

# Children and parent views of 3D printed gummy bears as an alternative dosage form for children – an interim analysis

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## Background

Many medicines currently available do not lend themselves to measuring small doses. Parents and carers often have to manipulate formulations which can lead to inaccurate dosing. Liquid medications may taste bad or contain excipients which are not recommended in paediatric patients. 3D printing offers potential for personalised paediatric medicines through its ability to develop the taste, shape, colour and tailored doses specific to patient needs and wants [1-3].

Despite this exciting potential, there is limited work exploring what children and their parents/carers actually want. This work will further contribute to the field by exploring the preferences of children and carers with regards to their medications.

## Aims

- Formulate and 3D print a series of gummy bears of different colours and flavours.
- Explore carer views of 3D printed medicines as an alternative to existing formulations and capture key barriers and facilitators to their implementation in practice.
- Explore children's views and preferences on the 3D printed gummy bears.

## Methodology

### Formulation

- Gels for printing were prepared dissolving fruit powders in purified water, and adding pectin, carageenan, xanthan gum, and fruit essence

### 3D printing

- BioX Cellink 3D printer was employed to produce gummy bears
- An extrusion-based printing system called Pressure-Assisted Microsyringe (PAM) was used
- Gels were printed at a typical speed of 20 mm/s, air pressure of 80 kPa, and 0.4 mm nozzle diameter, and nozzle temperature of 50°C

### Questionnaires

- University ethics was sought and granted (UREC22/PBS/004 and amended UREC23/PBS/010)
- E-questionnaires were prepared to capture carers' views using MSForms and piloted on the target groups
- Carers of children aged 4-11 years were asked to participate at a local museum and at Alder Hey Children's Hospital
- Paper-based questionnaires were deemed more suitable for children and designed to target those aged 4-11 years
- Children completed the questionnaires and shared their views at pop-up stands located in Alder Hey
- Children were asked to look, touch and smell the gummy bears, a Haribo® gummy bear, and look at a picture of a 3D printed disc

## References

1. Januskaite P et al., . I Spy with My Little Eye: A Paediatric Visual Preferences Survey of 3D Printed Tablets. *Pharmaceutics*. 2020 Nov 17;12(11):1100.( doi: 10.3390/pharmaceutics12111100. PMID: 33212847; PMCID: PMC769845). 2. Bracken L et al., .
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## Results

A series of bears were printed as per figure 1. Flavours printed were mint, orange, banana and strawberry.

30 carers completed questionnaires. Most (73%) reported struggling to administer a medicine to their child due to its taste or texture. They were happy to return to the pharmacy for ongoing supplies but would prefer refrigeration not being required.

25 children completed the questionnaire (Figure 2), mean age 4.2 years). Pink was the preferred colour (54%) and strawberry the optimal flavour (64%). Children liked the gummy bear shape but also thought the round disc was acceptable. When ranking the most important characteristics of a medicine they put taste first, followed by smell. Acceptability was shown with 84% of children declaring that they would be willing to take the 3D gummy bear if it was a medicine every day.

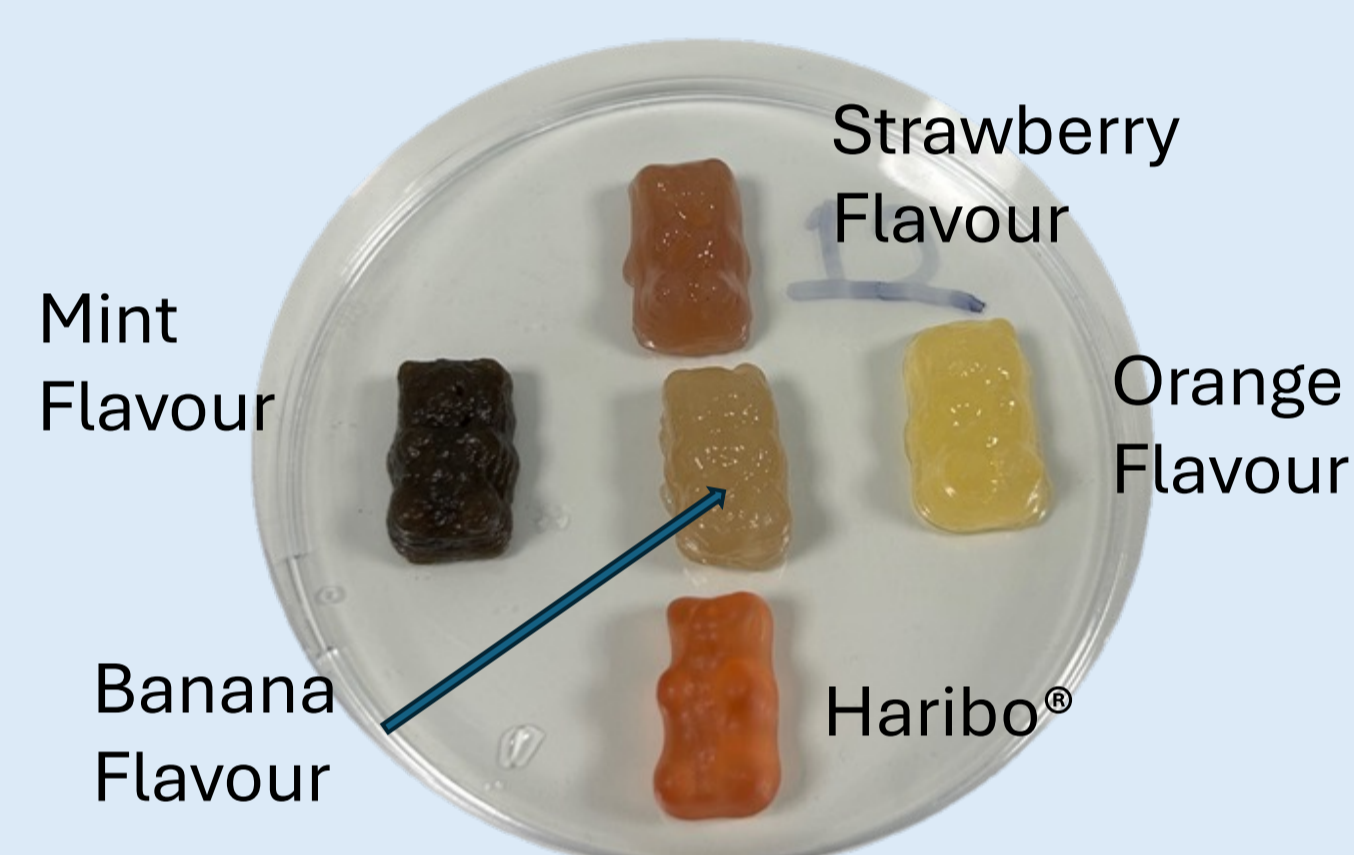


Figure 1. 3D printed gummy bears and Haribo® sweet that were presented to the children

Figure 2. The paper-based questionnaire completed by the children

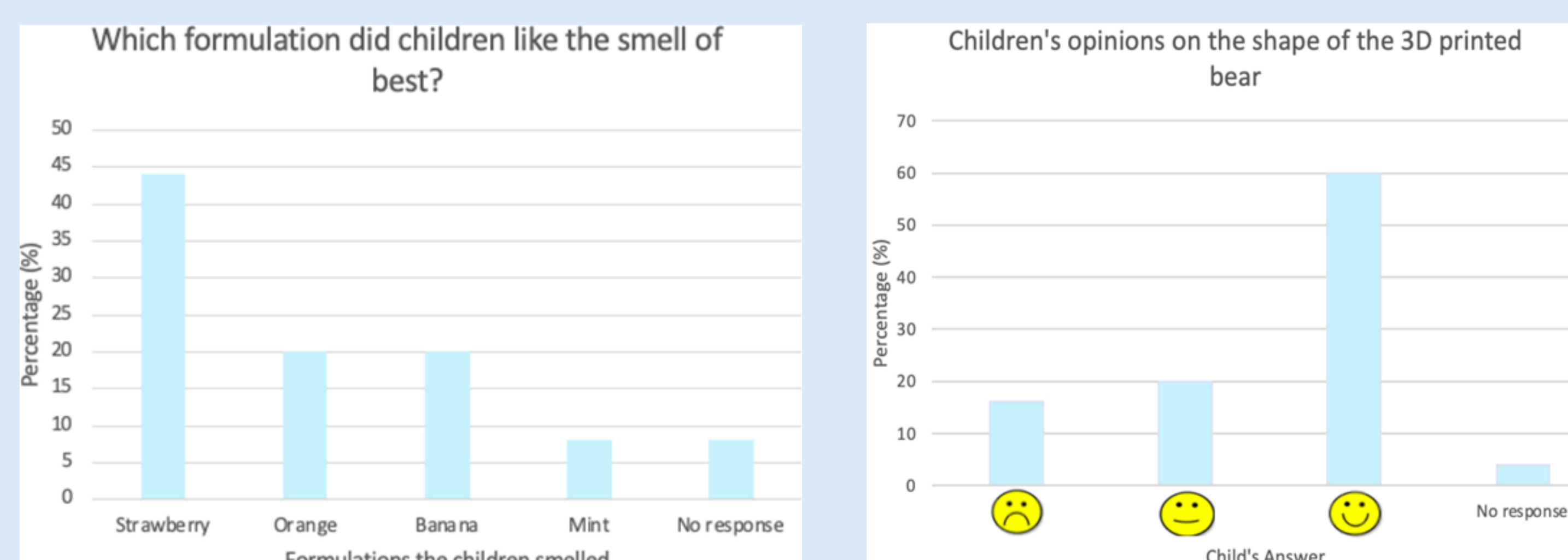


Figure 3. Children's views on the 3D printed gummy bears smell and shape

## Conclusion

The work contributes to the growing body of evidence about 3D printed medicines particularly for children. It highlights their acceptability as a dosage form, and that taste, colour and stability at room temperature are key areas for researchers to focus on to aid bench to bedside translation. Data collection is ongoing at a second hospital site to further confirm these conclusions.