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# Breast-feeding and early childhood caries: an assessment among Brazilian infants

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**Summary.** *Objectives.* The purpose of the present study was to evaluate early childhood caries among 12–36-month-old children from families living in poor socio-economic conditions in the city of Recife, Brazil, its association with the type and duration of feeding (e.g. natural, sugared, bottle and glass), as well as the relationship between a supplementary diet and the occurrence of this type of caries.

*Methods.* The present study consisted of a visual clinical examination of teeth that had been previously cleaned with gauze. This was carried out under natural light in a waiting room. Four calibrated examiners performed the examination and the kappa test value was 8·0. The parents or guardians were interviewed for the following information: name, address, age, type of feeding, number of sugary meals, sugar intake and habitual diet. Some 468 children were included in this study. Their ages ranged from 12 to 36 months. The sample was comprised of 222 (47·4%) males and 246 females (52·6%).

*Results.* Of the 468 children included in this study, 133 (28·4%) had caries. Only 59 (12·6%) of the children examined had been breast-fed, 20 (33·9%) of whom presented with caries. Three hundred and twenty-seven (69·9%) subjects had been bottle-fed with sugared milk, 86 (26%) of whom had caries. Two hundred and eight children had five or more sugary meals per day, 70 (33·6%) of whom had caries. No statistically significant relationship was seen between breast-feeding and the prevalence of tooth decay.

*Conclusions.* The results of the present study show that the prevalence of early childhood caries in 12–36-month-old children from poor backgrounds in Recife is in accordance with the rate found in other Brazilian cities and is extremely high compared with that of the world population as a whole. Early childhood caries was not clearly related to the type of feeding in this sample. The prevalence of early childhood caries increased with age, and the number of sugary snacks between meals and a cariogenic diet were strongly related to early childhood caries. The lack of fluoridated water and high rates of early childhood caries in lead the authors to suggest that fluoride dentifrice should be introduced at 12 months of age as a fluoride supplement and an important aid in the prevention of childhood caries. Additional studies in different cultures and societies need to be undertaken before a definitive conclusion can be drawn.

## Introduction

Because of developments in the food industry from 1920 up to the present, the practice of breast-feeding has decreased among the Brazilian population, and baby formulae also became available to low-income families from 1960, which increased malnutrition and premature child mortality.

Nowadays, there are sufficient scientific grounds to argue that mother's breast milk provides the best source of nutrition for the new-born infant.

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The Brazilian Ministry of Health and the local health authorities are making great efforts to encourage breast-feeding from birth up to the age of 2 years of age, although the UK Department of Health Committee on Medical Aspects of Food Policy (COMA) recommendations regarding dental disease specify 12 months [1].

The literature suggests that prolonged natural breast-feeding after 12 months is a risk factor for the occurrence of early childhood caries in infants [2–4].

Early childhood caries has been attributed to various factors such as prolonged and inappropriate bottle-feeding, prolonged on-demand breast-feeding, frequent use of medicine in syrup form, and sucrose-containing 'comfort foods' that are used as emotional pacifiers [5].

In recent years, a great number of epidemiological studies on early childhood caries have been published, and these have indicated that only a small proportion of children will develop caries that can be attributed to breast-feeding [2].

The purpose of this study was to evaluate early childhood caries among infants living in poor socio-economic conditions of the city of Recife, Brazil, and its association with the type and duration of feeding (e.g. natural, sugared, bottle and glass), as well as the relationship between a supplementary diet and the occurrence of such caries.

## Methods

The sample consisted of 468 children of both genders aged between 12 and 36 months (Table 1). These children were patients at the paediatric clinic of the Amaury de Medeiros Health Centre, which is part of the Maternity Hospital of the University of Pernambuco (UPE), Recife, Brazil. This hospital is located in an urban area, and its outpatient department provides health care to socio-economically disadvantaged children with no private health insurance.

There are only two public maternity hospitals in Recife that have infant feeding policies and health promotion strategies. Of these, the UPE Maternity Hospital was randomized to take part in this study. Socio-economically underprivileged children make up 70% of the population seen at the hospital; their more privileged counterparts do not use the public services, but go to private consultants, who are difficult to approach. Thus, this sample was composed of socio-economically disadvantaged children seen at this particular hospital.

**Table 1.** Distribution of the children by age group.

| Age group (months) | Number | Percentage |
|---|---|---|
| 12–18 | 149 | 31·8 |
| 19–24 | 148 | 31·6 |
| 25–36 | 171 | 36·5 |
| Total | 468 | 100 |

The calculation of the sample was based on: the senior author's earlier observations of the prevalence of breast-feeding caries at the Pediatric Dental Clinic of the School of Dentistry of Pernambuco in Recife; on Pinto's study [6] in Pernambuco in 1993; and on a study by Mattos-Granner *et al*. [7] in Piracicaba, São Paulo, Brazil. The calculation of the sample size was made by taking into consideration a 5·0% error, a 95% confidence interval and an estimated caries prevalence of 40% based on the literature.

The present study consisted of a visual clinical examination carried out in the waiting room under natural light [8,9], the teeth having been previously cleaned with gauze. Four calibrated examiners performed the examination and the kappa test value was 0·8. Previously, a pilot study had been carried out with six children of both genders aged between 12 and 36 months, whose carious, extracted or filled teeth were recorded as described by Fass and Ripa [3,10]. Loss of mineral substance with cavitation was considered caries, but white spots were not [3,10].

While the patients were being clinically examined, the mothers were interviewed for the following information: name, address, age, type of feeding, number of sugary meals per day, sugar intake, habitual diet, brushing of teeth and the age at which brushing was introduced. The number of teeth present and caries were also recorded.

The children's parents or guardians were previously informed about the aims of this study, and all of them gave their informed consent. The Ethics Committee of the University of Pernambuco approved the study design.

The proposed objectives were set out in bivariate tables indicating the variable response (i.e. presence or absence) of carious teeth and any association with the following variables: gender, age group, type of feeding and brushing of teeth. The chi-square ($\chi^2$) test was used with alpha values statistically significant at the 0·05 level.

**Table 2.** Mean dmft index, number of children with carious teeth and standard deviation (SD) by age group.

| Age group (in months) | Mean dmft index | Number of children with carious teeth | | |
|---|---|---|---|---|
| | | Number | Percentage | SD |
| 12–18 | 0·40 | 13 | 8·7 | 1·39 |
| 19–24 | 1·47 | 41 | 27·7 | 3·19 |
| 25–36 | 2·0 | 79 | 46·2 | 3·35 |
| Total | 1·29 | 133 | 28·4 | 2·64 |

**Table 3.** Distribution of children with regard to feeding practice.

| Type of feeding | Number | Percentage |
|---|---|---|
| Bottle milk + sugar | 327 | 69·9 |
| Cup + sugar | 43 | 9·2 |
| Breast-feeding + sugared bottle milk | 39 | 8·3 |
| Breast-feeding | 59 | 12·6 |
| Total | 468 | 100 |

The significance level considered was 5·0%, and the software used was SAS Version 6·12 computer program.

## Results

Of the 468 children studied, 222 (47·4%) were male and 246 (52·6%) were female (Table 2). Caries was more prevalent in females (30·1%) than in males (26·6%), but this difference was not statistically significant ($\chi^2 = 0{\cdot}705$, $P = 0{\cdot}401$).

One hundred and thirty-three (28·46%) of the 468 children studied presented with caries and 335 (71·6%) were caries-free (Fig. 1).

Of the children who were examined, 327 (69·9%) were bottle-fed with sugared milk (Table 3). The great majority of children were breast-fed only up to 6 months of age. The association between the type of feeding and the presence of caries did not prove to be statistically significant ($\chi^2$ test, $P = 0{\cdot}461$) (Table 4).

A supplementary cariogenic diet was noted for 84·0% of the children (Tables 5 and 6). Caries was more prevalent in children with a cariogenic diet (31·8%) than in those children without a cariogenic diet (10·7%), and the association between the two variables was highly significant ($\chi^2 = 13{\cdot}36$, $P < 0{\cdot}001$).

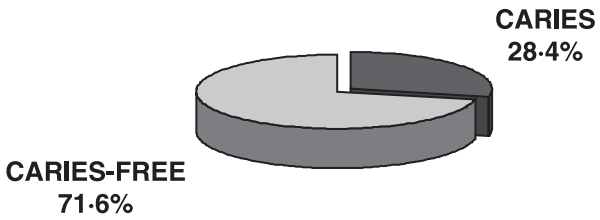


**Fig. 1.** Distribution of children according to the presence of caries.

**Table 5.** Distribution of children according to the number of meals taken daily.

| Number of meals | Number | Percentage |
|---|---|---|
| 3 | 16 | 3·4 |
| 4 | 60 | 12·8 |
| 5 | 184 | 39·3 |
| 6 | 158 | 33·8 |
| 8 | 50 | 10·7 |
| Total | 468 | 100·0 |

The association between the number of sugary meals per day and the presence of caries was statistically significant ($\chi^2 = 5{\cdot}044$, $P = 0{\cdot}025$) (Table 7).

Table 8 shows that children who did not brush their teeth presented with a higher percentage of caries (40·3% *vs* 26·1%) ($\chi^2 = 8{\cdot}101$, $P = 0{\cdot}004$).

When questioned about brushing, 169 (36·1%) of the mothers reported brushing their children's teeth, but 299 (63·9%) had not yet adopted the procedure. The earliest age at which brushing started was 14 months. The results show that the age at which the majority of children began brushing their teeth was 24 months.

## Discussion

An epidemiological study carried out in 1993 in the state of Pernambuco reported that 33·6% of

**Table 4.** Distribution of children according to feeding practice and the presence of caries.

| Feeding practice | Caries | | | | Total | |
|---|---|---|---|---|---|---|
| | Present | | Absent | | | |
| | Number | Percentage | Number | Percentage | Number | Percentage |
| Baby bottle sugared milk | 86 | 26·3 | 241 | 73·7 | 327 | 100 |
| Cup + sugared milk | 15 | 34·9 | 28 | 65·1 | 43 | 100 |
| Breast-feeding + baby bottle sugared milk | 12 | 30·8 | 27 | 69·2 | 39 | 100 |
| Breast-feeding | 20 | 33·9 | 39 | 66·1 | 59 | 100 |
| Total | 133 | 28·4 | 335 | 71·6 | 468 | 100 |

**Table 6.** Distribution of children according to the type of meal and the presence of caries.

| | Caries | | | | | |
|---|---|---|---|---|---|---|
| | Present | | Absent | | Total | |
| Type of meal | Number | Percentage | Number | Percentage | Number | Percentage |
| Cariogenic | 125 | 31·8 | 268 | 68·2 | 393 | 100 |
| Non-cariogenic | 8 | 10·7 | 67 | 89·3 | 75 | 100 |
| Total | 133 | 28·4 | 335 | 71·6 | 468 | 100 |

**Table 7.** Distribution of children according to the number of sugary meals consumed per day and caries.

| | Caries | | | | | |
|---|---|---|---|---|---|---|
| | Present | | Absent | | Total | |
| Number of sugary meals per day | Number | Percentage | Number | Percentage | Number | Percentage |
| ≤ 5 | 63 | 24·3 | 197 | 75·8 | 260 | 100 |
| > 5 | 70 | 33·6 | 138 | 66·4 | 208 | 100 |
| Total | 133 | 28·4 | 335 | 71·6 | 468 | 100 |

**Table 8.** Brushing of teeth and dental caries among children with erupted first primary molars.

| | Caries | | | | | |
|---|---|---|---|---|---|---|
| | Present | | Absent | | Total | |
| Brushing of teeth | Number | Percentage | Number | Percentage | Number | Percentage |
| Yes | 40 | 26·1 | 113 | 73·9 | 153 | 100 |
| No | 93 | 40·3 | 138 | 59·7 | 231 | 100 |
| Total | 133 | 34·6 | 251 | 65·4 | 384 | 100 |

36-month-old children had caries compared with 33% found among the Brazilian population as a whole [6]. These figures were higher because white spot decalcification was classified as caries. The present study noted that 28·4% of the children had more than one incisor tooth with caries on the labial surface.

Caries prevalence in children aged between 0 and 36 months in Piracicaba, São Paulo, including initial and cavitated lesions, was 34·8%, with 65·2% of the caries located in the front teeth [8]. This city has a fluoridated water supply, but the prevalence of childhood caries was similar to that found Recife [6].

Compared to the figures presented world-wide, the prevalence of early childhood caries in Brazil is very high [7,11,12]. In European countries such as the UK, Sweden and Finland, the prevalence of early childhood caries has varied from 1·0% to 12% [8,13,14].

A study on caries and its association with infant feeding and oral health carried out in São Paulo showed a caries prevalence of 46% in children aged from 3 to 4 years [15]. A similar prevalence was found in the present study in children from 25 to 36 months of age (46·2%), which suggests that the prevalence of caries increases with age, ranging from 8·7% in the 12–18-month age group to 46·2% in the 25–36-month age group.

Children from poor families deprived of breast-feeding are at risk and may not survive until their first birthday [16]. The Brazilian Health Ministry recommends breast-feeding until 24 months. Prolonged at will breast feeding has been associated with severe caries, although this phenomenon has been reported by only a few authors [17–19].

According to the present study, there were no differences in caries prevalence in relation to the four types of feeding: 26·3% for children who had baby bottle formula with added sugar; 34·9% for children who drank milk with added sugar from the glass; 30·8% for children who were breast-fed; and 33·9% for children who were only breast-fed.

Several studies have suggested that the association between caries and the type of feeding is not statistically significant, and the findings of the present study are in agreement with these [5,17,20,21].

In Recife, 69·9% of the children examined were fed with baby bottle formula with added sugar and

only 28·4% presented with early childhood caries. This finding reinforces Tinanoff's statement that sleeping with baby bottle milk or other sugary drinks does not always cause caries since the basic reasons for tooth demineralization in very small children, include both frequent exposure to a cariogenic diet and early infection with cariogenic bacteria [22].

The majority (84%) of the children examined had a complementary cariogenic diet that was rich in sucrose, and 31·8% of those who had a cariogenic diet presented caries, which shows a strong statistical association. This result was reinforced by a previous COMA report [1], which emphasised sucrose as the main carbohydrate responsible for the development of dental caries [23,24]. Both the World Health Organization and COMA recommended that non-milk products and cellular extrinsic sugar should not represent more than 10% of the total daily calorie intake, and that sugars should comprise no more than 10–20% of the human diet [1].

In this study, the association between the number of sugary meals and caries was statistically significant. Dental caries was more prevalent among the children who had more than five sugary meals per day than in those who had five or fewer (33·6% *vs* 24·3%). The COMA report recommended that the frequency of sugary meals should not exceed four per day, including main meals [1].

The association of snacking between meals during weaning and dental caries was reported by King [23] among children from poor families in the UK, and by Faine and Oberg [25] among their American counterparts. In Recife, a report of preventive dental care for the children of dentists revealed that the daily consumption of sugary liquids and solids ranged from zero to 18 ingestions, with a mean of five [26]. This is considered to be high for this sample population. In the American population, 75% of the dental caries in primary teeth is concentrated in 25% of the population from low-income families with an educational level lower than high school [25]. Early childhood caries among children from poor families in Recife increases with age and with the association between a cariogenic diet and the frequency of sugary food intake.

The population of Recife does not have the benefit of a fluoridated water supply. The present study also shows that children whose teeth were not brushed had a higher percentage of dental caries (40·3%) than those whose teeth were cleaned (26·1%).

Some research studies have noted that the benefit of brushing teeth in preventing dental caries is restricted to the effect of fluoride in the dentifrice [27,28]. Because children who did not brush their teeth presented with a higher percentage of dental caries (40·3% *vs* 26·1%), this study suggests that dentifrice was an important source of fluoride for the subjects who used it, especially since there is a lack of fluoridated water in Recife.

## Conclusions

It is possible to draw the following conclusions from the results of the present study: The prevalence of early childhood caries in 12–36-month-old children from poor families in Recife is in accordance with the rates found in other Brazilian cities and is extremely high compared to that of the general population world-wide. Early childhood caries was not related to the type of feeding in this sample of children. The prevalence of caries increased with age, and the number of sugary snacks between meals and a cariogenic diet were strongly related to early childhood caries. The lack of fluoridated water and the high rates of early childhood caries in Recife lead the authors to suggest that fluoride dentifrice should be introduced at the age of 12 months as an important preventive intervention. Additional studies in different cultures and societies need to be undertaken before a definitive conclusion can be reached.

**Résumé.** *Objectifs*. Cette étude a eu pour objectif d'évaluer les caries précoces chez de jeunes patients âgés de 12 à 36 mois appartenant à des familles de faible niveau socio-économique de la ville de Recife, Brésil, et leur association avec les types d'alimentation (naturelle, sucrée, biberon, verre) et leur durée, de même que la relation entre la nourriture supplémentaire et la survenue de ce type de caries.
*Méthodes*. L'examen clinique visuel a été mené dans la salle d'attente, à la lumière naturelle, après passage d'une gaze sur les dents. Il a été effectué par quatre examinateurs calibrés, avec valeur de 8,0 du test Kappa. Les parents ou personnes en charge ont été interrogés pour les informations suivantes: nom, adresse, âge, type d'alimentation, nombre de repas sucrés, prise de sucre et nourriture habituelle. 486 enfants ont été inclus dans l'étude, répartis en 222 garçons (47,4%) et 246 filles (52,6%).

*Résultats*. 33 (28,4%) des 468 enfants inclus présentaient des caries. Seulement 59 (12,6%) des enfants examinés avaient été allaités au sein, 20 (33,9%) d'entre eux présentant des caries. 327 (69,9%) avaient été nourris au biberon avec du lait sucré. 86 (26%) d'entre eux avaient des caries. 208 des enfants avaient au moins 5 repas sucrés par jour, 70 (33,6%) d'entre eux présentant des caries. Aucune relation statistiquement significative n'a été mise en évidence entre l'allaitement au sein et la prévalence des caries.
*Conclusions*. Ces résultats montrent une prévalence de la carie précoce, chez des enfants de Recife de 12 à 36 mois, similaire à celle d'autres villes brésiliennes. Elle est très haute par rapport à celle de la population mondiale. Aucun lien n'a pu être démontré avec le type d'alimentation. La prévalence s'est accrue avec l'âge. Les caries précoces étaient fortement corrélées au nombre de snacks sucrés entre les repas et à la nourriture cariogénique. L'absence d'eau fluorée et le taux élevé de caries de Recife amène les auteurs à suggérer l'introduction du dentifrice fluoré dès l'âge de 12 mois pour la prévention de ces caries. Des études supplémentaires dans d'autre milieux socio-culturels sont nécessaires pour tirer des conclusions définitives.

**Zusammenfassung.** *Ziele*. Diese Studie untersuchte frühkindliche Karies bei Kindern im Alter von 12 bis 36 Monaten aus Familien mit ungünstigen sozioökonomischen Bedingungen in der Stadt Reclife, Brasilien. Außerdem wurden Ernährungsart und Dauer (natürlich, Zuckerzusatz, Flasche, Glas) und Zusammenhänge zur Beikost mit dem Auftreten von Karies untersucht.
*Methoden*. In dieser Studie wurden Zähne mit Tupfern gereinigt und bei natürlichem Licht klinisch untersucht. Vier kalibrierte Untersucher führten die Studie durch, der Kappa Koeffizient betrug 0.8. Eltern oder Sorgeberechtigte wurden befragt hinsichtlich folgender.
*Angaben*. Name, Alter, Nahrungsmittel, Zahl gezuckerter Mahlzeiten, Zuckeraufnahme und Ernährungsgewohnheiten. Es wurden insgesamt 468 Kinder in die Studie aufgenommen in Altersstufen von 12 bis 36 Monaten, darunter 222 Jungen (47.4%) und 246 Mädchen (52.6%).
*Ergebnisse*. Von den 468 untersuchten Kindern wiesen 1433 (28.4%) Karies auf. Nur 59 (12.6%) der Kinder wurden gestillt, 20 davon (33.9%) wiesen Karies auf. 327 (69.9%) wurden mit gezuckerter Flaschennahrung gefüttert, davon zeigten 86 (26%) Karies. 208 der Kinder (69.9%) bekamen mehr als 5 gezuckerte Mahlzeiten am Tag, 70 davon wiesen Karies auf (33.6%). Es bestand keine statistisch signifikante Korrelation zwischen Stillen und Kariesprävalenz.
*Schlussfolgerungen*. Aus den Ergebnissen dieser Studie lässt sich schließen, dass die Prävalenz frühkindlicher Karies bei Kindern aus ökonomisch schwachen Familien der Stadt Recife mit der Rate anderer brasilianischer Städte übereinstimmt, bezogen auf die weltweite Prävalenz aber sehr hoch liegt. In der vorliegende Stichprobe war frühkindliche Karies nicht in irgendeiner Weise mit Stillen korreliert. Die Prävalenz nahm mit dem Alter zu, die Zahl zuckerhaltiger Mahlzeiten und kariogener Kost waren deutlich mit Karies korreliert. Das Fehlen von fluoridsupplementiertem Wasser und hohe Raten von frühkindlicher Karies lässt die Autoren folgern, dass Fluoridzahnpasta bereits im Alter von 12 Monaten eingeführt werden sollte, da Fluorid ein wichtiges Mittel zur Prävention frühkindlicher Karies ist. Weitere Studien müssen in verschiedenen Kulturen und Schichten durchgeführt werden, um zu definitiven Schlussfolgerungen zu kommen.

**Resumen.** *Objetivos*. El propósito de este estudio fue evaluar la caries del niño pequeño en niños entre los 12 y 36 meses, de familias que viven en condiciones socio-económicas pobres en la ciudad de Recife, Brasil y su asociación con los tipos y la duración de la alimentación (natural, azucarada, biberón y vaso) así como la relación entre la dieta suplementaria y la aparición de este tipo de caries.
*Métodos*. El presente estudio consistió en un examen clínico visual llevado a cabo en la sala de espera, con luz natural, de los dientes que han sido lavados previamente con una gasa. Cuatro examinadores calibrados realizaron la evaluación y valor del test Kappa fue de 8,0. Los padres o tutores fueron interrogados por la siguiente información: nombre, dirección, edad, tipo de alimentación, cantidad de ingestas azucaradas, ingesta de azúcar y dieta habitual. Se incluyeron en el estudio 468 niños, con edades entre 12 y 36 meses, comprendiendo 222 (47,4%) varones y 246 hembras (52,6%).
*Resultados*. De los 468 niños incluidos, 133 (28,4%) tenían caries. Sólo 59 (12,6%) de los niños examinados habían recibido lactancia materna, de los que 20 (33,9%) presentaban caries. 327 (69,9%) habían

sido alimentados con biberón y leche azucarada, de los que 86 (26%) tenían caries. 208 niños recibían 5 o más comidas azucaradas por día, de los que 70 (33,6%) tenían caries. No se observó una relación estadísticamente significativa entre lactancia materna y la prevalencia de caries.

*Conclusiónes*. De los resultados de este estudio puede concluirse que la prevalencia de caries del niño pequeño, en niños pobres de entre 12 y 36 meses de edad, en la ciudad de Recife está en relación con el porcentaje encontrado en otras ciudades brasileñas y es extremadamente alta comparada con la población mundial en conjunto; la caries del niño pequeño en esta muestra no estaba claramente relacionada con el tipo de alimentación. La prevalencia de caries del niño pequeño aumentó con la edad y la cantidad de golosinas con azúcar entre comidas, así como la dieta cariogénica estaba fuertemente relacionada con la caries del niño pequeño. La falta de agua fluorada y los altos índices de caries del niño pequeño en Recife, Brasil, condujo a los autores a sugerir la introducción del dentífrico fluorado a los 12 meses de edad como un suplemento de flúor y una importante ayuda en la prevención de la caries del niño pequeño. Necesitan llevarse a cabo estudios adicionales en diferentes culturas y sociedades para llegar a una conclusión definitiva.

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