



Creating tasty and appealing vegetable-based products for children using sensory science

Children's Acceptance Model for Product development Of Vegetables (CAMPOV)

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Children's vegetable intake is too low and a key barrier to this is low vegetable acceptance. To help industry successfully develop vegetable-based products for children, CSIRO has developed a new scientific framework, the Children's Acceptance Model for Product development Of Vegetables (CAMPOV).

Development of the CAMPOV model

A review of scientific literature, focused on food preference development and factors influencing children's vegetable acceptance, identified four key factors for consideration in increasing children's vegetable acceptance (Figure 1a). Using these factors, a product mapping exercise of intrinsic and extrinsic properties currently applied across snack products aimed at children was undertaken and considered (Figure 1b) when developing the CAMPOV model.

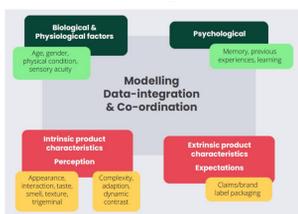


Fig 1a: Key determinants of relevance to developing new vegetable-based products for children. Adapted from Mojet (2001)¹



Fig 1b: Example of product mapping outcomes for taste properties of current products targeted towards children

Turning concepts into prototypes

Overall interest in concept	Concepts
High	Rainbow dippers Ice cream & ice block Fairy dust Rainbow squeeze-mate Crunch & Sip KIT Children's cooking KIT
Mixed response	Vegetable sheets Pizza base VeggieStix
Low	Yoghurt with vegetables Poppables / VegOPop Vegetable wraps & bread rolls Veggie bites Sipp'a soup

Using the results of the qualitative evaluation, two concepts were developed into prototypes: **'Rainbow Dippers'** and **Vegetable ice blocks**.

These prototypes were then evaluated quantitatively through a consumer acceptance test (CAT) with children.

Fig 4: Results of qualitative evaluation with children

Table 1: CSIRO Children's Acceptance Model for Product development Of Vegetables (CAMPOV)

Factor	Properties to promote children's vegetable acceptance
Intrinsic properties	
Appearance	Bright colours, atypical colours of veg, colour / shape contrast, fun shapes, small sizes/bite sized
Taste/flavour	Sweet taste, taste contrast (sweet/sour), suppression/absence of bitterness, flavoursome, pairing with liked tastes/flavours
New sensations	Novel sensations, fun sensations
Texture	Crunchiness, lack of textural contrast
Extrinsic properties	
Claims/branding	Sensory claims, imaginative language, fun characters on pack, absence of health claims
Fun	Fun eating experience
Psychological factors	
Associative learning	Pairing with liked tastes/flavours or other attributes
Previous experience	Encourage repeated trying, familiarity to existing
Role modelling	Mimicking parents

Concept development

Simultaneously, 14 vegetable-based concepts for children were developed through an iterative process:

- Brainstorming new vegetable-containing concept ideas
- Further development of the concepts using identified attributes of the CAMPOV model
- Developing visualisation/presentation sheets for each concept



Fig 2: Vegetable-based concepts developed

Qualitative evaluation of concepts



Fig 3: Methodology of qualitative assessment of concepts with children in focus groups

N=38 children	
5-6 years old	7-8 years old
Vegetable likers (2 groups, n=4-6)	Vegetable likers (2 groups, n=4-6)
Vegetable non-likers (2 groups, n=4-6)	Vegetable non-likers (2 groups, n=4-6)
Other measures collected: -Age -Gender -Neophobia score	
Context setting questions, e.g.: - What vegetables do you like to eat?	
Concept specific questions, e.g.: - What do you like/not like about this concept?	

Factors from the model that positively influenced children's interest:

- Bright colours
- Fun shapes and bite-sized pieces
- Good taste
- Fun eating experience
- Imaginative language
- Familiarity

Quantitative evaluation of prototypes

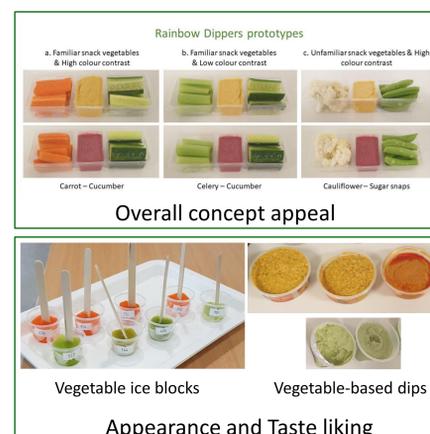


Fig 5: Presentation of Rainbow Dipper concepts and ice blocks during CAT, plus some examples of dips tested

- CAT with 104 children (6-8 years old)
- Tasting of 16 dips & 8 ice blocks, visual appeal of 6 Rainbow Dippers concepts
- Evaluated liking of appearance & taste with 5-point hedonic facial scale²



Results for the **Rainbow Dipper concepts** show that concepts using familiar snack vegetables were more appealing than with unfamiliar snack vegetables, regardless of dip colour or colour contrast.

The most liked **dips** had smooth appearance and were smooth and homogeneous in in-mouth texture, with an absence of chewy pieces, lumpy mouthfeel, textural contrast and residual pieces after swallowing. The most liked dips also rated high on light and creamy appearance.

The amount and source of vegetables and fruits affected children's liking of the **ice blocks**. Increasing the amount of vegetable juice from 50% to 70% negatively affected children's acceptance, whereas use of vegetable puree rather than juice influenced acceptance positively for green and negatively for orange ice blocks. Use of fruit puree instead of fruit juice negatively affected children's acceptance of the ice blocks.

Translation for industry application

Vegetable-containing products like those presented here can provide meaningful increases in vegetable intake of children (1/2 to 1 serve), as these products provide new consumption opportunities given that currently, most vegetables are consumed at dinner time. This research provided validation of several elements of the CAMPOV model; texture (liked: smooth/homogeneous, disliked: textural contrast, pieces in the food and remaining pieces after swallowing), appearance (liked: light appearance, glossy) as well as taste (sweet taste). The research demonstrated the usefulness of a specific theoretical model for product development for vegetable-based products for children.

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FOR FURTHER INFORMATION

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