

# PLANT-BASED ANALOGUES: A SENSORY-BASED AND CONSUMER-LED APPROACH TO UNVEIL CHALLENGES AND OPPORTUNITIES FOR THE CONSUMERS OF THE FUTURE

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## 1 INTRODUCTION

This PhD project aims to explore the sensory, psychological, and behavioral drivers of acceptability and rejection of plant-based fish. To accomplish this goal, the following activities were carried out:

- (A1) Literature review on sensory properties and acceptability of plant-based food analogues (Appiani et al., 2023)
- (A2) Italian Market inventory of plant-based analogues
- (A3) Study of consumer perception and main drivers of plant-based canned tuna acceptance
- (A4) Study of sensory drivers of liking and consumer emotional responses to plant-based breaded fish

The main outcomes from the two consumer studies (A3 and A4) are detailed.

## 2 MATERIALS & METHODS

**A3** 165 adults (48% female; age: 38 ± 14)

Eight canned-tuna samples:

- Five plant-based samples made with:
  - *pea protein*: PBT\_PEA
  - *wheat protein*: PBT\_WHEAT
  - *textured soy protein*: PBT\_SOY\_Water, PBT\_SOY\_Oil, PBT\_SOY\_Lem&Pep
- Three animal-based samples
  - TUNA\_Water
  - TUNA\_Oil
  - TUNA\_Lem&Pep

Samples identified through the online market inventory (A2)

**A4** 104 adults (52% female; age: 27.7 ± 8.9)  
98 children (57% female; age: 9.9 ± 0.8)

Seven breaded fish samples:

- Five plant-based samples made with:
  - *rehydrated rice flakes*: PB\_RICE-WHEAT\_STICKS; PB\_RICE-WHEAT\_STICKS
  - *rice protein*: PB\_RICE\_FILL; PB\_RICE\_STICKS
  - *rehydrated textured wheat proteins*: PB\_WHEAT\_FILL
- Two animal-based samples
  - COD\_FILL
  - COD\_STICKS

Samples identified through the online market inventory (A2)

### Questionnaires

- food frequency consumption of animal and plant-based foods [1,2]
- Food Frequency Lifestyle [3]
- Food Neophobia [4]

### Samples' evaluation

- Overall liking
- Check-all-that-apply (CATA)

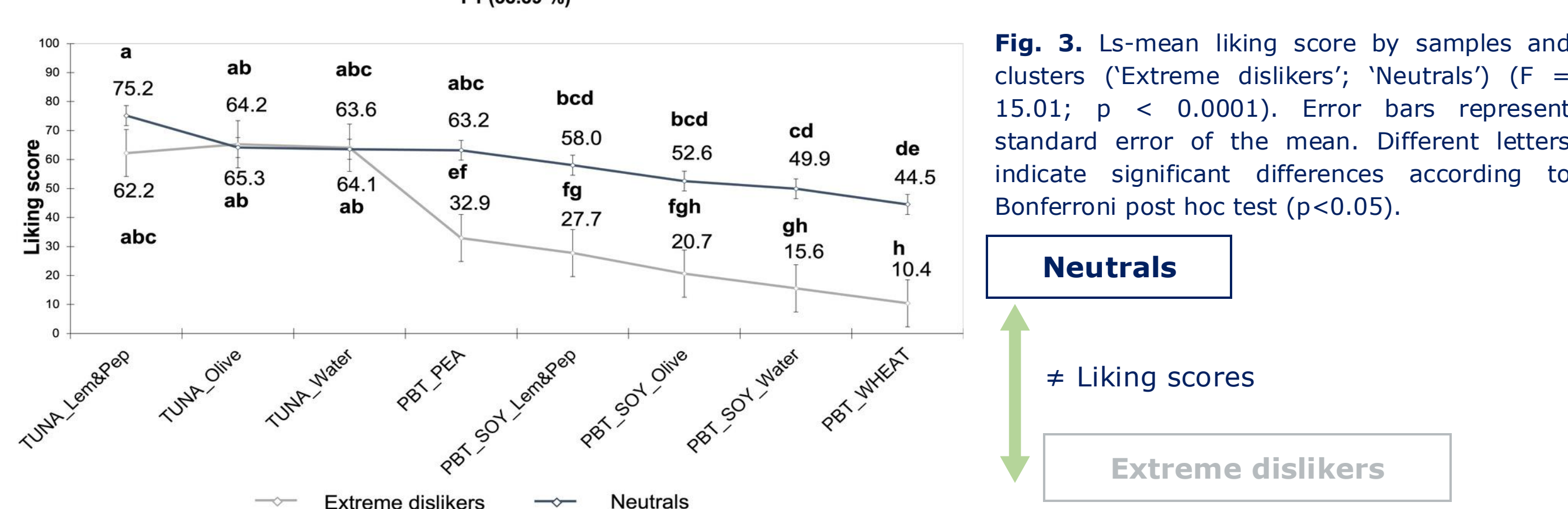
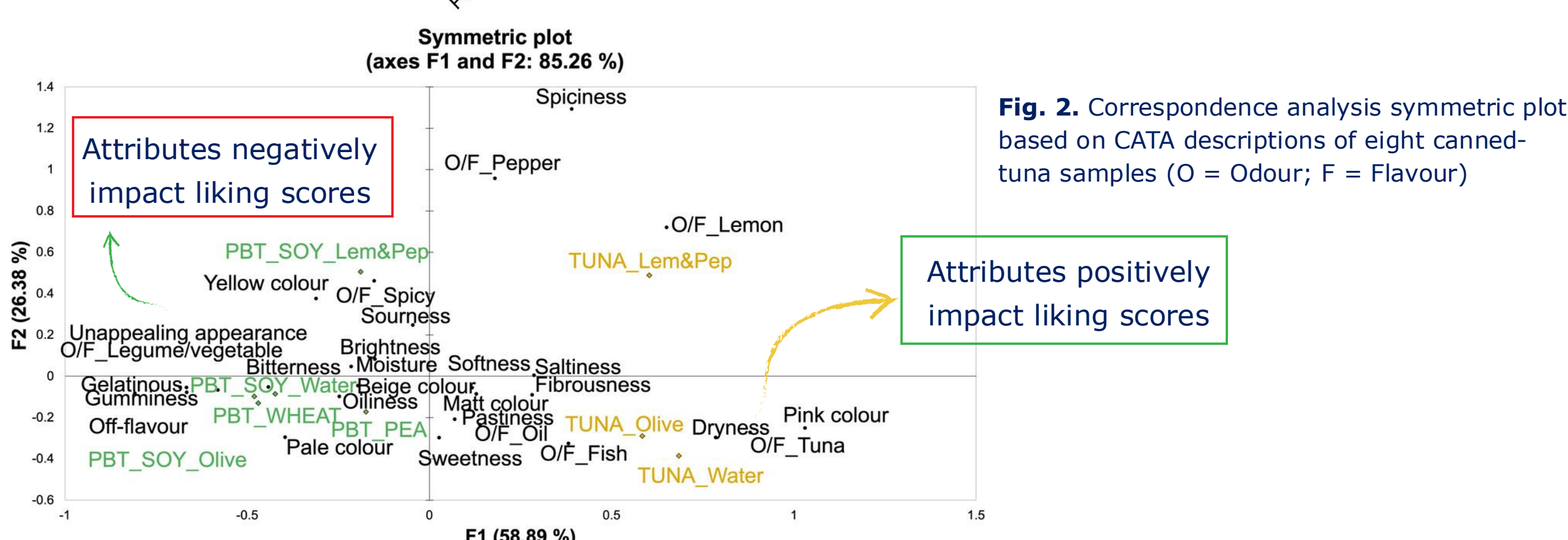
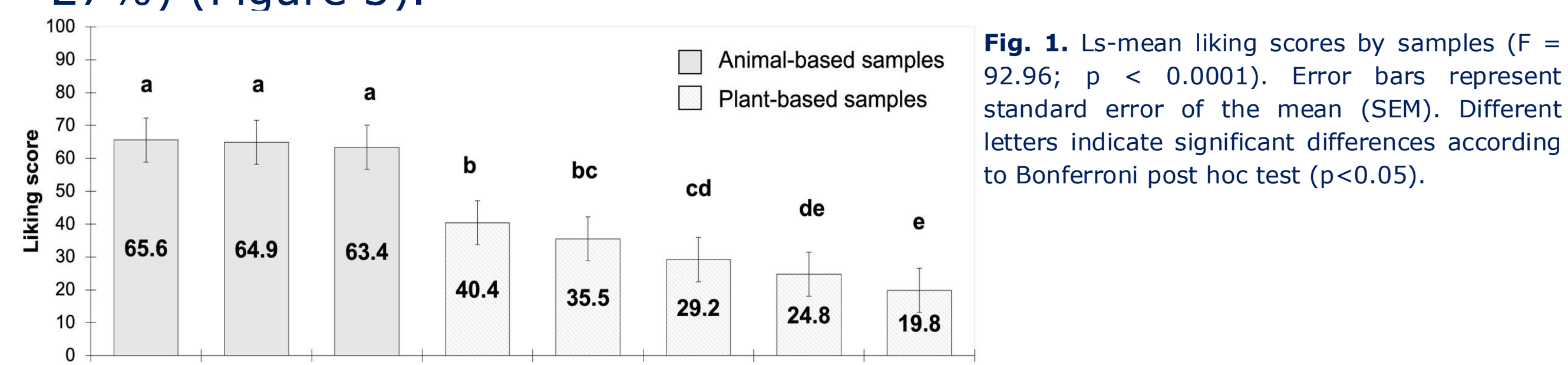
### Questionnaires

- Emotional profile [5,6]
- Food Neophobia [4,7]

⚠ Age-appropriate protocol with children

## 3 RESULTS

Animal-based products were well accepted (Ls-mean range: 63.4 – 65.6), while all plant-based canned tuna samples were disliked by consumers (Ls-mean range: 19.8–40.4)(Figure 1). The Figure 2 shows the sensory characterization of samples and drivers of liking. The Hierarchical cluster analysis identified two consumers segments: *Extreme dislikers* (n=121; 73%) and *Neutrals* (n=44; 27%) (Figure 3).



A research article entitled "Plant-Based Fish Analogues vs. Fish: Assessment of Consumer Perception, Acceptance, and Attitudes" is under review for publication

**A4** GLM results showed a significant effect of samples on overall liking in both children and adults (F=18.9, p<0.0001 and F = 14.7, p<0.0001; respectively). Although animal-based samples were the most liked, samples formulated with plant-based proteins were accepted by both age groups (Ls-mean: adults: 49.3-62.2, hedonic scale 0-100; children: 5.1-6.1, hedonic scale 1-9). However, in addition to their sensory qualities, the samples elicited distinct emotional responses: animal-based samples were associated with emotions of satisfaction and happiness, while plant-based samples elicited negative emotions such as disappointment, disgust and indifference.

## 4 CONCLUSIONS

The results highlight that the use of plant-based components influences the sensory profile of fish analogues, negatively affecting consumer liking. To gain wider acceptance, it is crucial to optimize their sensory properties through improved ingredient formulation and process optimisation. The addition of seasonings may successfully mask legume and vegetable odours, off-flavours, and mitigate bitterness. Furthermore, by adopting a multi-response approach, a complete product characterisation can be achieved, contributing to a better understanding of the factors that determine the liking of plant-based fish alternatives, which is valuable for product development and marketing strategies.

## REFERENCES

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