Third (highest) tertile (8+) | (55.1-72.2) | 61.7 | 4.5 | .8 | 33 | |
| **DMFS-categories** | | | | | | |
| First (lowest) tertile (0) | (55.1-72.4) | 62.0 | 4.9 | .6 | 60 | 0.43[NS] |
| Second (average) tertile (1) | (56-72.2) | 62.9 | 5.1 | 1.5 | 11 | |
| Third (highest) tertile (2+) | (54.9-70.8) | 61.1 | 3.9 | .6 | 36 | |

As seen in table (1), the unstimulated salivary flow rate ranged from 2.00 ml/min for the highest rate and 0.04 ml/min for the lowest mean rate.

Salivary flow-rate mean for males range from 0.16-0.1 ml/minute as well as female range from 0.01-1.2 ml/minute. In addition to that, salivary flow rate mean of the female

0.322 ml/min is obviously lower than the male 0.431 ml/min, however, the mean difference were unable to reach the level of significance.

Table(2)shows the correlation between sialic acid and study parameters.

A positive strong correlation recorded between flow rate in children and dental age (r = 0.400).

On other hand .there was a statistically a significant correlation between the salivary S.A and GI(p=0.04).

It is obviously noted from table (2) that children suffered from mild gingivitis recorded with lower salivary S.A mean 61.5 u\l compared to those with moderate gingivitis 61.9 u\l and the differences between the numerical value are non-significant when tested statistically

**Table 2: Linear correlation coefficient between salivary sialic acid and oral paramater**

| | **Sialic acid level (saliva)** |
|---|---|
| Salivary flow rate | R = - 0.104 p= 0.3 [NS] |
| PI | R = - 0.066 p = 0.5 [NS] |
| GI | R = 0.036 p = 0.71 [NS] |
| CI | R = 0 p< 0.001 |
| DMFs | R = 0.053 p = 0.59 [NS] |
| Ms | R = 0.016 p = 0.87 S] |
| Fs | R = 0.013 p = 0.89 [NS] |
| Ds | R = 0.057 p = 0.56 S] |
| DMFS | R = - 0.082 p = 0.4 [NS] |
| MS | R = - 0.122 p = 0.21 S] |
| FS | R =- 0.197 p = 0.042 |
| DS | R = - 0.015 p = 0.88 S] |
| Age | R = - 0.066 p = 0.5 [NS] |

Caries experience presented by DMFS (Decayed-Missing-Filled- Surfaces),

Table (1) shows the distribution of the data according to the severity of DMFS in to lowest, average and highest.

Statistically, a significant inverse correlation between the DMFS and salivery sialic acid R= -0.082 (P< 00.1)

Children of high salivary S.A mean had higher DMFS in second(average) 62.9 u\l and its decreased to reach 62.0 u\l at the first(lowest)DMFS and 61.1 u\l at the third(highest) DMFS, but there was non-significant difference between salivary S.A and DMFS, p > 0.001

As seen in figure (1), the mean sialic acid level was lowest (69.9 u\l) in age group range from 12-13 years, and increase to reach the maximum S.A mean 62.4 at age group range from 6-7 years .but the difference did not reach the level of significant. For each one year increase in age, the S.A level expected to increase by average of -0.117 unit.

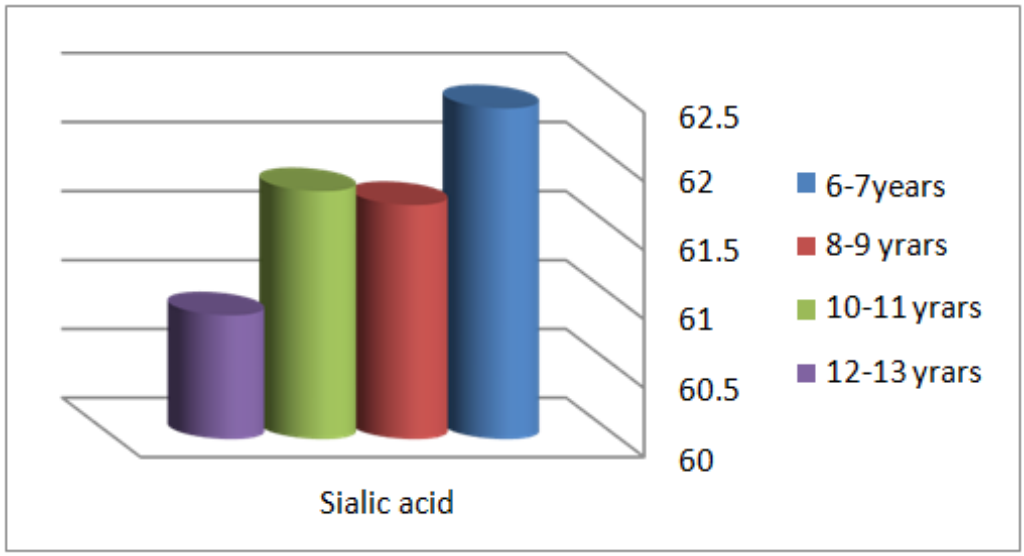


**Figure (1): Salivary sialic acid level and age group.**

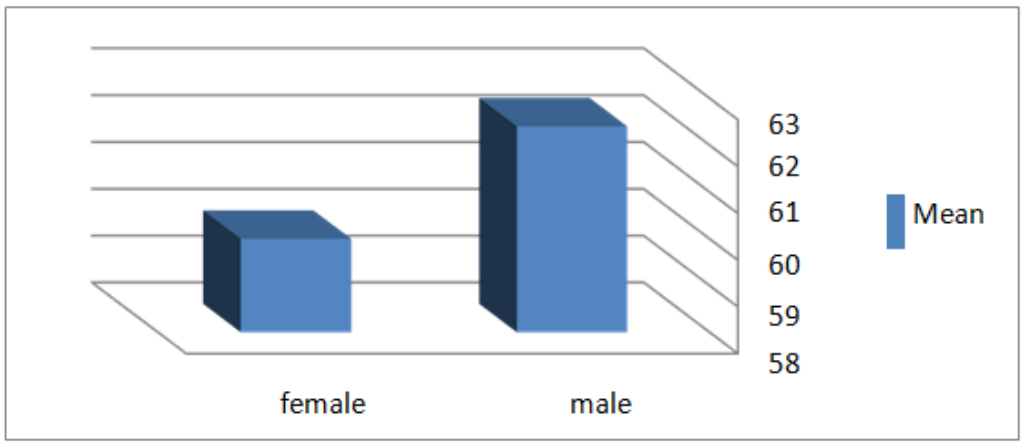


**Figure (2): Gender and salivary sialic acid**

When comparing salivary S.A mean of the two group,it's found that females are shown to be lower but statistically non-significant as compared to male (p> 0.001) as in figure (2).

Table (1) shows the plaque index classified into mild, moderate and severe index

The majority the student were with moderate pl mean score (62.4),followed with severe (61.1)and just 57.5 of mild score .

Although, mean sialic acid level was higher in student with moderate PI index, statistically failed to reach the level of significant differences between different group of plaque indices.

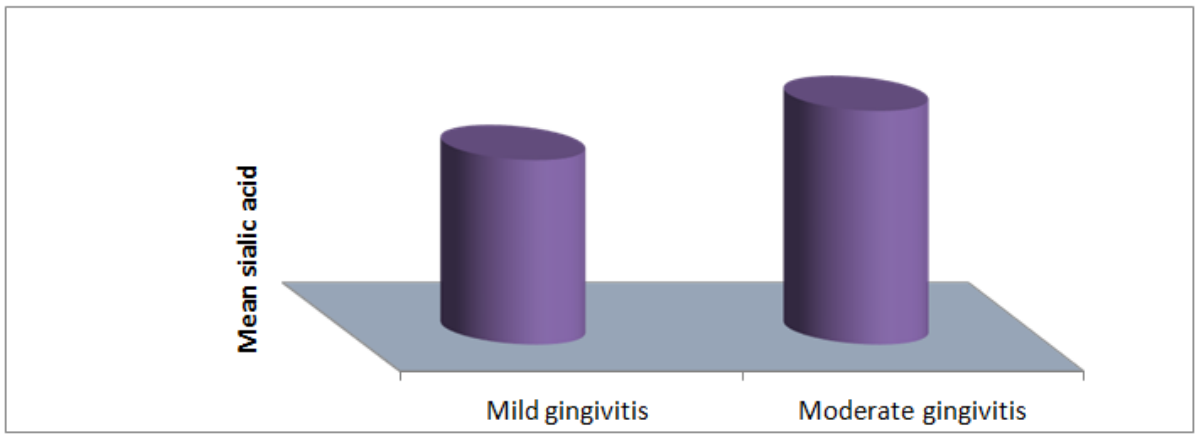


**Figure (3): severity of GI in relation to salivary sialic acid mean**

Figure (3), shows the GI distributed in to mild and sever gingivitis, with the majority of the student within moderate gingivitis

A multiple linear regression model was performed to evaluate both independent and the net association of the explanatory variables of sialic acid. These variables include: age,gender, salivary flow rate,PLI, GI,, decayed primary and permanent teeth surfaces of the participants.

As shown in table (3), the regression analysis showed that being a male is expected to increase the level of salivary sialic acid by a mean of 0.2 U/L compared to female after adjusting for the possible confounder effect of the other explanatory variables involved in this regression model. However, the effect of gender was unable to reach the statistical significance may be due to a small s sample size.

**Table 3: Multiple linear regression model of salivary Sialic acid with other variables.**

| | Partial egression oefficient | P | Standardized regression coefficient |
|---|---|---|---|
| Constant. | 62.2 | < 0.001 | |
| Plaque index. | -0.3 | 0.82 Non-ificant | - 0.025 |
| Gingival index. | 2.2 | 0.56 Non-ificant | 0.065 |
| Salivary flow rate. | -0.25 | 0.57 Non-ificant | - 0.063 |
| DS. | -0.02 | 0.8 Non-ificant | -0.026 |
| Ds. | -0.04 | 0.9 Non-ificant | -0.016 |
| Age (years). | -0.117 | 0.7 Non-ificant | -0.051 |
| Male gender compared to females | 0.2 | 0.85 Non-ificant | 0.021 |

$R^2 = 0.032$, P(Model) = 0.96[NS]

As shown in table 3, the regression model trying to explain the changes in salivary sialic acid was not significant statistically and failed to detect any important or statistically significant association for any of the tested explanatory variables with the outcome variable.

Gingival index and DMFs were positively correlation with sialic acid (r=0.036, r=0.053 (respectively, however fail to reach significance.

## Discussion

In present study, SA levels was estimated in salivary samples of primary school students, however, up to our knowledge, no previous studies were found to measure the level of salivary sialic acid in Iraqi children.

The was a negative relation between the age and SA, which agrees with Kuyatt and Baum[7] who found

a significant age related decrease in sialic acid level[7]. The older age group in this study (12-13 years) showed higher precent with teeth missing; that had a negative correlation with sialic acid level. This may be explained by negative correlation between free sialic acid and age in relation to missing teeth with less bacterial infection compared with lower percent of teeth missing.

Also, this agrees with Närhi et al [8], who mentioned that defense mechanism factors which were derived from gingival crevicular fluid were diminished in the absence of teeth [8].

Relation between salivary sialic acid, Plaque and gingival index

The results found a positive correlation between the salivary SA and gingivitis in children. This result is with a line of the result obtained by pervious studies performed by Jawazaly et al [9]. They discovered a significant relationship between gingivitis and

salivary SA [9]. In periodontal diseases,The increase in SA level may be result from raise in sialidase action[10].

Salivary Sialic acid are clearly increase to the individuals with gingival disease,its plays very important role in immunesystem .statistically a significant relationship between the salivary S.A and gingival condition ..

Considering, caries which is a multifactorial in aetiology, increase in caries activity (severity) may be explain by compination of several factores including bacteria,diet

,time and host and oral hygiene .thus, the physiology,composition and flow rate of saliva is the important parameter affecting dental caries susceptibility and altering oral health statues.

The greater part of the proteins in the saliva its glycoprptein, S.A is one of the important structure of salivary glycoprotein that participating in the plaque and acquired pellicle formation in the oral cavity as well as improving bacterial aggregation [12].

Salivary sialic acid level would influenced by oral infections[13,14]. more recently, it has need been accounted that salivary sialic acid level increase with salivary oxidative anxiety [15].

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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## Reference

1. Wang B, Brand-Miller J. The role and potential of sialic acid in human nutrition. Eur J Clin Nutr, 2003;57:1351-69.
2. Schauer R : Sialic acids and their role as biological masks. Trends Biochem Sci 1985; 10:357-60
3. Severi E, Hood DW, Thomas GH, Sialic acid utilization by bacteria pathogens,. microbiology, 2007;153(9);2817-22
4. Critchley P, Wood JM, Saxton CA, Leach SA . The Polymerisation of Dietary ars by Dental Plaque. Caries Res.1967; 1 : 112 – 29.
5. Ide M, McPartin D, Coward PY, Crook M, Lumb P, Wilson RF. Effect of tment of chronic periodontitis on levels of serum markers of acute phase ammatory and vascular responses .J Clin Periodontol. 2003; 30 : 334 – 40.
6. Tenovuo J, Lagerlof F. Saliva in: Thyistrup A,FejerskovText book of clinical ology. 2nd ed.openhagen:Munksgaard; 1996.
7. Brian L Kuyatt and Bruce J Baum. Characteristic of submandibular glands from ng and aged rats. J Den Res 1981; 60(5): 936-941
8. Närhi O T, Tenovuo J, Ainamo A, Vija P. Antimicrobial factors, sialic acid, and en concentration in whole saliva of the elderly. Eur J Oral sci 2007; 102(2): 120-
9. Jawzaly JI, Hasan HG, Ahmed B M. Relationships of salivary sialic acid and its tion in periodontitis with demographic properties and medical history. rnational Journal of Dental Research & Development (IJDRD) 2013;3(2):17–26.
10. Shetty PK, Pattabiraman TN. Salivary glycoproteins as indicators of oral ases. Indian J Clin Biochem. 2004;19:97–101.
11. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet 2007; 369: 51-59.
12. Rudney JD. Does variability in salivary protein concentrations influence oral robial ecology and oral health? Crit Rev Oral Biol Med 1995; 6: 343-367.

13. Eggers Lura H. An investigation into the relation between the sialic acid of va and dental caries. Arch Oral Biol 1961; 4: 141-146.
14. Shinohara M, Ohura K, Ogata K, Inoue H, Miyata T, Yoshioka M. The tionship between the sialic acid concentrations in the serum and whole saliva in with naturally occurring gingivitis. Jpn J Pharmacol 1994; 64: 61-63.
15. Cavas L, Arpinar P, Yurdakoc K. Possible interactions between antioxidant ymes and free sialic acids in saliva: a preliminary study on elite judoists. Int J rts Med 2005; 26: 832-835.