Sensory Evaluation Laboratory Report #2

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Abstract

The Sensory evaluation panelists consisted of San Diego State students and took place in the nutrition laboratory room on campus. A color association test was done with differently colored beverages to see if there was a correlation between color and its perceived taste, naturalness and personal preference. Results found that the light yellow colored beverage was the most preferred, found to look the most natural and sourest. However, there was not a strong correlation between color and what looked the sweetest. The preferred temperature for all the colored beverages was cold. The texture test evaluated four different food products using descriptive terms based on appearance, aroma, flavor, texture, and consistency. The paired comparison and triangle test were conducted to determine the differences in acidity of apple juice samples. Results found that most of the panelists were able to determine which sample was more acidic. The ranking test was performed in order to rank apple juice samples based on their degree of sourness and preference. Results found that most panelists were able to determine the correct ranking however found that there was no direct correlation between preference and sourness. The duo-trio test was done in order to see if panelists could determine which cookie sample differed from the standard. All of the panelists were able to determine the difference. In the scoring or rating test panelists scored the degree of sourness with a standard apple juice sample. All of the panelists were able to correctly score the least and most acidic.

Introduction

• Sensory Evaluation Background

Sensory evaluation of foods has been applied to many situations in research and development, quality control and food product marketing. Subjective tests must be used to assess differences in the quality of foods. Ultimately the degree of appeal to human sensory organs is used to evaluate food quality characteristics such as appearance, texture, taste, and aroma. Descriptive tests are analytical tests that are used to detail specific flavors or textures of a food or beverage. The paired comparison test is a difference test where two coded samples are presented simultaneously and panelists are asked to select the one that has more of a particular characteristic. The triangle test is a difference test performed on three coded samples. Two of the samples are identical and the third is different. All samples are presented simultaneously and panelists are asked to identify the odd sample. The ranking test is a difference test where more than two samples are simultaneously presented and the panelists rank the samples according to the intensity of the particular characteristic.
Number one is ranked as the greatest intensity. In the duo-trio test three samples are tested with two being identical while the third sample is different. Panelists determine which sample differs from the standard and what is the major difference. In the scoring or rating test a reference sample is given an arbitrary score of four and the panelists rate the other two samples intensity relative to the reference. In the beverage sensory testing, different colored foods or beverages are ranked by different parameters on a scale of one to five, five being the most and one being the least (Brown 2011).

- Color Perception

A 2010 study investigated whether balance and complexity due to addition of color in the presentation of food on a plate affect the attractiveness of the presentation as much as those factors affect the attractiveness of works of art. Also, the willingness to try the food and liking for the food in four presentations of: monochrome-balanced, colored-balanced, monochrome-unbalanced, and colored-unbalanced was measured. Results proved that manipulating color and balance in a food presentation affects its attractiveness but it does not alter how much one likes the flavor of the food (Zellner 2010). The color of a food product can affect appeal by making the food visually stimulating, however, it does not necessarily affect the flavor once the food is consumed. A 2008 study investigated the influence of fruit acids on people’s perception of the identity and the intensity of a variety of different fruit-flavored solutions. Participants had to identify the flavor of fruit-flavored drinks that were colored yellow, grey, orange, red, or else were presented as colorless solutions. The participants also rated the intensity of flavor, sweetness, and sourness of each solution using a Labelled Magnitude Scale (LMS). The participants identified the flavors of the beverages more accurately when citric and malic acids were added to the solutions, and/or when the solutions were colored appropriately (Zampini 2008). Appropriately colored beverages are liked more than inappropriately colored ones. Consumers have expectations of what color a certain food
should be and when it is not that preconceived color appeal for the food diminishes.

• Texture Analysis Studies

A study done in 2010 by Yven and others investigated the mastication of two samples of typical cereal food products previously characterized by different sensory, textural and mechanical properties, by two complementary approaches. Electromyographic records and image analysis of chewed food particles first confirm the importance of the brittle behaviour of the products on human mastication. For both products, the fragmentation is followed by a significant agglomeration after less than 10 chewing cycles, both phenomena being correlated to the force magnitude and its evolution. Then, artificial mastication is undertaken to shed more light on the capability of the chewing simulator to discriminate both products under dry mastication conditions. The results depict a qualitative agreement with human mastication and texture properties. When people chew their food they are able to analyze the texture. People evaluate food based on the texture and will develop either a liking or disliking based on this characteristic. A study done by Kayitesi and others (2010), marama/sorghum composite porridges (10% solids) were prepared and subjected to descriptive sensory analysis, consumer acceptance testing, texture analysis, pasting and colour measurements. Results showed that combining sorghum meal with full-fat marama bean flour has the potential to improve the sensory quality of sorghum porridge as a staple by providing acceptable sensory appeal. Improved texture of a product will have a positive affect on the appeal for a food.

• Difference Tests

Recent studies have shown that humans possess a multitude of bitter taste receptors and that the transduction of bitter taste may differ between one compound and another. Studies of mixture interactions suggest further that bitter compounds suppress or enhance sweet and sour tastes and interact with volatile flavor molecules (Drewnowski 2001).
eating habits are largely influenced by how foods taste. Without being the dominant taste sensation, bitter taste contributes to the complexity and enjoyment of beverages and foods. In a 2009 difference test conducted by Ross and others, the objective of the study was to determine if perceptible sensory differences existed between biodynamically and organically grown Merlot wines. Wine grapes were raised biodynamically or organically on a commercial vineyard with wines produced from 2001 to 2004. Sensory difference testing was performed to evaluate possible differences between the two wines within each vintage. Results of the triangle tests only showed a notable difference between the 2004 biodynamically and organically grown wines. Results of the directional paired difference test showed that the 2003 biodynamically grown wine was higher in musty/earthy aroma and bitterness. However, the 2003 organically grown wine was preferred. Panelists preferred the wine that was less bitter and had a milder aroma.

**Methods**

- **Panelists**

  The panelist demographics consisted of San Diego State students from both sections of the Nutrition 205 Lab. There were a total of forty four panelists. Of those forty four panelists 90.9% were female and 93.2% were single. The mean age of the panelists was 22.59. The oldest panelist was 37 and the youngest was 20. Also, 97.7% were foods and nutrition majors. Only 2.3% were graduates. Most students lived with a roommate, with 61.4% living with two or more roommates and 29.5% living with one other roommate. Only 2.3% of the panelists were smokers and 13.6% had allergies. Lastly, of the forty four panelists 63% drank apple juice.

- **Environment**

  The lab room had white walls with some color due to nutrition posters hung around the room with florescent lighting. Panelists from section one of the nutrition lab conducted the sensory
evaluation in the morning while section two conducted the experiment in the afternoon of the same day. The temperatures in the room were very cool with low humidity. Seating arrangements were organized into rows. The panelists sitting in the front of each row passed out samples down their own row one at a time for each sensory evaluation done. The noise level was ranged medium to high. Panelists talked in between evaluations and made facial gestures during tasting.

• Color Association/perception of beverages

For the beverage color and associations with other parameters test, five different colored beverages were displayed for the panelists to view. Parameters were scored only based off color association. The five colors were light yellow, dark yellow, chartreuse, dark chartreuse and emerald green. The students rated the beverages on sweetness, sourness, naturalness, artificiality, preference and dislike. They were given a scale of one to five, with one being the least and five being the most. The panelists also stated at what temperature they would drink the beverage, either warm, tepid, or cold. Lastly, they completed the question of whether or not they would drink the beverage.

• Descriptive Tests

In the first descriptive test panelists were given four different bite-size samples of selected products to describe based on their appearance, flavor, texture, aroma and consistency. They were given a list of words to pick from to evaluate the sample for each category. They tested goldfish crackers, raisins, almonds and marshmallows that were placed in 2 ounces sample cups. Panelists were asked to try one sample at a time and to take a sip of water in between each new sample. In the paired comparison test two coded samples of apple juice, sample 635T1 and sample 573T2, were presented simultaneously and panelists were asked to select the one that was more sour. The chance of selecting the correct sample was one out of two. With the triangle test three coded samples of apple juice were used. Two
samples were identical, sample 777 C1 and 542 E2. Sample 112 H9 was different. All samples were presented simultaneously and panelists were asked to identify the odd sample. The chance of guessing the odd sample was one out of three. The ranking test is where more than two samples are simultaneously presented and the panelists rank the samples according to the intensity of a particular characteristic. The sample with greatest intensity was ranked number one. Five samples of apple juice, 192 L3, 555 07, 695 F8, 543 K8 and 495 P2, were ranked on intensity of sourness and preference. In the duo-trio test three samples are presented at the same time, but a standard is designated, and the participant is asked to select the one most similar to the standard. In the rating test the panelists tested three samples of apple juice. Sample 0110 is the control and was given a ranking score of 4 out of 7. Sample 420M and S723 were rated by sour intensity relative to the reference.

- Statistical Analysis

The statistical information was entered into the computer by the instructor using excel and the standard deviation for ages was found.

Results

- Beverage Color Association
  - When the panelists were asked if they would drink the product, 93% would drink the light yellow, 25% would drink the dark yellow, 57% would drink the chartreuse, 30% would drink the dark chartreuse and 18% would drink the emerald beverage (see figure 1).
When the panelists were asked which product looked the sweetest, 27% said the dark yellow looked the sweetest and 2% said the chartreuse looked the sweetest (see figure 2). When the panelists were asked which product looked the sourest, 59% said the light yellow looked the sourest, 7% said the dark yellow looked the sourest and 7% said the emerald looked the sourest (see figure 3).
When panelists were asked which beverage looked the most artificial, 66% said the emerald looked the most artificial and 2% said the chartreuse looked the most artificial (see figure 4). When panelists were asked which beverage looked the most natural, 96% said the light yellow looked the most natural and 5% said the chartreuse looked the most natural (see figure 5).

When the panelists were asked which beverage they would most prefer, 84% would prefer the light yellow, 2% would prefer the dark chartreuse and 2% would prefer the emerald (see figure 6). When panelists were asked which product they would most dislike, 70% said they would most dislike Emerald and 2% said they would
When panelists were asked at what temperature they would drink each beverage, 89% would drink the light yellow cold and 2% would drink it warm. One hundred percent (100%) of the panelists would drink the dark yellow cold. Ninety-eight percent (98%) would drink chartreuse cold and 2% would drink it tepid. One hundred percent (100%) of the panelists would drink the dark chartreuse cold. Ninety-one percent (91%) would drink the emerald beverage cold, 2% would drink it hot and 2% would drink it warm (see figure 8).
Texture Description

- All forty four of the students tasted the goldfish sample with 23% finding the goldfish to appear symmetrical and 27% found it to appear dry. The rest of the students either found the goldfish to be asymmetrical, rounded, golden-brown, smooth, light brown and rough (see figure 9.1). Ninety percent (90%) of the students found the flavor of the goldfish to be salty and the rest thought it tasted either flat, sharp or musky (see figure 9.2). Fifty seven percent (57%) of the students found the texture of the goldfish to be crunchy while 41% found it to be crisp and the rest of the students found it to be gritty (see figure 9.3). Thirty four percent (34%) of the students found the goldfish to smell burnt while 30% described the goldfish to smell spicy and the rest either found it to smell sweet, sour, flowery or detected no aroma (see figure 9.4). Ninety-three percent (93%) found the consistency of the goldfish to be brittle and the rest found it to either be thin, thick or gummy (see figure 9.5).
Thirty eight of the panelists tested the raisin samples. Twenty percent (20%) thought the raisin sample appeared sticky, 18% thought it was dry, 25% thought it was rough and 20% thought it was glossy. The rest of the panelists thought it was either asymmetrical, dark or rounded (see figure 10.1). Forty-five percent (45%) of the panelists described the taste as sweet and 43% said it was fruity. The rest of the students said it was either sour, bitter or pastu (see figure 10.2). Twenty-seven percent (27%) of the panelists thought the texture was chewy, the rest were split between springy, firm, gritty, gummy, lumpy, mealy, rough, moist and rubbery (see figure 10.3). Fifty-two percent (52%) of the class described the aroma of the raisin as fruity and the rest said it was either spicy, sweet or sour (see figure 10.4). Forty-three percent (43%) found the consistency to be chewy and another 30% found it to be gummy. The rest of the panelists thought it was either brittle, thin, rubbery, and viscous (see figure 10.5).
Forty-one percent (41%) found the almonds to appear golden-brown and 25% light-brown, the rest thought it either appeared rounded, dry, rough, grainy, dull and smooth (see figure 11.1). Ninety-three percent (93%) found the almonds to taste nutty and the rest thought it appeared either flat or bitter (see figure 11.2). Thirty-four percent (34%) found the texture to be hard and 32% found it to be crunchy, the rest thought it was either crisp, rough, firm, gritty, chewy or adhesive (see figure 11.3). Fifty-five percent (55%) of the panelists found the aroma of the almonds to be burnt and the rest found it to either be sweet, sour, flowery and no aroma (see figure 11.4). Forty-six percent (46%) thought the consistency of the almond sample was brittle, 43% said it was thick and the rest said it was chewy (see figure 11.5).
For the marshmallow sample 82% of the panelists thought it appeared puffy and
the rest thought it was either smooth, dull, rounded, creamy or dry (see figure 12.1).
For the flavor of the marshmallow, 68% of the students thought it tasted sweet and
20% thought it was pasty. The rest of the panelists thought it was either fruity,
musky, flowery or flat (see figure 12.2). Thirty four percent (34%) found the texture
to be gummy, 27% found it springy and 16% found it velvety. The rest found it
either tender, chewy, rubbery and gelatinized (see figure 12.3). Ninety-three
percent of the panelists (93%) found the aroma of the marshmallow to be sweet
and the rest found it either sour, flowery or fruity (see figure 12.4). Forty-eight
percent of the panelists (48%) found the consistency to be chewy and 39% found it
gummy and 14% found it rubbery (see figure 12.5).
Marshmallow Appearance

- Appearance
- Symmetrical
- Smooth
- Puffy
- Dull
- Rounded
- Creamy
- Glossy
- Dry

Marshmallow Flavor

- Flavor
- Sweet
- Fruity
- Pasty
- Musky
- Flowery
- Flat

Marshmallow Texture

- Texture
- Velvety
- Springy
- Gummy
- Tender
- Chewy
- Rubber
- Gelatinized
- Smooth
- Moist
- Thick

Marshmallow Aroma

- Aroma
- Spicy
- Burnt
- Sweet
- Sour
- Flowery
- Fruity
• Paired Comparison

In the paired comparison test 98% of the panelists were able to determine that sample 573T2 (1% citric acid solution) was more sour than sample 635T1 (0% citric acid solution) (see figure 13).

• Triangle

One-hundred percent (100%) of the panelists were able to determine that sample 112H9 (1% citric acid solution) was more sour than sample 777C1 (0% citric acid solution) and sample 542E2 (0% citric acid solution).
Ranking

Most of the panelists were able to determine which sample was the most or least sour in the five samples of apple juice with varying percentages of citric acid. Eighty-four percent (84%) of the panelists ranked the apple juice with 10% citric acid as the most sour and 16% ranked the apple juice with 5% citric acid (see figure 14.1). Ninety-three percent (93%) of the panelists ranked the apple juice with 0% citric acid as the least sour and 7% of the panelists ranked the apple juice with 1% citric acid (see figure 14.2). More than half of the panelists, 55%, most preferred the apple juice with 0% citric acid and 7% most preferred the apple juice with 2.5% citric acid (see figure 14.3). A majority of the students, 84%, least preferred the apple juice with 10% citric acid and 16% least preferred the apple juice with 0% citric acid (see figure 14.4).
• Duo Trio

During the duo-trio test 100% of the panelists were able to determine which cookie sample differed from the standard. Sample 8175 was the standard and was a Nabisco Nilla Wafer as well as sample 1108. Sample 6104 was either an Albertson's, Ralph's or Safeway Vanilla Wafer. Thirty percent (30%) said the difference was in crunchiness, 21% said it differed in texture and 2% said it was brittle (see figure 15).
• Scoring/Rating

In the rating test, the reference sample, 0110, had been given an arbitrary score of four, one being the most sour and seven being the least sour. Sample 420M and sample S723 were rated by sour intensity relative to the reference. One-hundred percent (100%) of the panelists were able to determine which sample was most sour or least sour. Forty seven percent (47%) of the students gave sample S723 a score of 1, 45% gave it a score of 2 and 8% gave it a score of 3. for sample 420M 5% gave it a score of 5, 79% gave it a score of 6 and 16% gave it a score of 7 (see table 1).

<table>
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<td>Code</td>
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Discussion

In the beverage color association test the most preferred drink of the panelists was the light yellow color. According to a 2008 study conducted by Zampini, beverages that are appropriately colored will have more appeal. The yellow colored beverage resembled the color of lemonade thus giving the impression of naturalness which appeals to the taster. The rest of the colored beverages were more brightly colored and artificial looking. Research from a 2010 study done by Zellner showed that color makes food appear more attractive. In this study the color that appeared more natural was most attractive to the taster.

According to a 2010 study by Yven, texture and mouth feel contribute to preferences in foods. In the Descriptive test panelists described texture based off of the mouth feel, appearance and chewiness of the sample. Panelists also described the aroma and flavor of the samples. A study done by Kayitesi and others (2010) showed that improved texture will result in a greater appeal. Descriptions of the samples varied from the panelists, due to
people's personal preference of foods and in ways they would describe food choices.

In the difference tests of differentiating apple juice samples from one another based off of degree of sourness or differentiating cookie samples based off of human sensory, most of the panelists were able to determine which sample was different. However, the results show no correlation between preference and sourness. Results varied by which beverage panelists preferred due to personal preferences in taste. A 2001 study by Drewnowski showed that humans have a multitude of bitter taste receptors, and these receptors can vary from person to person. Bitter taste can contribute to the appeal of many beverages. In a 2009 difference test conducted by Ross and others, results showed that panelists chose the less bitter wine as the most preferred. This study found a correlation between bitter taste and preference, however the apple juice acidity tastes never gave a solid result.

Errors in the study may be due to the noise level during the tests. Panelists were engaging in conversation while sampling the products, which could have thrown off the results since panelists did not have their full attention. When testing the degree of sourness, panelists made facial gestures according to the acidity of the apple juice they were tasting. This could have changed results if other panelists were observing these facial gestures. Also, some of the results were given in front of the other panelists which may have influenced the panelists to change their results based off of majority.

Ways to improve the testing environment would be to have panelists test samples individually so that other panelists could not influence their results when recording and by avoiding observing other panelist's facial gestures. If panelists are tested together in one room, no talking should be permitted during testing so full attention is given by the panelist.
References


