



Background

- Treating dental caries in children with cardiac problems is complex because of the risk of infective endocarditis, the chronic nature of congenital heart disease, and the number of medications required.
- Medications with high sugar content or a pH of <5.5 may increase the risk of dental caries, and the need for dental procedures.¹
- Paediatric cardiac patients have less dental reviews than the general population, and their parents report a lack of understanding particularly regarding the risks of infective endocarditis.²
- Dental extractions and restorations are amongst the most common reason for hospital admission for this population.³
- Good dental health in children with cardiac problems could potentially reduce hospital admissions.



Aim

To determine the cariogenic potential of oral-liquid medications prescribed in the Cardiac Unit within The Children's Hospital at Westmead (CHW), to guide improvements in maintaining optimal oral health and reducing associated cardiac complications.

Method

A report of the top 50 most dispensed oral-liquid medications to the cardiac unit was obtained through iPharmacy software and ward imprest list.

A literature review was undertaken to determine the cariogenic potential of sugar and the effect of variations in pH.

Pharmaceutical companies were contacted to determine the precise sugar content (including sucrose, glucose, and dextrose) and pH of individual commercial preparations.

For extemporaneous products manufactured in CHW pharmacy, the sugar content was calculated and litmus paper was used to determine pH.

Patient education leaflets were developed on good dental hygiene and techniques to minimise dental damage from medications.

Information from this project will be incorporated into the hospital's Kid's Health Buddy, a mobile app and online resource, to be used by parents/carers and health professionals.

Results and discussion

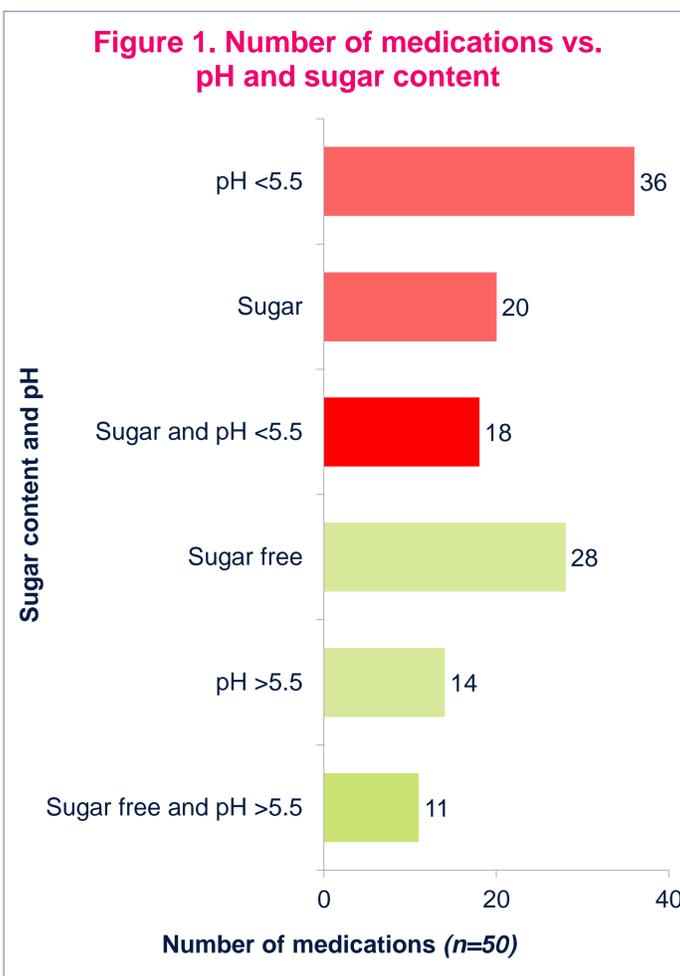
A significant number of medications that were prescribed to cardiac inpatients contained sugar (40%, $n=20$), a pH <5.5 (70%, $n=35$), or both sugar and pH <5.5 (36%, $n=18$). Only 11 medications (22%) were sugar free with a pH >5.5 that would not be a risk factor for caries (Figure 1).

More than half (64%, $n=18$) of medications that were sugar free were potentially erosive to enamel due to their low pH. There is a misconception that sugar free medications are better for oral health, however this can be misleading as it does not take into account other factors such as a low pH.

Dental decay is the destruction of the hard tissue of the mouth by fermented sugar derived from the diet. The implication is that the production of lactic acid by the oral biofilm (plaque) is the underlying process in the initiation of dental decay. Therefore, additional sugar and low pH from medications may accelerate dental decay.

The use of acids in oral-liquid medications are associated with an improvement in flavour, and are frequently added to increase palatability and stability¹.

Figure 1. Number of medications vs. pH and sugar content



Nine (18%) of the oral-liquid medications had a sugar content greater than 50% w/v. This is a much higher percentage than most carbonated beverages, e.g. ~11% w/v in Cola drink (Table 1).

Other dosage forms, such as effervescent tablets, orally-dispersing wafers, chewable tablets, and highly viscous medications were outside the scope of this study, however would be relevant for future investigation regarding the effect on oral health.

Azithromycin (*Zithromax*) contained the highest amount of sugar: 77.4% w/v, followed by alimemazine (*Vallergan*) with 68% w/v (Table 1).

Table 1. Medications with highest sucrose content

Product	mg/mL
Azithromycin (<i>Zithromax</i>) 200 mg/5 mL suspension	774
Alimemazine (<i>Vallergan</i>) 7.5 mg/5 mL syrup	680
Cefalexin (<i>Ibilex</i>) 250 mg/5 mL suspension	600
Ferrous sulfate (<i>Ferro-Liquid</i>) 30 mg/mL solution	600
Loratadine (<i>Lorapaed</i>) 1 mg/mL solution	600
Metronidazole (<i>Flagyl S</i>) 200 mg/5 mL suspension	600
Cefalexin (<i>Keflex</i>) 250 mg/5 mL suspension	595
Fluconazole (<i>Diflucan</i>) 50 mg/5 mL suspension	577
Voriconazole (<i>Vfend</i>) 40 mg/mL suspension	542.4
Digoxin (<i>Lanoxin</i>) 50 microg/mL elixir	300
For reference: Cola drink	106

Ferrous sulfate (*Ferro-liquid*) reported the lowest pH of 1.4, followed by phenoxymethylpenicillin (*Aspecillin V*) pH 2.2. This range is much lower than the pH of Cola drink, pH 2.5 (Table 2).

Table 2. Medications with lowest pH

Product	pH range
Ferrous sulfate (<i>Ferro-Liquid</i>) 30 mg/mL solution	1.4–5.3
Phenoxymethylpenicillin (<i>Aspecillin V</i>) 150 mg/5 mL	2.2–3.7
Loratadine (<i>Lorapaed</i>) 1 mg/mL solution	2.4–3.2
Oxycodone (<i>Oxynorm</i>) 1 mg/mL solution	2.5–3
Propranolol (<i>Auspman</i>) 10 mg/5 mL solution	2.5–3.5
For reference: Cola drink	2.5
Ibuprofen (<i>Fenpaed</i>) 100 mg/5 mL suspension	3–4
Fluconazole (<i>Diflucan</i>) 50 mg/5 mL suspension	3–5
Cefalexin (<i>Ibilex</i>) 250 mg/5 mL suspension	3–6
Ondansetron (<i>Zofran</i>) 4 mg/5 mL syrup	3–6
Captopril (<i>Capoten</i>) 5 mg/mL solution	3.5–4.5

Dental decay is largely preventable through appropriate education and training to clinical staff and caregivers. Counselling aids were developed regarding cariogenic oral-liquid medications and good oral hygiene techniques.

Conclusion

The majority of the commonly prescribed oral-liquid medications in paediatric cardiac patients are potentially cariogenic. Education and training of clinical staff and caregivers regarding cariogenic oral-liquid medications and good oral hygiene techniques may reduce the need for dental procedures and decrease the associated complications in cardiac patients.

References

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