Pediatricians' Perception about the Use of Antibiotics and Dental Caries—a Preliminary Study

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Abstract

Objectives: *This study aimed to evaluate pediatricians' perception about the use of antibiotics and dental caries.* ***Methods:*** *One hundred pretested questionnaires containing open and closed questions were distributed to pediatricians from public hospitals in Rio de Janeiro, Brazil.* ***Results:*** *The response rate was 60 percent. Considering the respondents, 73.3 percent frequently prescribed antibiotics, oral administration being the chosen mode (93.3%). Antibiotics were pointed out as being very sweet substances by 53.3 percent of the pediatricians. However, the same percentage did not know what sweetener was responsible for the sweet flavor, and just 40.6 percent recommended oral hygiene after the medicine's intake. Among the pediatricians, 56.7 percent related the use of antibiotics to the occurrence of dental effects, and 40 percent thought that antibiotics could cause a defect of tooth structure. Only one pediatrician (3.2%) associated the presence of fermentable carbohydrates in the composition of these medicines with dental caries.* ***Conclusions:*** *Pediatricians in this study did not perceive the correct relationship between the presence of fermentable carbohydrates in antibiotics and dental caries. Many of them believed these medicines promoted a defect of tooth structure favoring the development of dental caries. Further studies with a larger sample are necessary. [J Public Health Dent 2004;64(4):244-48]*

Key Words: pediatrics, antibiotics, sweetening agents, dental caries, oral health.

Dental caries is a localized disease resulting from localized bacterial activity of the indigenous oral microbiota (1). Part of this microbiota is capable of adhering to tooth surface, leading to dental biofilm formation. In the presence of fermentable carbohydrates such as sucrose and glucose, the bacteria present in the biofilm produce acids as products of their metabolism, which cause a drop in pH to levels at which there is dissolution of the mineral components of the tooth, a process called demineralization (2). With an increase in pH, the inverse process occurs—remineralization, in which there is a reprecipitation of mineral in the damaged area. Thus, the carious process is the dynamic de- and remineralizing process, which over time may result in a net loss of mineral and subsequently may possibly, but not always, lead to cavitation (3,4).

Therefore, as the dental biofilm is the determinant etiologic factor of dental caries, a decreased intake of nonmilk extrinsic sugars (5) and adequate and systematic cleaning of the teeth are effective methods for controlling this disease (1). However, it seems to be part of human culture to accept that, at some point in life, losing one's teeth is a natural process; in this context, dental caries is not seen as a preventable or controllable disease (6).

In Brazil, one observes that many parents and guardians associate the development of carious lesions in their children's teeth with the excessive consumption of certain antibiotic medications, which they believe promote "defects of the tooth structure" (7). In fact, the presence of sucrose in these medicines has been related to an increase in the prevalence of dental caries among children (8-17), although some studies have demonstrated that the use of antibiotics promoted a decline in caries experience (18,19).

The relationship between antibiotics and dental caries involves various factors. Among the most widely described factors in literature are the presence of sucrose in these medicines' formulations (15,20); the low pH of some formulations (21-23); high viscosity of liquid medications for oral intake (15,24); lack of oral hygiene after medication's intake (24); and frequency of intake of these liquid pediatric formulations (22,23,25)—emphasizing the regular use by children with chronic diseases such as cardiopathies, asthma, recurring otitis media, and infection of the upper respiratory tract (15,20,26). On the other hand, studies that reported reductions in dental caries with antibiotic therapy justify this observation based on the anticariogenic potential of antistreptococci antibiotics (18,19).

Although pharmacists are in an ideal position to influence the supply of medicines (27), parents have an innate reluctance to "interfere" in what they see as a medical decision (28). Considering that pediatricians are those mainly responsible for pediatric prescriptions and also for the supply of information to parents, this study evaluated the perception of these professionals about the use of antibiotics and the occurrence of dental caries in order to provide an overview of their influence on children's consumption of sugared antibiotics.

Methodology

This study was carried out in the pediatric services of public hospitals in the state of Rio de Janeiro, Brazil,

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where a pretested questionnaire was distributed to 100 pediatricians in the period from March to May 2001. The pretest was conducted in a university hospital with six pediatric service residents to check the appropriateness of the questionnaire to the survey. These respondents were not included in the final sample.

The survey was conducted with a convenience sample, as this was a preliminary study. The sample was selected from public hospitals where at least one of the authors had personal contact with the pediatric service staff. This physician was requested to be responsible for distributing the questionnaire to the other professionals. A week later the responses were collected. Pediatricians who did not return the filled-out questionnaires were personally contacted in the following week, which was the deadline for receiving the responses. Therefore, all physicians included in this study were pediatricians of public hospitals located in the state of Rio de Janeiro. The questionnaire was structured with open-ended and closed questions (Figure 1) focusing on the knowledge and practices of these professionals with regard to prescribing antibiotics for pediatric use and their relationship with dental caries. Thus, this questionnaire included issues considered relevant to the choice of pediatric antibiotics at the moment of prescription, pediatricians' knowledge of the substances used to give these medicines their sweet flavor, as well as oral hygiene recommendations after oral antibiotic intake. Furthermore, some popular Brazilian expressions such as "defect of tooth structure" and "dental effects" were included in the questionnaire just to denote an impairment of oral health that would be caused by antibiotics according to common understanding in Brazil.

FIGURE 1
Questionnaire to Evaluate Pediatricians' Perceptions About Use of Antibiotics and Occurrence of Dental Caries

QUESTIONNAIRE FOR PEDIATRICIANS FROM PUBLIC HOSPITALS IN RIO DE JANEIRO STATE

1) Gender: ☐Male ☐Female
Age:_____years
Undergraduation year:_____
University:_____
2) Have you graduated?
☐ No ☐ Yes. Course:_____
3) Do you usually attend?
☐Only children
☐Adults and children
☐Others_____
4) Where do you work?
☐Public service and private practice
☐Only public service
☐Others_____
5) In your opinion, are pediatric medicines too sweet?
☐ I do not know
☐ No
☐ Yes
6) Do you usually prescribe antibiotics for children?
☐ Never
☐ Rarely
☐ Frequently
7) Which are the commercial brands you most prescribe?
_____
8) Based on your daily practice in the **Public Health Service**, which of the factors below do you consider relevant when choosing a pediatric antibiotic at the time of writing your prescription (number from 1 to 4 **in order of importance, number 1 being the most important factor**)?
☐Medication features (spectrum of action, side effects, flavor and way of administration)
☐Child characteristics (age, medicine's acceptability and immune-deficiency)
☐Disease characteristics (severity of the case and type of microorganism involved)
☐Socio-economic factors (patient's financial status and the availability of the antibiotics in the public health services)
9) While prescribing antibiotics for children, which way of administration do you usually elect?
☐ Oral
☐IM
☐IV
☐Others_____
10) In your opinion, can antibiotics be related to dental effects?
☐ No
☐ Yes- Which alterations? _____
11) Do children usually complain about the taste of antibiotics?
☐No ☐Yes- Why? _____
12) What usually sweetens antibiotics? (You may choose more than one option).
☐ I do not know
☐Sugar substitutes
☐Glucose
☐Lactose
☐Sucrose
☐Fructose
☐Others _____
13) What is the mean concentration of these above-mentioned substance(s) in Brazilian antibiotics?
☐ I do not know
☐20% or less
☐between 20 and 40%
☐more than 40%
14) Do you recommend that children brush their teeth after oral intake of antibiotics?
☐No ☐Yes
15) In your opinion, are antibiotics too sweet?
☐ I do not know
☐No
☐Yes
16) In your opinion, do antibiotics cause a defect of tooth structure?
☐No- Why?_____
☐Yes- Why? _____

The research protocol was approved by the Ethical Committee on Research of the Community Health Department of the Federal Fluminense University. All the pediatricians participated voluntarily in this study. Data were entered into an Epi Info 6.04d software database and presented as absolute and relative frequencies.

Results

The percentage of questionnaires returned was 60 percent. The pediatricians who participated in the study ranged in age from 23 to 58 years old (mean=35.6±10.4 years old). Women comprised 75 percent of the respondents. Regarding medical practice, 93.3 percent exclusively treated children and 56.7 percent worked only in the public service, while 43.3 percent had private practice activities as well.

The prescription of antibiotics was frequently made by 73.3 percent of the pediatricians, and oral administration was the most frequently chosen mode (93.3%). Although 53.3 percent of the pediatricians believed that antibiotics are sweet substances, 61.7 percent stated that children generally complained about their flavor. Regarding antibiotics' sweeteners, 53.3 percent of the pediatricians did not recognize the type of carbohydrate present in the formulation of these medicines and 83.3 percent did not know the mean concentration of these substances. Among the sweeteners mentioned, sucrose (64.3%), sugar substitutes (53.6%), glucose (35.7%), and fructose (21.4%) were mentioned most fre-

quently. Although some pediatricians considered antibiotics as sweet formulations (53.3%), not all of them recommended oral hygiene after their intake (40.6%).

Among the factors considered relevant to the prescription of antibiotics, disease characteristics—severity of the case and type of microorganism involved—were emphasized as the most important factor by the majority of the pediatricians (84.9%), followed by medication features such as spectrum, side effects, flavor, and mode of administration (49.1%). It also was noted that child characteristics—age, acceptability of the medicine, and immune deficiency—were considered more relevant (47.1%) than socioeconomic factors—patient's financial status and the availability of the antibiotics in the public health service (45.3%).

The majority of the pediatricians in the study (56.7%) believed antibiotics cause dental effects. Considering these pediatricians' (n=34) reports, dental caries was identified as the main dental alteration (32.4%), followed by exclusively structural alterations (17.6%), and by their combination with dental caries (17.6%). Only 8.8 percent of them related tetracycline to the occurrence of dental effects and 2.9 percent mistakenly associated them with the use of erythromycins and not tetracyclines (Table 1).

Furthermore, with regard to the effect of antibiotics on teeth, some pediatricians reported that these medicines caused a defect of tooth structure (40.0%). The most frequent justifications for this situation were: favoring the occurrence of dental caries (20.8%), alteration in calcium metabolism present in the dental structure (16.7%), and alteration of the oral microbiota (16.7%), as shown in Table 2. Among the pediatricians (n=31) who did not believe the use of antibiotics caused a defect of tooth structure, 12.9 percent pointed out tetracycline as the only drug capable of causing this alteration, although it is no longer prescribed to children and its effect may no longer be found (Table 2).

Discussion

As this study was carried out with a convenience sample, it was not possible to identify how representative participants were of all Brazilian pediatricians. Moreover, other limita-

TABLE 1
Pediatricians' Perception about Use of Antibiotics and Occurrence of Dental Effects (%), Rio de Janeiro, Brazil (n=60)

Believe Antibiotics Cause Dental Effects	%	Justifications	%
Yes	56.7	Believe in this correlation but do not know which alterations could occur	20.6
		Antibiotics favor dental caries	32.4
		Antibiotics favor dental caries and cause structural alterations	17.6
		Antibiotics cause dental structural alterations	17.6
		Only tetracycline causes dental structural alterations	8.8
		Only erithromycine causes dental structural alterations	3.3
No	36.7		
Did not answer	6.6		

TABLE 2
Pediatricians' Perception about Use of Antibiotics and Occurrence of Defect of Tooth Structure, Rio de Janeiro, Brazil (n=60)

Believe Antibiotics Cause Tooth Structure Defects	%	Justifications	%
Yes	40.0	Favor of dental caries	20.8
		Alteration in calcium metabolism of the dental structure	16.7
		Alterations to the dental enamel	8.3
		Alterations to the oral microbiota	16.7
		Only tetracycline causes defect of tooth structure	4.2
		Do not know the cause	33.3
No	51.7	They only favor the development of dental caries due to the presence of sugar in their composition, but they do not cause defect of tooth structure	3.2
		Only repeated infections cause defect of tooth structure	3.2
		Antibiotics' use is not related to defect of tooth structure	12.9
		Own experience did not show evidence of relationship	3.2
		Infrequent use of antibiotics by children	3.2
		Antibiotics do not have components to cause defect of tooth structure	3.2
		Currently, antibiotics like tetracycline, which was capable of causing such alteration, are not used	12.9
		Do not know why	58.9
Did not answer	8.3		

tions—such as the high dropout rate and the small sample size from a localized area—limited the generalization of the obtained data. Although these factors may be considered important limitations, it should be stressed that this was a preliminary study that could lead to broader studies.

Pediatric antibiotics are frequently sweetened to make their flavor more pleasant to children (25). This could contribute to the development of dental caries mainly because of the frequency of oral prescriptions (93.3%), as shown in this study. This study showed that many pediatricians considered antibiotics to be sweet substances; however, the type of sweetener involved was hardly known. Among the pediatricians who mentioned the type of sweetener, many emphasized the use of sugar substitutes. Nevertheless, in Brazil, Lima et al. (29) verified through descriptive leaflets that the great majority of the analyzed antibiotics contained sucrose in their formulation. Neiva et al. (30) confirmed the presence of sucrose in 70 percent of the studied antibiotics using high performance liquid chromatography, although only 10 Brazilian antibiotics were analyzed and this number may not represent all the national antibiotics available in Brazil. These are the only available Brazilian studies that have analyzed the sugar content of medicines; neither of them identified sugar substitutes in the formulation of the evaluated antibiotics, although in some countries there are sugar-free pediatric medicines (11-31). After consultation with the National Health Surveillance Agency, no Brazilian government regulations were found with regard to the use of sugar substitutes in medicines. For this reason, the option for sugared syrups is probably an economic measure for pharmaceutical industries, as sucrose and similar carbohydrates are much cheaper than sugar substitutes such as xylitol or sorbitol.

Furthermore, a large number of pediatricians also recognized the presence of sucrose and other fermentable carbohydrates in the composition of antibiotics, as already demonstrated by some studies (22,29,30). This fact is of concern because of the known relationship between carbohydrates' consumption and dental caries, and it becomes even more alarming if one considers that not all of the pediatricians gave pediatric patients instructions on oral hygiene after medicine intake. Thus, it should be stressed that careful oral hygiene instructions are fundamental to prevent dental diseases caused by chronic use of liquid medication forms. On the other hand, particularly with antibiotics, there is a paradoxical antimicrobial effect that could also influence the relationship between antibiotics use and dental caries, although some studies (25,32) have reported higher prevalence of dental caries in chronically ill children who used sucrose-based medicines regularly, including antibiotics.

Some authors also emphasized the difficulty in maintaining favorable oral hygiene habits as a relevant factor in the risk of caries in sick children who continually use medications (15,20,22,23,33). Thus, the necessity of alerting guardians to the presence of sucrose in these formulations and the importance of oral hygiene after their intake is crucial.

Although Bigeard (26) had emphasized that, when prescribing sweetened medicine, priority should be given to those sweetened artificially with noncariogenic sweeteners such as xylitol, manitol, sorbitol, saccharine, cyclamate, or aspartame, in some countries the use of sugar-free pediatric medicines is still limited due to the lack of knowledge of these medicines among health professionals (11,17,31,34) and the population in general (17,27,34).

Regarding the factors relevant to the prescription of antibiotics, the socioeconomic status was considered the least important factor at the time of prescription. Although factors such as disease characteristics and medication features should prevail at the time of prescription, it is known that in the public health services in Brazil, a developing country, the patient's financial condition and availability of antibiotics constitute real limitations leading patients to opt for lower-cost medicines. This fact corroborates the study of Maguire et al. (13), who showed that the higher price of the artificially sweetened medicine contributed to the choice of similar ones with sucrose.

With regard to dental effects caused by the use of medicines, it is important to emphasize that tetracycline represents the only group of antibiotics capable of producing them when used during the tooth formation period (35). These alterations are characterized by staining of the clinical crowns, and do not make teeth more susceptible to dental caries. However, only a small percentage of the pediatricians (8.8%) identified tetracycline as being responsible for such alterations, while the majority believed dental effects could be caused by any other antibiotic (Table 1).

The occurrence of a tooth structure defect was reported as an effect of the use of antibiotics by a considerable number of pediatricians. This showed that it is recognized among the studied medical population that these medications could damage children's dentition favoring the establishment of dental caries, although no evidence had been found in the reviewed literature about a deleterious intrinsic effect of antibiotics on dental structure. Thus, it should be reiterated that the relationship between antibiotics and dental caries depends on their antimicrobial activity and on the presence of sucrose or other fermentable carbohydrates in their composition, no other mechanism being documented in the literature (26).

The results of this study supported the idea that it is a matter of urgency for pediatricians to be instructed about dental caries and its real relationship with fermentable carbohydrates, mainly because these professionals are the first to establish contact with the children and their families. Thus, pediatricians are in an ideal position to influence patients' attitudes toward oral health, either by informing them of hidden sugars that may be present in liquid medication or by stressing the necessity of performing adequate oral hygiene after medication intake.

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