Caries - Severity in Relation to Salivary Constituents Among Down's Syndrome Children in Comparison to Normal Children

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Abstract

Background: Considerable attention has been given to the degree to which children with Down's syndrome are susceptible to dental caries. These observations have been questioned by many researchers whether they are inherently resistant to caries or not.
Aim of study: Was to measure the changes in the level of calcium, phosphorus, sodium, potassium and urea in stimulated saliva and their relations to severity of dental caries among Down's syndrome children in comparison to normal children.
Materials and Methods: Fifty institutionalized children with Down's syndrome (study group) and 50 normal children (control group) aged 7-10 years old were included in this study. $D_{1-4}S$ and $d_{1-4}s$ were assessed according to Muhlemann's criteria (1976) and stimulated whole saliva samples were collected and chemically analyzed to determine the concentrations of the following constituents: Ions of calcium, sodium, potassium by Flame Atomic Absorption Spectrophotometer as well as salivary phosphorus and urea by using colorimetric method. All data were analyzed using SPSS version 13.
Results: The $D_{1-4}S$ and $d_{1-4}s$ scores were significantly lower in Down's syndrome children than the control group ($P< 0.01$, $P< 0.001$ respectively). Salivary sodium, potassium and urea were significantly higher in Down's syndrome children ($P< 0.001$), while salivary phosphorus concentration was noticed to be lower among study group compared to control group ($P> 0.05$).
Conclusion: This study suggests that children with Down's syndrome presents higher levels of salivary calcium, sodium, potassium and urea which may explain a lower caries severity compared to normal children.
Key Words: Down's syndrome, Dental caries, salivary calcium; sodium; urea; phosphorus.

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Introduction

Down's syndrome is a genetic disorder results from an extra copy of chromosome 21 and the most commonly recognized genetic cause of mental retardation [(1)]. The causes of Down's syndrome are unknown, but a variety of genetic and environmental factors have been proposed [(2)].

Most investigators have found that percentages of occurrence of dental caries were lower in Down's syndrome individuals [(3, 4)]. Therefore, the precise cause is still unclear [(3)]. Conflicting results in salivary changes among Down's syndrome were noticed. An increase, decrease, or no difference in the salivary calcium, phosphorus, sodium, potassium and urea were seen [(5, 6, 7)].

The aim of this study was to measure the changes in the concentration of these constituents in stimulated saliva and their relations to dental caries among Down's syndrome children in comparison to normal children.

Materials and Methods

This study was carried out during the period between March, 2006 and January, 2007. Four institutions for mentally retarded children were involved in the present investigation (Al-Karrada, Al-Wazeeryia, Al-Kadhymia, Al-Jameaa), distributed in Baghdad city. The study group included Down's syndrome children. Their ages were 7-10 years and they divided into two groups (7-8) and (9-10) years. The total number of Down's syndrome children examined was 50. Information concerning medical condition and the date of birth were collected from the personal file. A comparative sample of students (the control group) was chosen randomly from four primary schools matching with age and gender and in the same geographical area where Down's syndrome children examined. They were chosen randomly depending on lists of students in each class [8]. Tooth was diagnosed to be carious by using ($d_{1-4}s/D_{1-4}S$) index, this allowed recording decayed lesion by severity [9]. Clinical examination was conducted using plane mouth mirror and dental probe.

Stimulated salivary samples were collected and each child was asked to chew a piece of Arabic gum (0.5-0.7 gm) for one minute, all saliva was removed by expectoration [10], chewing was continued for ten minutes with the same piece of gum and saliva collected in a sterile screw capped bottle.

The salivary samples were centrifuged at 4000 r.p.m for 30 minutes; the clear supernatant was separated by micropipette and it was divided into 6 portions in test tubes, stored at -20ºC in a deep freeze till the time of analysis, which was carried out at the teaching laboratories of the Medical City Hospital.

Essential elements of saliva were analyzed at the Poisoning Consultation/Surgical Specialty Hospital. This was done by Flame Atomic Absorption Spectrophotometer using standardized procedure by air-acetylene, except for inorganic phosphorus and urea, as they were determined using colorimetric method. The standards of essential elements (calcium, sodium and potassium) were used to assess variation of analysis during assays by the use of recovery test. After determination of essential element concentration in a sample, known concentrations of standard solutions of each of the essential elements were added to the analyzed samples, expected concentrations were studied to assess accuracy [11]. Inorganic phosphorus in saliva samples was determined by using a colorimeteric method without deproteinization. A ready kit was used by Spinereact, S.A. Spain. Inorganic phosphorus reacts with molybdic acid forming a phosphomolybdic complex in the presence of reducing agent in alkaline medium originates a blue molybdenum color. The intensity of the color formed is proportional to the inorganic phosphorus concentration in the sample. Determination of urea was according to urease-modified Berthelot reaction [12]. A readymade kit by Biomaghreb was supplied for this purpose.

Statistical Analyses were done by using SPSS version 13 (Statistical Package for Social Sciences). The included variables were conveniently described by mean and SD and the parametric statistical tests of significance were used. The independent samples t-test was used to test the statistical significance of difference in means between two groups. Among the outcome quantitative variables, some of them were non-normally distributed because the tested variables showed a statistically significant departure from normality when tested by Semirnov-Kolmogorov test as in case of decay

experience assessment. The test of significance applied here are the non-parametric tests.

The Mann-Whitney test was used to further explore the significance of difference in median and mean rank between each pair of study groups. P value less than the 0.05 level of significance was considered statistically significant. The confidence limit was accepted at 95%.

Results

A sample of 50 Down's syndrome children from institutions was examined (study group) as well as 50 normal healthy children in primary schools (control group) matching with age and gender. The age range was 7-10 years, the mean age for study group was (9.1 ± 1.4) and for control group was (9.2 ± 1.3). The distribution of the total sample by age and gender is seen in Table 1.

Table 1: The Distribution of Total Sample by Age Groups and Gender.

Age (Years)	Study Group						Control Group					
	Male		Female		Total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
7-8	14	28	6	12	20	40	14	28	6	12	20	40
9-10	22	44	8	16	30	60	22	44	8	16	30	60
Total	36	72	14	28	50	100	36	72	14	28	50	100

Table (2) and (3) demonstrate the mean values of caries – experience by grades of lesion severity for primary and permanent teeth among both groups. A higher value of d_1 was seen among the study group compared to the control group. While value of d_4 was found to be high among the control group compared to the study group. For permanent teeth, higher mean values of all grades of lesion severity were recorded in the control group compared to the study group. Higher values of total decayed surfaces (ds, DS) were seen among the control group compared to the study group, with statistically highly significant differences (Mann-Whitney= 772.5, Z= -3.305, P< 0.01; Mann-Whitney= 895, Z= -2.8, P< 0.001 respectively).

Table (2): Decayed Surfaces (Mean and Standard Deviation) of Primary Teeth by Grades of Lesion Severity (d_{1-4}) according to Age Groups and Gender of Study and Control Groups.

Age Group (Years)	Gender	Study Group					Control Group				
		d_1	d_2	d_3	d_4	ds	d_1	d_2	d_3	d_4	ds
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
7-8	M	0.64 ± 0.93	0.43 ± 0.94	0.50 ± 0.94	1.64 ± 2.62	3.21 ± 2.67	0.00 ± 0.00	0.29 ± 0.83	1.14 ± 1.88	8.36 ± 4.91	9.79 ± 5.12
	F	0.67 ± 0.82	0.33 ± 0.82	0.00 ± 0.00	6.83 ± 13.39	7.83 ± 12.92	0.00 ± 0.00	0.00 ± 0.00	0.83 ± 1.33	8.83 ± 4.49	9.67 ± 4.27
	T	0.65 ± 0.88	0.40 ± 0.88	0.35 ± 0.81	3.20 ± 7.61	4.60 ± 7.32	0.00 ± 0.00	0.20 ± 0.70	1.05 ± 1.70	8.50 ± 4.67	9.75 ± 4.77
9-10	M	0.00 ± 0.00	0.41 ± 0.59	0.50 ± 0.96	3.05 ± 4.78	3.95 ± 4.85	0.00 ± 0.00	0.14 ± 0.35	0.64 ± 1.65	4.95 ± 3.43	5.73 ± 4.37
	F	0.38 ± 0.74	0.25 ± 0.71	0.75 ± 0.89	5.13 ± 6.69	6.50 ± 6.80	0.00 ± 0.00	0.13 ± 0.35	0.75 ± 1.39	3.63 ± 4.00	4.50 ± 4.21
	T	0.10 ± 0.40	0.37 ± 0.61	0.57 ± 0.94	3.60 ± 5.31	4.63 ± 5.44	0.00 ± 0.00	0.13 ± 0.35	0.67 ± 1.56	4.60 ± 3.57	5.40 ± 4.29
All	M	0.25 ± 0.65	0.42 ± 0.73	0.50 ± 0.94	2.50 ± 4.09	3.67 ± 4.11	0.00 ± 0.00	0.19 ± 0.58	0.83 ± 1.73	6.28 ± 4.34	7.31 ± 5.02
	F	0.50 ± 0.76	0.29 ± 0.73	0.43 ± 0.76	5.86 ± 9.69	7.07 ± 9.47	0.00 ± 0.00	0.07 ± 0.27	0.79 ± 1.31	5.86 ± 4.85	6.71 ± 4.86
	T	0.32 ± 0.68	0.38 ± 0.73	0.48 ± 0.89	3.44 ± 6.26	4.62 ± 6.18	0.00 ± 0.00	0.16 ± 0.51	0.82 ± 1.61	6.16 ± 4.44	7.14 ± 4.93

Table (3): Decayed Surfaces (Mean and Standard Deviation) of Permanent Teeth by Grades of Lesion Severity (D1-4) according to Age Groups and Gender of Study and Control Groups.

Age Group (Years)	Gender	Study Group					Control Group				
		D_1	D_2	D_3	D_4	DS	D_1	D_2	D_3	D_4	DS
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
7-8	M	0.00 ± 0.00	0.00 ± 0.00	0.14 ± 0.53	0.00 ± 0.00	0.14 ± 0.53	0.00 ± 0.00	0.50 ± 1.02	0.29 ± 0.61	0.07 ± 0.27	0.86 ± 1.46
	F	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.33 ± 0.82	0.33 ± 0.82	0.17 ± 0.41	0.17 ± 0.41	1.00 ± 1.10
	T	0.00 ± 0.00	0.00 ± 0.00	0.10 ± 0.45	0.00 ± 0.00	0.10 ± 0.45	0.10 ± 0.45	0.45 ± 0.94	0.25 ± 0.55	0.10 ± 0.31	0.90 ± 1.33
9-10	M	0.05 ± 0.21	0.41 ± 0.80	0.23 ± 0.61	0.00 ± 0.00	0.68 ± 0.89	0.09 ± 0.43	0.50 ± 0.74	0.14 ± 0.35	0.14 ± 0.47	0.86 ± 0.89
	F	0.00 ± 0.00	0.50 ± 0.76	0.13 ± 0.35	0.00 ± 0.00	0.63 ± 1.06	0.13 ± 0.35	0.88 ± 0.83	0.88 ± 1.36	0.00 ± 0.00	1.88 ± 1.81
	T	0.03 ± 0.18	0.43 ± 0.77	0.20 ± 0.55	0.00 ± 0.00	0.67 ± 0.92	0.10 ± 0.40	0.60 ± 0.77	0.33 ± 0.80	0.10 ± 0.40	1.13 ± 1.25
All	M	0.03 ± 0.17	0.25 ± 0.65	0.19 ± 0.58	0.00 ± 0.00	0.47 ± 0.81	0.06 ± 0.33	0.50 ± 0.85	0.19 ± 0.47	0.11 ± 0.40	0.86 ± 1.13
	F	0.00 ± 0.00	0.29 ± 0.61	0.07 ± 0.27	0.00 ± 0.00	0.36 ± 0.84	0.21 ± 0.58	0.64 ± 0.84	0.57 ± 1.09	0.07 ± 0.27	1.50 ± 1.56
	T	0.02 ± 0.14	0.26 ± 0.63	0.16 ± 0.51	0.00 ± 0.00	0.44 ± 0.81	0.10 ± 0.42	0.54 ± 0.84	0.30 ± 0.71	0.10 ± 0.36	1.04 ± 1.28

Tables (4) and (5) illustrate the mean concentration of salivary components in part per million (ppm) among study and control groups by age groups and gender. In study and control groups the highest concentration recorded was for potassium ions, while the lowest concentration was for calcium ions. A higher concentration of calcium, sodium, potassium and urea was recorded among the study group compared to the control group, differences were statistically highly significant (Na: t= 7.19; df= 98, P< 0.001; K: t= 6.801, df= 98, P< 0.001; Urea: t= 10.611, df= 98, P< 0.001). Total males and females had higher mean values of salivary calcium, sodium, potassium and urea among the study group compared to the control group, differences were statistically highly significant (calcium: Males; t= 3.095, df= 70, P< 0.01: Na: Males; t= 7.483; df= 70, P< 0.001; K: Males; t= 6.38, df= 70, P< 0.001; Females; t= 3.09, df= 26, P< 0.01; Urea: Males; t= 8.074, df= 70, P< 0.001; Females; t= 7.396, df= 26, P< 0.001). A higher total mean values of these elements were noticed among the study group compared to the control group at 7-8 and 9-10 years of age, these were statistically highly significant for potassium, sodium and urea (7-8 years: K: t= 5.951, df= 38, P< 0.001; Na: t= 6.034, df= 38, P< 0.001; Urea: t= 5.211, df= 38, P< 0.001; 9-10 years: K: t= 4.161, df= 58, P< 0.001, Na: t= 4.469, df= 58, P< 0.001; Urea: t= 9.662, df= 58, P< 0.001). With increasing age, the mean concentration of calcium was decreased in the study group with no statistical significant difference. While the opposite was observed in the control group with statistical significant difference (t= 2.393, df= 48, P< 0.05), while no significant differences were recorded regarding other elements by age advancing. Concerning the inorganic phosphorus results revealed lower concentration among the study group compared to the control group, however statistical differences were proved to be not significant. Total males and females demonstrated lower mean values among the study group compared to the control group. These were statistically not significant (P> 0.05). In both groups the mean concentration of salivary phosphorus was increased with increasing age, difference was statistically significant only in the study group (t= 2.071, df= 48, P< 0.05). Only a statistical significant difference was obtained at 9-10 years of age between both groups (t= 2.071, df= 58, P< 0.05).

Table (4): Mean Values of Salivary Constituents (ppm) among Study Group by Age Groups and Gender.

Age Group (Years)	Gender	Calcium	Inorganic Phosphorus	Potassium	Sodium	Urea
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
7-8	M	29.36 ± 2.11	64.25 ± 15.91	534.54 ± 69.96	418.54 ± 29.34	201.43 ± 61.00
	F	28.50 ± 3.45	62.54 ± 14.20	542.55 ± 70.44	401.53 ± 63.95	201.67± 47.08
	T	29.10 ± 2.52	63.74 ± 15.06	536.94 ± 68.33	413.44 ± 41.58	201.50 ± 55.94
9-10	M	28.84 ± 2.36	75.60 ± 15.37	521.87 ± 78.36	405.23 ± 40.09	211.36 ± 52.58
	F	27.44 ± 2.53	67.18 ± 19.79	486.78 ± 87.68	371.99 ± 60.41	230.00 ± 44.08
	T	28.46 ± 2.64	73.36 ± 16.73	512.51 ± 80.94	396.36 ± 47.63	216.33 ± 50.41
All	M	29.04 ± 2.42	71.19 ± 16.35	526.80 ± 74.44	410.40 ± 36.44	207.5 ± 55.36
	F	27.89 ± 2.88	65.19 ± 17.15	510.68 ± 82.87	384.65 ± 61.38	217.86 ± 45.94
	T	28.72 ± 2.58	69.51 ± 16.62	522.28 ± 76.38	403.19 ± 45.65	210.40 ± 52.64

Table (5): Mean Values of Salivary Constituents (ppm) among Control Group by Age Groups and Gender.

Age Group (Years)	Gender	Calcium	Inorganic Phosphorus	Potassium	Sodium	Urea
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
7-8	M	25.24 ± 3.93	68.83 ± 10.13	426.76 ± 53.26	307.52 ± 76.49	130.71 ± 28.14
	F	26.65 ± 2.04	67.78 ± 13.62	427.08 ± 29.83	302.57 ± 47.64	126.67± 23.38
	T	25.67 ± 3.48	68.51 ± 10.92	426.86 ± 46.64	306.04 ± 67.87	129.50 ± 26.25
9-10	M	27.93 ± 2.59	71.67 ± 10.54	438.81 ± 55.55	312.12 ± 69.90	124.55 ± 18.96
	F	27.75 ± 4.20	70.34 ± 12.08	437.06 ± 55.54	366.78 ± 60.39	113.75 ± 15.06
	T	27.88 ± 3.02	71.32 ± 10.77	438.34 ± 54.59	326.69 ± 70.88	121.67 ± 18.4
All	M	26.89 ± 3.40	71.19 ± 10.33	434.12 ± 54.23	310.33 ± 71.49	126.94 ± 22.78
	F	27.28 ± 3.38	69.24 ± 12.31	432.79 ± 45.05	339.26 ± 62.64	119.29 ± 19.4
	T	27.00 ± 3.36	70.20 ± 10.81	433.75 ± 51.37	318.43 ± 69.74	124.80 ± 21.97

Ratios between elements in saliva were determined as shown in Table 6. Results revealed a slightly higher median value of P/Ca and K/Na among the control group compared to the study group, a statistical significant difference was found for K/Na ratio (Mann-Whitney= 962, Z= -1.986, P< 0.05). Total males had a higher P/Ca and K/Na ratio among the control group compared to study group with statistically highly significant difference for K/Na ratio (Mann-Whitney= 414, Z= -2.636, P< 0.01). No age differences were recorded for salivary ratios between study and control groups. With increasing age P/Ca ratio was increased in the study group with statistical significant difference (Mann-Whitney= 144, Z= -3.08, P< 0.01). While no statistical significant differences were recorded concerning K/Na ratio in both groups.

Table (6): Molar Ratios between Salivary Constituents of Study and Control Groups by Age Groups and Gender.

Age Group (Years)	Gender	Study Group		Control Group	
		P/Ca	K/Na	P/Ca	K/Na
		Median	Median	Median	Median
7-8	M	2.28	1.38	2.89	1.58
	F	2.23	1.36	2.53	1.37
	T	2.28	1.37	2.69	1.43
9-10	M	2.71	1.34	2.56	1.43
	F	2.73	1.34	2.52	1.24
	T	2.72	1.36	2.54	1.40
All	M	2.5	1.36	2.63	1.46
	F	2.32	1.37	2.52	1.34
	T	2.49	1.37	2.55	1.40

Tables (7) and (8) illustrate the correlation coefficient between caries – experience of primary teeth and salivary elements among both groups. Results showed strong negative highly significant correlations between ds and salivary calcium, inorganic phosphorus, urea, sodium, and potassium among the study group. The same results were recorded among control group regarding ds and calcium, inorganic phosphorus and potassium. Regarding correlations between d_3, d_4 and salivary electrolytes, they were statistically highly significant except for urea and potassium with d_3 among the study group, while negative non-significant correlations were found between d_3 and most of salivary elements among the control group. Negative highly significant correlations were obtained between d_4 and salivary calcium, inorganic phosphorus and potassium. Regarding the molar ratio between salivary electrolytes, negative significant and highly significant correlations were found between d_4, ds and P/Ca ratio respectively in the study group.

Table (7): Correlation Coefficient between Caries – Experience (ds and Grades of Caries Severity) of Primary Teeth and Salivary Constituents (ppm) among Study Group.

	d_1		d_2		d_3		d_4		Ds	
	r	P	r	P	r	P	r	P	r	P
Ca	0.01	0.97	-0.17	0.25	-0.45	0.001**	-0.61	<0.001**	-0.80	<0.001**
P	-0.12	0.41	0.01	0.96	-0.32	0.022*	-0.52	<0.001**	-0.73	<0.001**
K	0.22	0.12	-0.12	0.43	-0.26	0.070	-0.72	<0.001**	-0.74	<0.001**
Na	0.23	0.11	-0.10	0.51	-0.35	0.013	-0.68	<0.001**	-0.75	<0.001**
Urea	-0.04	0.81	-0.19	0.19	-0.17	0.24	-0.54	<0.001**	-0.70	<0.001**
P/Ca	-0.15	0.31	0.09	0.54	-0.20	0.16	-0.31	0.027*	-0.48	<0.001**
K/ Na	-0.05	0.72	-0.26	0.07	0.10	0.50	-0.17	0.25	-0.24	0.10

*** Significant, ** Highly Significant**

Table (8): Correlation Coefficient between Caries – Experience (ds and Grades of Caries Severity) of Primary Teeth and Salivary Constituents (ppm) among Control Group.

	d_1		d_2		d_3		d_4		Ds	
	r	P	r	P	r	P	r	P	r	P
Ca	----	----	-0.06	0.66	-0.28	0.05	-0.85	<0.001**	-0.87	<0.001**
P	----	----	0.01	0.93	-0.23	0.11	-0.50	<0.001**	-0.52	<0.001**
K	----	----	-0.11	0.44	-0.21	0.14	-0.62	<0.001**	-0.64	<0.001**
Na	----	----	-0.10	0.48	-0.21	0.15	-0.12	0.40	-0.19	0.18
Urea	----	----	0.05	0.73	-0.06	0.67	-0.18	0.22	-0.19	0.19
P/Ca	----	----	0.09	0.53	-0.10	0.50	0.17	0.23	0.16	0.26
K/ Na	----	----	0.11	0.45	0.10	0.49	-0.11	0.44	-0.06	0.69

*** Significant, ** Highly Significant**

Tables (9) and (10) demonstrate the correlation coefficient between caries – experience of permanent teeth and salivary constituents among study and control groups. Data showed a negative non significant correlation between DS and salivary calcium, urea and sodium among the study group, while a statistical significant correlation was obtained with potassium and K/Na ratio. The same pictures were seen among the control group except for K/Na ratio. Concerning K/Na ratio, results showed negative non-significant correlations among the study group while positive correlation for K/Na ratio among the control group.

Regarding the grades of caries severity, results demonstrate negative non significant correlation between D_1, D_2, D_3 and salivary potassium and K/Na among the study group as seen in Table (9). Some elements showed a fluctuation in the direction of correlation. Among the control group results revealed positive significant correlation between D_2, D_4 and K/Na ratio as showed in Table (10) below. Calcium, inorganic phosphorus and urea exhibited

significant correlation with different grades of lesion severity.

Table (9): Correlation Coefficient between Caries – Experience (DS and Grades of Caries Severity) of Permanent Teeth and Salivary Constituents (ppm) among Study Group.

	D1		D2		D3		D4		DS	
	r	P	r	P	r	P	r	P	r	P
Ca	0.03	0.86	-0.08	0.57	0.02	0.92	----	----	-0.05	0.74
P	0.13	0.35	0.19	0.18	-0.17	0.24	----	----	0.08	0.59
K	-0.04	0.81	-0.28	0.05	-0.14	0.33	----	----	-0.31	0.031*
Na	0.20	0.17	-0.26	0.07	0.02	0.91	----	----	-0.09	0.53
Urea	0.07	0.66	0.08	0.6	-0.14	0.33	----	----	-0.05	0.76
P/Ca	0.16	0.26	0.24	0.10	-0.11	0.43	----	----	0.14	0.33
K/ Na	-0.12	0.39	-0.14	0.33	-0.15	0.30	----	----	-0.30	0.034*

*** Significant**

Table (10): Correlation Coefficient between Caries – Experience (DS and Grades of Caries Severity) of Permanent Teeth and Salivary Constituents (ppm) among Control Group.

	D_1		D_2		D_3		D_4		DS	
	r	P	r	P	r	P	r	P	r	P
Ca	0.17	0.25	0.04	0.81	-0.30	0.033*	-0.06	0.68	-0.03	0.83
P	0.06	0.66	-0.11	0.45	-0.35	0.014*	-0.05	0.74	-0.19	0.18
K	0.08	0.60	0.18	0.21	-0.24	0.10	0.04	0.81	0.15	0.29
Na	-0.03	0.82	-0.24	0.10	-0.13	0.38	-0.19	0.18	-0.24	0.09
Urea	0.12	0.41	0.07	0.61	-0.31	0.031*	-0.02	0.91	-0.08	0.57
P/Ca	-0.08	0.56	-0.16	0.28	-0.10	0.50	-0.05	0.73	-0.20	0.16
K/ Na	0.00	0.99	0.28	0.04*	0.01	0.95	0.28	0.046*	0.28	0.05

*** Significant**

Discussion

Results of the present study showed that the percentages of occurrence as well as the severity of dental caries were lower among Down's syndrome compared to control group. Previous studies recorded the same observation regarding dental caries [3, 4, 13, 14, 15]. For both primary and permanent dentitions, initial caries (d_1, d_2; D_1, D_2) were recorded to be higher than deep cavitations (d_3, d_4; D_3, D_4) among Down's syndrome children. The opposite picture recorded especially for primary teeth among normal children. This may indicate a variation in the chemical composition of teeth between the study and control groups that favor the progression of dental caries much easier in teeth of normal children.

This observation needs to be confirmed, however, by other study to analyze teeth chemically.

Saliva plays a significant role in relation to dental caries through its constituents [16, 17]. The buffer system in general composed of bicarbonate-carbonic acid, phosphate and others like urea [18, 19]. In the present investigation urea was analyzed and found to be high in concentration among Down's syndrome compared to the control group with statistically highly significant difference, this may explain the higher buffer capacity among study group. Ammonia production from the metabolism of urea by urease enzymes of oral bacteria moderates plaque acidification and may inhibit dental caries, as suggested by in *vitro* studies [20].

This may explain the strong negative highly significant correlation between urea and decayed fraction of primary teeth among study group while it was weak not significant correlation among control group. Concerning phosphate, no significant difference in the concentration of inorganic phosphorus was found between both groups. It is worth to mention, the phosphate is the main buffer of unstimulated saliva [21] which was not studied by present investigation.

Electrolytes in saliva especially calcium and phosphorus are necessary to maintain the integrity of teeth and considered to be an important variable explaining the difference in caries – experience [22]. In the present study, a higher calcium concentration was found among study compared to control group. Other studies recorded a similar finding [6, 23]. Explanation was not able to be given. It may be related to variation in nutrient intake of the diet. The increase in calcium concentration of saliva in the study group may explain the lower dental caries in comparison to the control, as an inverse and strong highly significant correlation was recorded between caries – experience of primary teeth and salivary calcium among both groups. Salivary phosphorus showed the lowest concentration among study compared to control group with no significant difference. Other studies also reported no differences in phosphorus concentration between Down's syndrome and normal children [6, 24]. Although a lower concentration of inorganic phosphorus was reported among study group, a strong negative highly significant correlation was seen between caries – experience of primary teeth and inorganic phosphorus among both groups. Previous studies reported a significant role of calcium and phosphorus in relation to increase resistance of teeth to dental caries, their presence in saliva may enhance remineralization and increase resistance of outer enamel surface to acid dissolution [21, 25].

Sodium and potassium concentrations were found to be higher in the study compared to control group with statistically highly significant difference. This increase in sodium and potassium concentration may be an indication of a characteristic trait of the trisomic state of the syndrome itself [26]. However, more studies are necessary to determine if there is an error in the sodium/potassium pump. The increased concentrations of sodium and potassium among Down's syndrome children may also explain the lower caries – experience compared to control group as a strong negative highly significant correlations were recorded between sodium, potassium and caries – experience of primary teeth in study group, while it was not significant in control group regarding sodium. The role of sodium and potassium in relation to dental caries is not well substantiated. Previous studies recorded either a presence of a negative correlation with dental caries or no correlation at all [14, 27, 28]. However, there is a limitation in the knowledge regarding the possible etiological factors of dental caries among those special populations. So this study was conducted to explore the possible etiological factors of this disease involving some of salivary constituents as electrolytes, and urea.

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