

A Dental Survey of a Small Group of Thai Children

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A SURVEY was undertaken by Kridakara et al.¹ in 1951 which provided data on the prevalence of dental caries in 2,300 Thai children and on their occlusal and gingival states. About half of these children were from the capital city of Bangkok and the remainder were from the provincial city of Chiang Mai and from Lampang in the northern hill country. The two latter centres are close together and about 700 kilometres north of Bangkok; although access is by no means difficult, they are not affected quite so much by the impact of western civilisation as is Bangkok. Nevertheless, there is a not inconsiderable increase in the extent of this impact at the present time (1958).

Since one of us had participated in a long term survey² of a selected group of boys and girls living in Bowral, New South Wales, who had a low prevalence of dental caries associated with a dietary regime marked by the absence of refined carbohydrates and meat (described in detail by Gilham and Lennon³ and which is a lactovegetarian diet), the opportunity was taken to make a survey of a similar age group of school children in Chiang Mai province. The examination was identical in every respect with that carried out in Australia, and the same examiner made the observations in both surveys. The examination included (1) observations on the extent of dental caries,

(2) bacteriologic examinations of the saliva (3) a qualitative analysis of the dietary program, and (4) prevalence of gingivitis and calculus.

This report will cover the first three sections.

METHODS AND MATERIALS

Four groups of children ranging in age from nine to sixteen years were examined. These groups consisted of school children attending Thai boys and girls schools in Chiang Mai and a mixed school in Sarapi Village, distant about 15 kilometres from Chiang Mai. Chiang Mai is the capital of the province of the same name, is the terminal of the northern railway system, the centre of various cottage industries and a centre for the marketing and milling of grain, timber and agricultural products. Sarapi is a village centre for agricultural workers.

The clinical examination was made in good light with a standard mirror and sharpened probes, identical in size and shape with those used in the Bowral surveys. A bite-wing radiographic survey of every child was made, with, wherever necessary, x-ray films of the anterior teeth. The clinical examinations were made by one examiner (R.H.) and the results of the examinations were subsequently compared with the radiographic examination.

Saliva was collected at a set time (10:30 A.M.) by the standard method of vigorously chewing paraffin wax and expectorating the saliva into a numbered sterile screw top bottle for a five-minute period. The bottles were then sealed with adhesive tape, placed in special fibreglass containers transported by air freight to Bangkok where they were collected and stored overnight in a refrigerator. Twenty specimens were sent in each batch as this was

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The work reported here represents part of a survey carried out in 1958 when one of the authors (R.H.) was serving as a WHO Consultant in Dental Health to the Government of Thailand.

the maximum number which could be properly processed in Bangkok. In order to maintain the saliva at an even temperature during the flight, the bottles were cooled in a refrigerator and then placed in the containers below a layer of crushed ice. Just prior to despatch the ice was removed and the space packed with cotton wool. In this way all the saliva arrived without damage and the bacteriologic procedures could be commenced as soon as the specimen had been allowed to reach room temperature.

The dietary record was obtained by interviewing each child and explaining the record sheet and method of recording the data. Each child was asked to record daily, by a stroke in the space provided, the number of servings of each item of food eaten. In order to test the comprehension of the child and to seek his cooperation, a record of the previous day's food was made, with the child's help, and checked by careful questioning so that each child was familiar with the information required and the method of recording it. The chart was designed to give the information in five food groups, and to facilitate evaluation an English translation of the name of each food was listed with the Thai language equivalent. Figure 1 shows the English translation.*

RESULTS

Table I shows the age groups of the children and the prevalence of dental caries. Of the eighty children, forty-two (52.5 per cent) were found to be caries-free (forty-seven [58.25 per cent] had no caries in the permanent dentition). Thirty-seven children had mixed dentitions and of these, twenty were caries-free. Of the forty-three children with permanent dentitions, twenty-two were caries-free.

The average prevalence of dental caries per child (for all the permanent teeth) expressed as DMF teeth† is:

* The dentist from Chieng Mai Hospital and class teachers cooperated in additional explanation and supervision of the daily food record.

† D = decayed; M = missing (extracted because of disease); F = filled in the permanent teeth.

Name _____ Birthday _____ Sex _____ No. _____

Please mark in the appropriate column with a ✓ the number of servings of foods each day.

Food Groups	Days							Total
	1	2	3	4	5	6	7	
Protein								
Pork, chicken, beef								
Egg								
Fat								
Lard, coconut								
Carbohydrate								
Rice								
"Glutinous" rice								
White noodle								
Yellow noodle								
Fruits and Vegetables								
Banana								
Orange, tomato								
Pineapple								
Papaya								
Mangkut								
Jack fruit								
Pumpkin								
Leaf vegetable								
Bean, bean sprout								
Confectionery								
Ice cream								
Coconut milk								
Lollies								
Toffee								
Coca-Cola								
Condensed milk								
Food in syrup								
Total								

FIG. 1. Form of diet record sheet used in survey of Chieng Mai and Sarapi Village school children.

- (1) All children, 1.12 DMF teeth;
- (2) Chieng Mai children, 1.97 DMF teeth;
- (3) Sarapi Village children, 0.27 DMF teeth.

Since there is always a difficulty of expressing accurately the prevalence of dental caries in the deciduous dentition, we have used a figure which shows the percentage of carious deciduous teeth, the df‡ teeth per 100 deciduous teeth as follows:

- (1) All children, 13.8 per cent;
- (2) Chieng Mai children, 19.4 per cent;
- (3) Sarapi Village children, 9.1 per cent.

The assessment of the experience of dental caries, using bite-wing films as a further aid, demonstrated six carious permanent teeth and one carious deciduous tooth, missed by clinical examination, but also eliminated eight deciduous teeth marked as having carious lesions on proximal surfaces.

‡ d = decayed; f = filled in the deciduous teeth.

TABLE I
Prevalence of Dental Caries of Eighty Thai Children Aged Nine to Sixteen Years

Age Group (yr.)	Average Age (yr. and mo.)*	No. of Children	No. of Mixed Denti-tions	No. of Perma-nent Denti-tions	Carious Teeth		Average Carious Teeth		Caries-Free Mouths	
					df†	DMF	df*	DMF*	Mixed Denti-tions	Perma-nent Denti-tions
<i>Chieng Mai</i>										
Girls:										
9-11	10.6(6.4)	10	8	2	20(60)	15	2.0(2.4)	1.5(1.75)	2	0
12-14	13.10(5.5)	6	..	6	...	25	...	4.16(5.0)	..	0
15-16	15.3(5.2)	4	..	4	...	5	...	1.25(1.7)	..	2
Boys:										
9-11	10.4(7.9)	9	4	5	1(30)	15	0.1(0.1)	1.66(2.5)	2	3
12-14	12.3(5.5)	11	5	6	0(18)	19	..	1.81(2.34)	3	1
Boys and Girls										
9-16	13.2(16.0)	40	17	23	21(108)	79	0.52(2.14)	1.97(2.9)	7	6
<i>Sarapi Village</i>										
Girls:										
9-11	10.4(8.7)	15	9	6	5(72)	9	0.33(0.97)	0.6(0.95)	5	4
12-14	12.11(5.4)	5	..	5	...	1	...	0.2(0.38)	..	4
Boys:										
9-11	10.1(10.0)	7	6	1	7(44)	0	1.0(1.2)	0(...)	3	1
12-14	12.11(10.0)	13	5	8	0(15)	1	0	0.07(0.33)	5	7
Boys and Girls										
9-14	12.1(15.4)	40	20	20	12(131)	11	0.30(1.79)	0.27(0.48)	13	16

* Standard deviations are given in parentheses.

† Figures in parentheses in this column are total number of deciduous teeth.

Table II shows the results of the dietary surveys, the range of lactobacillus acidophilus estimations and the Snyder colorimetric tests, and the relation between these diagnostic aids and the presence or absence of dental caries.

By relating the bacteriologic examinations of the saliva with the presence or absence of dental caries, fourfold tables were constructed which showed that only in the Chieng Mai children was there some relationship between the presence of lactobacilli and dental caries, and it is slightly significant ($\chi^2 = 2.887$, $P < 0.10$). The correlation between the Snyder

test and dental caries is poor in all groups, P being greater than 0.70 in each case. The limitations in using the single lactobacillus acidophilus counts and Snyder tests as diagnostic aids in assessing dental caries activity is recognised and is discussed later.

Table II also shows the general pattern of the eating habits of these children; fruit and vegetables were consumed somewhat more extensively than other food groups, the girls in both groups had more servings than the boys and confectionery was consumed much less by the village children than by those from the city.

TABLE II
Diet Pattern and Prevalence of Dental Caries Compared with Saliva Examinations of Seventy-Four* Thai Children

Age Group (yr.)	No.	Average Servings of Food During Five-Day Period						Prevalence of Caries		Lactobacillus Count			Snyder Test		
		Protein	Fat	Fruits and Vegetables	Carbohydrates	Confectionery	Total	df Teeth	DMF Teeth	0 to 999†	1,000 to 9,999	> 10,000	-	+	++
<i>Chiang Mai</i>															
Girls:															
9-11	9	15.2	3.7	13.2	13.3	5.2	50.6	1.8	1.5	6	..	2	4	..	4
12-14	5	11.5	2.5	12.3	11.6	9.6	47.5	...	4.8	3	2	1	1	1	4
15-16	4	14.0	4.5	18.7	12.7	8.2	58.1	...	1.25	4	2	2	..
Total	18	13.7	3.5	14.0	12.6	7.3	51.3	1.0	2.25	13(11)	2	3	7	3	8
Boys:															
9-11	9	13.8	3.4	13.7	11.4	5.3	47.2	0.1	1.66	5	3	1	3	1	5
12-14	10	12.1	2.4	12.7	12.4	5.6	45.2	0	1.81	6	3	1	2	2	6
Total	19	12.4	2.8	13.2	12.0	5.5	48.9	0.05	1.7	11(10)	6	2	5	3	11
<i>Sarapi Village</i>															
Girls:															
9-11	14	15.5	2.8	20.1	15.0	3.1	56.5	0.33	0.6	13	1	..	2	3	11
12-14	5	14.0	2.4	26.0	13.8	4.5	61.6	...	0.2	3	1	1	2	..	1
Total	19	15.1	2.7	21.6	14.6	3.7	57.8	0.26	0.52	16(11)	2	1	4	3	12
Boys:															
9-11	6	12.6	1.0	12.5	12.5	3.0	43.6	1.0	0.0	3	2	..	3	1	2
12-14	12	12.3	1.4	16.2	16.1	1.1	47.1	0	0.07	8	2	3	6	1	5
Total	18	12.4	1.4	15.5	15.0	2.4	46.8	0.38	0.05	11(9)	4	3	9	2	7

Correlation

Group	Lactobacillus				Snyder Test			
	Present		Absent		Negative		Positive	
	Caries	Caries-Free	Caries	Caries-Free	Caries	Caries-Free	Caries	Caries-Free
Chiang Mai†	15	3	11	10	6	3	20	10
Sarapi Village§	5	15	6	14	3	10	8	19
All children	20	18	17	24	9	13	28	29

* The smaller number arises because observations have been recorded on those children who returned satisfactorily completed records.

† Figures in parentheses are numbers of negative counts.

‡ Lactobacillus: $\chi^2 = 2.887$; $P < 0.10$. Snyder: $\chi^2 = 0.131$; $P > 0.70$.

§ Lactobacillus: $\chi^2 = 0.268$; $P > 0.50$. Snyder: $\chi^2 = 0.007$; $P > 0.95$.

|| Lactobacillus: $\chi^2 = 1.209$; $P > 0.30$. Snyder: $\chi^2 = 0.005$; $P > 0.95$.



TABLE III
Relation Between Food Groups and Experience of Dental Caries in Seventy-Four Thai Children

Group	No.	Average Servings of Food Groups for Five Days			Average Prevalence of Dental Caries	
		Carbo- hydrate*	Confec- tionery	Fruits and Vegetables	df Teeth	DMF Teeth
<i>Chieng Mai</i>						
Girls	18	12.6(4.9)	7.3	14.0	1.0	2.2
Boys	19	12.0(6.2)	5.5	13.2	0.05	1.9
<i>Sarapi Village</i>						
Girls	19	14.6(11.8)	3.7	21.6	0.26	0.52
Boys	18	15.0(12.3)	2.4	15.6	0.38	0.05

* Figures in parentheses show servings of glutinous rice.

Table III has been prepared to show this pattern and the prevalence of dental caries. There is a further difference in the composition of the carbohydrate foods (a distinction is here made separating confectionery and carbohydrate foods). The consumption of glutinous rice* is much higher in the children from the rural area. It is a custom which we observed commonly in the rural area among children of all ages.

A comparative picture of the experience of dental caries of these children may be seen in Table IV in which the data on the experience of dental caries of the Thai children, those from the Hopewood House² and those from the State School (N.S.W.)⁴ are given. The age group nine to thirteen years is presented because this age range is common to all three studies. It will be seen that there is a low experience of dental caries in the Thai children,

* Glutinous rice as eaten in this area is unrefined, frequently pounded in the home. It is prepared for eating by soaking the raw grain for about twelve to seventeen hours in water. The water is poured off and the rice is steamed until cooked. As its name implies, it has a higher gluten content than other forms and when prepared has a greyish colour; the grains stick together. When chewed, the bolus of food does not readily adhere to the tooth surfaces and in the many samples examined seemed to have a texture more like coconut.

and that the children from the Hopewood House have a similar low experience.

COMMENTS

The general pattern of the two groups of Thai children is clear. The prevalence of dental caries of the children in Chieng Mai based on the average DMF teeth is seven times that of the children from Sarapi Village: the percentage of carious deciduous teeth of the children in Chieng Mai is twice that of the children from Sarapi Village. In the case of the permanent teeth in the girls, it should be noted for the nine to eleven year age groups the differences are not so marked and in the twelve to fourteen year age groups where there appears to be a marked difference the two groups have a marked difference in the standard deviations. The two groups combined have about the same prevalence of caries as those children of similar age having a diet free of refined carbohydrates living in a home (Hopewood House Bowral, N.S.W.) and a very much lower prevalence of dental caries than a group of comparable age from schools in metropolitan and rural areas in New South Wales. Table IV shows this difference to be very marked in the thirteen year old children.

Only a limited interpretation should be given to the lactobacillus counts, since single deter-

TABLE IV

Comparison of the Average Number of DMF Teeth of Sixty-Nine Thai Children with That of Similar Age Groups of Children at Hopewood House, Bowral² and Attending State Schools in New South Wales⁴
(Average DMF Teeth for Each Age Group)

Group	Age (yr.)				
	9	10	11	12	13
Thai children	0.1(0.31)	1.64(2.23)	0.83(1.26)	0.74(1.62)	0.37(0.51)
Hopewood children	0.41(0.84)	0.38(0.82)	0.61(1.28)	1.08(1.90)	1.06(1.78)
State School children (N.S.W.)	4.44(2.32)	5.28(3.08)	6.98(4.10)	9.32(5.33)	10.70(5.15)

NOTE: Standard deviations are in parentheses.

minations may vary not only in the one individual⁵ but also in aliquot parts from the same sample⁶ in regard to any significance in relation to their magnitude and the pattern of dental caries existing at the time of the observations. However, Snyder colorimetric tests showed correlation with lactobacillus counts to the extent that when the latter was above 1,000 the Snyder test was 2 plus. The corollary to this did not hold, especially with the Sarapi Village girls in which group twelve had Snyder 2 plus but only three of these had lactobacillus counts above 1,000. Goldworthy⁷ has drawn attention to this problem and says "the question of duration of the 'infected' state of the mouth by *Lactobacillus* spp. is liable to be ignored." He demonstrated that there was a statistically significant association between the presence of various lactobacilli and the existence of untreated and therefore possibly active caries. He also showed that among the group of children referred to,² twenty-five caries-free children "yielded lactobacillus counts of various magnitudes and 20 per cent of such children had at least one count in excess of 10,000 at some one or other of the annual examinations."

NUTRITIONAL ASPECTS

The dietary pattern between the two groups of Thai children differs to the extent that confectionery is eaten more extensively by the city children and that the rural children eat more fruit and vegetables and unrefined glutinous rice. When setting out to obtain

information to enable a pattern of dietary habits to be determined the need of obtaining cooperation from the children was realised. In this matter the class teachers played a most helpful role, aided by the dentist in the area. The data give the broad pattern of the eating habits. Our own observations in the numerous visits to schools and health centres confirmed the recorded data that glutinous rice was eaten extensively in the rural areas. Socio-economic factors may have played a part in the reduction in amount of confectionery consumed by the village children.

Chandrapanond,⁸ in a survey of dietary patterns in Thailand, has pointed out that the daily average intake is low in calories (1,800) protein (47 gm.) and calcium (180 mg.) as well as in iron, vitamins B₁, B-complex and C. She has shown that the dietary pattern in some provinces remains severely restricted to whatever foods are available at the time, in contradistinction to the food supply in Bangkok. Basically, provincial diets depend on a large percentage of rice in either white, milled or "glutinous" forms. The average daily diet of the people of Chiang Mai has about 400 calories more than the average for people in Bangkok. Since "glutinous" rice is grown extensively, the farmers have adequate supplies for food. Neilson⁹ has observed that the Thais have enough rice to ensure a sufficient caloric intake, but often the glutinous rice is eaten without an accompaniment, when it is made into balls with the fingers and dipped in chili sauce. Because of the method of thresh-



ing, husking and winnowing, it is not completely decorticated and it does not adhere to the teeth.

Table III demonstrates a lower prevalence of caries associated with reduced intake of confectionery, a higher intake of fruits and vegetables and a higher proportion of "glutinous" unrefined rice.

SUMMARY

A group of provincial Thai children were examined clinically and radiographically in order to determine the prevalence of dental caries. Bacteriologic examinations were made of their saliva. A pattern of dietary habits was recorded and indicated a difference between city and rural communities.

The prevalence of dental caries was less in the rural areas and of the whole group was comparable with a special group in Australia, but had a considerably lower prevalence than a group from the general Australian community of the same age. The prevalence of dental caries was lowest in the rural area where less refined carbohydrates and more fruits and vegetables and glutinous rice were eaten.

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