Can you tell the fat content of milk?

Learning Outcome

Demonstrate proficiency in designing, conducting, and analysing sensory evaluation tests using ranking and triangle methodologies to assess perceived differences in milk samples with varying fat contents.

Group Activity

Participate effectively in a milk drink sensory panel, demonstrating an understanding of proper tasting techniques and evaluation procedures. Subsequently, students will design, set up, and conduct both ranking and triangle tests using milk samples with varying fat contents. They will gain hands-on experience in panel management, sample preparation, and data collection for these two distinct sensory evaluation methods. Students will also develop skills in analysing and interpreting results from both test types, understanding their respective strengths and limitations in the context of dairy product evaluation. This practical experience will enable students to critically assess the application of these sensory methods in quality control and product development within the dairy industry.

The Science

Introduction

Sensory science is a multidisciplinary field that investigates the perception, interpretation, and response to sensory stimuli by living organisms. It encompasses the study of the five primary human senses - sight, hearing, taste, smell, and touch - as well as other sensory modalities, such as proprioception (our body's movement) and thermoception (temperature changes). This discipline uses psychophysical and physiological methodologies to evaluate the complex relationships between stimuli and sensory responses, integrating knowledge from neuroscience, psychology, biology, and physics.

Sensory science applications are diverse and far-reaching, spanning from fundamental research into sensory mechanisms to practical applications in product development and quality control. In food science, sensory evaluation techniques are employed to assess consumer preferences, optimise product formulations, and ensure consistent quality. Beyond the food industry, sensory science plays a crucial role in fields such as environmental monitoring, medical diagnostics, and human-computer interaction. By quantifying and analysing sensory experiences, researchers and practitioners in this field contribute to our understanding of perception and inform the development of products and technologies that enhance human experiences and well-being.

Three-digit Codes

In sensory science, the use of three-digit codes for sample identification is a widely adopted practice that serves several important purposes. This method involves assigning a unique three-digit number to each sample presented to assessors during sensory evaluation tests,

such as triangle tests or other discrimination methods. The primary reason for employing three-digit codes is to minimise bias and ensure objectivity in the assessment process.

By using three-digit codes, researchers can effectively mask the identity of samples, preventing assessors from making assumptions or drawing conclusions based on any recognisable patterns or information. This approach helps to eliminate potential sources of bias that could arise from preconceived notions about the products being evaluated. Additionally, the use of three digits provides a sufficient number of unique combinations to accommodate a wide range of samples without repetition, whilst remaining simple enough for assessors to remember and record during the evaluation process. This method contributes to the overall reliability and validity of sensory research, allowing for more accurate and unbiased assessments of product characteristics and differences.

First Order Dynamics

In sensory science, first-order dynamics describe how our senses respond to changes in stimuli over time. This concept helps us understand how quickly our sensory systems react to new information and how they adapt when a stimulus remains constant. Essentially, first-order dynamics involve a straightforward response pattern, where the speed of reaction and recovery can be measured using a single time constant.

For example, when we smell a strong odour, our ability to perceive it often decreases over time if the smell stays the same; this is known as adaptation. In vision, when we move from a bright area to a dark one, our eyes take time to adjust, which can also be described using first-order dynamics. By studying these simple response patterns, researchers can better understand how our senses work and improve methods for testing and evaluating sensory experiences.

Latin squares are a powerful experimental design tool widely used in sensory science and other fields of research. This design is particularly useful when each subject needs to be measured under every treatment condition, whilst also controlling for changing conditions throughout the experiment. In a Latin square design, treatments are arranged in a square grid such that each treatment appears exactly once in each row and column, allowing for the control of two sources of variability simultaneously.

For instance, in sensory evaluation panels, Latin squares can be employed to balance the order of sample presentation, thereby mitigating potential carry-over effects and fatigue. The design is valuable when dealing with a limited number of experimental units or when there are constraints on randomisation. However, it's important to note that Latin squares are most effective when there are no significant interactions between rows, columns, and treatments, and they typically require the number of treatments to equal the number of rows and columns.

A	B	C
C	A	B
B	C	A

columns

rows				
	A	B	C	D
	B	C	D	A
	C	D	A	B
	D	A	B	C

Each treatment occurs in every column and row

Ranking Tests

Sensory ranking tests are widely used in sensory science to evaluate and compare multiple samples based on a specific sensory attribute or overall preference. In this method, assessors are presented with a set of samples and asked to rank them in order of intensity for a particular characteristic or according to their personal preference. The test is particularly useful when researchers need to determine the relative differences between products without quantifying the magnitude of those differences. Ranking tests are often employed in product development, quality control, and consumer research to identify preferred formulations or to assess the impact of ingredient or process changes on sensory attributes.

However, it is important to note that ranking tests do not provide information on the absolute intensity of sensory attributes or the degree of difference between samples. They are most effective when used with a limited number of samples, as assessor fatigue and sensory adaptation can become issues with larger sample sets.

Duo-trio & Triangle tests

The duo-trio and triangle tests are both discrimination tests used in sensory science to determine whether a perceivable difference exists between two products. In a duo-trio test, assessors are presented with three samples: a labelled reference and two coded samples, one of which matches the reference. The task is to identify which of the coded samples is identical to the reference. This test is often considered easier for assessors to perform compared to the triangle test, making it particularly useful for products with strong sensory characteristics or when working with untrained panellists.

The triangle test, on the other hand, presents assessors with three coded samples, two of which are identical and one different. The task is to identify the odd sample out. While statistically more powerful than the duo-trio test, the triangle test can be more challenging for assessors, especially with complex or subtle sensory differences. Both tests are frequently used in product development, quality control, and research to detect overall differences between products, such as those resulting from changes in ingredients, processing, or storage conditions. The choice between duo-trio and triangle tests often depends on the specific research objectives, the nature of the products being tested, and the level of expertise of the sensory panel.