Relationship between paediatric liquid medicines (PLMs) and dental caries among chronically ill children

Ankita Goyal[1*], Vatchala Rani[2], Bhadravathi Cheluvaiah Manjunath[3], Kanupriya Rathore[4]

[*1]Department of Dental Surgeon, Employees State Insurance Corporation Hospital Abu Road, India
[2]Department of Oral Pathology and Microbiology, Faculty of Dentistry Jamiya Miliya Islamiya University, India
[3]Department of Public Health Dentistry, Postgraduate Institute of Dental Sciences, India
[4]Department of Pedodontics, Faculty of Dentistry All India Institute of Medical Sciences, India

ABSTRACT

Introduction: Paediatric liquid medicines (PML) most often contain sucrose as a sweetening agent to mask the bitterness of active ingredients and make it more palatable; however, this may be a risk factor for dental caries. The purpose of this research was to assess the relationship between long-term pediatric liquid medicines (PLMs) consumption and dental caries in 2–12-years-old chronically ill children. **Methods:** A cross-sectional study was performed in a public pediatric hospital in India for a period of 6 months. A total of 455 children aged 2–12 years old with various chronic diseases who were receiving PLMs for more than 6 months were selected as the subjects in this study and compared with 531 children of similar age group and diseases who received other forms of medication. Dental caries was measured by DMFT/dmft DMFS/dmfs, and data collected were analyzed with SPSS (17th version) using statistical tests such as t-test and one-way ANOVA. Univariable logistic regression was used where the significance was fixed at a a p value of less than 0.001. **Results:** Children on PLMs had an increased risk of dental caries than those on other forms of medications (OR: 3.142, 95% CI: 2.37–4.15, $p < 0.001$). The prevalence of dental caries was higher (77.8%) in children consuming PLMs when compared to other forms of medication (52.7%). The mean DMFT and dmft scores were significantly higher in the study group when compared to the control group ($p = 0.001$). **Conclusion:** Long-term consumption of pediatric liquid medicines containing sucrose as a risk factor for dental caries among chronically ill children. sugar free options has to be used during prescription to prevent medication-triggered caries.

Keywords: Paediatric liquid medicine, medication-triggered caries, sugar-free medication

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[*]Corresponding author: Bhadravathi Cheluvaiah Manjunath, Senior Professor and Head, Department of Public Health Dentistry, Postgraduate Institute of Dental Sciences, Rohtak, Haryana, India, 55281. Phone: +919416929911; Email: bcmanju10@rediffmail.com

INTRODUCTION

Liquid medicines in the form of syrups are commonly prescribed to children as a part of therapy in treatment of various chronic and acute infections. These pediatric liquid medicines (PLMs) often contain sugar in the form of sucrose, which is added to increase the palatability and biocompatibility of the medicines.[1] PLMs posses a low pH, a high concentration of sugars, and a high titratable acidity which are considered as risk factors for dental caries.[2-5] Accumulating evidence from various studies[6-8] has pointed out a possible relationship between dental caries and long-term consumption of liquid oral medicines. Chronically ill children suffering from various diseases, such as epilepsy, malnutrition, asthma, nephrotic syndrome, congenital heart diseases and anaemia, require intake of liquid medicines on long-term basis which predisposes them to dental caries.[9-10]

PLMs account for 11% of all forms medicines, both prescribed and over the counter.[11] Studies on the prescription patterns by pediatricians have revealed that 60.4% of medicines are prescribed as syrup/suspension/oral drops/liquids and 32% are prescribed as tablets/capsules. Traditional cough suppressants and medicines against common cold comprise the drugs commonly given as syrups.[12] There are also similar reports[13-14] which provide evidence that PLMs are the most commonly prescribed drugs when compared to other forms of medicines and, hence, creating awareness among pediatricians regarding the adverse effects of sugar-based PLMs is an utmost priority.

Literatures present mixed results, showing both positive[14,15] and negative correlations[16] between sweetened liquid medicines and dental caries. Despite the availability of sugar free medicines (SFM), there is no decreasing trend in consumption of sweetened PLMs, which is mainly due to the lack of knowledge and awareness among both parents and health practitioners.[17-20] Possibly due to lack of proper evidence may also contribute to the hesitation among many medical practitioners about this correlation. Therefore, it is imperative to provide more evidence to create awareness among them about the association of dental caries with long-term consumption of sweetened PLMs. The present study was conducted with an objective to assess the dental caries experience and its relationship with long-term consumption of pediatric liquid medicines (PLMs) among 2-12 years old children with various chronic diseases in Jaipur, India.

METHODS

Study setting

A hospital based cross-sectional study was carried out in a period of six months at J.K Loan Hospital, Jaipur, Rajasthan, India, which is a leading public pediatric hospital of Rajasthan state. The study participants included patients visiting the hospital and suffering from various chronic diseases (Table 1 and 2). Ethical clearance was obtained from the research review board of Jaipur Dental College and approval was also sought from the concerned hospital authorities by submitting the detailed research proposal, with registry number of (No.F3(107)/MC/GS/2011 dated 15/11/2011). A written informed consent was obtained from the parents of all children who were willing to participate in the survey.

Participants

Based on the findings of the pilot study, a total of 455 chronically ill children inpatients between 2-12 years old under long-term (more than three months) PLMs therapy were included as subjects of the study group and a comparison group of 531 children who were newly diagnosed cases of chronic diseases as children visiting the outpatient department (OPD) who were on other forms of medication other than PLM (Table 1).

Inclusion criteria

Children aged 2-12 years, suffering from anemia, malnutrition, epilepsy, congenital heart disease, nephrotic syndrome, and asthma; receiving PLMs for more than three months whose parents gave the consent, were included in the study. For describing the study population, the study participants were divided into 2-5 years (primary dentition) and 6-8 years, and 9-12 years (mixed dentition).

Exclusion criteria

Children who were not on paediatric liquid medications on long-term basis or on any other form of medication were excluded from the study

group as well as those children whose parents did not give consent and those children suffering from any other systemic disease.

Training and calibration

Dental examination for every subject was carried out by a single investigator and a second examiner who entered the general information and the codes on the survey form. It took 5-7 minutes to examine a child. Prior to conducting the study, training and calibration of the examiners was done at the Department of Public Health Dentistry, Jaipur Dental College, Jaipur in order to limit examiner variability and the kappa value was found to be 0.82, which was satisfactory.

Intra examiner reliability was assessed by applying the DMFT/dmft/DMFS/dmfs/dft index on 30 selected subjects and recorded the findings. The same children were randomly re-examined on different days and, again, findings were recorded. The intra examiner variability was found to be 85%, which reflected a high degree of conformity in observation.

Pilot study and sample size calculation

Sample size calculation was done by considering study power at 80%, alpha error of 0.05, and beta error of 0.2. As per the results of pilot study which was carried out on 30 children, it was assumed that the prevalence of caries in non-exposed/control/ general population group was 35% while the same prevalence for the exposed group was 60% Thus, the sample size attained was 70 subjects in each group, which was further increased to 84 patients per group due to the consideration of the drop-out rate of 20%.

The survey was carried out using specific proforma designed in English which consisted of three parts.

a) General Information:

First part consisted of general information of children on long term PLM suffering from various chronic diseases regarding their name, age, gender, Postal address, contact details, group to which they belong (study/comparative), education level of child's mother and father.

b) Questionnaire: A pretested and validated questionnaire was used to obtain information regarding their oral hygiene practices, dietary habits and pattern of medication use. Both close ended and open ended question format was used.

c) Clinical examination: Second part of the study consisted of oral examination which was purely clinical (using mouth mirror and explorer); in which dental caries in the permanent dentition was assessed by DMFT and DMFS given by Henry Klein, Carole E Palmer and Knutson JW in 1938.21 For assessing the dental caries in the primary dentition (less than 5 years), dmft and dmfs and mixed dentition dft and dfs was used given by Gruebbel A.O. in 1944.22 Type III examination was conducted. The intra oral examination was carried out by the investigator under artificial white light in the inpatient and outpatient departments of J.K Loan Hospital, Jaipur under aseptic conditions.

Statistical analysis

All data were analyzed in SPSS 17 version and tests of significance such as t-test and one-way ANOVA were used. Descriptive statistics included computation of means and standard deviations. The odds ratio was calculated to provide an association with the dependent and independent variables and also other possible confounding factors using multivariate logistic regression. Differences were considered significant at $p < 0.05$.

RESULTS

In the present study, among a total of 986 chronically ill children, as many as 455 were included in study group children with long term paediatric liquid medicines (PLMs) with a mean age of 5.20 ± 2.310 years, while as many as 531 (not on long term paediatric liquid medicines (PLMs) were included in comparative group with the mean age of 5.21 ± 2.529, as presented in Table 1.

Table 2 showed the children suffering from chronic diseases like anaemia (19.3%), malnutrition (20.66%), epilepsy (18.46%), congenital heart disease (CHD) (9.89%), nephrotic syndrome (20.22%) and asthma (11.2%), which were included in the study group. Similar distribution was observed in the comparative group as well.

The mean dental caries experience was significantly higher (DMFT = 0.34 ± 1.00; dmft = 3.61 ± 3.47; DMFS = 0.60 ± 2.1; dmfs = 7.66 ± 7.98 respectively) among chronically ill children with long term paediatric liquid medicines (PLMs) treatment, when compared to comparative group

Table 1. Study participant characteristics

Age group	Study Group (children on long term paediatric liquid medicines (PLMs)				Comparison Group (not on long term paediatric liquid medicines (PLMs)			
	Male (N %)	Female (N %)	Total	Mean age±SD	Male (N %)	Female (N %)	Total	Mean age
2-5 years	137 (50.74)	133(49.25)	270	3.70 ±1.043	171(50.29)	169(49.70)	340	3.69±1.041
>5- 8 years	70 (49.29)	72(50.7)	142	6.64±0.764	58(49.70)	51(46.78)	109	6.51±0.762
>8- 12 years	17 (39.53)	26(60.46)	43	9.90±1.044	44(53.65)	38(46.34)	82	9.79±1.095
Grand total	224 (49.23)	231(50.76)	455	5.20±2.310	273(51.41)	258(48.58)	531	5.21±2.529
Mean age ± SD	5.05±2.252	5.35±2.360		5.20±2.310	5.25 2.527	5.17±2.535		5.21±2.529

Table 2.Classification diagnosis of disease participants in study group and comparison group

	Study group (children on long-term pediatric liquid medicines (PLMs)			Comparison group (not on long-term pediatric liquid medicines (PLMs)		
	Male	Female	Total	Male	Female	Total
Disease	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Anaemia	48(21.43)	40(17.32)	88(19.34)	66(24.18)	46(17.83)	112(21.09)
Malnutrition	41(18.30)	53(22.94)	94(20.66)	48(17.58)	56(21.71)	104(19.59)
Epilepsy	41(18.30)	43(18.61)	84(18.46)	45(16.48)	61(23.64)	106(19.96)
CHD	21(9.38)	24(10.39)	45(9.89)	32(11.72)	21(8.14)	53(9.98)
Nephrotic syndrome	47(18.30)	45(19.48)	92(20.22)	47(17.22)	38(14.73)	85(16.01)
Asthma	26(11.61)	26(11.26)	52(11.43)	35(12.82)	36(13.95)	71(13.37)
Total	**224**	**231**	**455**	**273**	**258**	**531**

(DMFT = 0.17 ± 0.71; dmft = 1.18 ± 1.62; DMFS = 0.23 ± 1.16; dmfs = 2.12 ± 3.52 respectively). The mean of dmfs was significantly higher among children suffering from anaemia (8.62 ± 8.21), malnutrition (9.28 ± 9.40) and nephrotic syndrome (7.50 ± 6.73) when compared to comparative group. All of these results were shown in Table 3.

Prevalence of dental caries was significantly higher in study group (77.8%) than in comparative group (52.73%). Caries prevalence was found more among females (78.78%) when compared to males (76.78%) in the study group. Caries free children was also significantly higher (47.26%) when compared to study group (22.19%) (Table 3).

Table 3. Comparison of dental caries experience among children with various diseases between two groups

Groups	Study group (children on long term paediatric liquid medicines (PLMs)					Comparative group (not on paediatric liquid medicines (PLMs)				
Diagnosis	N	DMFT	dmft/dft	DMFS	dmfs/dfs	N	DMFT	dmft/dft	DMFS	dmfs/dfs
Anaemia	88	0.20±0.59	3.87±3.37	0.22±0.63	8.62±8.21	112	0.16±0.74	1.11±1.81	0.17±0.78	1.96±3.54
Sig.(2-tailed)		0.720*	0.001***	0.637*	0.001***		0.720*	0.001***	0.637*	0.001***
Malnutrition	94	0.55±1.08	4.52±4.39	0.88±2.22	9.28±9.40	104	0.26±0.95	1.27±1.57	0.36±1.4	2.30±3.15
Sig.(2-tailed)		0.053*	0.001***	0.055*	0.001***		0.053*	0.001***	0.055*	0.001***
Epilepsy	84	0.17±0.66	3.40±3.16	0.32±1.27	6.86±7.83	106	0.15±0.64	1.28±1.43	0.23±1.34	2.18±3.11
Sig.(2-tailed)		0.772*	0.001***	0.657*	0.001***		0.772*	0.001***	0.657*	0.001***
CHD	45	0.00±0.00[a]	2.82±2.82	0.00±0.00[a]	5.26±6.03	53	0.00±0.00[a]	1.24±1.41	0.00±0.00[a]	1.81±2.54
Sig.(2-tailed)		NA	0.001**	NA	0.001**		NA	0.001**	NA	0.001**
Nephrotic syndrome	92	0.34±1.09	3.39±2.82	0.75±2.74	7.50±6.73	85	0.07±0.33	1.03±1.21	0.09±0.50	1.96±3.03
Sig.(2-tailed)		0.022**	0.001***	0.026*	0.001***		0.022*	0.001***	0.026*	0.000***
Asthma	52	0.76±1.74	2.98±3.58	1.42±3.45	6.78±8.06	71	0.30±0.87	1.14±2.13	0.50±1.77	2.46±5.38
Sig.(2-tailed)		0.085*	0.001**	0.085*	0.001**		0.085*	0.001**	0.085*	0.001*
Total average	455	0.34±1.00	3.61±3.47	0.60±2.1	7.66±7.98	531	0.17±0.71	1.18±1.62	0.23±1.16	2.12±3.52
Sig.(2-tailed)		0.002**	0.001***	0.001**	0.001***		0.002**	0.001***	0.001**	0.000***

*** p < 0.05; ** p < 0.01; *** p < 0.001**

Table 4 showed that the prevalence of dental caries was significantly higher in study group, whose under paediatric liquid medicines (PLMs) (77.8%) when compared to comparative group (52.73%). The caries prevalence was found more among females (78.78%) when compared to males (76.78%) in the study group. The caries free children was significantly found to be higher (47.26%) in the comparative group when compared to study group (22.19%).

Table 4. Prevalence of dental caries based on diagnosis among two groups

Diagnosis	Study group (children on long term paediatric liquid medicines (PLMs)						Comparative group (not on paediatric liquid medicines (PLMs)					
	Male		Female		Total		Male		Female		Total	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Anaemia	35	15.62	29	12.55	64	14.06	35	12.82	19	7.36	54	10.16
Malnutrition	39	17.41	47	20.34	86	18.90	28	10.25	26	10.07	54	10.16
Epilepsy	29	12.94	35	15.1	64	14.0	25	9.15	34	13.17	59	11.11
CHD	15	6.69	18	7.79	33	7.25	20	7.32	11	4.26	31	5.83
Nephrotic syndrome	37	16.51	36	15.58	73	16.04	20	7.32	25	9.68	45	8.47
Asthma	17	7.58	17	7.35	34	7.47	19	6.95	18	6.97	37	6.96
Total and % of caries prevalence	**172**	**76.78**	**182**	**78.78**	**354**	**77.80**	**147**	**53.84**	**133**	**51.55**	**280**	**52.73**
Caries free	**52**	**23.21**	**49**	**21.21**	**101**	**22.19**	**126**	**46.15**	**125**	**48.44**	**251**	**47.26**
Total population	**224**	**49.23**	**231**	**50.76**	**455**	**100.0**	**273**	**51.41**	**258**	**48.58**	**531**	**100.0**

Table 5. Multivariable logistic regression models for caries experience among children on long term paediatric liquid medicines (PLM) and without long term paediatric liquid medicines (PLMs)

Variable	Multivariable (with PLM)		
	Odds ratio	95% CI	p-value
Age range			
2-5years (ref)			
6-8 years	0.572	0.41-0.78	0.001
9-12 years	0.499	0.32-0.76	0.002
Gender			
Female(ref)			
Male	0.990	0.76-1.28	0.992
Group			
Without PLM(ref)			
With PLM	3.142	2.37-4.15	0.001
Start of tooth brushing			
Less than 6 months	1.656	1.10-2.48	0.019
Does not clean	1.809	1.33-2.45	0.000
Use of oral hygiene aids			
Toothpaste & toothbrush (ref)			
Neem/babul/miswak	1.769	1.06-2.92	0.034
Toothpowder	1.662	0.93-0.96	0.111
Finger/Ash/coal/salt/ soil/ tobacco powder/ any other	2.260	0.83-6.12	0.153
None	0.775	0.57-1.03	0.102
Use of fluoridated or non fluoridated toothpaste			
Fluoridated (ref)			
Non fluoridated	1.074	0.61-1.88	0.915
None	1.022	0.78-1.33	0.928

Variable	Multivariable (with PLM)		
	Odds ratio	95% CI	p-value
Eating of snacks/drinking milk/juices (sugared) in between meals			
Never (ref)			
Rarely	1.621	1.01-2.59	0.058
Once a day	3.087	1.56-6.07	0.002
More than once a day	1.588	0.91-2.76	0.136
Eating or drinking the sugary foods in a week			
Never (ref)			
Seldom	2.198	1.25- 3.86	0.008
Frequently	2.676	1.16- 6.14	0.032
Daily	2.503	1.35- 4.61	0.005
Frequency of paediatric liquid medicines (PLMs) usage			
Not yet started (ref)			
Once a day	1.731	0.95-3.13	0.092
Twice a day	3.723	2.73-5.07	0.000
More than two times	1.483	0.71-3.09	0.382
Duration of paediatric liquid medicines (PLMs) usage			
Not yet started using medicine (ref)			
3 months to 6 months	2.556	1.86- 3.51	0.000
> 6 months to 1 year	6.253	3.48- 11.22	0.000
> 1 year	2.799	1.52- 5.12	0.000
Degree of freedom (df)= 1			

Our study revealed that children who were under paediatric liquid medicines (PLMs) treatment had three times higher of dental caries risk than those who were not under paediatric liquid medicines (PLMs) treatment (OR 3.142; 95% CI (2.37 to 4.15); p = 0.001) (Table 5). Children who used miswak and babul chewing sticks for toothbrushing were at the higher risk for dental caries incidence (1.76 and 1.66 times more) when compared to brushing with commonly found toothbrush and toothpaste. Children who used non fluoridated toothpastes were 1.074 times more risk of dental caries when compared to the children who used fluoridated toothpaste. In between meal snacking once a day had a risk of 3.08 times of dental caries when compared to none. Eating or drinking sugary foods frequently in a week had 2.67 times more risk of dental caries when compared to none.

Children who used PLMs twice a day had 3.72 times more risk of dental caries (95% C.I (3.48- 11.22); p-value = 0.001). Children who were using PLM for more than 6 months were 6.253 times more at risk of getting dental caries when compared to children without PLM. (Table 5).

In present study, findings demonstrated that the children who were on PLMs for more than 6 months were 6.253 times more at risk of getting dental caries when compared to children who did not receive PLMs. Logistic regression revealed significant associations with children on pediatric liquid medicines.

DISCUSSION

Dental caries is a chronic disease which is more common than early childhood obesity, asthma, and diabetes due to multi-factorial reasons.[23,24] Scientific evidence through various published reports suggests that paediatric liquid medicines (PLM) possess high erosive and cariogenic potential which is detrimental to oral health.[3-7]

PLM may contain antibiotics or multivitamins and minerals as active ingredients. When antibacterial syrup medication was used, at first, there was significant decline in dental caries but then new accelerated form of carious lesions called as “Medication caries” was reported.[9,25-28] Addition of sucrose has overridden the strong anti-streptococcal spectrum. Concerning non-

antimicrobial medication, the cariogenic effect and erosive potential of the PLM may override the cariostatic effect of the therapeutics.[29-31] Hence, prolonged consumption of liquid medicines poses a significant threat for good oral health. The deleterious effect of antimicrobials in syrup form containing sugars can be minimised by incorporating sugar substitutes which are called sugar free medicines (SFMs).[32]

The findings of our present study further add to the growing body of knowledge regarding the association of pediatric liquid medicines and dental caries. Our study revealed that children consuming pediatric liquid medicines were 3.142 times more likely to develop dental caries than those without pediatric liquid medicines, which was highly significant. (OR 3.142, 95% CI (2.37 to 4.15) p = 0.001 (Table 5).

Our study corroborates with the findings of studies of Roberts[8] who examined chronically ill children and reported mean defs of 5.6, which was significantly higher than in the control group (1.3 defs) who were on tablet form of medication. Similarly, another study reported more caries in deciduous anterior teeth of children on PLMs when other contributing variables were controlled.[10] A study found that epileptic children who were on long-term PLMs therapy were 2.55 times more likely to develop dental caries (prevalence = 76.1%) than those with other forms of medications (prevalence = 55.6%).[14] It is not surprising to find the age adjusted odds ratios for caries experience as opposed to no caries experience in deciduous dentition of 1.27 (95%CI: 0.55-2.97) among children on PLMs versus their siblings.[10]

In present study, results revealed that the children who were using PLMs for more than 6 months were 6.253 times more at risk of getting dental caries when compared to children without PLMs. Liquid medicines may also be the reason for partial edentulousness among children. Maguire A, Rugg-Gunn A.J [9] reported a statistically higher "missing" component (p= 0.0419) among children on liquid medicines. The severity of dental disease along with children's medically compromised condition may be the reason for the extraction of the teeth, rather than restoration.

Dental caries is a chronic disease which is more common than early childhood obesity, asthma, and diabetes due to multi-factorial reasons.[22,23] Scientific evidence through various published reports suggests that pediatric liquid medicines (PLMs) possess high erosive and cariogenic potentials which are detrimental to oral health.[24,25] PLMs may contain antibiotics or multivitamins and minerals as active ingredients. When antibacterial syrup medication is used, there was a significant decline in dental caries at first; however, new accelerated form of carious lesions called as "Medication caries" is reported afterwards.[26] Addition of sucrose has overridden the strong anti-streptococcal spectrum in antimicrobial medication and, in non-antimicrobial medications, the cariogenic effect of the syrup may override the cariostatic effect of the therapeutics.[27] Hence, prolonged consumption of liquid medicines poses significant threat for good oral health.

Epidemiological evidence strongly supports the view that there is a strong relation between PLMs and a high level of dental caries.[7-10] Time factor in caries development is associated with frequency of sugar exposure. The findings in Vipeholm's study also showed that a frequent intake of food with high sugar concentrations increases caries activity.[28]

The risk of developing dental caries associated with the use of sweetened PLMs becomes aggravated when no measures of oral hygiene is performed. In children suffering from various chronic diseases, their body's resistance to the disease is already compromised and sweetened medications poses a significant threat to their dental health[7-10,14] Evidence also stated that calcium dissolution occurs from all paediatric liquid medicaments containing cariogenic sugars.[33] Several in vitro studies assessing the pH, sucrose concentration, titratable acidity, and viscosity have revealed the cariogenic and erosive nature of PLMs.[6,34-36] Findings of plaque pH studies have also proven its cariogenic nature.[29-31]

Frequent use of liquid medicine increases the risk of enamel caries by increasing the oral bacteria fermentation. With low pH environment, the micro-flora shifts from resident to more cariogenic one. It has also been reported that the critical ions such as calcium, phosphorus, and fluoride are involved in the decrease of de- and remineralisation of enamel and dentin in the presence of sucrose in oral environment.[32-34]

The need for sucrose use as a sweetening agent in liquid medicines, particularly in pediatric medical practices should be seriously questioned and reassessed. There is also a low level of awareness among pediatricians and pharmacists about the relationship of sweetened medicines and dental caries[31-36] In a survey conducted in Northen Ireland, just more than 17 percent of children are always provided with sugar-free liquid medicines.[37] The medical status of children is the only condition that influences pediatricians in making the decision to prescribe sugar-free medications (SFMs).[19] Specific campaigns to encourage the use of SFMs and further increase in their availability for all types of disease should be sought from manufacturers.[39]

Even though, SFMs are perceived as more expensive than sweetened medicines, the benefits from prescribing these will outweigh the high cost.[40] Therefore, high consumer pressure on pediatricians and, subsequently, on manufactures can influence the increase in sale of SFMs.[41] Although there is a support for the sugar- free option, there is a need to raise the awareness among health professionals, parents, and pharmacists to move towards SFMs.[42] A more multi-professional approach is also essential among other stakeholders, like manufactures and regulators, with regards to the provision of sugar free PLMs which can prevent medication caries among chronically ill children.

Limitations of the study

The results of the study cannot be extrapolated as the study was localized to one particular hospital. Long-term studies should further be conducted by including different hospital settings. The ability of analytical cross-sectional studies to draw valid conclusions about association between outcomes and risk factors is limited as both are measured simultaneously. Therefore, it becomes very difficult to measure whether the disease or the exposure comes first that causation should always be confirmed by more precise studies.

CONCLUSION

Long-term consumption of paediatric liquid medicines containing sucrose may be a risk factor for dental caries among chronically ill children and sugar free options has to be used during prescription to prevent medication-triggered caries.

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