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Does bronchial asthma influence dental health of the diseased children?

Da li bronhijalna astma utiče na zdravlje zuba obolele dece?

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Abstract

Background/Aim. Asthma is a chronic inflammatory lung disorder. The effect of asthma drugs on oral health is still the subject of debate among researchers in dentistry. The aim of this study was to evaluate dental status in asthmatic children and evaluate the possible effect of drugs treating asthma on dental health. **Methods.** Study participants were divided into two groups: the asthma (AG) and the non-asthma (NAG) group. Based on the symptoms of asthma and the possibility for effective control of the disease, the AG group was divided into two subgroups. The oral examination of the teeth was performed using a probe and mouth mirror under artificial light in accordance with the recommendations of the World Health Organization. Saliva analysis was carried out by the GC Saliva-Check Buffer, according to the manufacturer's instructions. **Results.** The study included 136 children aged 6 to 16 years (10.5 ± 3.3). The mean of decayed, missing, and filled teeth (dmft/DMFT) of the children in the AG group (6.0 ± 4.0/3.3 ± 4.4) was higher than in the NAG group (4.8 ± 4.4/2.5 ± 3.4), but significant differences were not observed between the groups. Salivary pH values were found to be similar in both groups, but the quantity and buffering capacity of the stimulated saliva were found to be significantly lower in the AG group ($p < 0.001$ and $p < 0.05$, respectively). **Conclusion.** Although the prevalence of dental caries in the AG group was similar to that of the NAG group in this study, decreased quantity and buffering capacity of the stimulated saliva in the AG group may contribute to higher values of dental caries in asthmatic children in the future.

Key words:
anti-asthmatic agents; asthma; child; dental caries; saliva.

Apstrakt

Uvod/Cilj. Bronhijalna astma je hronično zapaljensko oboljenje disajnih puteva. Uticaj antiastmatskih lekova na oralno zdravlje još uvek je predmet istraživanja u stomatologiji. Cilj rada je bio da se proceni zdravlje zuba dece sa astmom, kao i da se ispita uticaj antiastmatskih lekova na stanje zdravlja zuba. **Metode.** Ispitanici su bili podeljeni na dve grupe: deca sa astmom (AG) i deca bez astme (NAG). Na osnovu prisutnih simptoma astme, kao i mogućnosti njene efikasne kontrolisanosti, grupa AG je podeljena u dve podgrupe. Stomatološki pregled obavljen je pomoću stomatološke sonde i ogledalca pod veštačkim osvetljenjem, u saglasnosti sa preporukama Svetske zdravstvene organizacije. Za analizu pljuvačke je korišćen *GC Saliva-Check Buffer*, prema uputstvu proizvođača. **Rezultati.** Ispitivanje je obuhvatilo 136 dece, uzrasta od 6 do 16 godina (10,5 ± 3,3). Prosečne vrednosti karijesnog, ekstrahovanog, plombiranog (kep/KEP) zuba kod dece u grupi AG (6,0 ± 4,0/3,3 ± 4,4) bile su više u odnosu na iste vrednosti u grupi NAG (4,8 ± 4,4/2,5 ± 3,4), ali nisu utvrđene značajne razlike između ispitivanih grupa. Takođe, pH vrednosti pljuvačke bile su slične u obe grupe, ali su nađene značajno niže vrednosti količine i puferskog kapaciteta stimulisane pljuvačke u grupi AG ($p < 0,001$ i $p < 0,05$ redom). **Zaključak.** Iako je u ovoj studiji prevalenca karijesa u grupi AG bila slična kao i u grupi NAG, smanjene vrednosti količine i puferskog kapaciteta stimulisane pljuvačke u grupi AG mogu doprineti većoj podložnosti karijesu te grupe u budućnosti.

Ključne reči:
antiastmatici; astma; deca; zub, karijes; pljuvačka.

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Introduction

Bronchial asthma is a chronic inflammatory disorder of the airways that causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing (particularly at night or early in the morning) [1]. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. Asthma prevalence has been increasing across all ages and gender worldwide. Asthma is a serious global health problem that usually starts in childhood, and the patients have to take lifelong therapy [2]. The majority of asthmatic patients require long-term medication, which is usually administered using various forms of inhalers. The effect of these drugs on oral health has been the subject of debate among dental practitioners [3].

Systemic diseases like bronchial asthma have a detrimental effect on the oral cavity, such as reduction of salivary secretion and change in salivary composition and pH. The negative effects of dental caries occurrence include pain, dysfunction, poor appearance, and speech problems [4]. However, these oral health problems vary from person to person and depend on the frequency of cariogenic drinks and food consumption, as well as oral hygiene.

Hamid et al. [5] suggested that dental caries and asthma are the most common chronic diseases in childhood. Children with chronic medical disorders mostly require long-term medication, which puts them at high risk of oral diseases in general and dental caries in particular [5].

Caries lesions are formed through a complex interaction between acid-producing bacteria and fermentable carbohydrates. It is also affected by many host factors, including saliva and the inherent nature of the teeth [6]. Saliva plays an important role in oral health as it maintains the integrity of oral hard and soft tissues and protects the oral tissue against bacterial, fungal, and viral infections. Moreover, salivary buffers can reverse the low pH, thus preventing enamel demineralization. Furthermore, an increase in caries prevalence in asthmatic patients was reported to be associated with prolonged use of ß2 agonists that lead to decreased salivary flow, altered saliva composition, and decreased pH, affecting the protective properties of saliva [7]. Higher rates of caries among asthmatics were considered possible due to antiasthmatic medications containing fermentable carbohydrates and sugar [3].

The aim of this study was to compare the prevalence of dental caries in asthmatic and non-asthmatic children, as well as to evaluate the relationship between the types, time of taking, and the duration of asthma medication and dental caries in asthma groups.

Methods

This study was based and designed according to the recommendations for epidemiological surveys (National Oral Health Survey) defined by the World Health Organization (WHO) [8]. This one-year-long study was conducted according to the Declaration of Helsinki of 1975, as revised in 2000. The study was approved by the Ethical Committee of Faculty of Medicine in Foča, University of East Sarajevo (No. 01-8/37).

Study population

The parents and children involved in the study were informed about the objectives and procedure. The parents approved the participation of their children in this study by signing written consent, and children were permitted to leave the process at any time during the study.

The present study was conducted among 136 children aged 6 to 16 years. Participants were divided into two groups. The first group consisted of 68 children with asthma (asthmatic group – AG), without any other systemic disease, treated at the University Hospital or Primary Care Facility in Foča. The second group consisted of children without asthma (non-asthmatic group – NAG) or any other chronic disease who visited the Faculty of Medicine in Foča, Dentistry Program. The AG and NAG were matched by gender and age (± 6 months).

Symptoms were evaluated according to medical history, physical examination, spirometry results, and data obtained after completing the basic disease-related questionnaire. The level of asthma control was determined according to the results of the asthma control test. Based on the symptoms of asthma and the level of asthma control, the AG group was divided into two subgroups. The first subgroup consisted of children with good controlled asthma (GCA), while the second subgroup consisted of children with partly controlled asthma (PCA). Asthma was considered to be under good control if: children had symptoms no more than 2 days a week; these symptoms did not wake them from sleep more than 1 or 2 nights a month; they could perform all usual activities; they took quick-relief medicines no more than 2 days a week; they did not have more than one asthma attack a year that required taking systemic steroids, and their peak flow did not drop below 80 percent of their personal best value. Asthma was considered only partly controlled if: children had symptoms more than 2 days a week; they could not perform normal physical activities and they had nocturnal symptoms; they had more asthma attacks a year that required taking asthma drugs, and their peak flow dropped below 80 percent of their personal best values [1]. Children with uncontrolled asthma were not recorded in this study.

Dental examination

Dental examinations were carried out in a dental chair by using a dental mirror and probe under artificial light, according to the WHO criteria [8]. All participants were examined, and saliva samples were collected at the Department of Pediatric and Preventive Dentistry, Faculty of Medicine in Foča.

Clinical measurements

Caries status was determined by the number of decayed (d/D), missing (m/M), and filled (f/F) primary (dmft) and permanent (DMFT) teeth. No radiographs were taken.

Saliva sampling was conducted in the morning hours. Individuals were instructed not to drink, eat, or use chewing gum for at least 2 h before sampling, not to rinse their mouths, and not to take medicine at least an hour prior to the visit. Patients were placed in an upright, relaxed position with their heads tilted down. Saliva hydration, salivary consistency, resting saliva pH, stimulated saliva flow (quantity), stimulated saliva pH, and saliva buffering capacity were recorded using the GC Saliva-Check Buffer test (GC Corporation, Tokyo, Japan) according to the manufacturer's instructions.

Statistical analysis

The results' analysis was carried out using the Statistical Package for Social Sciences (SPSS version 19.0 for Windows, SPSS Inc., Chicago, IL, USA). The χ^2 tests were used to compare differences in categorical variables. An Independent-samples *t*-test was used to compare differences in dental caries status between the AG and NAG, as well as between the subgroups. One-way analysis of variance (ANOVA) was used to test differences in the caries status in relation to the time of taking medication and the type of administered medication. The Mann-Whitney test was used for saliva testing between the AG and NAG, as well as the subgroup with good controlled asthma and partly controlled asthma. A $p < 0.05$ was considered statistically significant.

Results

The study population consisted of 68 (50%) asthmatic and 68 (50%) non-asthmatic children. There were 53 (39%) boys and 15 (11%) girls in the AG ($p < 0.05$) compared to 53 (39%) boys and 15 (11%) girls in the NAG ($p < 0.05$). The mean ages were 10.5 ± 3.3 years and 10.5 ± 3.3 years, respectively, in the two groups. In the NAG, 63.0% of participants were using inhaled corticosteroids (ICS), 13.2% bronchodilators (inhaled long-acting beta-2 agonists), and 23.5% combination of steroid inhalers and bronchodilators. On average, 27.9% of respondents used asthma medications for at least two years, and 57.7% of respondents were taking asthma drugs several times a day.

Characteristics of the participants' salivary samples are presented in Table 1. The resting saliva flow rate was approximately the same between the AG and the NAG. Moreover, there was no statistically significant difference in resting saliva flow between the GCA and PCA subgroups. Sticky saliva was more common in the AG than in the NAG. Lower salivary pH was found in the PCA subgroup. The very low buffering ability of saliva was observed in 27.9% of patients in the AG compared to 13.2% of patients in the NAG (Table 1).

The percentage of children with caries-free primary dentition in the AG and NAG was 16.7% and 25%, respectively, while the percentage of children with caries-free permanent dentition in the AG and NAG was 28.6% and 44.5%, respectively. The results of the present study showed a higher prevalence and severity of dental caries among asthmatic patients compared to the matched healthy children in both primary and permanent dentitions (Tables 2 and 3), but these differences were not statistically significant. Results indicated higher values of mean d/D, F, and DMFT in the AG, group in children who were using the anti-asthmatic drugs in the afternoon (Tables 4 and 5). Moreover, the dmft/ DMFT were higher in the PCA subgroup compared to the GCA, both in primary and permanent dentition, but statistical significance was not observed.

Table 1

Values of saliva testing in the asthma group (AG), non-asthma group (NAG), and subgroups of asthmatic children

Saliva testing (parameters)	AG (n = 68)	NAG (n = 68)	GCA (n = 44)	PCA (n = 24)	*p/q*
Hydration, RS (% ± SD)					
< 30 s	30.9 ± 0.8	38.2 ± 0.7	34.1 ± 0.8	25 ± 0.7	*p = ns; †p = ns
30–60 s	35.5 ± 0.8	45.6 ± 0.7	34.1 ± 0.8	37.5 ± 0.7	
> 60 s	33.8 ± 0.8	16.2 ± 0.7	31.8 ± 0.8	37.5 ± 0.7	
Viscosity, RS (% ± SD)					
watery	26.5 ± 0 .8	45.6 ± 0.7	31.8 ± 0.8	16.7 ± 0.7	*p = 0.001; †p = ns
frothy	33.8 ± 0.8	39.7 ± 0.7	31.8 ± 0.8	37.5 ± 0.7	
sticky	39.7 ± 0.8	1.7 ± 0.7	36.4 ± 0.8	45.8 ± 0.7	
pH, RS (mean ± SD)	6.8 ± 0.5	6.7 ± 0.4	6.9 ± 0.5	6.7 ± 0.5	*q = ns; †q < 0.05
Quantity, SS (% ± SD)					
> 5 mL	29.4 ± 0.8	44.1 ± 0.6	29.5 ± 0.8	29.2 ± 0.8	*p = 0.001; †p = ns
3.5–5 mL	26.5 ± 0.8	42.6 ± 0.6	31.8 ± 0.8	16.7 ± 0.8	
< 3.5 mL	44.1 ± 0.8	13.2 ± 0.6	38.6 ± 0.8	54.2 ± 0.8	
Buffering capacity, SS (% ± SD)					
normal	19.1 ± 0.6	26.5 ± 0.6	22.7 ± 0.6	12.5 ± 0.6	*p < 0.05; †p = ns
low	52.9 ± 0.6	60.3 ± 0.6	54.5 ± 0.6	50 ± 0.6	
very low	27.9 ± 0.6	13.2 ± 0.6	22.7 ± 0.6	47.5 ± 0.6	

GCA – good controlled asthma; PCA – partly controlled asthma; RS – resting saliva; SS – stimulated saliva; n – number of subjects; % – percentage of subjects; *p* – level of statistical significance (Mann-Whitney test); *q* – level of statistical significance (Independent-samples *t*-test); ns – non significant; SD – standard deviation. * – statistical significance between AG and NAG; † – statistical significance between GCA and PCA.

Table 2

Values of dental status in primary dentition

Study group	d ± SD	m ± SD	f ± SD	dmft ± SD
AG (n = 30)	4.6 ± 3.5	1.2 ± 2.2	0.2 ± 0.5	6.0 ± 4.0
NAG (n = 28)	3.4 ± 3.8	0.7 ± 1.5	0.6 ± 1.5	4.8 ± 4.4
GCA (n = 21)	4.4 ± 3.7	0.9 ± 2.1	0.1 ± 0.3	5.5 ± 4.3
PCA (n = 9)	5.2 ± 3.3	1.7 ± 2.5	0.3 ± 0.7	7.3 ± 3.1
p	*ns; †ns	*ns; †ns	*ns; †ns	*ns; †ns

AG – children with asthma; NAG – children without asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; dmft index – number of decayed (d), missing (m) and filled (f) primary teeth; SD – standard deviation; *p* – level of statistical significance (Independent-samples *t*-test); ns – non significant.
*** – statistical significance between AG and NAG; † – statistical significance between GCA and PCA.**

Table 3

Values of dental status in permanent dentition

Study group	D ± SD	M ± SD	F ± SD	DMFT ± SD
AG (n = 68)	1.5 ± 3.1	0.2 ± 0.5	1.6 ± 2.2	3.3 ± 4.4
NAG (n = 68)	0.6 ± 1.4	0.3 ± 1.2	1.7 ± 2.5	2.5 ± 3.3
GCA (n = 44)	1.0 ± 2.1	0.2 ± 0.5	1.4 ± 1.9	2.6 ± 3.6
PCA (n = 24)	2.4 ± 4.3	0.3 ± 0.6	1.8 ± 2.7	4.5 ± 5.5
p	*< 0.05; †< 0.05	*ns; †ns	*ns; †ns	*ns; †ns

AG – children with asthma; NAG – children without asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; DMFT index – number of decayed (D), missing (M), and filled (F) permanent teeth; SD – standard deviation; *p* – level of statistical significance (Independent-samples *t*-test); ns – non significant.
*** – statistical significance between AG and NAG; † – statistical significance between GCA and PCA.**

Table 4

Values of dental status (primary dentition) in relation to time of medication administration

Parameters of dental status	Only in the morning	Only in the afternoon	In the morning and evening	Before sleeping	*p*
Decayed teeth ± SD					
AG (n = 30)	3.4 ± 3.6	0.0 ± 0.0	3.5 ± 3.5	7.0 ± 2.5	< 0.05
GCA (n = 21)	3.6 ± 4.3	0.0 ± 0.0	3.7 ± 3.7	6.3 ± 2.8	ns
PCA (n = 9)	3.0 ± 1.4	0.0 ± 0.0	3.0 ± 3.0	8.0 ± 1.8	< 0.05
Missing teeth ± SD					
AG (n = 30)	2.4 ± 3.2	0.0 ± 0.0	1.2 ± 2.3	0.3 ± 0.6	ns
GCA (n = 21)	1.2 ± 2.6	0.0 ± 0.0	1.1 ± 2.5	0.3 ± 0.6	ns
PCA (n = 9)	5.5 ± 2.1	0.0 ± 0.0	1.6 ± 1.5	0.0 ± 0.0	< 0.01
Filled teeth ± SD					
AG (n = 30)	0.3 ± 0.7	0.0 ± 0.0	0.2 ± 0.4	0.3 ± 0.5	ns
GCA (n = 21)	0.0 ± 0.0	0.0 ± 0.0	0.2 ± 0.4	0.0 ± 0.0	ns
PCA (n = 9)	0.3 ± 0.7	0.0 ± 0.0	0.0 ± 0.0	0.3 ± 0.5	ns
dmft ± SD					
AG (n = 30)	6.1 ± 5.2	0.0 ± 0.0	4.9 ± 4.1	7.4 ± 2.7	ns
GCA (n = 21)	4.8 ± 5.7	0.0 ± 0.0	5.0 ± 4.3	6.8 ± 3.4	ns
PCA (n = 9)	9.5 ± 0.7	0.0 ± 0.0	4.6 ± 4.2	8.3 ± 1.5	ns

AG – Children with asthma; GCA – good controlled asthma; PCA – partly controlled asthma; dmft index – number of decayed (d), missing (m) and filled (f) primary teeth; n – number of subjects; SD – standard deviation; *p* – level of statistical significance (One-way ANOVA); ns – non significant.

Table 5

Values of dental status (permanent dentition) in relation to time of medication administration

Parameters of dental status	Only in the morning	Only in the afternoon	In the morning and evening	Before sleeping	*p*
Decayed teeth ± SD					
AG (n = 63)	1.2 ± 2.3	11.5 ± 7.7	1.1 ± 1.8	1.6 ± 3.8	< 0.001
GCA (n = 40)	1.1 ± 2.4	0.0 ± 0.0	1.0 ± 2.2	0.6 ± 0.5	ns
PCA (n = 23)	1.5 ± 2.2	11.5 ± 7.7	1.1 ± 1.3	2.8 ± 5.7	< 0.01
Missing teeth ± SD					
AG (n = 63)	0.0 ± 0.0	0.5 ± 0.7	0.3 ± 0.6	0.1 ± 0.3	ns
GCA (n = 40)	0.0 ± 0.0	0.0 ± 0.0	0.3 ± 0.6	0.0 ± 0.0	ns
PCA (n = 23)	0.0 ± 0.0	0.5 ± 0.7	0.3 ± 0.6	0.1 ± 0.3	ns
Filled teeth ± SD					
AG (n = 63)	0.9 ± 1.2	2.5 ± 2.1	2.1 ± 2.6	0.3 ± 0.5	< 0.05
GCA (n = 40)	1.0 ± 1.2	0.0 ± 0.0	1.8 ± 2.2	0.3 ± 0.5	ns
PCA (n = 23)	0.5 ± 0.7	2.5 ± 2.1	2.6 ± 3.2	0.0 ± 0.0	ns
DMFT ± SD					
AG (n = 63)	2.1 ± 3.3	14.5 ± 9.2	3.5 ± 3.9	2.0 ± 4.1	< 0.01
GCA (n = 40)	2.1 ± 3.3	0.0 ± 0.0	3.2 ± 4.0	1.2 ± 0.9	ns
PCA (n = 23)	2.0 ± 2.8	14.5 ± 9.2	4.0 ± 3.7	3.0 ± 6.2	< 0.05

AG – children with asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; DMFT index – number of decayed (D), missing (M), and filled (F) permanent teeth; SD – standard deviation; *p* – level of statistical significance (One-way ANOVA); ns – non significant.

Discussion

Oral health is an important part of overall health. Therefore, the promotion of oral health and the quality of life is an important objective of modern dentistry. Literature data indicate a possible association between systemic diseases, including asthma, and oral health. Systemic diseases can affect the defense mechanisms and patient's motivation and may be considered risk factors for oral diseases [3, 7].

Bronchodilators play a major role in asthma therapy, while corticosteroids are second in line. The more severe forms of asthma require a combination of several antiasthmatic drugs. A recent study showed that inhalation drugs have some negative impact on oral health, depending on their dosage, frequency, and length of use [9]. Factors associated with the severity of the disease and/or medicaments used for treatment may increase the risk for the development of caries due to the reduced secretion of saliva, as well as lower salivary pH in asthmatics [3, 6, 7, 10–15]. Moreover, certain inhalers contain fermentable carbohydrates in the form of lactose, which mask the bitter medication taste and improve patient tolerance but may contribute to an increased caries risk as well [15].

Normal salivary flow is one of the most important protective factors against caries. All changes in the amount or composition of the saliva can alter the oral health status. This study showed that asthmatic children had a smaller amount of unstimulated saliva. Furthermore, the saliva was stickier in the asthmatic children, and the resting salivary flow was below normal as droplets of saliva were formed at the orifices of the minor glands in more than 60 seconds. Sticky and less viscous saliva facilitates accumulation and adhesion of bacteria to the tooth surface, as well as retention of deposits in the mouth, as the capacity of saliva to flush microorganisms and substrates and maintain oral cleanliness may be influenced by its consistency and flow rate [16].

Stimulated salivary flow is important to facilitate flushing away acids originating from the food, dental plaque, or other sources (like gastric reflux). In this study, the amount of stimulated saliva was reduced in the AG. The stimulated flow was lower than 3.5 mL/min in almost half of the children in this group, followed by low and very low buffering capacity. Results of this study also showed that medications used in the asthma treatment did not have any visible impact on the tested saliva parameters with respect to their dosage, frequency, duration of use, as well as the time of medication administration during the day. A significant difference was not observed in saliva pH values between asthmatic and non-asthmatic children in this study which is consistent with the literature data that attributes the absence of the difference to the fact that the measurement of salivary pH was not performed immediately after the use of antiasthmatic drugs [17].

Buffer capacity testing indicates saliva's effectiveness in neutralizing acidity in the mouth. Karova and Christoff [14] pointed out that the use of inhaled antiasthmatic drugs leads to the rapid reduction of the salivary pH. The pH value was recorded to be the lowest in the first five minutes after the drug use and increased during the first 30 min. However, it did not reach the values registered prior to the drug administration. In the other studies, it was reported that 30 min after using beta-2 antagonist, salivary and plaque pH declined to a critical level (pH = 5.5), causing enamel demineralization [3, 15].

The average dmft/DMFT values were higher in primary and/or permanent dentition in asthmatic children in several studies [2, 6, 17–20]. Those values were reported to be higher in children who used inhaler forms of drugs [18], especially salbutamol inhalers (bronchodilators) [19]. In contrast to the above-mentioned studies, other studies do not demonstrate a positive relationship between asthma and dental caries [21–29]. These findings are in accordance with our study. The preva-

lence of dental caries in asthmatic children in this study was higher than in the healthy control group, both in primary and permanent dentition, but it was not statistically significant. However, this finding supports the claim that asthmatic children may be at higher risk for tooth decay. This study showed a higher prevalence, without statistical significance, of dental caries in asthmatic children, particularly in the subgroup of children with partly controlled asthma.

The dmft/DMFT index values in both groups were high. This could be explained by insufficient knowledge, as well as the lack of interest of children and their parents in their oral health, increased consumption of sweet products, inadequate oral hygiene, and insufficient awareness of the importance of regular dental examinations. In addition, the fact that patients involved in this research lived in an area with less than 0.6 ppm F in drinking water might have contributed to the high index values. The devastating fact that, in general, children in this region had higher dmft/DMFT values, as shown by the results of previous studies [30], may have also contributed to the lack of difference in mentioned values between asthmatic and non-asthmatic children.

In this study, non-asthmatic children had higher salivary buffering capacity and a larger amount of stimulated saliva compared to children with asthma. The fact may speak in favor of the influence of asthma medications on composition, pH value, and amount of saliva.

Eloot et al. [23] did not observe any relationship between the severity of asthma, the period of exposure to medication, and the prevalence of caries. In contrast to that, in our study, the average DMFT and the value of component D were higher if the children used asthma medications in the afternoon period. It appeared that poor oral hygiene and dietary habits, usage of antiasthmatic drugs in the afternoon, as well as a decrease in the salivary flow rate and salivary pH, may lead to pronounced caries development in children with asthma.

Vázquez et al. [4] showed that the presence of nocturnal asthma symptoms and usage of antiasthmatic drugs during the night in preschool children could lead to the caries development in primary dentition, although the relationship between caries and asthma was not found. The results of our study showed that the value of component 'd' in primary dentition was higher in patients who consumed asthma medications prior to sleeping.

The difference in dental status between asthmatic and non-asthmatic Brazilian children younger than eleven years of age was not observed, while a larger prevalence of dental caries was recorded in children with asthma older than this age. These differences were followed by a positive correlation between the number of *Streptococcus mutans* and the severity of asthma [31]. Having in mind the fact that caries is a multifactorial disease, other studies [32] reported that lower dmft or DMFT index was found in primary and/or permanent dentition in asthmatic children than in healthy children.

Conclusion

Although children with asthma had a higher average dmft/DMFT values compared to children without asthma, the difference was not statistically significant. Therefore, this study did not confirm a mutual association between asthma and caries.

Further studies are necessary to clarify the possible asthma impact on dental health and thus improve everyday dental practice related to preventive measures planning, as well as dental assessment and treatment of patients with asthma.

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