RESEARCH

Evaluation of Cariogenic and Erosive Potential of Prescribed Pediatric Medicaments in Northeast of Turkey: An In Vitro Study

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ABSTRACT

Evaluation of Cariogenic and Erosive Potential of Prescribed Pediatric Medicaments in Northeast of Turkey: An In Vitro Study

Background: To purpose of the present study is to evaluate *in vitro* the cariogenic and erosive potential of the medicaments prescribed for pediatric use in the Northeastern Region of Turkey.

Methods: In the present study, 30 different medicaments of 14 different drug groups were selected among the medicaments prescribed by pediatricians. The pH, Total Titration Acidity (TTA), Total Soluble Solid Content (TSSC), Total Sugar Content (TSC) of the medicaments were measured. The data obtained in this way were analyzed by using the SPSS Statistics Software. The Pearson Chi-Square Test was used in all groups when comparing the pH, TTA and TSSC values.

Results: It was determined that the median pH values of the medicaments that were tested ranged between 3.11 and 7.62; and 53.3 % of the medicaments had pH levels below the critical median value (5.5). It was found that the TTA values were low in all groups according to the median value. The highest TTA value was measured 23.8770 and the second was 22.9540.The lowest TSSC was found to be 1.3320, and the highest TSSC was 1.4450. Sugar content was detected in 33 % of the medicaments that were used in total sugar content analysis.

Conclusion: The medicaments that were analyzed showed physical chemical properties showing cariogenic and erosive potentials in dental tissues. In this respect, healthcare professionals, drug manufacturers, and parents must be informed about the risks caused by the consumption of potentially harmful medicaments in dental tissues.

KEYWORDS

Erosion, Enamel, Drug

ÖZ

Türkiye'nin Kuzeydoğusunda Reçete Edilen Pediatrik Ilaçların Karyojenik ve Aşındırıcı Potansiyelinin Değerlendirilmesi: Bir In Vitro Çalışma

Amaç: Çalışmanın amacı, Türkiye Kuzeydoğu bölgesinde pediatrik kullanım için reçete edilen ilaçların karyojenik ve eroziv potansiyelini *in vitro* olarak değerlendirilmesidir.

Gereç ve Yöntemler: Çalışmada pediatristler tarafından reçete edilen ilaçlar arasından 14 farklı ilaç grubuna ait 30 farklı ilaç seçildi. İlaçların pH, total titrasyon asitliği (TTA), toplam çözünebilir katı içeriği (TSSC), toplam şeker içeriği (TSC) ölçüldü. Elde edilen veriler SPSS istatistik yazılımı kullanılarak analiz edildi. Tüm gruplarda pH ve TTA, TSSC değerleri açısından karşılaştırma yapılırken Pearson ki-kare testi uygulandı.

Bulgular: Test edilen ilaçların pH ortanca değerleri 3.11 ile 7.62 arasında değiştiği; ilaçların % 53.3'nün pH ortanca değerinin kritik pH (5.5) in altında olduğu tespit edildi. Ortanca değere göre TTA değerleri tüm gruplarda düşük olarak bulgulandı. En yüksek TTA değeri 23.8770 ve ikinci olarak 22.9540 olarak ölçüldü. En düşük TSSC değerinin 1.3320 ve en yüksek TSSC değerinin 1.4450 olduğu saptandı. Toplam şeker içerikleri analizinde kullanılan ilaçların %33 'ünde şeker içeriği tespit edildi.

Sonuç: Analiz edilen ilaçlar, diş dokularında karyojenik ve eroziv potansiyel gösteren fizikokimyasal özellikler gösterdi. Bu doğrultuda sağlık profesyonelleri, ilaç üreticileri ve ebeveynler diş dokularına potansiyel olarak zararlı ilaçların tüketilmesinden kaynaklanan riskler hakkında bilinçlendirilmelidir.

ANAHTAR KELİMELER

Erozyon, Mine, İlaç

In recent years, the prevalence of tooth decay in children is higher in developing countries than economically-developed industrial countries, and has emerged as a serious public health problem.[1,2] For this high tooth decay prevalence, it is reported that the number of frequently prescribed medicaments and increased and non-prescribed drug intake pose serious risks.[3] Studies conducted on frequently prescribed pediatric oral medicaments focus on the erosive and cariogenic potentials of medicaments on teeth.[4,5]

Usually, pediatric medicines in syrups form are prescribed for children, which are easy to accept. Most syrups are for children often contain various additives (colorants, sweeteners, aroma, etc.) to taste and smell. Also, acidic preparations are

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considered necessary for drug distribution, chemical stability, physiological compatibility and increasing palatability. Although the use of these medicaments are usually lasts for short periods, they may be used for longer periods especially by patients suffering from respiratory allergies, asthma and convulsions or tonsillitis, otitis, sinusitis, allergic rhinitis, and recurrent acute diseases.[6,7] In general, medicaments are prescribed to be taken every eight hours a day or 10 times a week. However, other healthy children who seldom take short-term medicaments are also at risk for erosion and decay development.[1]

pH analysis is considered as an important factor in terms of tooth erosion and decay potential of the medicaments.[8,9] In addition, other important physicochemical characteristics like Total Titration Acidity (TTA) and Total Soluble Solid Content (TSSC) are also important for the erosive potential of a substance.[10] Total titration acidity is an indirect measure of the saliva buffer amount needed for the drug to reach a neutral pH. The total soluble solid substance content is defined as a measure of the total soluble solid contents in a drug (i.e. proteins, lipids, glutathione, mineral salts, vitamins, organic acids, pigments, and other substances). It is speculated that this value, which has a direct relation with the viscosity of the ingested foods, facilitates the retention of dietary components on the teeth surfaces.[9,11] In addition, there is also an obvious relation between oral medicaments that contain sugar and tooth decay development.[12]

As a result of the reasons like non-rational drug use and excessive prescribing of medicaments, excessive medicaments are consumed in our country.[13] For this reason, the purpose of the present study was to *in vitro* evaluate the cariogenic and erosive potential of prescribed medicaments for pediatric use in the Northeastern Region of Turkey. H: The medicaments used in the study will have harmful effects on the hard tissues of the teeth depending on their physical-chemical properties.

MATERIALS AND METHODS

Study area and design:

In the study, the medicaments, which were prescribed by pediatricians for pediatric patients with acute or chronic diseases in the relevant region, and which were widely used for long periods, were selected. A total of 30 different active medicaments of 14 different groups were used (Table 1). The pH, TTA, TSSC and Total Sugar Content (TSC) values of the medicaments were measured at Karadeniz Technical University, Faculty of Pharmacy (Table 2). The products were evaluated in the randomized experiment by taking the mean values with 3 repetitions for each sample of the drug to provide a single value.

pH and Titration Acidity Measurement:

A total of 5 mL was taken from the drug samples in syrup form for measurements and TTA analysis with pH meter and TTA analysis, and the measurements were made with 50 mL deionized pure water. In the measurement of the medicaments that were in tablet form, 5 g of the tablets were weighed, and diluted with deionized pure water to 50 mL in the same way. After the pH of the diluted samples was measured (Table 2), 0.1N NaOH was added to the sample for TTA analysis to reduce the pH range of the medicaments that were in acidic form to 8.2-8.4, and the amount of NaOH used was recorded. These data were placed in relevant place in the formula to calculate TTA.

$$\text{Acidity (\%)} = \frac{\text{VxNxFxM}_{eq}\text{(g)x100}}{\text{Sample Volume}}$$

V: NaOH amount used

N: NaOH normality = 0.1

F: Correction factor = 1.0306

Meq (g): milliequivalent per gram of citric acid = 0.064 mg/ml

Sample volume: 5 ml

Total Soluble Solid Content Measurement:

Total Soluble Solid Content or Brix degree (°Bx), was measured with Abbe Refractometer (Optica 2WAJ , Ponteranica, Italy). Water was used as standard to make Abbe refractometer measurable.

In Abbe Refractometer, which is one of the tools used in determining Refractive Index, the substance whose Refractive Index would be determined was placed as a liquid film between the two prisms. The lit area, which was formed by the light sent to the prisms and the rays that came at a critically smaller angle, and the dark area, which was created by the rays that came at a larger angle than the critical angle, were observed. The % weight concentration was read from the upper scale on the Refractometer, and the Refractive Index was read from the lower scale. The Refractive Index and % concentration (sugar content) values were recorded (Table 2).

Table 1.

General-brand names of medicaments, pharmaceutical forms and their values in mg / ml with manufacturers

THERAPEUTIC CLASS	NUMBER(n)	GENERAL NAME	BRAND NAME	PHARMACEUTİCAL FORM	Mg/ml	MANUFACTURERS
ANTIHISTAMINE	3	Cetirizine Hcl	ALLERSET®	Syrup	1	Santa Farma
		Deslorotadin	DELODAY®		2.5/5	VEM
		Hydroxyzine HCl	ATARAX®		2	UCB
ANTIEMETIC	3	Ondansetron	ZOFRAN ZYDIS™ ®	Tablet	4	Novartis
		Metoclopramide	METPAMID®	Syrup	5/5	Sifar
		Trimetobenzamide HCl	AMETIK®	Drop	50/0.5	Kurtsan
ANTIPARASITIC	3	levamisole hydrochloride	STYRAX®	Syrup	40/5	Sanofi aventis
		Pirantel pamoat	KONTIL®	Suspension	250/5	Hüsnü Arsan
		Albendazole	ANDAZOL®	Suspension	200/10	Biofarma
ANTIBACTERIAL	3	Amoxicillin + clavulanic acid	AUGMENTIN®	Suspension	600/42.9/5	GlaxoSmithKline
		Cefuroxime axetil	ZINNAT®		125/5	
		Clarithromycin	MACROL®		250/5	Sanovel
ANTIEPILEPTIC	3	Sodium valproate	CONVULEX®	Syrup	50	Lİba
		Oxcarbazepine	TRILEPTAL®	Suspension	60	
		Carbamazepine	TEGRETOL®	Syrup	100/5	Novartis
CORTICOSTEROID	3	Prednisolone	DELTACORTRIL®	Tablet	5	Pfizer
		Dexamethasone 21-phosphate disodium	DEKORT®	Bulb	8/2	Deva
		Budesonide	PULMICORT®	Nebulizer	0.25	AstraZeneca
NON-OPIOID ANALGESICS	1	Paracetamol	CALPOL 6 Plus®	Suspension	250/5	GlaxoSmithKline
NSAIDS	2	Ketoprofen	PROFENID®	Syrup	1	Eczacıbaşı
		İbuprofen	DOLVEN®		100/5	Sanofi
SYSTEMIC ADRENERGIC	2	Salbutamol	VENTOLIN®	Syrup	250/50	GlaxoSmithKline
		Terbutaline sulfate + guaifenesin	BRICANLY®		1.5/66.5/5	AstraZeneca
RESPIRATORY SYSTEM / COLD ALIGN	3	dextromethorphan hydrobromide + pseudoephedrine hydrochloride + chlorpheniramine maleate	BENICAL®	Syrup	10 /20/2 /5	Bayer Consumer Care
		Paracetamol + oxolamine citrate + chlorpheniramine maleate	KATARIN®	Syrup	120/50/1/5	Biofarma
		Guaifenesin ephedrine hydrochloride	BROKSIN®		100/6.66/5	Tripharma
SEDATIVE	1	Passiflora Liquid Extract	PASSIFLORA®	Syrup	700/5	İlsan-İltaş
ANTIPSYCHOTIC	1	Risperidone	RISPERDAL®	Oral solution	1	Johnson and Johnson
PSYCHOANALEPTIC	1	Fluoxetine hydrochloride	PROZAC®	Oral liquid	20/5	Lilly
MULTIVITAMİNS	1	Omega 3+ EPA+DHA+ Vitamin A+Vitamin D+Vitamin E+ Vitamin K+Iodine+Selenium	NUTRİGEN STRAWBERRY OMEGA 3®	Syrup	800/224/336/150µg/2.5 µg/3/15 µg/45 µg/10 µg/2.5	Nutrigen

Table 2.

General-brand names of medicaments, pharmaceutical forms and their values in mg / ml with manufacturers

GROUP	DRUGS	pH	TTA (%)	TSSC (%Bx)	TSC (g%)
ANTIHISTAMINE	ALLERSET®	49500	.1846	53	.0000
	DELODAY®	62500	.1451	49	.0000
	ATARAX®	38200	.0594	59.5	263200
ANTIEMETIC	ZOFRAN®	76200	.0132	44682	.0000
	METPAMID®	33100	.2704	1	.0000
	AMETIK®	48200	.0264	34	250000
ANTIPARASITIC	STYRAX®	43500	.6728	59.5	.0000
	KONTIL®	55800	.1055	44683	.0000
	ANDAZOL®	67900	.0396	44697	133300
ANTIBACTERIAL	AUGMENTIN®	58400	238770	39.5	634900
	ZINNAT®	63200	.0792	38.5	363600
	MACROL®	52500	.1055	45	307700
ANTIEPILEPTIC	CONVULEX®	67800	.0528	53	.0000
	TRILEPTAL®	36400	.3958	16	.0000
	TEGRETOL®	44700	.0923	16	.0000
CORTICOSTEROID	DELTACORTRIL®	72400	.0132	5	.0000
	DEKORT®	71100	.0198	44683	.0000
	PULMICORT®	49500	.0396	2	.0000
NON-OPIOID ANALGESICS	CALPOL®	65900	.0594	62.5	125000
NSAIDS	PROFENID®	66400	.0528	56.5	333300
	DOLVEN®	46700	.4880	25	.0000
SYSTEMIC ADRENERGIC	VENTOLIN®	39000	.4353	3	.0000
	BRICANLY®	42100	.2704	32.5	.0000
RESPIRATORY SYSTEM / COLD ALIGN	BENICAL®	64500	.0329	44711	.0000
	KATARIN®	31100	229540	49.5	.0000
	BROKSIN®	69400	.0264	39	.0000
SEDATIVE	PASSIFLORA®	57100	.0857	37.5	235300
ANTIPSYCHOTIC	RISPERDAL®	33300	.6200	44683	.0000
PSYCHOANALEPTIC	PROZAC®	41300	.0396	59.5	200000
MULTIVITAMİNS	NUTRIGEN®	45600	.0396	44683	.0000

**In single measurements, the measurement itself was taken as the median value.*

Total Sugar Content Measurement:

In the calculation of total sugar content, 25 ml drug sample was taken and 5 ml Hcl was added and 100 ml diluted. After heating at 70oC, and kept in a 10-minute water bath, cooled and the pH was neutralized with 30 % NaOH. A total of 40 ml water was added to Fehling A and B solutions prepared in a separate place, and were boiled for 4 min. The drug sample was titrated with this prepared solution. During the titration, the formation of a brick-red-like precipitate was observed as an indicator of the turning point. The reduction of sugar was observed by converting the end point of the reaction to the colorless form of methylene blue and calculations were made by recording the volume spent as a result of titration.

$$\text{Total Sugar content (\%)} = \frac{F_{EQ} \text{ x Dilution x } 100}{V_{titration}}$$

Equivalence of factor (FEQ):1

Vtitration= Titration volume required

Dilution: 100/25=4

Statistical Analysis:

The mean values were statistically analyzed by using Statistics Software SPSS 13.0 (SPSS Inc., Chicago, IL, USA) in the analysis stage of the data. A reference median value was determined by considering all groups for each measurement, and the data were edited with a high score for those values above this reference value, and a low score for below, and the results were made into categorical variables. The Pearson Chi-Square Test was used in the comparisons in all groups in terms of pH, TTA, and TSSC (Bx%) values. A p value <0.05 was considered significant.

RESULTS

The median pH values of the medicaments tested in the study were between 3.11 (Katarin®) and 7.62 (Zofran®), the mean pH value was 5.31, and 53.3 % of the medicaments was below the critical pH (5.5) (Table 2). The TTA values of the medicaments were found to be between .0132 % (Zofran®, Deltacortril®) and 23.8770 % (Augmentin®). Among the medicaments that had the highest TTA values, Augmentin ® (23.8770 %) was the first, and Katarin® was the second (22.9540 %). Although the medicaments had mostly citric acid, they also contained acids like acetic, hydrochloric, benzoic, stearic, tartaric, ascorbic, and ascorbic acid.

The TSSC (Bx %) values of all medicaments were measured, and the lowest value was determined as 1 % (Metpamid®), and the highest value was determined as 62.5 % (Calpol 6 Plus®). Sugar content was found in 33% of the medicaments that were used in the analyses of total sugar content. The highest TSC value was determined in Augmentin® with 63.4900 % in the antibacterial group, followed by Zinnat® with 36.3600 %. Although there was sugar content in all of the medicaments in the antibacterial group, it was not detected in the corticosteroid, antiepileptic, systemic adrenergic, respiratory system/cold groups.

Although there were sucrose (Andazol®, Profenid®, Prozac® Atarax®, Calpol 6 Plus®, Zinnat®); sugar (Citraks®, Macrol®), saccharose (Passiflora®) in the contents of medicaments that made up TSC values, there were also aromas such as saccharine, sorbitol, aspartame, banana aroma, vanilla, mint, tutti frutti, caramel, mixed fruit, blackberry, hazelnut, orange, strawberry cream and artificial flavors. According to the median values found in the distributions in the group, low pH levels were detected in more drug samples in antihistaminic, antiemetic, antiepileptic, systemic adrenergic, antipsychotic, psychoanalytic, and multivitamin groups. The TTA values in all groups were found to be low according to the median value. The total soluble solid contents were found to be higher in antihistaminic, antiparasitic, antibacterial, corticosteroids, nonnarcotic analgesic, respiratory system/cold, sedative, psychoanaleptic groups in intra-group analyses (Table 3).

Table 3.

Below the median value determined for each measurement = low; above the median value = distribution by properties classified as high

	pH (low/high)	TTA (low/high)	TSSC (low/high)
ANTIHISTAMINE	2/1	3/-	-/3
ANTIEMETIC	2/1	3/-	2/1
ANTIPARASITIC	1/2	3/-	1/2
ANTIBACTERIAL	-/3	2/1	1/2
ANTIEPILEPTIC	2/1	3/-	2/1
CORTICOSTEROID	1/2	3/-	-/3
NON-OPIOID ANALGESICS	-/1	1/-	-/1
NSAIDS	1/1	2/-	1/1
SYSTEMIC ADRENERGIC	2/-	2/-	1/2
RESPIRATORY SYSTEM / COLD ALIGN	1/2	2/1	1/1
SEDATIVE	-/1	1/-	-/1
ANTIPSYCHOTIC	1/-	1/-	1/-
PSYCHOANALEPTIC	1/-	1/-	-/1
MULTIVITAMİNS	1/-	1/-	1/-
*p	p=0.528	p=0.804	p=0.480

** p: Pearson chi-square test*
*** Reference median values obtained according to Table 2; pH: 5.1; T: 0.08; TSSC: 1.38*

DISCUSSION

The hypothesis of the study was accepted partly. Although low pH, and high TSSC (Bx %), TTA and TSC values were not detected in all of the medicaments that were analyzed, it was concluded that each drug poses a risk in terms of tooth decays and erosive effects in long-term use.

Since healthcare professionals prefer to use syrup forms of medicaments, especially in pediatrics[6,7], considering the patient compliance, except for 4 medicaments (Zofran® (tablet), Deltacortril® (tablet), Pulmicort® (nebulizer), Ametik® (drop)), which did not have syrup form and were prescribed in the region, generally pharmaceutical syrup forms of medicaments were preferred in the study. The most common Over-the-Counter (OTC) preparations given to children are analgesics, cough medications and vitamins.[14] The medicaments used in our study were chosen from similar drug groups because they were prescribed by pediatricians and easily obtained in the region where the study was conducted.

In this study, the pH values of 53.3 % medicaments were found to be below 5.5 pH, which is considered to be critical for enamel demineralization. Similarly, the pH values of medicaments show an acidic pH which is below most critical pH values in the current literature between 2.5[9] and 6.9.[15] Xavier et al.[7] reported that antipsychotics and antitussives showed the lowest pH values. In this study; however, it was found that 53.3 % of the rate found, although there was single

number of medicaments in some groups, occurred because low pH levels were detected in more drug samples in antihistamines, antiemetic, antiepileptic, systemic adrenergic, antipsychotic, psychoanaleptic, and multivitamins. This is important because especially antipsychotic medicaments[7], which may need to be used for an indefinite period, and[5] prescribed to children due to the high prevalence[7] of upper respiratory diseases to be used several times a day, and in the systemic adrenic group, which can be widely used without being recommended.

When the contents of the medicaments were examined in this study, it was found that there were mostly citric acid, and other acids such as acetic, hydrochloric, benzoic, stearic, tartaric, ascorbic, and sorbic acid. Similarly, in other studies, the type of the acid medicaments contained was commonly mentioned[7] as citric acid and then hydrochloric, tartaric or benzoic acid.[9] The widespread use of citric acid in drug contents is extremely important since it is a strongly erosive agent because it increases the rate of decomposition of tooth enamel by chelating calcium.[16]

As a result of the analyses, it was determined that the TTA values of the medicaments ranged between 0.0132 % (Zofran®, Deltacortril®) and 23.8770 % (Augmentin®). Among the medicaments that had the highest TTA value, Augmentin® (23.8770 %) was the first, and the second was Katarin® (22.9540 %). In a previous study, high TTA[9,17] in medicines confirms the erosive structures of the medicaments. In another study, a medicament that had a pH that was close to 6 exhibited a high TTA value. A possible explanation for this result is the possibility that some components in its content may not have reacted with the base used to neutralize it (10). In this study, the findings of TTA values being found low in all groups in the median intragroup analysis may be because some substances in the contents of these medicaments do not react with the NaOH used to measure the TTA values.

In this study, it was a drug from the antibiotic group that had the highest TTA value. In addition, all medicaments in the antibiotic group showed a higher value than median value in terms of both TSC and TSSC (Bx %) values in intra-group analysis. For this reason, although antibiotics are antimicrobial in nature, their usage in children that use long-term medicament must not be ignored because of the erosive effects of the enamel.[18,19] As a result of the analysis, it was seen that the TTA values of the medicaments are in a wide range. Xavier et al.[7], who reported a similar conclusion, attributed this result to the characteristics of the active components of the medicaments they used.

Although the TSSC (Bx %) values of all the medicaments differed between the medicaments, the lowest value was measured in a close range as 1% (Metpamid®) and the highest value was 62.5 % (Calpol 6 Plus®). The fact that each drug that was used in the study had a certain TSSC (Bx%) value and even the TSSC (Bx %) value in group analyses based on median value being found to be high in antihistaminic, antiparasitic, antibacterial, corticosteroid, nonnarcotic analgesic, respiratory system/cold, sedative, psychoanaleptic groups is important because it poses a risk for tooth decay.[7] In their study, Xavier et al.[7] found the mean amounts of soluble solids at lower values for the antiemetic class, whose composition did not contain sugar. Although this study had a similar outcome, every drug did not show it, which is considered to be because of the different solid amounts of the medicaments other than sugar.

Although drug values like pH and TTA are unquestionably important in tooth decay development, more and more researchers suggest that added sweeteners are of primary importance for the development of common tooth decays.[3,18] In this study, in 33 % of the medicaments had sugar contents; antihistaminic, antiemetic, antiparasitic, nonnarcoticalgesic, nonsteroidal-anti-inflammatory, sedative, psychoanaleptic and antibacterial drug groups. The highest TSC content was in Augmentin® with 63.4900 % in the antibacterial group, followed by Zinnat® with 36.3600 %.

In a previous study, it was found that 82 % of the syrup formulations that were evaluated contained sugar that contraindicated use by children with diabetes, and could increase the risk of caries in case of regular use.[9] In this study, the 33 % low percentage was associated with the use of a small number of medicaments in total and on a group basis. Similarly, In their study, Cavalcanti et al.[9] reported only 5 medicaments among 15 medicaments in their composition had sucrose content in relation to total sugar content. In other medicaments, they detected sodium saccharine artificial sucrose substitutions.

In this study, there were sucrose (Andazol®, Profenid®, Prozac®, Atarax®, Calpol 6 Plus®, Zinnat®), sugar (Citraks®, Macrol®), saccharose (Passiflora®), as well as aromas and artificial flavors such as saccharin, sorbitol, aspartame, banana essence, vanilla, mint, tutti frutti, caramel, mixed fruit, blackberry, hazelnut, orange, strawberry cream. It can be speculated that the medicaments analyzed, whose contents contained sucrose, have the potential to provide caries development since there is a solution of sucrose concentration to create cariogenic biofilm.[15] In this study, for Dolven®, which has sucrose in the ingredients and whose TSC value could not be determined, it is thought that this result has been reached because of looking at reducing sugars in the

study and sucrose is not a reducing sugar.

Selecting a small number of drugs or even a single drug in some groups are limitations in this study. Therefore, more medicament-based evaluations have been made. However, in group-based analysis, according to the median value in antibacterial group medicaments, high TSSC (Bx %) and TSC values were detected in every 3 medicaments. Also, in antihistamine group medicaments, low pH, high TSSC (Bx %) values were detected in every 3 medicaments also one medicament had sugar content. Compared to the other groups, it is thought that more care should be taken in long-term use of these two groups of medicaments.

Oral clearance can be expected to be less effective in young children than in adults because of lower saliva flow and less pronounced oral muscle coordination ability.[18] When it is considered that primary teeth are less mineralized than permanent teeth, tooth decay and erosion, can be seen more for these reasons especially in milk teeth.[5] It should also be considered that the medicaments in liquid form are usually viscous syrups, that penetrate into the approximal areas and fissures which are cannot be accessed by toothbrush.[9] For this reason, many preventive measures are recommended such as taking medicaments during meals not between meals, avoiding taking medicament before bedtime, chewing sugar-free gums to stimulate saliva secretion, doing topical fluoride practices and regular dental check-ups, churning mouths with water after taking each dose of the drug[9], brushing teeth with a fluoride toothpaste twice a day (NaF, 1450 micrograms/g)[20] (not immediately after taking the drug to avoid abrasive effect).[1,2,4]

Most parents are not aware that pediatric medicaments in the syrup form or granule contain sugar.[21] In a previous study, it was found that 94% of parents did not brush the teeth of their children after syrup use.[22] For this reason, considering the cariogenic and erosive potential of sweetened and acidic medicaments that are prescribed for children, parents must be informed about this issue for adequate oral clearance after each dose of the drug as the primary step.[9] Medical prescriptions must always be supervised by healthcare professionals, and if possible, cariogenic or sugar-free medicaments should be prescribed.[15,22] However, it is considered that opinions based on the production of medicaments with low sugar content may be recommended to drug manufacturers.

Since this study was conducted under *in vitro* conditions, the results cannot be fully reflected *in vivo* conditions (the presence of pellicle and saliva).[18] However, the fact that selected medicaments are preferred only by pediatricians in this region can be considered among the limitations of this study.

CONCLUSION

1. A total of 53.3 % of the medicaments used in the study showed acidic pH values below the critical pH level.
2. Sugar content was detected in 33 % the medicaments used in the study.
3. In the intragroup analyses made over the median value in antibacterial group medicaments, high TSSC (Bx %) and TSC values were detected in every 3 medicaments.
4. In the intragroup analyses made over the median value in antihistamine group medicaments, low pH, high TSSC (Bx %) values were detected in every 3 medicaments also one medicament had sugar content.

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