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In-Vivo Assessment of Shift in Plaque Ph Resulting from Pediatric Syrups for Duration of One Hour

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ABSTRACT

Aim: To evaluate the pH shift of dental plaque following mouth rinse with the frequently recommended pediatric syrups. Materials and Methods: Forty participants were selected of age groups 12-14 years and categorized into 4 groups of 10 each based on usually used pediatric syrups. Oral prophylaxis was done to all the participants. After measuring the baseline resting plaque pH on test day, individuals were instructed to rinse with five milliliters of the pediatric syrup samples, swish around the mouth cavity for ten seconds, and then spits out. Samples of supragingival plaque were taken using the harvesting method at baseline and five, ten, fifteen, thirty, forty-five, and sixty minutes after rinsing with each medication. Plaque's pH was measured with a digital pH meter. One-way ANOVA and Tukey's post hoc test were used to statistically assess the collected data. Results: Mean pH of the pediatric syrups resulting in acidic pH in all the samples having highest acidic pH in Ibugesic. Ibugesic demonstrated the greatest decrease in plaque pH of any pediatric syrup in 5 minutes. Within 60 minutes, the pH gradually returned to near normal. Conclusions: All healthcare practitioners should be concerned with lowering the cariogenic risk of pediatric syrups.

INTRODUCTION

Children continue to experience dental cavities despite the numerous advancements. Many parents are aware that tooth cavities and sugar are directly related. They do not, however, know that many pediatric syrups contain added sugars that are disguised. There have been reports of sugar particularly sucrose being added to pediatric syrups since the fifteenth century to mask the disagreeable taste of some active ingredients and make it more acceptable to children.[1]

These pediatric syrups are supplemented with excess acids in addition to sugars. Children who regularly use medications and have ongoing or recurring health issues are especially vulnerable to cariogenic potential and acidogenic properties. In the inner layer of dental plaque on the tooth surface, the oral bacteria break down sugar and raise the local concentration of organic acid, lowering the pH of the mouth and causing demineralization.[2] To evaluate the shift in plaque pH following oral rinsing with the frequently prescribed pediatric syrups, this study was carried out in-vivo.

1. Materials and Methods:

The study comprised 40 healthy individuals, including both gender, aged 12-14, with a simplified oral hygiene index score of ≤ 1.2 and decayed, missing, and filled teeth score of ≤3. Patients with illnesses, antibiotic therapy, medications or treatments that affected salivation, periodontal diseases, missing teeth or dental caries or any kind of restoration in index teeth were excluded.

The enrolled participants were educated about study and informed consent was obtained. Oral prophylaxis was performed and split into four groups of ten depending on pediatric syrups: Group 1: Ibugesic, Group 2: Calpol®, Group 3: Augmentin® Duo, and Group 4: Mox®. pH of medications was calculated by three times utilizing digital pH meter and mean was recorded.

Participants were summoned early in the morning for the test and instructed to refrain from any oral hygiene practices for 48 hours before to the test and not to eat anything except plain water on the day of test to maintain research homogeneity. Baseline measurement of resting plaque pH was done followed by rinsing and swishing around the oral cavity of 5ml of sample pediatric syrups for 10sec without ingesting it. Samples of supragingival plaque were collected using sterile spoon excavator by harvesting technique from the maxillary buccal surface of molars at baseline, five, ten, fifteen, thirty, forty-five, and sixty minutes after rinsing with each drug and mixed with 20 milliliters of distilled water and stored in a sterile plastic bottle.

Following the procedure, participants were asked to rinse their mouths with plain tap water right away. One hour later, supervised toothbrushing was recommended, and they were told to return to their regular oral hygiene practices. For each person, the identical process was performed. The containers containing the collected plaque samples were promptly sealed. Within an hour of the sample being collected, the pH of the plaque was measured with a digital pH meter. The electrode was cleaned with twice-distilled water, blotted with blotting paper, and then submerged in a standard pH solution of 7.0 both before and after each plaque pH reading. This guaranteed consistent measurements and a continuous monitoring of the readings' drift. After three iterations of the readings, the average was calculated.

All the data was collected and recorded and statistically analyzed using one ANOVA and Tukey's multiple post hoc tests utilizing SPSS software 23. The level of significance was adjusted to 0.001.

2. Results

Table 1 shows that all pediatric syrups have acidic pH, with Ibugesic® having highest acidic pH at 4.89±0.05. Table 2 details the changes in plaque pH after rinsing with various syrups, showing a baseline pH of 6 to 7. Most patients experienced a significant drop in plaque pH, peaking within five minutes of rinsing. Ibugesic® caused the largest decline, with a statistically significant difference noted. Plaque pH returned to near normal within 60 minutes.

Table 1: Mean pH of the pediatric syrups

Pediatric Syrup Brand Name	Chemical composition	Mean pH
Ibugesic (Cipla Ltd)	Ibuprofen	4.89±0.05
Calpol (Glaxosmithkline Ltd)	Paracetamol	6.34±0.03
Augmentin Duo (Glaxosmithkline Ltd)	Amoxicillin and Potassium clavulanate	6.32±0.05
Mox (Sun Pharmaceutical Ltd)	Amoxicillin	6.52±0.02

Table 2: Shift in the mean and standard deviation of plaque pH after rinsing with different pediatric syrups at various time intervals

Pediatric Syrups	Baseline	5 min	10 min	15 min	30 min	45 min	60 min
Group 1	7.24±0.05	6.20±0.01	6.24±0.09	6.43±0.02	6.56±0.9	6.70±0.04	6.79±0.08
Group 2	6.98±0.07	6.51±0.03	6.59±0.12	6.62±0.11	6.71±0.23	6.78±0.45	6.88±0.34
Group 3	7.02±0.12	6.40±0.07	6.55±0.13	6.59±0.03	6.67±0.13	6.71±	6.80±0.60
Group 4	6.86±0.08	6.55±0.13	6.60±0.14	6.64±0.21	6.72±0.26	6.79±0.12	6.83±0.13
f-value	2.247	8.397	7.008	6.990	5.720	1.388	1.506
p-value	0.02	0.001*	0.001*	0.001*	0.001*	0.02	0.04

*Statistically Significant

DISCUSSION

Sugars like sucrose, glucose, and fructose in pediatric syrups increase the risk of dental caries in children. These syrups may inhibit the demineralization-remineralization process due to their low pH and high sugar content. Bacteria convert sugars to acidic byproducts, lowering plaque pH and leading to ionic dissolution of hydroxyapatite, resulting in carious lesions. This study examines how commonly prescribed pediatric syrups affect dental plaque pH, a key factor in cariogenic risk.[3,4] A pH electrode meter was used to determine the average pH of each pediatric syrup are conventional digital pH meters, portable and have been studied quickly used in this investigation.[5] Plaque pH testing is significantly influenced by the age of the plaque. The two-day-old plaque in an investigation adapted to fermenting carbohydrates more quickly than the older, more developed plaque in terms of pH alterations.[6] In this study, participants refrained from brushing for two days before pH readings to ensure accurate responses to carbohydrate challenges. Plaque pH typically ranges from 6 to 7. However, consumption of low pH or sugary drinks reduces plaque pH, as oral bacteria break down carbohydrates in liquid medications, further lowering mouth pH.[2] Pediatric syrups cause an acidic shift in plaque pH, according to the study's findings, however Ibugesic caused the most drop, with a mean pH of 4.89±0.05. This conclusion is troubling since enamel demineralization, which paves the way for dental cavities, can be greatly increased by a pH below 5.5. The initial drop in pH observed within the first five minutes suggests that immediate actions may be necessary to mitigate possible adverse effects on dental health following the administration of these syrups containing high sucrose amount, whereas gradual recovery of the oral pH to the near-normal value within 60 min was seen. This can be due to the salivary buffering system (mainly bicarbonates), which gets activated with the increased salivary secretion and occurs due to an acidogenic challenge. Among the pediatric syrups included in our study, none of them caused the drop in the plaque pH to critical pH (5.5). This does not preclude the possibility of enamel decalcification in certain circumstances.[7] The study limits short duration of pH measurement post-rinsing, variations in individual saliva production and composition was not considered. Longer-term studies may provide a more comprehensive understanding of the cumulative effects of repeated syrup usage over time.

CONCLUSION

This study highlights the immediate and significant impact of pediatric syrups on plaque pH, emphasizing the need for increased awareness and strategies to manage the cariogenic risks associated with these medications among healthcare practitioners, parents, and caregivers.

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