Caries prevalence and severity in urban Fijian school children

L. M. JAMIESON¹, W. M. THOMSON¹ & R. MCGEE²

¹Department of Oral Sciences, PO Box 647 and ²Department of Preventive and Social Medicine, University of Otago School of Medicine, PO Box 913, Dunedin, New Zealand

Summary. *Objectives.* To determine the prevalence and severity of dental caries in a sample of urban Fijian school children.

Design. Cross-sectional.

Sample and methods. Children aged between 6 and 8 years who attended one of four primary schools in different localities of Suva completed self-report questionnaires and were examined for dental caries.

Results. A total of 704 children (response rate = 72.4%) returned questionnaires and were examined dentally. The prevalence of dental caries in the primary dentition was 87.6% and in the permanent dentition, 46.7%. The mean dfs and mean DFS were 8.43 (SD 7.82) and 2.38 (SD 1.37), respectively. High caries prevalence and severity were associated with infrequent brushing, snacking on sugar-containing foods, having seen a dentist before, and having last visited a dentist because of pain.

Conclusions. The caries prevalence of the sample was comparable with findings from a national oral health survey conducted in 1985/86, but the caries severity was greater. As in other developing countries, this may be due to an increased availability of refined sugar products without a concurrent rise in oral health awareness. The study findings contribute to the overall picture of Fijian school children's dental health.

Introduction

The prevalence of child dental caries in developed countries has decreased markedly in the last halfcentury [1–3], although children from ethnic minority groups and low socio-economic backgrounds in these nations are still recognized as having high levels of dental disease [2–8]. The overall improvement has been attributed to factors such as improved nutrition, water fluoridation, the introduction of fluoride-containing dentifrices, and greater dental awareness [4–7]. By contrast, the general consensus is that caries prevalence among children in developing countries is increasing [9–17]. This trend appears to be stronger in developing countries where sugar intake has increased, but weaker in countries where a poor economy restricts sugar intake [16,18]. It has also been suggested that caries prevalence in children is beginning to decrease in developing countries where dental health services and preventive programmes are becoming more established [19,20].

Fiji (population = $700\ 000$) is a developing country which, due to its central position and relatively large land mass, is often referred to as 'the hub of the Pacific' [21]. People from around the Pacific seek employment and education there, and its population comprises a blend of Melanesian, Polynesian, Micronesian, Indian, Chinese and European cultures [22]. A nation-wide oral health survey conducted in 1985/ 86 [23] identified certain groups (such as 5-6-yearold children) as having high dental disease experience. Since that time, there have been changes in the economic situation and demographic composition of many Pacific nations, together with greater consumption of cariogenic food and beverage products [16]. These factors are likely to have affected child dental health, and there is a need to obtain more recent information on the dental health needs of this group.

Correspondence: L. M. Jamieson, Department of Oral Sciences, University of Otago School of Dentistry, PO Box 647, Dunedin, New Zealand.

The aim of this study was to examine the prevalence and severity of dental caries in a sample of urban Fijian school children. It was hypothesized that dental disease experience would be higher than in earlier surveys.

Methods

The Fijian Ministry of Health granted permission for the study, and selected four Suva primary schools that provided an ethnically diverse mix of children considered to be representative of urban Fijian school children. All 6-8-year-old children who attended these schools were invited to take part in the study, and each was given a consent form, an information sheet and a self-report questionnaire. The latter sought information on the child's sex, ethnicity, age, the frequency of tooth brushing, fluoride toothpaste usage, the frequency of snacking between meals, the type of snacks (snacks the child typically ingested were categorized into 'sugar-containing' or 'nonsugar-containing' food groups), the frequency of soft drink ingestion, and the child's use of dental services. Parental occupation was used to categorize each child's household into the high, medium or low occupational group, using an employment classification obtained from the Fiji Bureau of Statistics [24].

Following return of the signed consent forms and completed questionnaires, each child was dentally examined by a calibrated examiner (LMJ). The dental examinations followed standard World Health Organization procedures [25], took place under natural light in school classrooms, and used standard explorers and mirrors. Each tooth was recorded as 'present', 'missing' or 'primary', and each surface was recorded as 'sound', 'decayed', 'filled', 'filled with decay' or 'extracted due to caries'. A tooth was considered 'sound' if it showed no evidence of treated or untreated caries; 'decayed' if any lesion had a softened floor or wall, or undermined enamel; 'filled' if there were one or more restorations and no decay; 'filled with decay' if there were one or more restorations and one or more decayed areas; and 'extracted due to caries' if a tooth had been removed because of decay (and, if it was a primary tooth, the participant was not of an age where natural exfoliation of this tooth would be expected) [25]. Data were entered into an SPSS database. Every 30th child was examined twice to ensure reliability (the second examination occurring at the end of the day of the

first examination), and Kappa and intraclass correlation coefficient values for six key variables (brushing frequency, whether the child had been to a dentist before, and the status of four key tooth surfaces) were above 0.80 in all instances. Differences in proportions were tested using the Chi-square test, while those for means were tested using analysis of variance (or the Mann–Whitney *U*-test where the normality criterion was violated). Levels of statistical significance were set at P < 0.05.

Results

Of a total of 972 eligible children, 171 did not return a signed consent form and 97 were absent on the day of examination, leaving 704 participants (a response rate of 72.4%). All subsequent analyses are confined to the latter group. The socio-demographic characteristics of the sample are presented in Table 1. There was an approximately equal distribution of females and males, similar proportions of Fijian and Indian children, and an approximately even distribution across the age and occupational groups. Children were categorized into the age groups '6 years', '7 years' and '8 years', and the mean age was 7.34 years (SD 0.98).

The dental self-care and dietary characteristics of the sample are presented in Table 2. Most children reported brushing once or more each day, and 651 children reported using a fluoride toothpaste. Three hundred and seventy-two children reported snacking once or more each day, and six hundred and twentyone children snacked on sugar-containing foods. Six hundred and nine children reported drinking soft

Table 1. Socio-demographic characteristics.

	Number (%)	
All combined	704 (100.0)	
Sex		
Male	355 (50.4)	
Female	349 (49.6)	
Ethnicity		
Fijian	327 (46.4)	
Indian	301 (42.8)	
Other	76 (10.8)	
Age		
6 years	266 (37.8)	
7 years	232 (33.0)	
8 years	206 (29.3)	
Occupational group		
High	195 (27.7)	
Medium	271 (38.5)	
Low	231 (32.8)	

Table 2.	Dental	self-care	and	dietary	characteristics
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	Number (%)	
All combined	704 (100.0)	
Brushing frequency		
Never or occasionally	48 (6.8)	
Once or more a day	656 (93.2)	
Fluoride dentifrice used		
Yes	651 (92.7)	
No	51 (7.3)	
Snacking frequency		
Never or occasionally	332 (47.2)	
Once or more a day	372 (52.8)	
Snack type		
Sugar	621 (88.2)	
Non-sugar	83 (11.8)	
Soft drink consumption		
Never or occasionally	609 (86.5)	
Once or more a day	95 (13.5)	
Visited a dentist before?		
Yes	407 (57.8)	
No	297 (42.2)	
Reason for last dental visit		
Check-up	92 (22.6)	
Pain	315 (77.4)	

drinks never or occasionally. Four hundred and seven children had visited a dentist before, and three hundred and fifteen of these children had last visited because of pain.

Six hundred and seventeen children had caries experience in their primary dentition, while 329 had caries experience in their permanent dentition. The mean dfs was 8.43 (SD 7.82), while the mean DFS

was 2.38 (SD 1.37). Sixteen children were cariesfree. Caries prevalence and severity by sociodemographic characteristics are presented in Table 3. The mean dfs was higher for 6-year-olds than other age groups, while the mean DFS was higher for 8year-olds than the younger age groups.

Caries prevalence and severity are presented in Table 4 by dental self-care and dietary characteristics. Children who brushed 'never or occasionally' had more severe disease experience than those who brushed regularly, and children who snacked on sugary food items had higher mean dfs than those who consumed non-sugar snacks. Children who had visited a dentist before had higher caries experience than those who had not visited, while those who had last visited because of pain had higher caries severity than those who had visited for a check-up.

An upper quartile split was used to identify the 182 children with high caries experience in the primary dentition (dfs > 11). In order to determine whether any variables were associated with high caries experience after controlling for other contributing factors, high disease experience was modelled using logistic regression, with the socio-demographic and dental self-care variables that were significant in the bivariate analyses being entered as independent variables. These were: age (6-year-old = 1, 7 or 8-year-old = 0), brushing frequency (brushes never or occasionally = 1, brushes 1+ times per day = 0), snack type (sugar-containing snacks = 1, non-sugar containing snacks = 0) and reason for last dental

Table 3. Caries prevalence and severity by socio-demographic characteristics (n = 704).

	Prevalence primary		Prevalence permanent		
	teeth (%)	Mean dfs (SD)	teeth (%)	Mean DFS (SD)	
All combined	617 (87.6)	8.43 (7.82)	329 (46.7)	2.38 (1.37)	
Sex					
Male	314 (88.5)	8.39 (7.94)	178 (50.1)	2.34 (1.39)	
Female	303 (86.8)	8.47 (7.66)	161 (46.3)	2.43 (1.34)	
Ethnicity					
Fijian	298 (91.1)	8.63 (7.65)	171 (52.3)	2.50 (1.59)	
Indian	254 (84.4)	8.09 (7.07)	148 (49.2)	2.23 (1.06)	
Other	65 (85.5)	8.57 (8.64)	40 (52.6)	2.43 (1.20)	
Age					
6 years	235 (88.3)	9.47 (8.60)*	113 (42.5)	2.05 (0.87)†	
7 years	205 (88.4)	8.71 (7.34)	118 (50.9)	2.39 (1.29)	
8 years	177 (85.9)	6.77 (7.01)	110 (53.4)	2.80 (1.79)	
Occupational group					
High	168 (86-2)	7.78 (7.03)	81 (41.5)	2.27 (1.40)	
Medium	235 (86.7)	8.62 (7.69)	135 (49.8)	2.48 (1.47)	
Low	208 (90.0)	8.79 (8.64)	108 (46.8)	2.37 (1.22)	

 $*P < 0{\cdot}001.$

 $\dagger P < 0{\cdot}05.$

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	Primary dentition		Permanent dentition		
	Prevalence (%)	Mean dfs (SD)	Prevalence (%)	Mean DFS (SD)	
All combined	617 (87.6)	8.43 (7.82)	329 (46.7)	2.38 (1.37)	
Brushing frequency					
Never or occasionally	44 (91.7)	11.81 (9.74)*	15 (31.3)†	1.96 (0.62)‡	
Once or more per day	573 (87.3)	8.18 (7.61)	314 (47.9)	2.41 (1.40)	
Fluoride dentifrice used					
Yes	567 (87.1)	9.24 (7.27)	299 (45.9)	2.39 (1.10)	
No	48 (94.1)	8.39 (7.87)	29 (56.9)	2.38 (1.39)	
Snacking frequency					
Never or occasionally	282 (84.9)‡	8.19 (7.78)	149 (44.9)	2.41 (1.37)	
Once or more per day	335 (90.1)	8.64 (7.86)	180 (48.4)	2.35 (1.36)	
Snack type					
Sugar	552 (88.9)	8.73 (8.01)*	299 (48.1)†	2.40 (1.40)	
Non-sugar	65 (78.3)	6.17 (5.75)	30 (36.1)	2.27 (1.08)	
Soft drink consumption					
Never or occasionally	535 (87.8)	8.32 (7.59)	281 (46.1)	2.37 (1.33)	
Once or more per day	82 (86.3)	9.13 (9.17)	48 (50.5)	2.44 (1.56)	
Visited a dentist before?					
Yes	363 (89.2)	8.67 (7.56)	195 (47.9)	2.49 (1.45)‡	
No	254 (85.5)	8.10 (8.16)	134 (45.1)	2.24 (1.23)	
Reason for last dental visit					
Check-up	74 (80.4)	7.09 (7.08)‡	35 (38.0)†	2.16 (1.08)‡	
Pain	289 (91.7)	9.13 (7.66)	160 (50.8)	2.58 (1.53)	

Table 4. Caries prevalence and severity by dental self-care and dietary characteristics (n = 704).

**P* < 0.005. †Chi-square *P* < 0.05.

 γ Cni-square P < 0.

 $\ddagger P < 0{\cdot}05.$

Table 5. Logistic regression model* for high primary dentition disease prevalence (dfs > 11).

	В	SE	Sig	Odds ratio (95% CI)
Male	0.185	0.176	0.538	0.83 (0.59, 1.17)
Fijian	0.421	0.181	0.079	1.76 (0.94, 3.31)
Six-year-old	0.526	0.182	0.002	1.75 (1.22, 2.51)
Brushed never or occasionally	0.217	0.285	0.453	1.24 (0.71, 2.17)
Snacked on sugar-containing foods	0.693	0.316	0.009	2.00(1.08, 3.72)
Last visited a dentist because of pain	0.303	0.282	0.475	1.35 (0.78, 2.35)

*Model χ^2 22.76; d.f. 6; 74.1% correctly predicted.

visit (last visit because of pain = 1, last visit for a check-up = 0). Sex was also included (male = 1, female = 0), as was ethnicity (Fijian = 1, Indian and other = 0). The findings are presented in Table 5. Six-year-old children had higher odds of having high disease experience than their older counterparts, while children who snacked on sugar-containing foods had twice the odds of being in the high disease group than those who snacked on non-sugar containing items.

Discussion

This paper was based on information obtained from a cross-sectional survey designed to measure the

caries prevalence and severity in a sample of urban Fijian school children. From an epidemiological perspective, the survey was not ideal; the sample was not randomly selected, and this limits our ability to generalize from the data. Nevertheless, the findings suggest that, while caries prevalence among Fijian children has not increased, caries severity has risen.

The welcoming Pacific Island smile has long been used to promote tourism in Pacific Island nations. European explorers 200 years ago even commented on the 'wonderful teeth' of the local people in these countries [26]. As early as 1967, however, Barmes speculated that the low caries prevalence in Pacific regions would change with the dietary alterations accompanying greater Westernization [27]. It is now generally recognized that dental health in the Pacific is becoming worse [16,19,23,26,28–31].

In the 1985/86 Fijian national oral health survey, the prevalence of caries in primary teeth was reported as 85%, with a mean 3.9 affected teeth per child [23]. In comparison with studies in 1948 and 1965, the 1985/86 figures showed a considerable improvement for caries prevalence in the primary dentition (of the order of 30-40% between the ages 5-6 and 7-8) [23]. This was attributed to the introduction of health education programs, distribution of free toothbrushes and dentifrices to school children and a fluoridation scheme developed in Suva. The prevalence of caries in primary teeth in the current study was 87.6%, with a mean 8.4 affected teeth per child. While it is difficult to compare findings because of sampling differences, our data suggest that, in the 16 years since the last national oral health survey, caries severity may have increased while caries prevalence in the primary dentition of Suva school children has stayed relatively constant.

Six-year-old children in our study had higher mean dfs than their older counterparts, while 8-year-old children had higher mean DFS than younger children. Because of the dental developmental stages of such age groups, however, these findings were not unexpected. Although most children reported using a toothbrush, those who brushed infrequently had higher levels of disease experience than regular brushers, supporting previous reports of the benefits of regular brushing for dental health [32-34]. The association of snacking on sugar-containing foods with high levels of dental disease is also supported elsewhere [9,17,35]. In Suva, there is an increasing availability of refined sugar in the form of sweets, iced lollies, biscuits and chocolate. These were all sold at the canteens of schools where examinations took place, and outside the schools by street vendors. To compound this, large quantities of sugar are usually used in tea, the principal drink from infancy in Fiji (often consumed with each meal taken at home) [22].

While the Government provides dental services to all schools in Fiji, our findings indicate that not all children in our sample utilize this service, and most of those who do seek relief of pain rather than routine care. In other countries, high levels of dental disease have been associated with children who seek dental treatment for symptomatic rather than preventive reasons [36,37].

While caries levels among children in the current study were comparable with those from other developing countries [18,20,38–40], they were still far short of the World Health Organization goal of having 50% of all 5- and 6-year-olds caries-free by the year 2000 [41]. Fluoridated water (0.6 p.p.m), fluoride dentifrices and Government dental services are available to the children of Suva, but it appears that these measures are not enough to counter the changes in dietary habits that are occurring. A recent re-evaluation of health services in Fiji has resulted in a greater awareness of oral health problems, but there are still more pressing health issues (such as clean water and control of infectious diseases) that demand immediate Government attention. These problems are ubiquitous in the developing world, and oral health may not be considered important until other, more fundamental health requirements have been met [42].

It is likely that the need for dental healthcare resources and oral health promotion in Fiji will increase. Effective implementation of these services, and a curtailing of the marketing of Western food products, may encourage Fijian children to develop sound dental health practices, thus helping to preserve the famous 'Bula' smile.

Acknowledgements

The authors would like to thank the Fiji Ministry of Health and the Fiji School of Medicine for their assistance in this study.

Résumé. *Objectifs.* Déterminer la prévalence et sévérité des caries dentaires chez des enfants scolarisés fidjiens en milieu urbain.

Protocole. Etude transversale

Echantillon et méthodes. Les enfants âgés de 6 à 8 ans, fréquentant l'une des quatre écoles primaires de différentes localités de Suva, ont répondu à des questionnaires et ont été examinés pour des caries dentaires *Résultats.* Le questionnaire a été renvoyé par 704 enfants (taux de réponse = 72,4%) qui ont été examinés. La prévalence des caries dentaires en denture lactéale était de 87,6% et de 46,7% en denture définitive. Les caf et CAF étaient respectivement de 8,43 (sd. 7,82) et 2.38 (sd. 1,37). Des caries fréquentes et sévères ont été associées à un brossage inconstant, le grignotage d'aliments sucrés, avoir vu un dentiste auparavant et avoir vu un dentiste pour une douleur.

Conclusions. La prévalence des caries de l'échantillon était comparable aux données obtenues lors de

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l'évaluation nationale de santé buccale menée en 1985/86, mais la sévérité des caries était plus importante. Comme dans d'autres pays développés, cela peut être dû à la disponibilité de produits sucrés raffinés sans augmentation parallèle de prise de conscience concernant la santé buccale. Les données présentes contribuent à la connaissance globale sur la santé dentaire des enfants fidjiens scolarisés.

Zusammenfassung. *Ziele.* Bestimmung der Prävalenz und des Schweregrades von Kindern einer urbanen Stichprobe von Schulkindern auf Fidschi.

Design. Querschnittstudie.

Stichprobe und Methode. Kinder im Alter von sechs bis acht Jahren, die eine der vier Grundschulen in den verschiedenen Gegenden von Suva besuchten, füllten selbständig Fragebögen aus und wurden im Hinblick auf Karies untersucht.

Ergebnisse. Insgesamt 704 Kinder füllten die Fragebögen aus und wurden untersucht. Die Kariesprävalenz im Milchgebiss lag bei 87.6%, im bleibenden Gebiss bei 46.7%. Die mittleren dfs und DFS-Werte waren 8.43 (\pm 7,82) sowie 2,38 (\pm 1.37). Eine hohe Kariesprävalenz und deren Schwere waren assoziiert mit unregelmäßigem Zähneputzen, naschen von zuckerhaltigen Zwischenmahlzeiten, ein früherer Zahnarztbesuch, sowie ein Zahnarztbesuch aufgrund von Beschwerden.

Schlussfolgerungen. Die Kariesprävalenz war vergleichbar mit Werten aus einer nationalen Untersuchung aus dem Jahr 1985/86, der Schweregrad war stärker ausgeprägt. Wie in anderen Entwicklungsländern könnte dies verursacht sein durch höhere Verfügbarkeit von zuckerhaltigen Produkten ohne gleichzeitige Erhöhung des Bewusstwerdens der Bedeutung von Mundgesundheit. Die Studienergebnisse tragen bei zu einem Gesamtbild der Zahngesundheit von Schulkindern auf Fidschi.

Resumen. *Objetivos.* Derterminar la prevalencia y severidad de caries en una muestra de niños de colegios urbanos de Fiji.

Diseño. Estudio transversal.

Muestra y métodos. Los niños entre seis y ocho años que asistieron a una de las cuatro escuelas primarias en diferentes localidades de Suva completaron cuestionarios de autorrespuesta y fueron examinados en busca de caries.

Resultados. Devolvieron los cuestionarios y se les realizó la exploración dental a un total de 704 niños (porcentaje de respuesta = 72,4 por ciento). La prev-

alencia de caries dental en la dentición temporal fue del 87,6 por ciento y en la dentición permanente del 46,7 por ciento. La media cos y la media COS fueron 8,43 (ds 7,82) y 2,38 (ds 1,37) respectivamente. La prevalencia de caries alta y la severidad se asociaron con cepillado infrecuente, ingesta entre horas de alimentos que contienen azúcar, no haber visto antes a un dentista y haber visitado últimamente a un dentista debido al dolor.

Conclusiones. La prevalencia de caries de la muestra fue comparable con los hallazgos de un estudio sobre salud bucal nacional realizado en 1985/86, pero la severidad de la caries fue mayor. Al igual que en otros países en desarrollo, esto puede ser debido a un aumento de la disponibilidad de productos con azúcar refinado sin un aumento concomitante en cuidados en higiene bucal. Los hallazgos del estudio contribuyen al conocimiento global de la salud dental de los niños de las escuelas de Fiji.

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