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Stomatology

Variations of salivary flow rates in Brazilian school children

Variações do fluxo salivar em crianças brasileiras

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ABSTRACT: The salivary flow rate (SFR) in healthy individuals may vary according to different factors. There is a scarcity of studies from different geographical areas that analyze SFR variations in children. The aim of this study was to verify stimulated salivary flow rate (SFR) variations in 6 to 12-year-old children, from four different public schools of Rio de Janeiro and correlate these data to gender, age, type of dentition, and health status. Clinical data were taken from the children's medical records that were kept at those schools. Oral examination and sialometry were performed in every child. Salivary flow rate was obtained by chewing-stimulated whole saliva under standard conditions. There were significant differences in SFR according to age ($p = 0.0003$). Six and 12-year-old children showed the lowest SFR, and when they were excluded from the analysis, no significant differences were found ($p = 0.21$). There were also significant differences in SFR among children from different public schools ($p = 0.0009$). The gender did not show any correlation to SFR, even when children were stratified by age ($p = 0.36$). Correlation between SFR and deciduous, mixed or permanent dentition was not found as well. These results show that the analyzed clinical variables did not seem to influence SFR in this children population.

DESCRIPTORS: Age groups; Child; Saliva.

RESUMO: O fluxo salivar (FS) em indivíduos saudáveis pode variar em função de diversos fatores. Dados sobre a análise das variações do FS em crianças de diferentes regiões geográficas são escassos na literatura. O objetivo deste trabalho foi estudar possíveis variações do FS em crianças de quatro escolas públicas do Rio de Janeiro, apresentando entre 6 e 12 anos de idade, além de correlacionar esses dados com gênero, idade, tipo de dentição e estado de saúde. A história médica das crianças foi obtida dos registros nas escolas. Em todas as crianças foram realizados exame bucal e sialometria. O FS foi obtido pelo método de saliva total estimulada mecanicamente, em condições padronizadas. Houve diferenças no FS em relação à idade ($p = 0{,}0003$). Crianças de 6 e 12 anos mostraram as menores médias de FS, mas quando estas crianças foram eliminadas da análise, não houve mais diferenças significativas no FS em relação à idade ($p = 0{,}21$). Houve também diferenças significativas nas médias dos FS entre as escolas ($p = 0{,}0009$). Não houve correlação do FS com gênero, mesmo quando as crianças foram agrupadas em relação à idade ($p = 0{,}36$). Também não houve correlação entre FS e as dentições decídua, mista ou permanente. Esses resultados mostram que na população de crianças estudada não houve influência das variáveis clínicas analisadas sobre o FS.

DESCRITORES: Grupos etários; Criança; Saliva.

INTRODUCTION

The salivary flow rate (SFR) in healthy individuals may vary according to different factors. The knowledge of the influence of different variables on SFR may be important for understanding oral health status and the importance of saliva protection at different ages. Most of these data were obtained from adults, little being known about differences in SFR in children.

There is a scarcity of studies from different geographical areas that analyze SFR variations in children[3,4,6,7,10,11,13,19]. Published data have suggested that the climate may have some influence on SFR[5,6]. Moreover, variations regarding gender[4], age[3,4,19], weight[3], height[3], nutrition[7], health status[3,8,9,14,15,16,20] and the type of dentition[3] have been pointed out. Differences in saliva composition in

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children and adolescents of different ages have also been shown[6,10].

The aim of this study was to verify SFR variations in the school children population of Rio de Janeiro and correlate these data to gender, age, type of dentition and health status.

METHODS

Patient population

This is a cross-sectional study of SFR measurements in a school children population. The children included in the study were recruited from four public schools in different neighborhoods of Rio de Janeiro. In each school, we measured the SFR of all 6 to 12-year-old healthy children from randomly selected classes of each grade. If any child had any oral mucous abnormality that needed treatment or could interfere in SFR, he/she would be excluded from the study. Mucosal variations and development defects that did not need any care were not considered as exclusion criteria. The ethical committee of the Federal University of Rio de Janeiro approved the study.

Data collection

Data regarding age, gender and health status were taken from the children's medical register form. Every child was submitted to oral mucosa and dental examination under artificial room light, at the classroom in a school chair. If any alteration of the oral mucosa was observed, the child was excluded from the study. The alteration would be properly registered in the children's form, and treated when necessary. The type of dentition was registered as deciduous, mixed or permanent. SFR was obtained by chewing-stimulated whole saliva under standard condition[15]. The saliva samples were collected between 2 and 5 pm. Participants were asked to chew pre-weighted unflavored gum (1 g) for six minutes. In the first minute, saliva should be swallowed, and then the participants were instructed to spit the accumulated saliva periodically into a discard cup for the next five minutes. Salivary flow was then measured with a discard syringe. Only the liquid component (not the foam) of saliva was measured. The SFR results were determined as milliliters per minute.

Statistical analysis

For comparison between dichotomous variables, the chi-square test was used; for comparison between dichotomous and numeric variables, Kruskal-Wallis was used. Regression analysis was performed for continuous variables.

RESULTS

Two hundred and forty-three children were evaluated from March to November 2002. Two children were excluded from the study for presenting traumatic ulcerations of the oral mucosa.

There were 113 female (47%) and 128 male (53%) children, out of the 241 included children. The mean age was 9.2 years (ranging from 6 to 12 years), but 68% of them were between 9 and 11-years-old (Table 1).

Regarding health status, allergic problems were recorded for 3 children (1.2%). These children were not using any medication, so they were not excluded from the study. Dentition registration revealed deciduous teeth only in 10 children (4%), mixed dentition in 174 (72%) and permanent teeth only in 57 children (24%). Children were younger in schools 1 and 3 than in schools 2 and 4 ($p < 0.0001$). Moreover, there were significant differences in the prevalent type of dentition among schools ($p = 0.0006$).

The number of children evaluated in each school, besides data about gender, age, type of dentition and mean SFR are demonstrated in Table 2.

The mean SFR was 1.23 ± 0.59 ml/min (range from 0.2 to 3.4 ml/min) and there was no significant statistical correlation between SFR and gender or type of dentition. However, there were significant differences in SFR ($p = 0.0009$), age ($p < 0.0001$) and type of dentition ($p = 0.0006$) among the different schools.

Six and 12-year-old children had the lowest mean SFR. But when children of these ages were eliminated, significant statistical difference ceased to exist in mean SFR ($p = 0.21$), even if they were stratified by gender ($p = 0.74$). When children were selected by age, boys produced significantly more saliva than girls in the 7-year-old children ($p = 0.02$) – and girls produced more saliva than boys in the 8-year-old children ($p = 0.06$). The other ages did not show significant differences in SFR between genders (Table 1).

Correlation analysis between SFR and gender, and between age and the type of dentition was performed for each school, but no significant correlation was found (Table 2).

TABLE 1 - Mean values, standard deviation (SD), and gender differences of salivary flow rates (SFR) in 241 school children.

Age	No. of children	%	Mean ± SD (mL/min)*	Range (mL/min)	Gender	No. of children by gender	Mean SFR ± SD (mL/min) by gender	*p* value for gender
6	17	7.1	0.77 ± 0.44	0.2 – 1.7	Female	12	0.74 ± 0.45	0.16
					Male	5	0.86 ± 0.55	
7	27	11.2	1.47 ± 0.55	0.7 – 2.7	Female	13	1.23 ± 0.45	0.02
					Male	14	1.70 ± 0.55	
8	27	11.2	1.38 ± 0.50	0.4 – 2.2	Female	10	1.57 ± 0.46	0.06
					Male	17	1.21 ± 0.49	
9	43	17.8	1.25 ± 0.62	0.3 – 3.4	Female	21	1.22 ± 0.46	0.84
					Male	22	1.26 ± 0.71	
10	66	27.4	1.24 ± 0.55	0.2 – 2.7	Female	28	1.30 ± 0.61	0.60
					Male	38	1.20 ± 0.51	
11	54	22.4	1.23 ± 0.62	0.3 – 3.4	Female	27	1.14 ± 0.56	0.34
					Male	27	1.33 ± 0.72	
12	7	2.9	0.70 ± 0.50	0.2 – 1.6	Female	2	0.67 ± 0.37	1.00
					Male	5	0.73 ± 0.75	
Total	241	100	1.23 ± 0.59	0.2 – 3.4	Female	113	1.19 ± 0.55	0.36
					Male	128	1.27 ± 0.62	

*p = 0.0003.

TABLE 2 - Clinical data from 241 children separated by school.

School	n (%)	Female n (%)	Male n (%)	Median age (range)*	Dentition†			Mean SRF (range) (mL/min)‡
					Deciduous n (%)	Mixed n (%)	Permanent n (%)	
1	50 (21)	25 (50)	25 (50)	7.5 (6-9)	5 (10)	45 (90)	0	1.4 (0.4-2.7)
2	51 (21)	27 (53)	24 (47)	10.5 (8-12)	0	20 (39)	31 (61)	1.1 (0.2-2.6)
3	53 (22)	18 (34)	35 (66)	9.3 (7-10)	0	39 (74)	14 (26)	1.4 (0.3-3.4)
4	87 (36)	43 (49)	44 (51)	9.4 (6-12)	5 (6)	70 (80)	12 (14)	1.1 (0.2-3.4)

All schools were located at different neighborhoods in the city of Rio de Janeiro: school 1 – Bairro Formiga; school 2 – Santa Cruz; school 3 – Benfica (Manguinhos); school 4 – Tijuca. *p < 0.0001. †p = 0.0006. ‡p = 0.0009.

DISCUSSION

There was a significant correlation between age and SFR in this study. Six and 12-year-old children, the extreme ages of this study, had the lowest mean SFR. However, children of these ages formed the smallest samples. When data from these children were eliminated, significant statistical correlation ceased to exist between age and mean SFR. Some publications point out that SFR increases with age in children and adolescent populations[3,4,13,19], although there have been controversies in other studies[1,6,11,12].

Hormonal alterations have been suggested to influence SFR[19]. In this study, it was not possible to measure such correlation. However, as far as age is concerned, the lowest mean SFR was found in 12-year-old children, suggesting that older age had a negative influence on SFR. Another problem in analyzing children populations is that younger children may not be able to cooperate properly with sialometry[4]. Maybe the 6-year-old children in this study might have some difficulty understanding sialometry properly, and that would explain their lower SFR.

There were also significant differences in SFR among children from different public schools from Rio de Janeiro. We can not give an explanation for this fact, since SFR was analyzed according to each one of the clinical variables for each school and there were no related statistical differences.

There were only two children presenting mucosa alterations that needed care, and they were excluded from the study. The prevalence of oral lesions is usually higher in children population. Maybe this prevalence is underestimated due to the conditions under which oral examination is carried out.

The three children with allergic problems were not analyzed as a different variable because of the small number of affected individuals.

Regarding other clinical data that may influence SFR, previous studies had shown that males have higher saliva output than females[2,17,18], even in children populations[3,4,13,19]. This could not be pointed out in this study, which showed no differences in SFR between genders, even when the children were stratified by age. The same results were related by Rotteveel *et al.*[12] (2004) although they used different methods. Moreover, some authors[3] have found that weight and height of the children may influence SFR. Unfortunately, these data were not measured in this study. It should also be emphasized that children that attend public schools in Brazil are from lower socioeconomic classes. This fact must be considered when comparing this study to others in the literature.

Climate differences have been shown to influence SFR in children from different countries in controversial ways[3,6]. Dawes explains that in the summer months the SFR is lower than in wintertime because of dehydration[5]. However, Bretz *et al.*[3] (2001) found higher SFR in children from Brazil than in those from USA. In this study, this variable was not considered because no climate differences were expected, as the weather in Rio de Janeiro is stable all year long.

Some of the variables that could influence SFR were minimized. First of all, the saliva samples were always collected at the same time of the day. Moreover, all children were from the same economic status and none of them were taking any medication, nor presented any kind of disease that could cause hyposalivation.

Contrasting with some published data, SFR was not correlated to any clinical variables that were analyzed in this children population. Moreover, even with the studied homogenous population, the chewing-stimulated SFR showed a wide range variation. No author tried to establish a normal parameter for SFR in the children population as there is for adults[16]. We believe that there should be parameters for clinicians analyzing SFR, but personal variations must be considered when establishing oral health status.

In clinical practice, SFR should be routinely measured as a prevention procedure for oral health. Furthermore, conflicting data in the literature must be better studied. It is important to pay attention to the fact that different problems may arise when children and adult populations are compared. Further studies that deal with the influences of different geographical areas on SFR are needed in order to establish SFR parameters for the children population.

CONCLUSION

The results of the present study show that clinical variables like gender, age, type of dentition and health status were not correlated to salivary flow rate variations in the analyzed school children population from Rio de Janeiro.

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