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**Original Article**

# Availability of sugar-free medicine for children: Are we denying their needs?

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**Abstract** This study aimed to review the availability of sugar-free medicine available in the market using the online Monthly Index of Medical Specialties (MIMS) Malaysia 2016. Data collection was obtained from product information (PI) for prescription medications contained in the MIMS Malaysia 2016. Concise information for each product was collected based on therapeutic class groupings. The therapeutic class obtained from PI was assigned to one of the 11 major therapeutic classes. PI that stated its use in paediatrics was further reviewed for the availability of sugar free ingredient. Each product was then allocated into the poison groups: Group B, Group C and Non-Scheduled Poison. A total of 282 PI items from 336 companies in MIMS Malaysia 2016 that satisfied our eligibility criteria were reviewed. Of the 282 PI items reviewed, most of the products, 169 (59.9%) were sugar-based product, while 87 (30.9%) of them belong to sugar free products. Our study found that most of the medicines reviewed in the MIMS Malaysia 2016 were under Group C (134 of total 282). There is still a high number of sugar-containing medicines despite the promotion of sugar-free medication. Therefore, consumers need to be educated on the use of sugar-free medicines in children to increase the demand and availability in the market.

**Keywords:** Cariogenic; paediatric patients; product Information; sucrose; sugar-free medicine.

## Introduction

A survey in New Zealand showed that over half of the prescribed and over-the-counter medicines for children contain sugar (Durward and Thou, 1997). In a study in north-east of England, 59% of liquid oral medicines prescribed in the hospital pharmacies and community pharmacies for long-term use were sugar-based (Maguire and Rugg-Gunn, 1994).

Southeast Asia children aged 5- to 6-year-old has been reported with a substantial prevalence of caries incidence. Malaysian children has been quoted as having up to 75% caries prevalence (Duangthip *et al*., 2017). Dietary sugar has been identified as one of the pathological factors that causes dental caries (Pitts *et al*., 2017). There is an association between sugar containing medicines and dental caries especially in chronically sick children that requires long term medication (Scottish Intercollegiate Guidelines Network, 2000). High caries prevalence has been reported in children with congenital heart disease despite intensive prevention efforts. Authors found a strong correlation between the duration of digoxin intake with caries experience among the observed patients (Stecksén-Blicks *et al*., 2004). The most common type of sugar used is sucrose which is harmful for teeth especially for children who are on long-term treatment (Maguire and Rugg-Gunn, 1994).

Sugars include monosaccharide such as glucose, fructose and disaccharides such as sucrose, lactose, and maltose. The British National Formulary for Children (BNF for Children) defines sugar-free medicines as oral liquid preparations that do not contain fructose, glucose or sucrose (Joint Formulary Committee, 2015). Evidences have shown that some oral medications, both prescription and non-

prescription, have sucrose contents of up to 80% since it is cheap, and easy to process. Cost is cited as one of the hindering factor in producing sugar free medication as a substitute to the currently available drugs in the market (Mackie and Hobson, 1993). The cariogenic potential of paediatric liquid medications is positively observed in children that was prescribed a long term sugar based medication when compared with children who does not require any medication (Sahgal *et al*., 2002).

To the best of our knowledge, no published evidence is available in reporting the types and availability of sugar-free medication available in the Malaysian market. As a starting point, we reviewed the online MIMS Malaysia 2016 for the availability of sugar-free medication for paediatric patients.

## Materials and methods

The PI in the online MIMS Malaysia 2016 were reviewed from July till August 2016 for the availability of medication in liquid formulation for paediatric patients. The search term 'liquid medication' has been included as well as 'suspension', 'elixir', 'linctus', 'syrups', 'drops' and 'effervescent tablet'. Paediatric patients were defined as children younger than 12 years of age (Clark *et al*., 2015). Each product was grouped according to the classifications of Poisons Act 1952 [Act 366]: Poison Group A, B, C, and Non-Scheduled Poison (NP) (Attorney General's Chambers of Malaysia, 2006). Poison Group A is categorised as dangerous drugs and psychotropics. Poison Group B are drugs that can be dispensed only per the prescription of a registered medical practitioner, dentist, or veterinary surgeon. Poison Group C are drugs that can be sold only in a pharmacy as dispensed medications with an entry in the prescription book while NP can be bought over the counter. The therapeutic class obtained from PI was assigned to one of these 11 major therapeutic classes: (1) central nervous or neuromuscular system, (2) anti-infectives (systemic), (3) metabolic or endocrine system or hormones, (4) gastrointestinal tract (GIT) or genitourinary tract (GUT) or hepatic system, (5) respiratory, (6) cardiovascular or hematopoietic system, (7) eye or ear or throat or skin, (8) vitamins & minerals, (9) allergy & immune system, (10) musculo-skeletal system and (11) nutrition. PI that cited the use in paediatrics was further reviewed for the availability of the sugar free ingredient (e.g. sorbitol, saccharin, and aspartame) through MIMS Malaysia 2016, drug information leaflets or correspondence with the manufacturers. The results were analysed using the Statistical Package for the Social Sciences, version 23 (SPSS Inc., Chicago, IL). Descriptive statistics including frequencies and percentages were used for the data analysis.

## Results

From a total of 3,130 medications available from MIMS Malaysia 2016, 282 PI items from 463 companies that satisfied our eligibility criteria were reviewed. Of the 282 reviewed PI items, most of the products, were sugar-based, 169 (59.9%) and some of them, 87 (30.9%) were sugar-free while 26 (9.2%) of them were unidentifiable.

The mostly used preparation for children is syrup; with as many as 124 of the 282 reviewed PI fall into these types of medicines. This is followed by oral suspension (74), oral solution (29), oral liquids (18), and linctus (14). With regards to the classification of sugar, "sucrose" was the highest percentage (23.4%) type of sugar contained in the oral liquid preparations intended for children, followed by "sodium saccharin" (11.0%) and "sugar, sucrose" (10.3%). The percentage of "non-identifiable or "variable status" is high at 22.7%. This is mainly because there is no information available in the PI for the medication studied. Further details on the types of preparations can be found in Table 1.

The majority of the products (134/282; 47.5%) were from poison Group C, while the rest belonged to NP (83/282; 29.4%) and poison Group B (65/282; 23.1%). For PI items under poison Group B, "anti-infectives (systemic)" or the oral liquid medicine was the most available (76.9%) medication available for children For PI items under poison Group C and NP, "respiratory" has the highest percentage of 55.2%, and 28.9%,

**Table 1** Classification of sugar based on nine types of medicines intended for children

| Classification of sugar | Type of preparations | | | | | | | | | Total, n [%] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oral suspension, *n* [%] | Syrup, *n* [%] | Oral liquid, *n* [%] | Linctus, *n* [%] | Oral drops, *n* [%] | Elixir, *n* [%] | Oral solution, *n* [%] | Effervescent tablet, *n* [%] | Oral emulsion, *n* [%] | |
| Sucrose | 15[20.8] | 32[25.8] | 4[22.2] | 2[14.3] | 2[20.0] | 2[20.0] | 8[27.6] | 1[33.3] | 0[.0] | 66[23.4] |
| Sodium saccharin | 10[13.9] | 10[8.1] | 2[11.1] | 0[.0] | 6[60.0] | 0[.0] | 3[10.3] | 0[.0] | 0[.0] | 31[11.0] |
| Sugar, sucrose | 8[11.1] | 18[14.5] | 1[5.6] | 0[.0] | 0[.0] | 1[10.0] | 1[3.4] | 0[.0] | 0[.0] | 29[10.3] |
| Glucose | 4[5.6] | 11[8.9] | 1[5.6] | 1[7.1] | 0[.0] | 0[.0] | 3[10.3] | 0[.0] | 0[.0] | 20[7.1] |
| Sodium saccharin, sorbitol | 6[8.3] | 6[4.8] | 3[16.7] | 1[7.1] | 0[.0] | 0[.0] | 2[6.9] | 0[.0] | 0[.0] | 18[6.4] |
| Sorbitol | 2[2.8] | 4[3.2] | 0[.0] | 1[7.1] | 1[10.0] | 0[.0] | 2[6.9] | 0[.0] | 0[.0] | 10[3.5] |
| Aspartame | 7[9.7] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[33.3] | 0[.0] | 8[2.8] |
| Sucrose, glucose | 2[2.8] | 3[2.4] | 0[.0] | 2[14.3] | 0[.0] | 0[.0] | 1[3.4] | 0[.0] | 0[.0] | 8[2.8] |
| Sugar | 3[4.2] | 3[2.4] | 0[.0] | 0[.0] | 0[.0] | 1[10.0] | 0[.0] | 0[.0] | 0[.0] | 7[2.5] |
| Sodium saccharin, saccharin | 0[.0] | 2[1.6] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 3[10.3] | 0[.0] | 0[.0] | 5[1.8] |
| Aspartame, sorbitol | 0[.0] | 1[.8] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[3.4] | 1[33.3] | 0[.0] | 3[1.1] |
| Sugar, glucose | 0[.0] | 1[.8] | 0[.0] | 1[7.1] | 0[.0] | 1[10.0] | 0[.0] | 0[.0] | 0[.0] | 3[1.1] |
| Sodium saccharin, aspartame | 1[1.4] | 0[.0] | 1[5.6] | 0[.0] | 0[.0] | 0[.0] | 1[3.4] | 0[.0] | 0[.0] | 3[1.1] |
| Saccharin | 2[2.8] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 2[.7] |
| Fructose | 0[.0] | 1[.8] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[.4] |
| Mannitol | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[3.4] | 0[.0] | 0[.0] | 1[.4] |
| Xylitol | 0[.0] | 1[.8] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[.4] |
| Aspartame, mannitol | 1[1.4] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[.4] |
| Sugar, glucose, sucrose | 0[.0] | 1[.8] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 0[.0] | 1[.4] |
| Non-identifiable/variable status | 11[15.3] | 30[24.2] | 6[33.3] | 6[42.9] | 1[10.0] | 5[50.0] | 3[10.3] | 0[.0] | 2[100.0] | 64[22.7] |
| **Total** | 72[100.0] | 124[100.0] | 18[100.0] | 14[100.0] | 10[100.0] | 10[100.0] | 29[100.0] | 3[100.0] | 2[100.0] | 282[100.0] |

**Table 2** Therapeutic classes of oral liquid medicines intended for children according to poison group

| Therapeutic class | Poison group | | | Total, *n* [%] |
|---|---|---|---|---|
| | Group B, *n* [%] | Group C, *n* [%] | Group NP, *n* [%] | |
| Central nervous/neuromuscular system | 4[6.2] | 17[12.7] | 11[13.3] | 32[11.3] |
| Anti-infectives (systemic) | 50[76.9] | 3[2.2] | 5[6.0] | 58[20.6] |
| Metabolic/endocrine system/hormones | 2[3.1] | 1[0.7] | 7[8.4] | 10[3.5] |
| Gastrointestinal tract (GIT)/ genitourinary tract (GUT)/hepatic system | 3[4.6] | 3[2.2] | 22[26.5] | 28[9.9] |
| Respiratory | 3[4.6] | 74[55.2] | 24[28.9] | 101[35.8] |
| Cardiovascular/hematopoietic system | 1[1.5] | 0[0.0] | 0[0.0] | 1[0.4] |
| Eye/ear/throat/skin | 0[0.0] | 0[0.0] | 1[1.2] | 1[0.4] |
| Vitamins & minerals | 0[0.0] | 0[0.0] | 9[10.8] | 9[3.2] |
| Allergy & immune system | 2[3.1] | 36[26.9] | 0[0.0] | 38[13.5] |
| Musculo-skeletal system | 0[0.0] | 0[0.0] | 2[2.4] | 2[0.7] |
| Nutrition | 0[0.0] | 0[0.0] | 2[2.4] | 2[0.7] |
| Total | 65[100.0] | 134[100.0] | 83[100.0] | 282[100.0] |

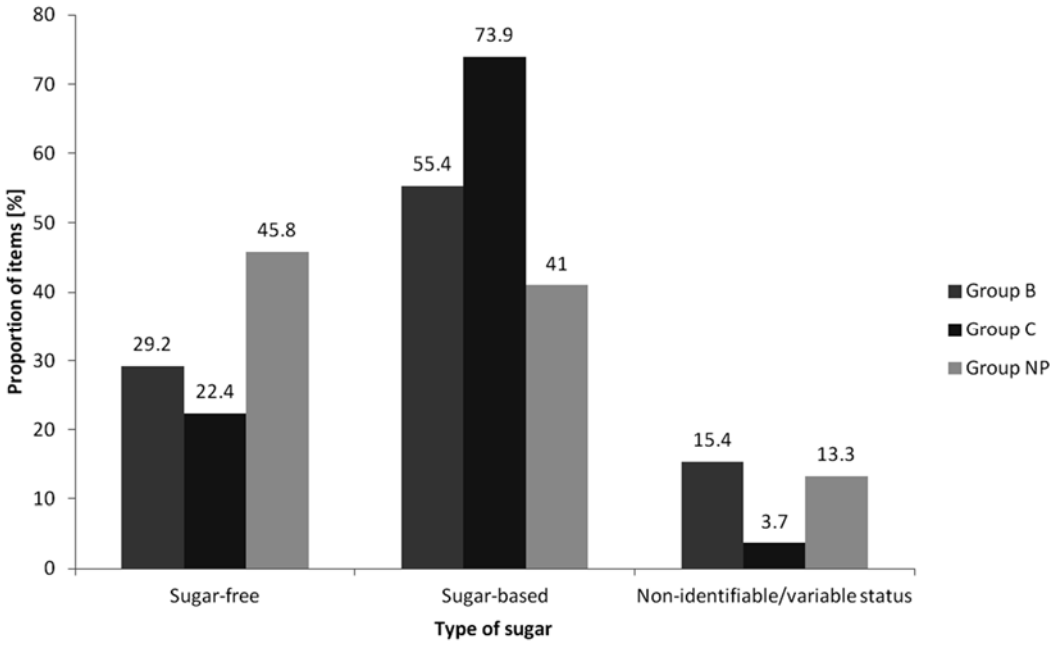


**Fig. 1** Proportions of types of sugar in MIMS Malaysia 2016 online for 282 prescription medications according to poison group.

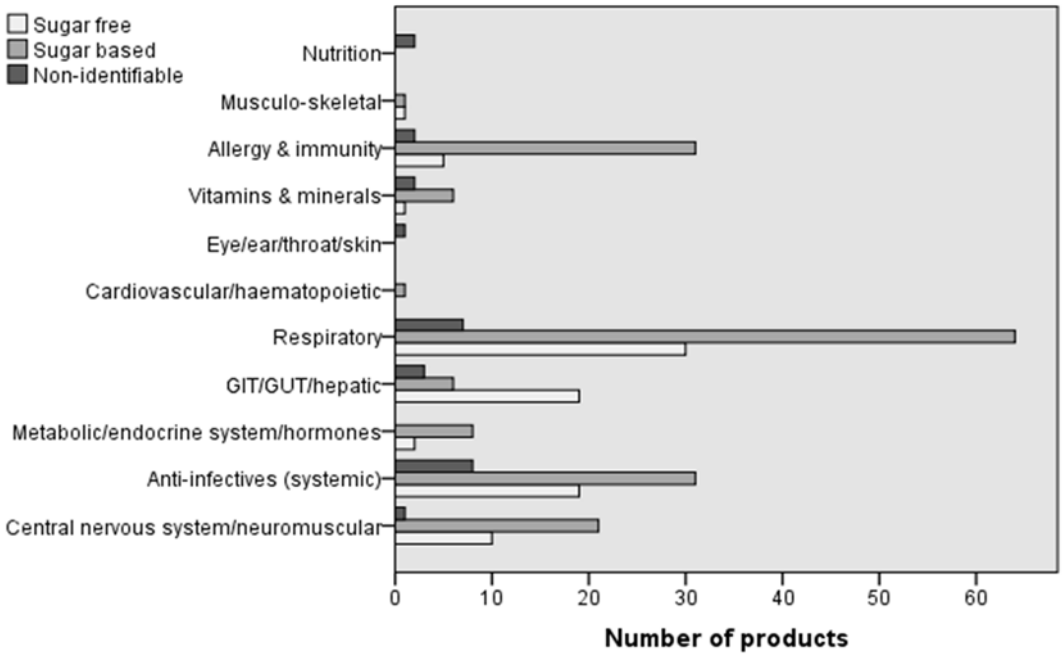


**Fig. 2** Types of sugar in oral liquid formulations intended for children based on therapeutic classes found in MIMS Malaysia 2016 online. (GIT: gastrointestinal tract; GUT, genitourinary tract).

respectively (Table 2). As for the PI items under poison Group B and C, "sugar-based" items had the highest proportion of 55.4% and 73.9%, respectively, followed by "sugar-free" items with 29.2% and 22.4%. On the other hand, for PI items under NP, "sugar-free" items had the highest proportion of 45.8%, followed by "sugar-based" items at 41.0% (Fig. 1).

The therapeutic classes with the highest proportion of products for children were "respiratory" (35.8%) followed by the "anti-infectives (systemic)" (20.6%). Regarding the availability of the sugar-free medicine, "respiratory" has the highest percentage at 34.5% followed by the "anti-infectives (systemic)" and "GIT/GUT/ hepatic system" which have the same percentage of 21.8%. There are no sugar-free products that fall under therapeutic group of "cardiovascular/hematopoietic system", "eye/ear/throat/skin" and "nutrition" (Fig. 2).

## Discussion

Agents are added to the pharmaceutical products to improve its appearance, bioavailability, and palatability. One study showed that 50% of the most commonly prescribed liquid oral medicine contained high sugar percentage (Stecksén-Blicks *et al*., 2004). 59.9% of the 282 reviewed PI in the MIMS Malaysia 2016 were sugar-based product. These finding is comparable to that reported by Durward and Thou (1997).

Sucrose is the most common type of sugar that are being used in the oral liquid preparations intended for children in Malaysia. We noted in Table 1 that sugar free medicine mostly used sugar substitute such as aspartame, sorbitol, mannitol and xylitol in their preparations. Although there is an evidence of sugar free medicine available in the market, the number is still quite low.

In terms of poison group, our study found that most of the sugar-based medicines reviewed were under group B and C. Hence, this is where the healthcare professionals are at an ideal position to play their role in promoting sugar-free medicines to their patients. Parental request for sugar free medication has been the main reason that influences pharmacists in the United Kingdom to provide sugar free prescription

(Mcveigh and Kinirons, 1999). Health practitioners may be able to play a vital role in providing valuable information about oral health issues in relation with prescribed medication's sugar content. This is because they are the front liner that will establish primary contact with children and their families. Awareness of parents towards sugar-free medicines contributes to better product decision making (Hunter *et al.,* 2000).

One study in Brazil found that 51.4 % of children from 111 mothers that were interviewed need to use drugs regularly especially in the forms of antibiotics, antihistamines and drugs to treat the respiratory problems (de Menezes *et al*., 2010). Our finding indicates that drugs that falls under the therapeutic class of (5) respiratory was the type of drugs with highest number of sugar-based content. There was a positive association between the frequent use of sugar-containing medicines and the number of early caries lesion (Llena *et al.,* 2015). Twenty-nine paediatrics antibiotics were assessed in terms of their cariogenic and erosive potentials and the study indicates that most of the analysed antibiotics presented high sugar concentration, titratable acidity and viscosity, and low pH which can be considered as risk factors for dental caries and erosion when consumed frequently (Valinoti *et al.*, 2016). Thus, the use of sugar-free medicines is essential in preventing the dental caries in paediatric patients. It is difficult to find evidence of the most commonly used medicine among children as further study need to be done in looking at current health trends among our children. But we can deduce from our data that medication for respiratory purposes is the most commonly used. This would be helpful fact to encourage manufacturers to use sugar substitute for this type of medication.

There is insufficient data regarding the types of sugar used in the oral liquid medicines as some of the companies failed to include them in the PI. Further research is required to determine the use of sugar-free medicines among the Malaysian children. These would help the policy maker to underline strategies to reduce risks posed by sugared medication in children that need long term prescription and to improve the perception of health professional towards sugar-free medicines. Oral health education should be included in the medical, pharmacy and nursing curriculum to promote better understanding among healthcare providers (Mohd-Dom *et al.,* 2009).

## Conclusion

The availability of sugar-free medicines from all oral liquid preparations intended for children is still low. About two thirds of the total oral liquid preparations for children are sugar-based. The results of this study supported the idea that the availability of sugar-free medicines should be given priority and health professionals should promote the use of sugar-free medicines in children especially those undergoing long-term treatment.

## Declaration of interest

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