Sensory evaluation of alternative proteins

A quick-start guide | *Invest in sensory science for strategic advantage*

Investment in sensory

This guide provides an overview of best practices for sensory testing in the alternative protein industry.

KEY CONSIDERATIONS

Target consumers
Select participants who are representative of your target consumers.

Benchmark & controls
Include benchmark and control products for comparison.

Integrated sensory
Sensory testing throughout the development cycle provides informed, evidence-based insights that guide decision-making.

Let sensory guide the way

Early-stage testing helps screen prototypes and identify promising directions, while mid-stage descriptive and discrimination testing refines formulation and ensures product consistency. At later stages, consumer acceptance tests validate market readiness and optimize positioning. Integrating sensory evaluation across the full cycle minimizes costly missteps, ensures alignment with consumer expectations, and ultimately enhances the likelihood of product success.

What do you want to know?

Clearly articulating what you want to know or learn about your alternative protein product is the foundation of any successful sensory study.

The information needed and the decision at hand guide every aspect of the sensory study, from selecting the appropriate sensory method, choosing the right participants, designing the study protocol, and planning data analysis.

A well-defined question ensures that the data collected is meaningful, interpretable, and aligned with your objectives—allowing you to make confident, evidence-based decisions. This guide is designed to help make sure you are asking the right questions from the start.

Sensory testing process flow

1 Research question
Identify the goal, key product questions, and what information is needed to address the question.

2 Select method
Align the method with the research question. Consider the type of data you expect to get and ensure it informs the decision at hand.

3 Conduct study
Setup the study following best practices, include appropriate controls, and consider the number and type of participants needed.

4 Analysis & reporting
Clean data, conduct statistical analysis, assess consumer segmentation, make valid comparisons, and present findings.

Sensory testing across the development cycle

Concept development
- Focus groups
- Projective techniques
- Consumer co-creation
- Concept testing

Product optimization
- Hedonic testing
- Descriptive analysis

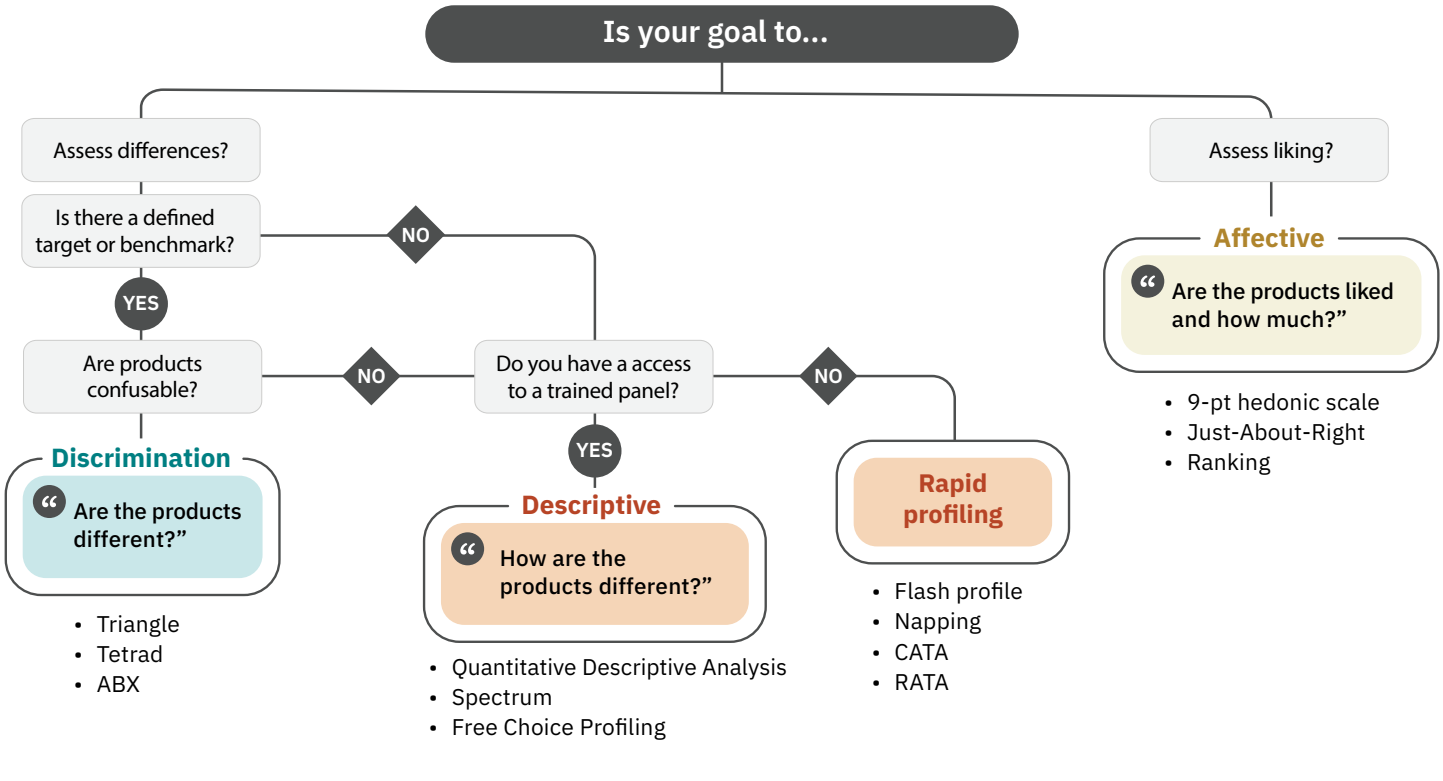
Commercialization
- Hedonic tests
- Shelf-life

Prototype development
- Descriptive analysis
- Rapid profiling
- Hedonic testing

Scale up
- Discrimination
- Temporal methods

Post-launch
- Descriptive analysis
- Discrimination

Decision tree · *What method do I need?*



Selecting the method and your participants

	Discrimination "Are the products different?"	Descriptive "How are the products different?"		Affective "Are the products liked and how much?"
Method(s)	Triangle Tetrad	Descriptive Analysis (QDA, Spectrum)	Temporal Methods Sorting, Flash Profile	9-point hedonic scale, Just-About-Right (JAR)
Who	Consumers (30-50)	Trained panel (8-12)	Consumers (30-50)	Target consumers (80-100+)
Best used for	• Assessing parity • Ingredient changes • Shelf-life testing • Quality assurance	• Developing lexicon • Ingredient changes • Shelf-life testing • Quality assurance	• Characterizing dynamic profiles • Quick feedback	• Confirming commercialization • Assessing parity • Identifying top prototypes • Ingredient changes
Notes	Does not tell you what the difference is between products	Requires a target Never ask for liking	Does not require a benchmark & can ask liking	Consider target market and cosumer segementation

Sensory design and considerations

Participants

- Screen for demographics, usage, dietary preferences, consumer values, attitudes, and personality traits
- Avoid internal biases: seek external participants and consumers to avoid biased results
- Power relies on numbers: use an appropriate number of participants based on the method and desired statistical power

Control samples

- Benchmarks help to assess performance and provide context
- Duplicate samples help to evaluate participant reliability and test reproducibility
- Include relevant controls: to demonstrate parity, must include a well-liked animal product, but can also include a top-performing alternative

Data analysis

- Plan: develop the data analysis plan early
- Data cleaning: remove outliers, unrealistic responses, and participants who do not follow directions
- View distribution and variability, not just the means — large variation could indicate segmentation
- Match the statistical test to the type of data
- Understand the limitations of each method, including too few participants and bias constraints, when drawing conclusions

Setup

- Serve all samples blinded with a three-digit blinding code (typed, neat)
- Balance and randomize the sample order to minimize order bias, for example first-order effects
- Minimize distractions and consider sound, light, and odors, keeping conditions consistent for all participants
- Present all samples the same way, including cut, size, shape, and temperature

Tips!

Context matters: Serve products as they are typically consumed. Context impacts perception and acceptance.

Complex attributes: Alternative proteins differ in mouthfeel, flavor, and aftertaste; consider methods to detect specific attributes or whether consumers require descriptors or examples.

Expectation effects: Information, product descriptions, and labeling can shape liking by forming expectations. Consider testing without information, followed by testing with information to separate sensory quality from expectation bias.

Avoid these common mistakes

Overinterpretation: Avoid overinterpretation. For example, a significant difference in a discrimination test doesn't necessarily mean consumers will prefer one sample over another.

Employees: Employees and stakeholders are biased and familiar with the products, and therefore do not represent the target consumer. Consumers are essential for affective studies, while employees can provide useful but limited input in some scenarios.

What Method?: Align with the question and the required data to make a decision.

Controls: Select a control product that represents the target and one that is well-liked.

Segmentation: Understanding that consumer variability exists and can explain differences in the drivers of acceptance.

Interpretation of statistics: Statistical significance is not the same as the effect size. Make sure not to overinterpret the findings. For example, the p-value indicates whether two products are different, but it does not show how big that difference actually is.

Resources

Textbooks:

- Sensory Evaluation of Food: Principles and Practices (Heyman & Lawless, 2010)
- Sensory Evaluation Techniques (Meilgaard, Carr, & Civille, 2007)

GFI's industry consultants list — see section on sensory and consumer science

Online training and courses:

- Institute for Food Technologists (IFT)
- UC Davis Certificate — 12-month program
- Penn State World Campus Online Courses
- Sensory Spectrum

Sensory software: Compusense, RedJade, FIZZ, Sensory Spectrum tools, SIMS

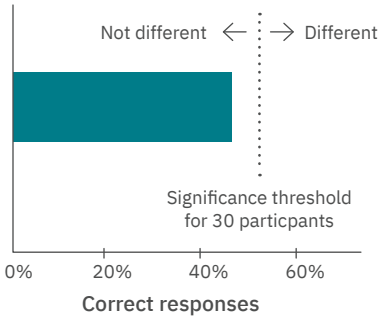
Case Study

Plant-based alternative proteins

Here are case studies on plant-based products to illustrate the three main types of sensory tests: discrimination, descriptive, and affective, with a defined question, specific method, and key setup considerations.

Discrimination

"Are the products different?"

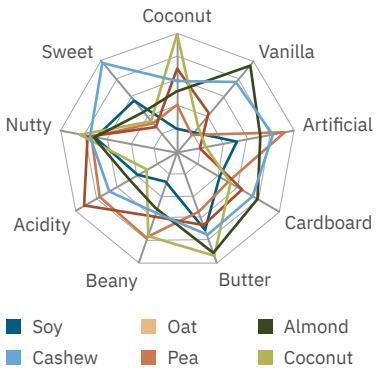


Question: Can consumers tell the difference between our new plant-based nugget and the leading conventional chicken nugget?
Method: The gold standard for discrimination testing is the triangle test.
Instructions: Select the sample that is different.
Setup: Three samples are presented, two are the same, and one is different. Samples are presented in balanced order (AAB, ABA, BAA, BBA, BAB, ABB). Participants sample one at a time, with each presented with a three-digit-blinding code.
Participants: 30–50 unbiased individuals.
Data analysis: Binomial statistics to determine whether the number of correct identifications is statistically greater than chance. In a group of 30, 15 or more people would need to select the odd sample to reach statistical significance.
What it will not tell you: What about the samples are different or which sample is liked more.

Descriptive

"How are the products different?"

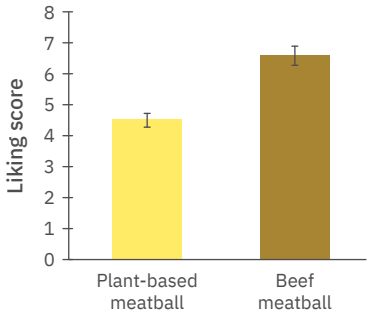
Flash profile of plant-based milks



Question: What are the key flavor and texture profiles of milks? Identify the most promising sensory positioning in the marketplace.
Method: Flash profiling is a rapid descriptive method often used to identify the target attributes and their intensity levels.
Instructions: Participants individually generate their own descriptors and rate products on each attribute.
Setup: Participants sample one at a time in a randomized order, with the option to retry samples as needed. Select all plant-based milks and dairy milks, prioritizing products with the leading sales. Samples are presented with a three-digit-blinding code.
Participants: 15–20 unbiased individuals.
Data analysis: Consensus sensory maps can be developed using principal components analysis.
What it will not tell you: Participants' liking of products.

Affective

"Are the products liked and how much?"



Question: Is our plant-based meatball liked compared to the benchmark animal product? Have we achieved hedonic sensory parity?
Method: The gold standard 9-point hedonic scale.
Instructions: Rate liking for specific attributes and overall liking.
Setup: Samples are presented one at a time in a randomized order.
Participants: 80–100 target consumers. More are needed to examine consumer segmentation.
Data analysis: Check for normal distribution. Conduct a two-tailed t-test (alpha=0.05) to determine if products are liked differently. A p-value less than 0.05 would indicate no statistical difference in liking ratings.
What it will not tell you: What attribute would be beneficial to change if products are not well-liked.