# Dental Caries Experience of Preschool Children from Different Ethnic Groups in Guangxi Province in China

Xiaojuan Zeng[a]/Yan Luo[b]/Minquan Du[c]/Raman Bedi[d]

**Purpose:** To describe the caries status and oral health-related behaviors of three- to five-year-old Chinese children by their ethnic background, and to identify potential determinants of caries experience.

**Materials and Methods:** A cross-sectional survey was undertaken in a multi-ethnic province (Guangxi) in Southern China. Representative samples of preschool children from two ethnic groups (Han and an ethnic minority Zhuang: 487 Han and 470 Zhuang children) were examined using decayed, missing, filled teeth/surface (dmft/dmfs) indices. The children's general information as well as their personal oral hygiene practices and dietary habits were collected based on a structured questionnaire.

**Results:** Overall, 60% of children had caries with a mean dmft value of 3.01. Zhuang children had a significantly higher prevalence of rampant caries (13% vs. 9%), mean dmft (3.36 vs. 2.66) and mean dmfs (5.10 vs. 3.76) than the Han children. Decayed teeth/surfaces dominated the dmft/dmfs indices for both Han and Zhuang children. Multiple regression analysis showed that ethnicity and drinking fruit juice from feeding bottles during babyhood were significantly related to dmft.

**Conclusion:** There was a higher level of caries experience in the Zhuang ethnic minority than in Han preschool children.

**Key words:** dental caries, ethnic groups, oral hygiene practice, dental behavior

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Dental caries experience is the outcome of a complex set of social, environmental and genetic determinants. Although dental caries in preschool children has declined in the past 20 years, the decrease is not observed equally across all populations (Watt and Sheiham, 1999). The relationship between health and social inequality is well established and a variety of social indicators has been used in health research. Ethnicity is a variable that combines biological and socio-cultural features, and has been receiving increasing attention (Bedi and Uppal, 1995).

Ethnic differences in child dental health have been found in industrialized countries (Bedi and Elton, 1991; Hallett and O'Rourke, 2002; Okunseri et al, 2002; Prendergast et al, 1997; Thomson, 1993). Minority racial and ethnic groups are considered as disadvantaged people and have dental needs that are not met (Dhawan and Bedi, 2001; Verrips et al, 1992; Waldman, 1995). For example, caries experience is significantly higher among minority ethnic groups than in white Caucasian groups in the United Kingdom; dmft scores among Asian children being at least 1.5 – 2 times higher

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than in white Caucasian children (Bedi and Elton 1991; Paul and Bradnock, 1986; Perkins and Sweetman, 1986; Prendergast et al, 1997). Obvious differences in feeding habits and oral hygiene practices were observed; a significantly lower proportion of Asian children had good to fair oral cleanliness scores than white Caucasian children (Bedi and Elton, 1991; Dykes et al, 2002; Shiboski et al, 2003; Williams and Fairpo, 1988). Differences between various ethnic groups have also been well reported in Scandinavia where immigrant groups were at higher risk (Verrips et al, 1992; Widström and Suksis-Jansson, 1985; Zimmerman et al, 1988).

Oral health status and related behavior among minority ethnic groups are critical issues in a multicultural society. Socio-cultural changes or lifestyle issues may help to obtain a better understanding of disease etiology, thereby contributing to the development of effective prevention strategies. In the People's Republic of China, the ethnic Chinese, known as the Han Chinese, compose 93% of the total population. The remaining population is composed of 55 ethnic minorities distributed throughout the country. The National Dental Health Survey conducted in 1995/1996 provides baseline information on the oral health status of the population in Mainland China but does not specifically relate to minority ethnic communities (Wang et al, 2002). To date, little is known concerning dental health and associated behavioral practices of ethnic groups in China and whether such ethnic differences in oral health also occur or not.

Guangxi, the ninth largest province, is located in southern China. It is a multi-ethnic region with a total of 36 ethnic minorities. Zhuang is the largest minority ethnic community, and accounts for one third of the population of the Guangxi Province. The purpose of this study was to assess the prevalence of dental caries among Han and Zhuang preschool children from Guangxi, to report their oral hygiene practices and dietary habits, and to identify potential determinants of caries experience.

## MATERIALS AND METHODS

### *Sample*

This study was carried out in Guangxi Province, Southern China. The sample was drawn from three- to five-year-old children attending kindergartens. Approval of the study was obtained from the local government and the heads of the kindergartens.

A multi-stage sampling technique was employed to obtain a representative sample of subjects. The capital city of Guangxi Province, Nanning, and its two satellite counties, Wuming and Mashan, were involved in the study. These three places are located close to each other and the fluoride concentrations in the water are supposed to be similar. In each place a list of all kindergartens was obtained from the local Department of Education. A total of seven kindergartens were randomly selected in the three places. Using class lists of the sampled kindergartens a systematic random sampling procedure was carried out to select children after stratification by age and gender. Using these sampling methods, 957 children were selected in total.

### *Clinical Examination*

The oral examinations were carried out at the kindergartens by three dentists from Guangxi Dental Hospital. The children were examined while sitting under natural light. A plain mouth mirror and a periodontal probe were used. All teeth and surfaces were examined for caries using diagnostic criteria and methods recommended by the WHO oral health survey (World Health Organization, 1997). For the purpose of this study, rampant caries was defined when caries affected the smooth surface of two or more maxillary incisor teeth, as in previous surveys of early childhood caries (Al-Malik et al, 2002; Petti et al, 2000).

The three examiners were calibrated prior to the survey to ensure the uniform application of diagnostic criteria. Duplicate examinations on 30 children attending one kindergarten yielded a high level of inter-examiner agreement with kappa value of 0.86.

### *Questionnaire*

Based on a questionnaire, the children's general information and dietary habits, as well as their personal oral hygiene practices or toothbrushing were collected. In the urban area, the questionnaire was passed to the mothers of children by the kindergartens. Teaching staff at the kindergartens ensured that forms were completed and returned. In rural

**Table 1 Caries experience and prevalence in Chinese preschool children by ethnicity**

| | No. of children | Caries-free N (%) | R-caries* N (%) | Mean dmft* (SD) | Mean dmfs* (SD) |
|---|---|---|---|---|---|
| Han | 487 | 198 (40.7) | 42 (8.6) | 2.66 (3.31) | 3.76 (5.86) |
| Zhuang | 470 | 181 (38.5) | 61 (13.0) | 3.36 (3.99) | 5.10 (7.13) |
| Total | 957 | 379 (39.6) | 103 (10.8) | 3.01 (3.67) | 4.42 (6.55) |

* Significant difference between Han and Zhuang in R-caries ($p = 0.037$), mean dmft ($p = 0.003$), mean dmfs ($p = 0.001$)

areas, the examiners interviewed the parents and completed the questionnaires.

The questions assessed oral hygiene practice and included: frequency of toothbrushing per day, with or without help; toothpaste used; and age when toothbrushing started. Information on the dietary behavior of each child was collected together with details of infant feeding practice and bottle-fed drinks in babyhood. The social class questions included covered the education level of both fathers and mothers. The parents' education levels were classified into two groups: 1) post-secondary and 2) secondary or below.

### *Statistical Analysis*

The statistical analysis was performed using the SPSS software. Prevalence of caries, rampant caries, mean dmft and dmfs were calculated for each ethnic group. Chi-square test was used to assess the differences in the distribution of caries prevalence between the children in both ethnic groups. The differences in the mean scores of dmft/dmfs were tested utilizing t-test.

Multivariate regression analysis was performed to identify potential determinants of caries experience. Ethnicity and social class variables (parental education status), oral hygiene practice variables (frequency of toothbrushing, start of brushing, help with brushing, toothpaste used), dietary behavior variables (infant feeding type, drinks during babyhood) were entered into a regression model, predicting the dependent variables of caries experience index (dmft) and presence of caries (caries prevalence).

## RESULTS

Clinical examinations were carried out on 957 children aged three to five years, of whom 487 (51%) were Han and 470 were Zhuang.

### *Caries Experience*

Overall, 60% of children had caries with a mean dmft value of 3.01 (Table 1). Forty-one percent of Han children and 39% of Zhuang children had no caries with the difference being statistically insignificant ($p > 0.05$). The prevalence of rampant caries in the Zhuang group was 13%, which was higher than that in the Han group ($p < 0.05$). In addition, the mean dmft and dmfs scores of Zhuang children were significantly higher than those of Han children ($p < 0.01$), 3.36 and 5.10 as compared with 2.66 and 3.76, respectively.

For either Han or Zhuang children, the decayed teeth dominated the dmft index, while very few teeth were restored and no teeth were lost due to caries in both ethnic groups (Fig 1). Han children had a significantly lower mean dt value compared with Zhuang children (2.62 vs. 3.34, $p < 0.01$). Similarly, statistically significant differences in mean ds values (3.72 vs. 5.08, $p < 0.01$) were observed between the two ethnic groups. There were no significant differences in mean filled teeth

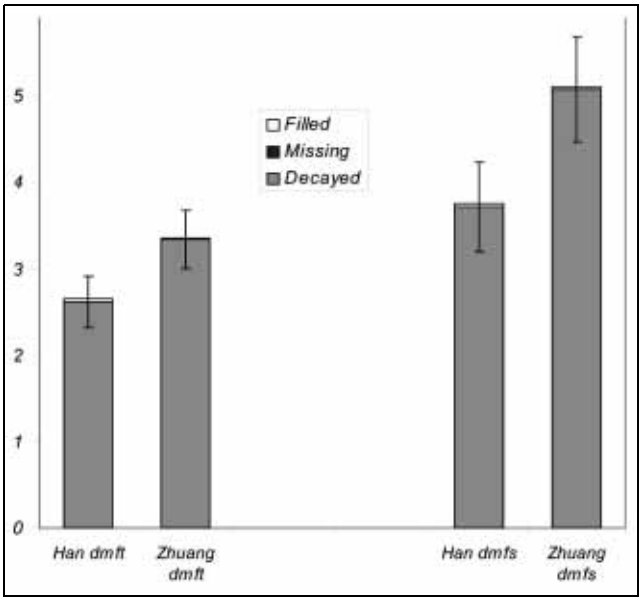


**Fig 1** Mean numbers of decayed, missing, and filled teeth and surfaces by ethnicity. * Significant difference between Han and Zhuang in mean dt (p = 0.002) and ds (p = 0.001)

(0.04 vs. 0.02) or filled surfaces (0.04 vs. 0.03) between Han and Zhuang children.

### *Oral Hygiene Practice*

Of those children who had been dentally examined, around 70% of them returned questionnaires. Table 2 shows the oral hygiene practice of Han and Zhuang children. Significant difference in frequency of toothbrushing was observed between the two ethnic groups ($p < 0.01$). The Zhuang children were less regular brushers and around 5% of them never brushed their teeth.

Few differences were observed between Han and Zhuang children in comparison to whether the child brushed with help or brushed alone, when brushing started, and whether fluoridated toothpaste was used ($p > 0.05$).

### *Dietary Behavior*

Many differences in infant feeding type between the two ethnic groups were observed (Table 2). There were 238 (69%) Han children who had been wholly breast-fed compared to 81% of Zhuang children ($p < 0.01$). More Han children had been both breast- and bottle-fed than Zhuang children (25% vs. 15%; $p < 0.01$).

During babyhood, 31% of Han children only drank milk from a feeding bottle, compared to 44% in the Zhuang group. The difference was statistically significant ($p < 0.01$). For children who also had other drinks besides milk, 52 (15%) Han children drank fruit juice from the bottle, while 37 (11%) of Zhuang children also had this drink. In addition, significantly more Han children had herbal drinks from the bottle than Zhuang children ($p < 0.01$).

### *Social Class*

The mothers of 60% of Han children had a high education level (post-secondary) compared with 53% in the Zhuang group (Table 2); the difference was not statistically significant ($p > 0.05$). Similarly no significant difference was found when comparing the educational level of fathers in the two groups.

### *Multiple Regression Analysis*

Table 3 presents the results of the regression analysis for caries experience (dmft), in which variables remaining statistically significant are summarized. This shows that ethnicity and having fruit juice in babyhood were independently related to caries experience when other variables were taken into account.

Table 4 displays the regression model predicting the presence of caries. Other factors being equal, the mother's educational level and drinking fruit drinks from a feeding bottle during babyhood had a significant independent effect on caries prevalence. Children drinking fruit juice during babyhood were twice as likely to be affected by caries compared with children who did not have this drink (OR = 2.097). The children whose mothers had a higher education level (post-secondary school) were more likely to be caries free than those children whose mothers had a lower education (secondary school or below) (OR = 0.690).

## DISCUSSION

Zhuang is the largest ethnic minority group in China. This group mainly lives in Guangxi Zhuang Autonomous Region of China. The lack of previous

**Table 2 Oral hygiene practice, dietary habit and social class by ethnicity**

| | Han | | Zhuang | |
|---|---|---|---|---|
| | N | % | N | % |
| Toothbrushing* | | | | |
| 1–2 times/day | 219 | 63.5 | 188 | 59.9 |
| Occasionally | 125 | 36.2 | 111 | 35.4 |
| Never | 1 | 0.3 | 15 | 4.8 |
| With help | 79 | 23.0 | 63 | 21.3 |
| Without help | 265 | 77.0 | 233 | 78.7 |
| Age started less than 12 months | 28 | 8.1 | 14 | 4.7 |
| Age started over 12 months | 316 | 91.9 | 285 | 95.3 |
| Fluoridated toothpaste | 124 | 36.7 | 91 | 31.1 |
| Non-fluoridated toothpaste | 214 | 63.3 | 202 | 68.9 |
| Infant feeding* | | | | |
| Breast-fed only | 238 | 69.0 | 254 | 80.9 |
| Bottle-fed only | 20 | 5.8 | 12 | 3.8 |
| Both | 87 | 25.2 | 48 | 15.3 |
| Drinks from a feeding bottle | | | | |
| Milk only* | 107 | 31.0 | 139 | 44.3 |
| Fruit juice | 52 | 15.1 | 33 | 10.5 |
| Herbal drinks* | 41 | 11.9 | 15 | 4.8 |
| Mother's education | | | | |
| Post-secondary | 205 | 59.6 | 166 | 53.0 |
| Secondary or below | 139 | 40.4 | 147 | 47.0 |
| Fathers' education | | | | |
| Post-secondary | 236 | 68.8 | 199 | 63.4 |
| Secondary or below | 107 | 31.2 | 115 | 36.6 |

* Significant difference between Han and Zhuang in toothbrushing frequency ($p = 0.001$), feeding type ($p = 0.002$), drinks from feeding bottle as a baby (milk only, $p = 0.001$; herbal drinks, $p = 0.001$)

publications on the caries status of preschool children among different ethnic groups within China inhibits comparison of data of this study with others. Some bias in the questionnaire results may be due to the two different methods of administration, i.e. self-completion versus interview, in the urban and the rural areas. The questionnaire was pilot tested in parents from urban areas and the results showed that they had no problems with completing the questionnaire by themselves. However, when the parents in the rural countryside were asked to complete the written questionnaire they came across problems in understanding and answering the questions. Thus an interview with standardized prompts was provided for parents in rural settings by an independent interviewer who was not connected with the clinical examination.

The results of the investigation revealed some differences in caries experience between the ethnic groups. Dental caries occurred more frequently and severely in children from the Zhuang groups. The association between caries and ethnicity was also

**Table 3 Results of regression analyses for caries experience (dmft). Regression coefficients (B), standard error (SE), significance (P) and 95% CI for B are specified**

| Variables | B | SE | P | 95% CI for OR | |
|---|---|---|---|---|---|
| | | | | lower | Upper |
| Ethnicity (Han/Non-Han) | 1.086 | 0.293 | 0.000 | 0.512 | 1.661 |
| Fruit juice from bottle as a baby (having/not having) | 0.945 | 0.430 | 0.028 | 0.101 | 1.790 |

**Table 4 Results of logistic regression for caries risk (prevalence). Regression coefficient (B), standard error (SE), significance (P), odds ratio (OR) with 95% CI for OR**

| Variables | B | SE | P | OR | 95% CI for OR | |
|---|---|---|---|---|---|---|
| | | | | | lower | Upper |
| Fruit juice from bottle as a baby (having/not having) | 0.740 | 0.277 | 0.007 | 2.097 | 1.219 | 3.608 |
| Mothers' education (high/low) | – 0.370 | 0.172 | 0.032 | 0.690 | 0.493 | 0.968 |

demonstrated with the multivariate regression analysis. The influence of ethnic background on caries experience (dmft) was significant; Zhuang children were more likely than Han children to be affected by caries. In China, ethnic minority groups, especially those with low populations, mostly live in isolated rural locations, where their own lifestyle, dietary habits and language/dialectics are preserved. The relatively closed lifestyle, lack of communication channels and geographic isolation may naturally limit their access to information on oral health promotion and also cause them to have less exposure to fluoride.

For both Han and Zhuang ethnic groups much of the caries experience was untreated, and the proportional percentage of filled teeth was extremely low. The low level of dental treatment might be attributed to lack of recommendations from health care organizations and limited accessibility to preventive care and treatment services. In addition, primary teeth still remain a low priority for consideration of treatment needs, based on the parental belief that they are temporary. This is particularly the case among minority ethnic groups living in rural areas.

When comparing the oral hygiene practice between the two ethnic groups, the Han children appear to be more regular tooth brushers. Apart from the fact that few statistically significant differences were detected, there were more Han children who started toothbrushing at less than 12 months, used fluoridated toothpaste and brushed with help. Furthermore, a small number of Zhuang children (around 5%) never brushed, suggesting that there is a need to provide ethnic minorities with appropriate and culturally sensitive dental health information. It has been suggested that a mono-cultural dental health promotion system fails to define and meet the needs of a minority population group whose health perceptions and behavior differ substantially from those of the mainstream (Dykes et al, 2002).

Variations among ethnic groups were also observed in terms of infant feeding practices. Significantly more Zhuang children were wholly breast-fed compared with Han children. On the other hand, more Han children had other drinks, such as fruit juice and herbal tea, besides milk from a feeding bottle during babyhood. Results of regression analysis showed that drinking fruit juice as a baby was an independent caries risk indicator.

Based on the presented results, higher levels of caries experience were found among the Zhuang ethnic minority group than among Han children. Much of the caries experience was left untreated for both ethnic groups. The construction of an oral health education programme is recommended. More specifically, such a programme should be culturally appropriate with the goal of improving the preventive dental behavior of parents from ethnic minorities, followed by their young children. Utilization of dental services should be promoted and made accessible to all ethnic groups.

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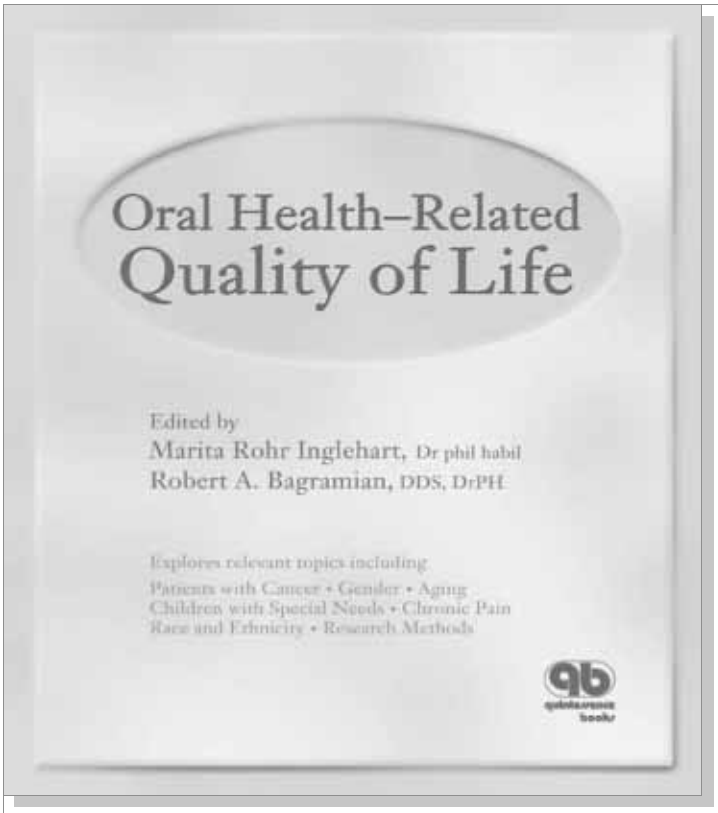


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