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Composition of the parotid saliva in Chilean children with Down's syndrome

Composición de la saliva parotidea en niños chilenos con síndrome de Down

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Parotid gland saliva was collected from three groups of Chilean human subjects: Down syndrome, non-Down mentally retarded, and normal individuals. Their salivary flows, pH and electrolyte concentrations were determined. Variables were subjected to ANOVA statistical tests that showed no differences between Down and control groups in salivary flow, pH, chloride, sodium and bicarbonate concentrations. The potassium concentration in the saliva from Down syndrome patients was significantly lower than that of control individuals. Student's t-tests showed significant differences between Down syndrome individuals and controls for potassium and sodium. These last differences may be indicative of a characteristic trait of the trisomic state or of the syndrome itself.

INTRODUCTION

Down syndrome constitutes one of the world's most common chromosomal aberrations in man, with rates that vary between 1 in 700 to 1 in 1000 live newborns in European and American populations (Penrose, 1949; Penrose, 1961; Polani, 1962; Adams *et al.*, 1987). Studies in latinamerican populations have reported incidences of 1 to 2 in 1000 live newborns, a figure slightly smaller than the one reported for the Chilean population of 1 in 500 (Castilla *et al.*, 1980; Nazer *et al.*, 1989).

Patients with Down syndrome present anatomical and biochemical alterations that involve most of the tissues of the organism (Smith and Wilson, 1973). Several anomalies have been described in the oral cavity, such as in the size and form of the palate, delay in the eruption of deciduous and permanent dentitions, absence and fusion of teeth, alterations in tooth form, anomalies of the oclussion and of the calcification of the enamel, high prevalence of periodontal disease, and low incidence of caries (Cohen and Cohen, 1961; Cohen and Winer, 1965; Reuland-Bosma and Van Dijk, 1986). Previous reports indicate that the parotid saliva in Down patients shows significantly higher values for pH, sodium, calcium and bicarbonate concentrations when compared to controls (Winer *et al.*, 1963; Winer and Feller, 1972).

Recent studies have shown a high incidence of caries in a Chilean population with Down syndrome (Jara *et al.*, 1986; Aedo, 1987; Jara *et al.*, 1988). Notwithstanding that Down syndrome is one of the most frequent and better studied congenital malformations, studies of the salivary composition are very scarce (Winer *et al.*, 1963; Winer and Feller, 1972) and have not been attempted as yet in Chile.

The purpose of the present study was to analyze the flow, pH, sodium, potassium, chloride and bicarbonate concentrations of parotid saliva in patients with Down syndrome, non-Down mentally retarded, and normal individuals from Santiago, Chile, searching for possible significant differences between them.

MATERIAL AND METHODS

Individuals with Down syndrome as well as those non-Down mentally retarded were

randomly selected from the school population attending "Escuela Especial E-497" (State School for mentally retarded individuals located in the South Metropolitan Area of Santiago). The Down syndrome group, all with trisomy 21 (confirmed by cytogenetic diagnosis), comprised 19 individuals (10 males and 9 females), with ages ranging from 10 to 25 years old, and a mean of 19.5 years. The non-Down mentally retarded group included 21 individuals (17 males and 4 females), with ages ranging from 11 to 22 years old, with a mean of 15 years. Mental retardation in this group was non-specific and not associated to other specific syndromes. Moreover, none of these individuals was taking special drugs at the moment of the present examination. Normal individuals were randomly selected from the school population attending "Escuela D-472" and "Liceo A-94" (State preparatory and high schools, respectively, located in the same Metropolitan Area of Santiago). This group comprised 20 individuals (17 males and 3 females), with ages ranging between 10 to 19 years old, with a mean of 14 years.

Parotid saliva was collected with a plastic intraoral cup, according to the method designed by Schaefer *et al.* (1977). Intraoral cups of different sizes were made to fit comfortably in the mouth of each individual. All samples were taken in the morning two hours after breakfast. Each individual was instructed to rinse his mouth three times with tap water to reduce the amount of extraneous debris in the salivary sample. The parotid glands were stimulated with lemon juice swabbed on the back side of the tongue at the rate of four swabs per minute. After discarding the first 4 to 5 drops of secretion, an intraoral cup was placed against the bucal surface over the Stenon's duct entrance affixing a gentle pressure on the cup. Collection was made over a period of 30 minutes. The intraoral cup was removed from the mouth and its content was transferred to a cold graduated tube with a sterile Pasteur pipette, measured and stored on ice.

The secretion rate for each individual was determined by measuring the volume of fluid collected during a period of 10 minutes. The pH levels were recorded with a standard pHmeter immediately after obtaining the samples. Chloride concentrations were determined by titration, using Moohr's technique (1959), cited in Lynch (1972). Sodium and potassium concentrations were determined by flame photometry (Boling, 1964). Bicarbonate concentrations were measured with an arterial gas analyser (Corning, Model 165/2). All laboratory instruments used in the determinations were previously calibrated according to the values for stimulated parotid saliva in normal individuals (Mandel, 1974).

RESULTS

Table 1 shows the range and mean values of the parotid salivary flow, pH and electrolyte concentrations in Down, non-Down and normal Chilean individuals. The results of the ANOVA tests indicated that no significant differences between the three groups were detected with respect to secretory rates, pH, sodium, chloride and bicarbonate electrolyte concentrations ($p = 0.118$, 0.704, 0.388, 0.988 and 0.273, respectively). The only significant difference that we observed was for the potassium levels ($p = 0.024$). A Student-Newman-Keuls test applied to these data revealed significant difference in the potassium concentration when the Down syndrome group was compared both to the non-Down mentally retarded and normal groups. Nevertheless, no significant difference was observed between non-Down mentally retarded and normal individuals.

The results of the Student's t-tests applied to our samples were very similar to those obtained with the ANOVA tests, and reflect the consistency of the results. A significant difference was observed for potassium between Down *vs* non-Down, as for Down *vs* normal individuals ($t = 2.248$, $p < 0.05$ and $t = 3.103$, $p < 0.05$, respectively), and for sodium when comparing Down *vs* normal individuals ($t = 2.113$, $p < 0.05$).

TABLE 1

Flow, pH and electrolyte concentrations of parotid saliva in Down, non-Down mentally retarded and normal individuals

	Down syndrome (N = 19)		Non-Down Mentally retarded (N = 21)		Normal individuals (N = 21)	
	Range	$\bar{X} \pm$ S.D.	Range	$\bar{X} \pm$ S.D.	Range	$\bar{X} \pm$ S.D.
Flow (ml/10 min)	0.12 – 2.60	0.57 ± 0.69	0.23 – 2.00	0.90 ± 0.53	0.33 – 3.60	0.98 ± 0.70
pH	6.73 – 8.06	7.51 ± 0.36	6.62 – 8.08	7.56 ± 0.33	6.45 – 8.03	7.61 ± 0.42
Na^+ (mEq/l)	5.00 – 48.00	22.79 ± 11.35	2.00 – 46.00	19.00 ± 13.65	3.00 – 61.00	17.10 ± 3.07
K^+ (mEq/l)	18.00 – 25.20	21.01 ± 2.21	17.40 – 32.30	23.27 ± 3.98	20.30 – 30.80	23.58 ± 2.93
Cl^- (mEq/l)	11.00 – 40.00	19.69 ± 8.04	6.00 – 44.00	19.25 ± 10.60	10.00 – 48.00	19.30 ± 3.49
Bicarbonate (mEq/l)	1.20 – 21.40	12.36 ± 17.06	1.00 – 25.70	9.68 ± 5.82	1.10 – 21.40	9.94 ± 5.29
Total anions		32.05		28.93		20.24
Total cations		43.80		42.37		40.68

When the Bonferroni correction was applied to our data, only two probabilities were no longer significant, that for potassium when comparing Down *vs* non-Down groups, and that for sodium between Down and normal individuals, though they were in the borderline of statistical significance.

DISCUSSION

We have compared the population characteristics of parotid saliva, trying to establish if the variables considered in the present study were associated to the trisomic genotype (and hence to the syndrome). No significant differences were detected between the three groups with regard to secretion rate, pH, chloride and bicarbonate electrolyte concentrations. Significant differences were observed for potassium levels between the Down syndrome group *vs* non-Down group, and also between Down *vs* normal individuals. Differences were also observed for sodium levels when comparing Down *vs* normal individuals. These results support the hypothesis that Down syndrome individuals have differences in their electrolytes secretions with respect to the control groups, given that no differences were detected in sodium and potassium levels between non-Down and normal individuals. Potassium may be used as an indicator of the functional state of the parotid's secretory-excretory duct, because these structures are in charge of ions secretion. Thus, this difference in potassium may be associated to the existence of alterations in the parotid gland. This hypothesis has also been proposed by Winer and Feller (1972).

The above authors (Winer and Feller, 1972) made a similar study using three analogous sample groups, but they employed a different method for collecting the salivary samples. Because of this last reason, their results are not comparable to ours. Nevertheless, they reported an increase in the sodium, potassium, calcium, chloride, phosphorus, and bicarbonate levels in the parotid saliva from Down's patients compared to non-Down and normal groups (Table 2).

In spite of the above, the results obtained from the present study suggest that the differences encountered in the levels of potassium and sodium secretions may be due to the trisomic state. A confirmation of this hypothesis would need an interpopulation study in order to rule out the influence of ethnic differences between populations.

TABLE 2

Characteristics of parotid saliva in Chilean and USA populations

	Down syndrome		Non-Down mentally retarded		Normal individuals	
	CHILE (N = 19)	USA (N = 20)	CHILE (N = 21)	USA (N = 13)	CHILE (N = 20)	USA (N = 10)
	$\bar{X}$ ± S.D.	$\bar{X}$ ± S.D.	$\bar{X}$ ± S.D.	$\bar{X}$ ± S.D.	$\bar{X}$ ± S.D.	$\bar{X}$ ± S.D.
Flow (ml/10 min)	0.57 ± 0.69	3.25 ± 2.10	0.90 ± 0.53	6.85 ± 2.91	0.98 ± 0.70	7.73 ± 3.39
pH	7.51 ± 0.36	7.31 ± 0.14	7.56 ± 0.33	7.41 ± 0.06	7.61 ± 0.42	7.27 ± 0.13
Na^+ (mEq/l)	22.79 ± 11.35	22.60 ± 17.80	19.00 ± 13.65	21.10 ± 11.90	13.74 ± 3.07	20.50 ± 19.91
K^+ (mEq/l)	21.01 ± 2.21	20.00 ± 4.90	23.37 ± 3.98	20.21 ± 3.31	23.58 ± 2.93	19.00 ± 2.60
Cl^- (mEq/l)	19.69 ± 8.04	16.50 ± 8.60	19.25 ± 10.60	16.40 ± 5.80	19.30 ± 3.49	23.93 ± 11.82
Bicarbonate (mEq/l)	12.36 ± 5.87	17.06 ± 10.30	9.68 ± 5.82	15.85 ± 5.60	9.94 ± 5.29	16.21 ± 7.61

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