

## The relationship between diet and dental caries in 2 and 4 year old children in the Emirate of Abu Dhabi

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الهدف من هذه الدراسة هو تحديد العلاقة بين أسلوب التغذية والنخر السني عند أطفال من الامارات (أبو ظبي) تتراوح أعمارهم بين ٢ الى ٤ سنوات .  
ثلاثة مناطق من الامارات (أبو ظبي) شملتها هذه الدراسة وتم اختيار عينة عشوائية من الأطفال عددها (١٦٠ طفلاً) وقسمت الى مجموعتين (٨٠ طفلاً في كل مجموعة) حسب  
أعمارهم ، و (١٢٠ طفلاً) من العين (٦٠ طفلاً في كل مجموعة) ، و (١٢٠ طفلاً) من المنطقة الغربية (٦٠ طفلاً في كل مجموعة) كلها اختيرت عشوائياً ، الاختيار تم من مراكز  
التوليد وصحة الطفل ومن روضة الأطفال . وتم ارسال الاستبيان الى والدي الطفل ملته بالمعلومات عن الأسلوب الغذائي للأطفال قبل فحص أسنانهم . تم اجراء الفحوصات السريرية  
كلها بواسطة خبير وطبقاً لمعيار منظمة الصحة العالمية .

وتم تحليل المعلومات للتحقق من مدى انتشار النخر السني على مرحلتين مستخدمين برنامج spss

. وكان النخر مرتفعاً ما بين ١٧،٧ الى ٢٨،٨ في الأطفال الذين أعمارهم سنتين ، و ١٥،١ الى ٦٢،٢ كانت نسبة النخر عند الأطفال بعمر ٤ سنوات .

وكانت نسبة النخر تتراوح من ٣٦% الى ٤٧% للأطفال بعمر سنتين و ٧١% الى ٨٦% للأطفال بأعمار ٤ سنوات . ويمكن أن نستنتج من هذه الدراسة أن أسلوب تغذية الأطفال  
له علاقة بحدوث النخر .

The aim of this study was to determine the relationship between dietary behaviour and dental caries in 2 and 4 year old children in the Emirate of Abu Dhabi. All three regions of the Emirate of Abu Dhabi were included. In Abu Dhabi, 160 children (80 in each age group), 120 in Al-Ain (60 in each age group) and 120 in the Western Region (60 in each age group) were selected randomly. Selection was made from the Maternity and Child Health Centres for the 2 year olds in Abu Dhabi, Al-Ain and Western Region and for 4 year olds in Al-Ain and Western Region, while four year olds in Abu Dhabi were selected from kindergartens. A questionnaire requiring information on dietary behaviour of the children was sent to parents before the child was dentally examined. All clinical examinations were conducted by one trained examiner, using the World Health Organization (WHO) criteria. Data were analysed for prevalence and experience of dental caries in two steps (bi-variate and multivariate), using an SPSS programme. Caries experience was high: it ranged from 1.7 dmft to 2.8 dmft in 2 year olds and from 5.1 to 6.2 dmft in 4 year olds. The prevalence of dental caries ranged from 36% to 47% in 2 year olds and from 71% to 86% in 4 year olds. The dietary factors related to caries prevalence and experience in these children in the Emirate of Abu Dhabi were 'preparation of the food for the child between meals by the maid, father or grandparents', 'feeding of the child by grandparents when parents are away', 'types of foods in the main meals', 'eating frequency between meals', 'types of drinks between meals' and 'types of foods between meals'. It can be concluded that the way young children are fed is related to the occurrence of dental caries. Qualitative studies are needed to find a way to reduce this problem.

### Introduction

The Emirate of Abu Dhabi is the largest and the most populated emirate in the United Arab Emirates. It contains three main regions: Abu Dhabi, the largest region, encompassing a population of 628,020; Al-Ain, the second largest region containing 324,168 people and the Western Region the least populated region, containing 64,812.<sup>1</sup> Over the past 25 years, the emirate has undergone several changes in terms of sources of drinking water and eating habits. The main source of drinking water in the emirate, today, is desalinated water from the sea and the concentration of fluoride in this water is very low.

Studies on eating habits in the emirate have been scanty, but a national survey in the UAE about 10 years ago showed that 70% of families

purchased 'fast foods'.<sup>2</sup> No information on food consumption in young children in the Emirate appears to be available. Considering the similarity in culture and the similar effect of modernisation in the Gulf countries, it can be noted that some studies in these countries have shown an increase in consumption of sweets in children's diet. For example, a study in Riyadh, Saudi Arabia, showed that young children aged 17 months had started to eat cariogenic snacks, such as chocolates, sweets, dates, bakery products and ice cream about twice a day, with no proper oral hygiene: the mean dmft of children aged 4-6 years in this study was reported to be 6.9.<sup>3</sup> In Kuwait, 12% of pre-school children had experienced nursing caries and the study highlighted the use of sweetened drinks in bottles by these children.<sup>4</sup>

In the Emirate of Abu Dhabi, severity of dental caries has increased between 1991 and 1996. Ten years ago, the mean dmft of 5 year olds was reported to be 5.1, 5.0 and 3.1 in city, rural and

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private schools in Abu Dhabi, respectively,<sup>5</sup> while in 1996, a mean dmft of 8.4 in 5 year olds in Abu Dhabi was reported.<sup>6</sup> In this study, children aged 2 and 4 years were also included. Mean dmft of 1.7, 3.2 and 2.8 were recorded in 2 year olds in Abu Dhabi, Al-Ain and the Western Region, respectively, while the mean dmft for 4 year old children was 6.2, 5.2 and 5.1 in the same three regions.

Holm<sup>7</sup> reviewed information on dental caries in young children in many developing and developed countries. Changes in diet and especially increasingly frequent consumption of sugar were the main explanations for the high caries experience in many developing countries. A study in Riyadh, Saudi Arabia, investigated the caries experience in 2 and 4 year old children according to their socio-economic status: mean dmft of 1.7 and 0.4 in 2 year olds and 3.0 and 0.7 in 4 year olds from low and high socio-economic groups respectively, were reported.<sup>8</sup>

There are some measures that seem important in caries prevention: controlling the amount of sugar intake by individuals in their diet and the optimum use of fluoride are two important measures.<sup>9-10</sup> This study was carried out to investigate the relationship between diet and dental caries prevalence and experience in young children aged 2 and 4 years in the Emirate of Abu Dhabi.

### Materials and Methods

The study was undertaken in 1996 in the three regions of the Emirate of Abu Dhabi - Abu Dhabi, Al-Ain and Western Region. Kindergartens (KG) and health centres (HC) were the sampling units in this study. The target numbers to be sampled in each region for each of the two age groups were 80 in Abu Dhabi, 60 in Al-Ain and 60 in Western Region, so as to make a total of 160 children in Abu Dhabi, 120 children in Al-Ain and 120 in the Western Region. A total of 12 KGs and HCs were therefore selected randomly in Abu Dhabi (six for each age group), 10 in Al-Ain (5 for each age group) and 6 in the Western Region (3 for each age group). The 2 year old children in the three regions were selected randomly from these Maternity and Child Health Centres. Four year old children in Abu Dhabi were selected randomly from a centrally held list provided by the Ministry of Education, while in the two other regions selection was via Maternity and Child Health Centres. The number of children sampled in each KG or HC was in proportion to the number in the KG or HC, so that each child had the same chance of being selected.<sup>6</sup>

A questionnaire, requesting information on dietary behaviour, was sent to parents before the child was dentally examined. It included 12 questions concerning children's dietary behaviour at meals and in-between meals, frequency of eating, types of foods eaten by children, use of sweetened chewing gum, breast-feeding and feeding at bed-time. Parents who were unable to complete the questionnaire were assisted by the reception staff prior to the dental examination.

All clinical examinations were conducted by one trained examiner, using the WHO criteria and the WHO assessment form for dental caries in deciduous teeth.<sup>11</sup> These data were obtained to investigate the relationship between caries prevalence and experience and dietary behaviour in 2 and 4 year old children. A 10% re-examination of children was undertaken, with children being selected without the examiner's knowledge. Details of the description of the methods used for recording dental caries were reported earlier.<sup>6</sup>

The data were analysed using an SPSS programme. The relationships between the questionnaire responses and caries prevalence and experience were detected by bivariate analysis, using Chi square test for caries prevalence, and t-test and one way ANOVA for caries experience (dmft). Multivariate logistic regression analysis was used to identify the influence of the dietary variables on dental caries prevalence, while multivariate linear regression analysis was used to study the influence of these factors on dental caries experience (dmft). The level of probability chosen to indicate which variables were strongly related to caries occurrence in multivariate analyses was 0.1, as the study was exploratory.<sup>12</sup>

### Results

All 28 kindergartens and health centres sampled agreed to participate in the study. In the three regions, 421 children, of whom 207 were males and 214 were females, participated in the study (Table 1). Only eleven children from the two age groups in the three regions did not consent to take part (2.8%). The reliability coefficient<sup>13</sup> for re-examination of 10% of the children for dmft was 0.98, which indicates an error variance of 2%. Dental caries prevalence and experience for both age groups have been reported in a previous publication,<sup>6</sup> but relevant results are presented in Table 2. Prevalence ranged from 36% to 47% in 2 year olds, and from 71 % to 86% in 4 year olds. The mean dmft ranged from 1.7 to 3.2 in 2 year olds,

and 5.1 to 6.2 in 4 year olds, in the three regions.

**Table 1.** Number and gender of children who participated in the study in the three regions.

Age (y)	Region			Gender		Total
	Abu Dhabi	Al-Ain	Western Region	Male	Female	
2	93	62	62	112	105	227
4	77	61	66	95	109	204
Total	170	123	128	207	214	421

**Table 2.** Dental caries prevalence and experience in 2 and 4 year old children in the three regions.

Age (y)	Abu Dhabi		Al-Ain		Western Region	
	% prevalence	dmft (SE)	% prevalence	dmft (SE)	% prevalence	dmft (SE)
2	36	1.7(0.34)	45	3.2(0.61)	47	2.8 (0.49)
4	86	6.2 (0.59)	74	5.2 (0.66)	71	5.1 (0.65)

SE = standard error of the mean

**Table 3.** Bivariate relationship between dental caries prevalence and a number of dietary factors. Data presented as the percentage of children according to categories and the percentage of children who had caries.

Variable	Category	Percent(n) of Children according to Category	Percent(n) of Children in Category who had Caries	P-Value
Who prepares food for the child in-between meals	1 =Mother	80.0 (337)	55.5 (187)	2 0.006
	2=Father, g.father, g.mother, others	8.6 (36)	63.9 (23)	
	3=Maid	11.4 (48)	79.2 (38)	
Who often feeds the children when parents are away	1=Mother( never been away)	61.8 (260)	61.9 (161)	2 0.015
	2=G.mother, g.father, other	20.4 (86)	62.8 (54)	
	3=Maid	17.8 (75)	44.0 (33)	
Types of foods in the main meals	1=Rice, meats	40.9 (172)	59.9 (103)	2 0.07
	2=Milk, fresh fruits	28.0 (118)	55.1 (65)	
	3=Biscuits, other sweets	5.7 (24)	70.8 (17)	
	4=All of the above	25.4 (107)	58.9 (63)	
Eating frequency	1 = 3 times a day	61.8 (260)	59.6 (155)	1 0.36
	2= 4-5 times a day	30.2 (127)	60.6 (77)	
	3= more than 5 times a day	8.1 (34)	47.1 (16)	
Eating frequency in-between meals	1=1 time	19.7 (83)	51.8 (43)	2 0.12 <sup>1</sup>
	2=2 times	55.1 (232)	59.5 (138)	
	3=More than 2 times	25.2 (106)	63.2 (67)	
Types of drinks in-between meals	1=Tea, coffee, natural fruit juices, milk	87.6 (369)	58.0 (214)	2 0.31
	2=Soft drinks, other fruit juices, other drinks	12.4 (52)	65.4 (34)	
Who usually feeds the children	1 = Mother, mother/father	93.8 (395)	59.5 (235)	2 0.34
	2=Father, g.mother, g.father, maid, all	6.2 (26)	50.0 (13)	
Feeding practice at bedtime	Yes	41.8 (176)	61.4 (108)	2 0.38
	No	58.2 (245)	57.1 (140)	
Breast feeding practice	1= None, birth to six month	27.3 (115)	56.5 (65)	1 0.54
	2= More than six months	72.7 (306)	59.8 (183)	
Frequency of chewing sweetened gum	1= None	41.3 (174)	60.3 (105)	1 0.69
	2=1 time a day	34.0 (143)	53.1 (76)	
	3= More than 1 time a day	24.7 (104)	64.4 (67)	
Types of foods in-between meals	1 =Biscuit, other fruits	54.4 (229)	58.5 (134)	2 0.86
	2=Fresh fruits	45.6 (192)	59.4 (114)	
Frequency of eating pastries	1=None	40.9 (172)	57.6 (99)	1 0.87
	2=One or two times a day	54.2 (228)	60.5 (138)	
	3= More than two times a day	5.0 (21)	52.4 (11)	
Types of foods at bedtime	1=Milk with sugar, fruit juice with sugar, other sweets	61.9 (109)	61.5 (67)	2 0.97
	2=Milk w/out sugar, fruit juice without sugar, tea	38.1 (67)	61.2 (41)	

P values obtained by Chi Square tests. 1 - Denotes linear association test. 2 - Denotes Pearson Chi Square test.

A number of dietary factors investigated in this study were related to caries prevalence and experience in these 2 and 4 year old children. Who prepares food for the children in between meals', who often feeds the children when parents were away', and types of foods taken by children in the main meals' were variables most strongly related to dental caries prevalence in the bi-variate analysis (Table 3). Children who had their food prepared by maids had the highest caries level. Those who were fed by grandparents or other relatives when parents were away from home had also higher dental caries. Consumption of biscuits and other sweets eaten in the main meals were related to high caries prevalence in these children. In the multivariate logistic regression analysis, only two factors were strongly associated with caries prevalence in these children (Table 4). The risk factors were grandparents feeding the children when parents were away and other relatives in the family other than parents, and frequency of eating more than three times a day.

**Table 4.** Dietary factors related to dental caries prevalence determined by multivariate logistic regression analysis. P values given in bold when p<0.1.

Variables	Risk Factors	P-Value
Who often feeds the children when parents are away	Grandparents and others in the family	<b>0.02</b>
Eating frequency in-between meals	More than three times	<b>0.03</b>
Who prepares food for the children		0.32
Types of foods in-between meals		0.34
Eating frequency		0.35
Who usually feeds the children		0.48
Frequency of eating pastries		0.58
Breast feeding practice		0.60
Feeding practice at bedtime		0.78
Types of foods in the main meals		0.82
Types of foods at bedtime		0.88
Frequency of chewing sweetened gum		0.93

For caries experience (dmft), bi-variate analysis showed that four dietary factors were moderately strongly related to caries experience in 2 and 4 year old children in the Emirate: eating frequency in-between meals', who often feeds the children when parents were away', who prepares food for

the children', and types of drinks in-between meals' (Table 5). The mean dmft in children who ate more than twice a day between meals was 5.1 compared with 3.2 dmft in children who ate only once between meals. Dental caries experience in children who were fed by their mothers was high: these mothers were always at home and never left their children to be fed by others, a mean dmft of 4.4 was recorded in these children. As in the analyses for caries prevalence, children who were fed by maids experienced more dental caries than those fed by others, a mean dmft of 5.5 was recorded in these children. Soft drinks and other sweetened drinks were also revealed to affect dental health of these children. Those who had soft drinks, sweetened fruit juice and other sweetened juices in-between meals had a higher level of dental caries.

Multivariate linear regression analysis revealed associations between four dietary factors and caries experience (Table 6): who fed the children when parents were away', eating frequency in-between meals', who prepares food for the children in-between meals', and types of foods in-between meals' were related to dental caries experience in 2 and 4 year old children. As in the above logistic analysis, mothers who were at home and feed their children' were a risk factor as children of these mothers had the highest dental caries experience. Those who ate more than three times a day were more at risk of dental caries compared with those who ate less. The maid was also a risk factor when they prepare food for these young children. Biscuits and other sweetened fruits were risk factors when eaten in-between meals.

### Discussion

The three regions of the Emirate were included because of the very high caries prevalence and experience in these young children. The sample size was estimated according to the WHO criteria and a larger number of children were sampled in Abu Dhabi because it is the largest and the most populated region. Kindergartens and health centres were selected randomly within each region and children in these schools and health centres were also selected randomly from lists provided by the Ministries of Education and Health which contained the names and dates of birth of these children. The WHO criteria<sup>11</sup> for examination of dental caries at the cavitation stage were used to record dental caries. Examination of 2 year olds was slightly difficult, although parents'

**Table 5.** Bivariate relationship between dental caries experience (dmft) and a number of dietary factors.

Variable	Category	Mean dmft (SE)		P-value
Eating frequency in-between meals	1=1-time	3.19	(0.50)	1 0.01
	2=2 times	3.68	(0.30)	
	3=More than 2-times	5.14	(0.54)	
Who often feeds the children when parents are away	1=Mother (never been away)	4.37	(0.31)	1 0.05
	2=G.mother,g.father, other	3.62	(0.50)	
	3=Maid	2.87	(0.53)	
Who prepares food for the children	1 =Mother	3.71	(0.27)	1 0.06
	2=Father, g.mother, g.father, others	4.19	(0.80)	
	3=Maid	5.46	(0.68)	
Types of drinks in-between meals	1=Tea, coffee, natural fruit juices, milk	3.79	(0.25)	2 0.07
	2=Soft drinks, other fruit juice, other drinks	5.08	(0.76)	
Types of foods in-between meals	1=Biscuit, other fruits	4.30	(0.34)	2 0.11
	2=Fresh fruits	3.54	(0.32)	
Frequency of eating pastries	1=None	3.85	(0.38)	1 0.26
	2=1-timeaday	2.92	(0.57)	
	3=2-times a day	4.26	(0.36)	
	4=More than 2-times a day	3.71	(1.06)	
Breast feeding practice	1=Birth-I -month	4.69	(1.33)	1 0.26
	2=1-2 months	4.11	(0.99)	
	3=Until 6-months	2.75	(0.40)	
	4=More than 6-months	4.12	(0.28)	
Who usually feeds the children	1=Mother,mother and father	4.01	(0.24)	2 0.30
	2=G.mother,g.father, maid, all	3.00	(0.97)	
Frequency of chewing sweetened gum	1=None	3.77	(0.36)	1 0.35
	2=1-timeaday	3.73	(0.40)	
	3=More than 1-time a day	4.55	(0.51)	
Eating frequency	3 times a day	4.01	(0.30)	1 0.62
	4-5 times a day	4.04	(0.44)	
	More than 5 times a day	3.18	(0.86)	
Feeding practice at bedtime	Yes	4.43	(0.38)	2 0.78
	No	3.60	(0.30)	
Types of foods at bedtime	1=Sweet tea, milk w/sugar, fruit juice w/sugar	4.45	(0.47)	2 0.87
	2=Milk w/out sugar, fruit juice w/out sugar	4.32	(0.63)	
Types of foods in the main meals	1 =Rice, meats	3.32	(0.37)	1 0.95
	2=Milk, fresh fruits	4.51	(0.55)	
	3=Biscuits, other sweets	1.53	(0.58)	
	4=All	3.22	(0.71)	

1 - Denotes one way ANOVA

2 - Denotes independent sample t-test

cooperation was important for the success of this investigation. All clinical examinations were made by a trained examiner and a 10% re-examination of children revealed high reliability. The response rate for the questionnaire (98%) was high.

Data analysis was undertaken in two steps: to determine dental caries prevalence and experience, and to relate various possible risk factors to dental caries prevalence and experience. While bi-variate analyses are useful for observing relationships, these relationships can

be influenced by confounding factors: multivariate analysis was used to remove the effect of possible confounders, if they were included in the model.

The results of this study revealed that dental caries prevalence and experience was high in both age groups and in all three regions. The dmft of 2 and 4 year olds in the Emirate of Abu Dhabi is higher than 1.7 and 0.4 dmft in 2 year olds and 3.0 and 0.7 in 4 year olds reported<sup>8</sup> in Riyadh, Saudi Arabia. The mean dmft of 5.6 in 4 year olds in the Emirate is also much higher than that reported<sup>14</sup> in

Table 6. Multivariate linear regression analysis to determine the relation between dietary factors and dental caries experience (dmft). P values given in bold when  $p < 0.1$ .

Variables	Risk Factors	P-Value
Who feeds the children when parents are away	Mother	<b>0.001</b>
Eating frequency in-between meals	More than three times	<b>0.01</b>
Who prepares food for children in-between meals	Maids	<b>0.02</b>
Types of foods in-between meals	Biscuits, other fruits	<b>0.07</b>
Types of food/drink at bedtime		0.20
Frequency of chewing sweetened gum		0.30
Types of drinks in-between meals		0.31
Types of foods in the main meals		0.31
Frequency of eating pastries		0.38
Eating frequency		0.57
Breast-feeding practice		0.60
Who feeds the children		0.66
Feeding practice at bedtime		0.66

Gizan, Saudi Arabia (dmft of 1.2 in 3 to 4 year olds) and dmft of 2.4 in children between the ages of 1.4 and 4.4 years in Kuwait.<sup>15</sup>

In this study, some dietary factors were related to dental caries prevalence and experience in 2 and 4 year old children. There is no doubt that consumption of sugar is positively associated with increased experience of dental caries.<sup>9-1016</sup> However, the way in which sugar is eaten or drunk varies between countries, so that it is important to look at the influence of different sugar-eating habits on caries development. In this study, children who ate more sweets had higher dental caries experience, and the increased availability of sugar-containing products in the Emirate might have been responsible for increased consumption by young children. There would appear to be no previous information regarding the feeding practices of young children in the Emirate of Abu Dhabi, but this issue has been investigated in Kuwait<sup>15</sup> showing that bottle-fed children were more likely to develop dental caries.

Associations between sugar-consumption and dental caries at the age of 12 and 18 months have been reported in Sweden,<sup>17</sup> and in the UK using cross-sectional data of pre-school children.<sup>18,19</sup> In the developing countries, changes in the diet have been considered to be responsible for high caries

experience in many young children.<sup>7</sup> Sugar consumption introduced in infancy is maintained throughout childhood<sup>20</sup> and frequency of eating in-between meals, particularly sweets, associated with caries development.<sup>20,21</sup>

The effect of preparation of children's diets by a variety of people, whether mothers, other relatives or maids needs further investigation. Interviewing people who are responsible for children's diet might be an appropriate way for collecting information on their attitudes towards the diet of young children.

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