

Saliva and Dental Caries in Down Syndrome Children (Air Liur dan Karies Pergigian dalam Kalangan Kanak-kanak Sindrom Down)

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ABSTRACT

The objective of this study was to determine the association between dental caries and salivary characteristics (flow rate and pH) in the children with Down syndrome. A cross sectional study was conducted on 53 Down syndrome children at selected Down syndrome centres in Kelantan. Sociodemographic data was obtained, resting flow rate and pH were measured using Saliva-Check BUFFER® by GC co., Japan and clinical oral examination was done. Caries experience was calculated based on the index of decayed, missing and filled teeth (DMFT) for permanent dentition and decayed and filled (dft) for deciduous dentition. The mean age of the children was 11.7 (SD 5.51) years and 98.1% of them were Malays. The prevalence of dental caries for deciduous and permanent dentition was 57% (95% CI: 43%-70%) and 74% (95% CI: 61%-86%), respectively. The mean dft was 4.2 (SD 5.66) and DMFT was 4.7 (SD 4.97). The mean resting flow rate was 0.19 (SD 0.10) mL/min while mean pH was 6.2 (SD 0.45). There were no significant differences in the saliva resting flow rate and pH between the low and high carious group in both the deciduous and permanent dentitions ($p > 0.05$). Caries prevalence was low in the deciduous but higher in permanent dentition in children with Down syndrome. Saliva resting flow rate and pH did not influence the caries experience.

Keywords: Caries; saliva flow rate; salivary pH; Trisomy 21

ABSTRAK

Objektif kajian ini adalah untuk menentukan kaitan antara karies pergigian dengan ciri-ciri air liur (kadar aliran dan pH) dalam kalangan kanak-kanak Down syndrome. Kajian hirisan lintang ini telah dilakukan ke atas 53 kanak-kanak sindrom Down di beberapa pusat sindrom Down di Kelantan. Data sosio demografi, kadar aliran air liur dan pH waktu rehat dan pemeriksaan pergigian dilakukan. Kadar pengalaman karies diukur berdasarkan indek karies, kehilangan gigi dan tampalan (DMFT) untuk gigi kekal dan karies dan tampalan (dft) untuk gigi susu. Purata umur kanak-kanak terlibat ialah 11.7 (SD 5.51) dan 98.1% daripada mereka adalah Melayu. Prevalen karies gigi untuk gigi susu dan kekal ialah 57% (95% CI: 43%-70%) dan 74% (95% CI: 61%-86%). Purata dft ialah 4.2 (SD 5.66) dan DMFT ialah 4.7 (SD 4.97). Purata kadar air liur ialah 0.19 (SD 0.10) mL/min manakala pH ialah 6.2 (SD 0.45). Tiada perbezaan yang signifikan dalam kadar aliran air liur waktu rehat dan pH dalam kedua-dua kumpulan berkaries rendah dan tinggi ($p > 0.05$) pada gigi susu dan kekal. Prevalen karies gigi susu adalah lebih rendah berbanding dengan gigi kekal. Kadar aliran air liur dan pH tidak menentukan pengalaman karies.

Kata kunci: Kadar aliran air liur; karies pergigian; pH air liur; Trisomi 21

INTRODUCTION

Down syndrome is an autosomal chromosomal disorder caused by trisomy of all or a critical part of chromosome 21 (Hennequin et al. 1999). It affects approximately 1 in 600-700 live births globally (Desai 1997). The incidence of Down syndrome in one of the largest government hospital in Malaysia was reported to be 1: 959 live births (Hoe et al. 1989).

Children with Down syndrome may have different dental characteristics such as congenitally missing teeth and microdontia (Oredugba 2007). Often, the teeth are in Angle's class III relationship with posterior cross bites due to underdeveloped midfacial region. The tongue has deep fissures and appears large with a short and narrow maxilla (Wilkins 1999).

de Castilho et al. (2007) stated, based on literature review worldwide caries prevalence in Down syndrome is low compared with other individuals. This may be due to factors such as delay in eruption of teeth, changes in saliva composition, teeth morphology with less pronounced pits and fissures and different in microbiota associated to dental biofilm.

One of the major functions of human saliva is to protect dentition against dental caries (Kirstila et al. 1998). The saliva pH level is ranged between 6.3 and 6.9. Flow rate and buffering capacity of saliva play an important role in the organization of oral microbiota because they maintain the saliva pH. However, in Down syndrome individuals, there may be physiological alterations in the saliva flow rate and its composition which are fundamental

to colonization of the microorganisms (de Castilho et al. 2007). These changes will reduce the protective function of saliva on the tooth surfaces.

There are currently little data on dental caries and saliva characteristics, among the Down syndrome children in Malaysia. Therefore, the aim of this study was to determine the resting flow rate and pH of saliva in Down syndrome children and their association with dental caries.

MATERIALS AND METHODS

A cross sectional study was carried out in various Down syndrome centres in Kelantan, Malaysia. These centres were chosen regardless whether it is governmental or non-governmental organization (NGO). Down syndrome children aged between four and 25 years old were included in this study. The children with underlying medical problems or medications that can result in xerostomia were excluded from the study.

The sample size of 60 children was calculated using Power and Sample size calculation (PS) software. Sociodemographic data such as gender, age and ethnicity were obtained from the children. Salivary parameters were measured for resting flow rate and resting pH. During saliva collection procedure, the children were seated in an upright position with head slightly bending forward, to assist in the saliva collection. Saliva was collected using manufacturer provided cup and testing was done using *Saliva-Check BUFFER*[®] by GC co. Japan. This test kit was manufactured in China, Lot: 20060601; MFD: 2006-06; EXP: 2009-06. After registration, the children were not allowed to take any food or drink to ensure that the saliva was free from food stimulation. This procedure was done to ensure the accuracy of the saliva test (Kirstila et al. 1998). All the saliva collection was done according to manufacturer's protocol.

Clinical oral examination was done using disposable probe and mirror by a single examiner while the patient seated upright on a dental chair under good lighting. The dental examination was charted based on the index of decayed, missing and filled teeth (DMFT) for permanent dentition and decayed and filled teeth (dft) for deciduous dentition (Klein et al. 1938).

The data were analysed by using SPSS version 12.0 (SPSS Inc. Chicago 2003). Descriptive statistics such as means and standard deviation (SD) for continuous variables (age, DMFT/dft, resting salivary flow rate and pH level), and frequency and percentages for categorical variables (gender and ethnic) were determined. The prevalence of dental caries was calculated at 95% CI. The caries indices was divided into two groups, low and high caries. For permanent dentition, the cut off point for low caries was DMFT less than three (Oral Health Division 1998) while for primary dentition the low caries was considered as dft less than five (Oral Health Division 2007). Independent t-test was used to determine the association between dental caries and resting flow rate as well as pH of the saliva.

Ethical approval was obtained from the Research Ethics Committee (Human) of Universiti Sains Malaysia (USM/KK/PPP/JEPem [202.3(10)]).

RESULTS

A total of 53 Down syndrome children participated in this study. The socio-demographic characteristics of the children were as shown in Table 1. The mean age of the children was 11.7 (SD 5.51) years. There was almost an equal distribution between male and female. The majority (98.1%) of them were Malays. The mean resting flow rate of saliva was 0.19 (SD 0.10) mL/ min while mean pH of saliva was 6.2 (SD 0.45). The prevalence of dental caries for the permanent dentition was 74% (95% CI: 61%-86%) while for the primary dentition was 57% (95% CI: 43%-70%).

CARIES EXPERIENCE

In the deciduous dentition, the mean (SD) dft was 4.2 (SD 5.66). The mean (SD) decayed (d) was 4.2(SD 5.67) whilst the mean filled (f) component was 0.02 (SD 0.14). In the permanent dentition, the mean DMFT was 4.7 (SD 4.97). The mean (SD) decayed (D) was 3.98 (SD 5.09), mean filled (F) was 0.42 (SD 0.92) and missing (M) was 0.26 (SD 0.92).

There were no statistical differences in the association between resting saliva flow and dental caries among low and high caries children in both primary and permanent dentitions (Table 2).

TABLE 1. Socio demographic profiles of the subjects (n=53)

Variables	Mean (SD)	Freq. (%)
Age	11.7 (SD 5.51)	
Gender		
Male		27 (50.9%)
Female		26 (49.1%)
Ethnic		
Malay		52 (98.1%)
Chinese		1 (1.9%)
Indian		0 (0%)
others		0 (0%)

TABLE 2. Association between dental caries and resting flow rate (mL/min)

Dentition	<i>n</i>	Resting flow rate mean (SD)	Mean difference (95% CI)	<i>t</i> statistic (df) ^a	<i>p</i> value
Primary					
High	17	0.16 (0.074)	0.05 (-0.056, 0.112)	1.816 (51)	0.075
Low	36	0.21 (0.109)			
Permanent					
High	24	0.19 (0.09)	0.005 (-0.512, 0.062)	0.197 (51)	0.845
Low	29	0.18 (0.11)			

df: degree of freedom for *t* statistic

Similarly, there were also no statistical differences between the resting saliva pH and dental caries experiences among low and high caries children in both dentitions (Table 3).

DISCUSSION

The current study was done in Kelantan, a state situated at the northeast of Malaysia, bordering Thailand with vast majority of its local population being Malays. In this study, it was found that caries prevalence in deciduous dentition was low (57%) compared with normal children (80.9%), (Oral Health Division 2005). Generally, the incidence of dental caries among children with Down syndrome had been reported to be extremely low (Pilcher 1998). Stabholz et al. (1991) found that 84% of young subjects with Down syndrome were free from caries. Morinushi et al. (1995) postulated that this may be due to delayed eruption of the teeth, increased spacing between the teeth or possible differences in chemical properties of the saliva. Deciduous caries experience (dft) showed that the mean dft was 4.2 which was almost similar (4.1) with the normal children (Oral Health Division 1998) even though, the Down syndrome children had bigger 'd' component (4.2) than the normal children (3.7) (Oral Health Division 1998). This similarity was due to the fact that the carious tooth in normal children was being well treated as seen in the 'f' component (Down syndrome = 0.02, normal = 0.5) (Oral Health Division 1998). This is attributed to the outreach dental programme extended by the Ministry of Health of Malaysia to school children using its mobile dental services. However, provision of

dental care for the special needs children is hampered by poor coverage, lack of trained dental personnel and public awareness (Oral Health Division 2004).

The prevalence of dental caries in permanent dentition was higher (74%) in Down syndrome children compared with normal population, 57.1% (Oral Health Division 1998). This finding was in agreement with the study done by de Castilho et al. (2007), prevalence of dental caries will increase with age in individuals with Down syndrome. The increased risk of caries may be due to the presence of xerostomia, easy availability of cariogenic foods, facial muscles hypotonia which contributes to masticatory problem and inefficient natural cleansing action that allow food stagnation.

Down syndrome children were having permanent caries experiences (DMFT) higher (4.7) than normal children, 1.9 (Oral Health Division 1998). Conversely, Nunn et al. (1993) found that the permanent caries experience was at 2.0 and the study done by Oredugba (2007) revealed even lower DMFT score of 0.67. A low DMFT among the normal children is expected due to the well-organized and extensive coverage of the school dental program under the Malaysian Ministry of Health. However, among the Down syndrome children, delayed eruption of primary and permanent teeth, congenitally missing teeth and microdontia resulted in fewer caries occurrence during their childhood (National Institute of Dental and Craniofacial Research 2008). In older Down syndrome children, lack of manual dexterity and choices of cariogenic foods may lead to oral hygiene problems. Therefore, a large number of young people with Down syndrome lose their permanent teeth in their early teens (Oredugba 2007).

TABLE 3. Association between dental caries and resting pH of saliva

Dentition	<i>n</i>	Resting pH mean (SD)	Mean difference (95% CI)	<i>t</i> statistic (df) ^a	<i>p</i> value
Primary					
High	17	6.3 (0.60)	-0.1 (-0.44, 0.21)	-1.741 (21.8)	0.467
Low	36	6.2 (0.37)			
Permanent					
High	24	6.3 (0.31)	-0.1 (-0.37, 0.13)	-0.954	0.344
Low	29	6.2 (0.54)			

df: degree of freedom for *t* statistic

Salivary parameters were measured for resting flow rate and resting pH only since most of the Down syndrome children were unable to spit out saliva and chew the paraffin wax that used to stimulate the saliva. Resting flow rate found in this study was at 0.2 mL/min, similar to other studies done by Yarat et al. (1999) (0.11 mL/min, SD: 0.14) and Siquire et al. (2005) (0.34 ± 0.14). This range was considered low compared with the normal children as studied by Yarat et al. (1999) and Siquire et al. (2005) who found that the flow rate among the normal children was 0.75 (SD: 0.22) and 0.56 ± 0.18 , respectively. The mean salivary pH found in this study was slightly lower or acidic (6.2) as compared with normal people (7.1) (Farsi 2007). However, study done by Yarat et al. (1999) revealed a higher pH at 7.32 (SD 0.66) which was not statistically significant when compared with their normal group [7.41 (SD 0.42)]. In deciduous and permanent dentition, there were no significant associations between dental caries and resting flow rate as well as resting pH. As discussed earlier, the caries prevalence was low in deciduous but high in permanent dentition in the children with Down syndrome.

Dental caries is a complex multifactorial disease. Several factors have been associated with the prevalence of dental caries in both children and adults. Even though salivary flow and composition play an important role in maintenance of oral health (Lamkin & Oppenheim 1993), individual's diet and intake of fermentable carbohydrates in foods and beverages can greatly influence caries occurrence (Mason 2004). Results from this study showed that as the Down syndrome children grow older; the caries problems become more severe. This may be associated with length of exposure of the teeth to the disease process (Creighton & Wells 1966), less assistance from their care-givers (Oredugba 2007) and availability of cariogenic food choices (National Institute of Dental and Craniofacial Research 2008). Therefore, they need help to carry out their routine oral hygiene care. They should be educated in proper oral hygiene, receive the benefits of both systemic and topical fluoride as well as occlusal sealants (Pilcher 1998). Due to delay eruption of permanent dentition, it is critical to maintain the primary dentition as long as possible.

CONCLUSION

Caries prevalence was low in primary dentition but higher in permanent dentition in Down syndrome children compared with their normal counterparts. Saliva characteristics such as resting flow rate and pH did not appear to influence the caries experience. There may be other factors in the saliva, diet, oral hygiene and abnormalities in Down syndrome children that may have contributed to the caries occurrence.

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