

Method development to investigate consumption habits and flavour preference of Ghanaian children for a Bambara Groundnut beverage

Anissa C. Davel*, Marta W. Vasconcelos

CBQF, Centro de Biotecnologia e Química Fina, Universidade Católica Portuguesa, Edifício de Biotecnologia, Rua de Diogo Botelho, 1327, 4169-005 Porto, Portugal

*s-adavel@ucp.pt

Introduction:

Improving food quality and access is necessary to combat the prevalence of food insecurity and malnutrition in Sub-Saharan Africa. Bambara Groundnut (BGN), a traditional African legume, can contribute to this. BGN is nutrient dense, nitrogen fixing, and drought tolerant. Consumption of the traditional crop has declined due to cash-crop uptake and BGN's hard-to-cook factor.

The start-up; WhatIF Foods (WF) developed a BGN beverage to valorise BGN, improve livelihoods of small-scale farmers, and combat malnutrition in children.

The current landscape is dominated by sweetened milk powders and excess consumption of sweetened beverages. Sugar-free product design is desired, while aligning with local preferences is needed for effective uptake.

A sensory evaluation was conducted with children in partner farmer communities (Northern Ghana) to investigate how the BGN beverage should be flavoured.



Figure 1 BGN; from plant to plant-based beverage. a) Partner farmer BGN field. b) BGN seeds after harvest. c) BGN plant-based beverage (WhatIF Foods™).

Materials and methods

1. Three focus groups: understanding flavour preferences



Figure 2 Interview in Kumbungu, Ghana

- In Northern Ghana community schools
- Questions translated to and asked in Dagbani.
- Started with individual interviews to minimise children influencing each other. Focus group format was then used to improve engagement.
- Question themes: type of foods consumed and liked, milk consumption frequency and format, preference for sweet things.

2. 1st flavour development: based on focus group results

- Mango
- Banana
- Tigernut: mentioned in association with favourite foods and also locally grown
- Original BGN beverage: the baseline product

3. 1st round sensory evaluation: preference and degree of liking

- Groups of 3 children from upper primary (ages estimated between 8 – 16 yrs)
- Coded samples randomly presented, and children guided through the questionnaire
- Ranking by elimination ¹
- 5-point smiley scale

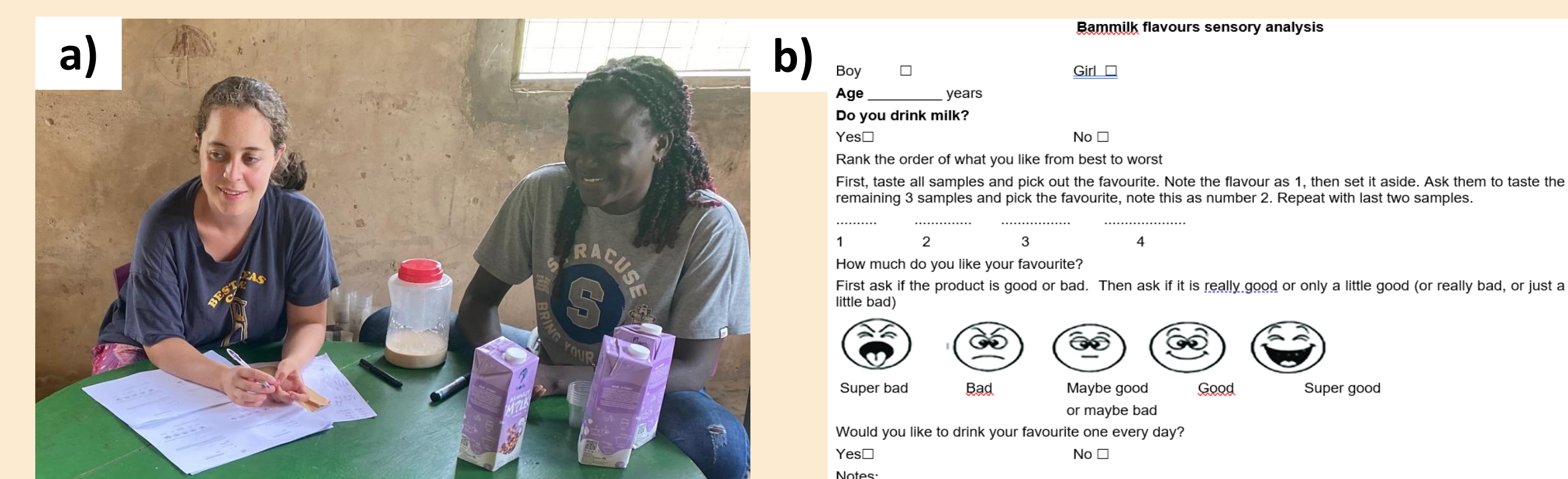


Figure 3 Sensory evaluation facilitation (a) and questionnaire (b)

4. 2nd flavour development: fruit flavour vs sweetness

- Mango
- Banana
- Sugar sweetened original BGN beverage: the baseline product

5. 2nd round sensory evaluation: degree of liking

- Groups of 2 children
- Same sample presentation and answer recording process as above.
- Only ranking by elimination



Figure 4 2nd round sensory evaluation

References

- ¹Birch, L.L. (1979) 'Dimensions of preschool children's food preferences', Journal of Nutrition Education, 11(2), pp. 77–80.
²Rakotosamimanana, V.R. and De Kock, H.L. (2020) 'Sensory studies with low-income, food-insecure consumers', Current Opinion in Food Science, 33, pp. 108–114.
³Popper, R. and Kroll, J.J. (2011) 'Consumer testing of food products using children', Developing Children's Food Products, pp. 163–187.

Acknowledgments

This research was supported by the H2020 project Realising Dynamic Value Chains for Underutilised Crops (RADIANT), a Research & Innovation Action supported by European Commission's Horizon 2020 programme under Grant Agreement number 101000622. The authors would like to extend their gratitude to the CBQF - Center for Biotechnology and Fine Chemistry for hosting and facilitating the experimental work of this study. Special thanks to WhatIF Foods for their collaboration, the children for participating, and to Dr Erika Moelich for her support in how to approach the sensory evaluation.

Results and discussion

❖ 1st round sensory evaluation:

Ghanaian children rated the original BGN flavour as least preferred. Product improvement is therefore necessary.

- The mango, banana, and tigernut flavours were ranked equally.
- Ranking by elimination was successfully implemented.
- The smiley scale was not successful. Each child selected the most positive response.
- There were instances of children trying to select the sample that their neighbour was selecting to give the 'right' answer.

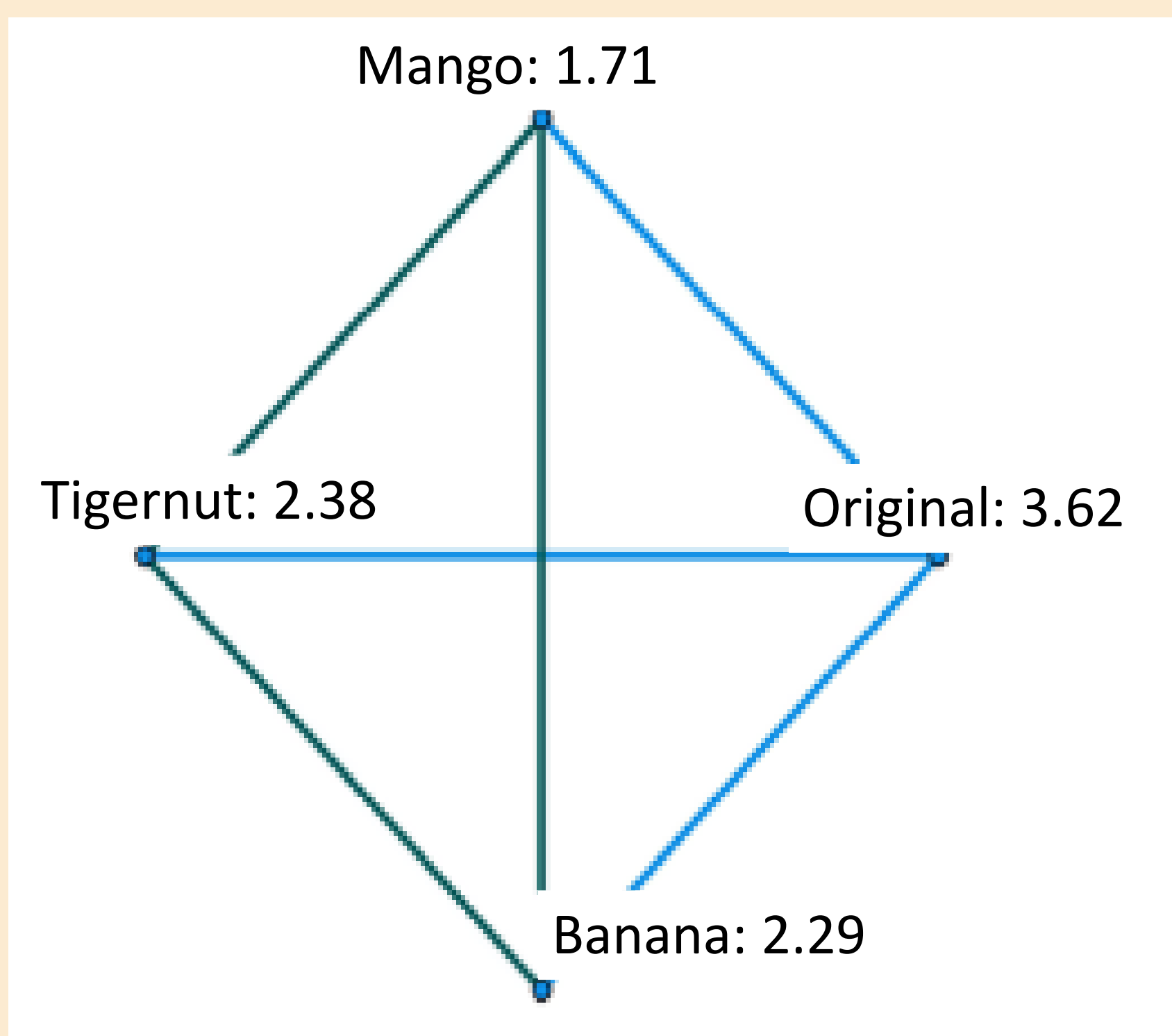


Figure 5 Related Samples Friedman's two-way analysis of variance by ranks (1st sensory evaluation). Mean ranks are displayed alongside sample name. Significantly different samples (on the 5% level) are connected by the blue line.

❖ 2nd sensory evaluation

There was no significant difference in preference between the mango flavoured or sugar-sweetened BGN beverage samples

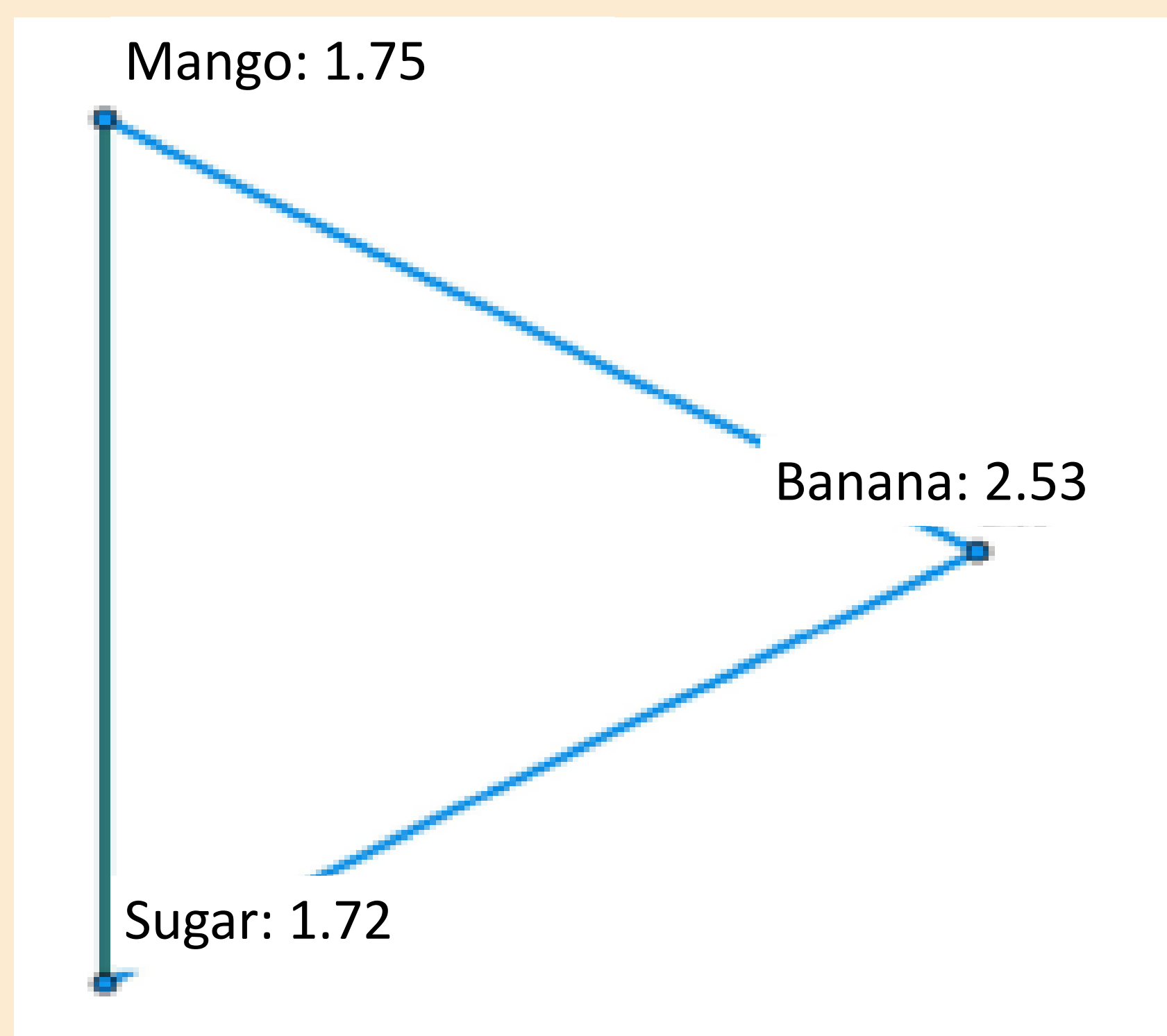


Figure 6 Related Samples Friedman's two-way analysis of variance by ranks (2nd sensory evaluation). Mean ranks are displayed alongside sample name. Significantly different samples (on the 5% level) are connected by the blue line.

❖ Methodology insights

More research is needed into context appropriate sensory evaluation methodologies as current methodologies are not universally applicable.

Immense shyness and desire to give the 'right' answer → looking to see what the other children do.

The smiley scale did not work → only selected the most positive response

Self-administering the test was not possible → evaluator needed to explain questions and record all answers

- Food insecure/ low-income consumers may be less willing to give 'negative feedback' therefore making it challenging to gather results reflecting true feeling ².
- Interview-sensory evaluation is known but typically conducted one-on-one with children below the age of eight ³.
- The need for guided evaluation contradicts the typical expectation that by age eight children are theoretically able to perform most standard sensory tests and self-administer tests with little assistance ³.

Ranking by elimination in a 2 person focus group format:

- **successful non-verbal method**
- **reduced interpersonal influence while creating a safe environment**

Conclusions

The original product needs modification with the key aspect being sweetness, not a need to 'mask' the BGN flavour. Care would be necessary to avoid using sugar to achieve this, to prevent exacerbation of the overconsumption of sweetened beverages.

Sensory evaluation conducted in groups of two using ranking by elimination was successfully used to obtain results. More research is needed to validate the reliability and replicability of this non-verbal group-based approach.

More research is needed into adapting methodologies to different contexts with participants of different cultural and socio-economic backgrounds.