Sensory Evaluation Lab Report

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Abstract

Sensory evaluations are used in research and development, quality control, and food product marketing. The senses of sight, touch, taste, smell, and hearing were used to observe and compare several samples of food products and beverages’ appearance, flavor, texture and/or aroma. The objective of this sensory evaluation study was for panelists to consciously make an evaluation based on only sensory characteristics. The tests conducted were as follows: color association, descriptive terms, paired comparison, triangle test, duo trio test, rating test, and ranking test. The color association test was conducted with different colored beverages to study the correlation between color and perceived taste, naturalness versus artificialness, and overall personal preference. Results found that majority of panelists were able to successfully complete all assigned tasks efficiently by use of perceived senses. The findings of this study are able to aid researches interested in consumer preference create new strategies for product production and marketing techniques.
Introduction

New food products and beverages are constantly being introduced to the world. The food industry continues to flourish and expand with new methods that aim to captivate all five human senses: taste, touch, sight, smell, and sound. The success of any particular company is highly dependent on the understanding of its consumers. Sensory evaluation labs are able to guide food and beverage companies to properly produce and market what majority of consumers need or are interested in. The five types of taste, sweet, salty, sour, bitter, and umami (savory), play an important role in food selection (Brown, 2011).

Studies have revealed that consumers and the certain color of the items purchased are linked. Garber and others (2000) were able to find the connection between the color of food and food labels. In this study, 389 students at the undergraduate level were observed to examine possible association of beverage color with the perceived flavor of the beverage. An orange flavored fruit beverage was colored orange, clear, and purple and labeled according to the color associated to familiar beverages. The orange colored beverage was labeled orange, the clear colored beverage was labeled fruit drink, and the purple beverage was labeled grape. The purple beverage was reported by the subjects as being more tart while the orange beverage was reported as having refreshing qualities. As Garber and other expected, the subjects were unable to accurately classify the flavor with the difference in color and labeling. Garber and other concluded that color plays a key role identifying flavor and overall expectation of a beverage (Garber et. al. 2000).

The identity of food and consumer’s expectations of its flavor can also be greatly influenced by texture. A study by Turnick (2011) was conducted showing the importance of texture and food identification. Blindfolded subjects were incapable of identifying foods once pureed because of the lack of texture of the food. According to Turnick (2011), texture
acceptability is based on age, culture, expectations, physiology, the contrast of multiple textures
within one meal, and the time of day when eating occurs. A single food item can be described
numerous of ways depending on these certain aspects. It was also noted in this particular study
that Americans favor crispy, crunchy, firm, tender, and juicy textures (Turnick, 2011).

The objective of this sensory evaluation lab by San Diego State University Nutrition 205
students is to evaluate test results based on honest, unbiased results by means several tests
including color association, descriptive terms, paired comparison, triangle test, duo trio test,
rating test, and ranking test. With these test, the students will be exposed to identifying
differences among samples, using descriptive terms to explain perceived appearance, flavor,
texture, aroma, consistency, and mouthfeel of food products, along with ranking samples in order
of intensity and preference.

Methods

Panelists

The panelists of this sensory evaluation lab consisted of San Diego State untrained
students from four sections of Nutrition 205: Intro to the Science of Food Lab. Section 1
participated on a Monday at 9:00AM, section 2 participated at 1:00PM, section 3 participated at
4:00PM, and section 4 participated the following day (Tuesday) at 9:00AM. A total of eighty-six
students participated. Data shows that 84.88% were female and 15.12% were male. Of the
eighty-six participants, 65.12% were between the ages of 19 and 22, 20.93% between the ages of
23 and 26, and the remaining was aged between 27 to 39 years. As for student status, most
panelists were undergraduate students with 93.02% and few were graduate students with merely
6.98%. Majority of the panelists (98.84%) were also Foods and Nutrition majors. As for living
conditions, 74.42% of panelists were living with two or more roommates, while 22.09% were
living with one roommate and 3.49% were living alone. When panelists were asked their marital status, 89.53% responded as single, 6.98% responded as married and 3.49% responded as divorced. Only 4.65% of the panelists admitted to being smokers and 24.42% claimed to have allergies. Of the eighty-six panelists, 6.98% identified themselves as being vegan and 3.49% identified themselves as being vegetarian.

Environment

The Sensory Evaluation Lab took place in San Diego State University’s food science laboratory, also known as West Commons 203. This laboratory contained two doors and no windows. The two doors remained closed throughout the testing. All testing was conducted under reasonable controlled conditions. Lighting, humidity, and temperature of the testing place were within normal range. Individual desks were organized with an even amount of rows in the center of the laboratory surrounded by food science lab equipment, including sinks, cabinets, and stove top tables. The rows of desks were relatively close together and panelists were told not to look or talk to fellow panelists around them. Noise level throughout the evaluation was medium. The use of phones or any other electronic devices was prohibited. One instructor with the aide of one laboratory technician gave all instructions to the panelists. One laboratory teaching assistant inputted data of results.

Color Association

Panelists were given a sensory beverage color association test. Parameters for this particular test were solely base on color association. Five differently colored beverages were arranged in front of each section of seated panelists on a countertop for visual observation. Each
of the beverages was in a transparent container. The colors consisted of light yellow, dark yellow, chartreuse, dark chartreuse, and emerald. Panelists were asked if he or she drinks apple juice and their yes or no answers were recorded. The panelists were then instructed to rate the beverages according to sweetest, sourness, artificiality, naturalness, most preferable, and most disliked based on the beverages’ colors. The colors were rated on a scale of one to five with five being the most and one being the least. Numbers two, three, and four were used to rate second, third and fourth of each attribute. Panelists were asked to report their ratings honestly by raising a hand when asked about the association to a particular colored beverage. Panelists were then asked to rate each color at which temperature he or she would prefer to drink each beverage at (cold, tepid, warm, or hot). Panelists were asked to report their ratings honestly by raising a hand when asked the appropriate association with which he or she answered. Lastly, panelists were asked, yes or no, if he or she would drink the light yellow beverage, the dark yellow beverage, the chartreuse beverage, the dark chartreuse beverage, and/or the emerald green beverage. Answers were recorded in the same manner as the previous ratings and question.

**Descriptive Terms**

Panelists were asked to evaluate an array of food products using descriptive terms. Panelists were provided with a list of descriptive terms prior to the start of the evaluation. These terms were to be used to describe each food product’s appearance, flavor, texture, aroma, consistency, and mouthfeel. The food products consisted of goldfish crackers, raisins, almonds, and marshmallows. Each panelist was given two samples of each food product in a white two ounce sample cup along with a small Styrofoam cup of drinking water. The drinking water was given to the panelists to cleanse the pallet between the sampling of each food product. The
panelists were instructed to write down a descriptive term from the provided list on a given questionnaire describing their experience with each food product. Once all panelists completed this task, the instructor asked panelists to honestly report their descriptive terms by raising a hand when the corresponding descriptive term was being recorded.

*Difference Tests*

A series of tests, including a paired comparison test, a triangle test, a scoring test, a ranking test, and a duo-trio test, were performed by the panelists. Samples of apple juice and mixture of apple juice with added citric acid were used for the paired comparison test, the triangle test, the scoring test, and the ranking test. Vanilla wafer cookies were used for the duo-trio test. Both the apple juice samples and the vanilla wafer cookie samples were served in a small, white one ounce cup. Prior to the evaluation, panelists were given evaluation sheets for the duo-trio test and scoring test to record results. Rankings of the paired comparison test, the triangle test, and the ranking test were recorded by panelists in his or her individual Nutrition 205: Introduction to the Science of Food lab manual. Water was present in white Styrofoam cups for the panelists to take sips between each sample to cleanse his or her pallet.

The objective of the paired comparison test was to evaluate which sample has more of a particular characteristic. In this particular evaluation, the characteristic being tested was the sourness. The chance of selecting the correct sample was one out of two. One sample consisted of 0% citric acid added to apple juice and the other sample consisted of 1% citric acid added to apple juice. The apple juice with 0% citric acid was sample coded 635T1 and the apple juice with 1% citric acid added was sample coded 573T2. Panelists recorded which sample he or she
perceived as less and more sour. The instructor asked the panelists to report his or her answers honestly by raising a hand with the corresponding answer said aloud.

The objective of the triangle test was to evaluate which of two samples are identical and which one is different. The three samples were presented to the panelists simultaneously with similar appearance. The chance of selecting the odd sample was one out of three. Two samples of apple juice with 0% citric acid added were sample coded 777C1 and 542E2 and one sample of apple juice with 1% citric acid added was sample coded 112H9. Each panelist recorded which samples he or she perceived as the same and which one was different. The instructor asked the panelists to report his or her answers honestly by raising a hand with the corresponding answer said aloud.

The objective of the ranking test was to rank more than two samples presented simultaneously according the intensity of a particular characteristic. In this particular evaluation, five samples were ranked by the overall flavor intensity. Panelists recorded what he or she perceived as most intense as #1, followed by #2, #3, #4, and #5. The panelists then ranked his or her order of preference using the same one to five scale. Apple juice with 0% citric acid added was sample coded 495P2, apple juice with 1% citric acid added was sample coded 543K8, apple juice with 2.5% citric acid added was sample coded 695F8, apple juice with 5% citric acid added was sample coded 192L3, and apple juice with 10% citric acid added was sample coded 555D7. The instructor asked panelists to report his or his rankings honestly by raising a hand to the corresponding ranking said aloud.

The objective of the duo-trio test was to evaluate which food sample differs from the standard sample presented first. In this particular evaluation, panelists were asked to determine which of vanilla wafer cookies differed from the vanilla wafer cookie presented first. The
standard (a Nabisco Nilla brand wafer cookie) was sample coded 8175. Of the two samples that followed, one (a Safeway brand wafer cookie) was sample coded 6104 and one (a Nabisco Nilla brand wafer cookie) was sample coded 1108. Panelists were asked to record with sample he or she perceived as different from the standard. The panelists were then asked to record if the perceived difference was due to dryness, crunchiness, or less vanilla. The instructor asked panelists to report his or her answers honestly by raising a hand to the corresponding answer said aloud.

The objective of the scoring/rating test was to evaluate intensity of samples given a standard. In this particular evaluation, panelists were asked to rate the level of sourness two samples after receiving a reference sample. The reference sample was coded 0110. One sample with 1% citric acid was coded as 420M and one sample with 5% citric acid was coded S723. With a reference sample of an arbitrary score of four, panelists were asked to rank sample 420M and S723 on a scale of one being more sour and seven being less sour. The instructor asked panelists to report his or his rankings honestly by raising a hand to the corresponding ranking said aloud.

**Statistical Analysis**

All statistical information was received and recorded in an Excel Microsoft spreadsheet via the instructor with the assistance of a laboratory aide. Panelists were asked before each recording of information to report honestly. Percentages were calculated and added the Excel Microsoft spreadsheet by the instructor for data observations.

**Results**

*Color association*
All eighty-six panelists participated in the beverage association portion of this sensory evaluation lab. According to the data collected, 59.30% of panelists reported that he or she drinks apple juice while 40.70% reported he or she does not drink apple juice (see Figure 1).

![Figure 1: Evaluation in Percentage of Nutrition](image)

When panelists were asked which beverage was perceived as most sweet 25.58% reported light yellow, 15.12% reported dark yellow, 6.98% reported chartreuse, 15.12% reported dark chartreuse, and 37.21% reported emerald (see Figure 2).
When panelists were asked which beverage was perceived as most sour, 54.65% reported light yellow, 12.79% reported dark yellow, 17.44% reported chartreuse, 6.98% reported dark chartreuse, and 5.81% reported emerald (see Figure 3).
When panelists were asked which beverage was perceived as most artificial, 0% reported light yellow, 6.98% reported dark yellow, 2.33% reported chartreuse, 10.47% reported dark chartreuse, and 80.23% reported emerald (see Figure 4).

![Figure 4: Evaluation of Beverage Perceived as Most Artificial in Percentage by Nutrition 205 Students](image)

When panelists were asked which beverage was perceived as most natural, 96.51% reported light yellow, 0% reported dark yellow, 0% reported chartreuse, 0% reported dark chartreuse, and 3.49% reported emerald (see Figure 5).
When panelists were asked which beverage did he or she most prefer, 84.89% reported light yellow, 4.65% reported dark yellow, 5.81% reported chartreuse, 3.49% reported dark chartreuse, and 0% reported emerald (see Figure 6).
When panelists were asked which beverage did he or she dislike most, 5.81% reported light yellow, 15.12% reported dark yellow, 3.49% reported chartreuse, 9.30% reported dark chartreuse, and 66.28% reported emerald (see Figure 7).

![Figure 7: Evaluation of Beverage Perceived as Most Disliked in Percentage by Nutrition 205 Students](image)

When panelists were asked at what temperature he or she would drink the light yellow colored beverage, 93.02% responded cold, 13.95% responded tepid, 13.95% responded warm, and 9.30% responded hot (see Figure 8).
When panelists were asked at what temperature he or she would drink the dark yellow colored beverage, 76.74% responded cold, 6.98% responded tepid, 4.65% responded warm, and 0% responded hot (see Figure 9).
When panelists were asked at what temperature he or she would drink the chartreuse colored beverage, 80.23% responded cold, 11.63% responded tepid. 4.65% responded warm, and 2.33% responded hot (see Figure 10).

![Figure 10: Evaluation of Chartreuse Colored Beverage Temperature Preference in Percentages by Nutrition 205 Students](chart)

When panelists were asked at what temperature he or she would drink the dark chartreuse colored beverage, 81.40% responded cold, 5.81% responded tepid, 0% responded warm, and 0% responded hot (see Figure 11).
When panelists were asked at what temperature he or she would drink the emerald colored beverage, 75.58% responded cold, 5.81% responded tepid, 1.16% responded warm, and 3.49% responded hot (see Figure 12).
Majority of panelists (87.21%) answered “yes” when asked if he or she would drink the light yellow colored beverage. Only 12.79% answered “no” (see Figure 13).

![Figure 13: Evaluation of Panelists who Would Drink The Light Yellow Colored Beverage by Nutrition 205 Students](image)

More panelists (60.47%) answered “no” when asked if he or she would drink the dark yellow colored beverage. The remaining 39.53% answered “yes” (see Figure 14).
When panelists were asked if he or she would drink the chartreuse colored beverage, 44.19% answered “no” and 55.81% answered “yes” (see Figure 15).
More panelists (67.44%) answered “no” when asked if he or she would drink the dark chartreuse colored beverage. The remaining 32.56% answered “yes” (see Figure 16).

![Figure 16: Evaluation of Panelists who Would Drink the Dark Chartreuse Colored Beverage by Nutrition 205 Students](image)

Majority of panelists (81.39%) answered “no” when asked if he or she would drink the emerald colored beverage. The remaining 18.60% answered “yes” (see Figure 17).
Descriptive Terms

When panelists were asked to describe the appearance of the goldfish cracker, 29.07% responded golden brown, 25.58% responded dry, and 25.58% responded dry. When panelists were asked to describe the flavor of the goldfish cracker, 70.13% responded salty, 16.88% responded sharp, and 7.79% responded flat. When panelists were asked to describe the texture of the goldfish cracker, 45.46% responded crunchy, 44.16% responded crisp, and 5.19% responded flaky. When panelists were asked to describe the aroma of the goldfish cracker, 31.33% responded burnt, 31.33% responded nothing, and 26.51% responded flavory. When panelists were asked to describe the consistency of the goldfish cracker, 45.45% responded brittle, 37.66% responded cheesy, and 14.29% responded thin. When panelists were asked to describe the mouthfeel of the goldfish cracker, 58.44% responded crunchy, 28.57% responded crispy, and 10.39% responded gritty (see Table 1).
When panelists were asked to describe the appearance of a raisin, 25.88% responded sunken, 22.35% responded dry, and 16.47% responded sticky. When panelists were asked to describe the flavor of the raisin, 47.62% responded sweet, 36.91% responded fruity, and 4.76% responded bitter. When panelists were asked to describe the texture of the raisin, 30.12% responded chewy, 26.51% responded gummy, and 10.84% responded lumpy. When panelists were asked to describe the aroma of the raisin, 38.82% responded fruity, 31.76% responded sweet, 8.24% responded nothing, and another 8.24% responded burnt. When panelists were asked to describe the consistency of the raisin, 58.33% responded chewy, 30.95% responded gummy, and 7.14% responded rubbery. When panelists were asked to describe the mouthfeel of the raisin, 53.57% responded sticky, 13.10% responded smooth, 11.90% responded slimy, and another 11.90% responded gritty (see Table 2).
When panelists were asked to describe the appearance of the almond, 29.07% responded dry, 16.28% responded rough, and 13.95% responded golden brown. More than half (65.48%) described the flavor of the almond as nutty while 19.05% of panelists used the term flat and 14.29% used the term stale. When panelists were asked to describe the texture of the almond, 38.55% responded hard, 19.28% responded firm, and 13.25% responded crunchy. Majority of the panelists (94.05%) described the aroma of the almond as having none. Very few described the aroma of the almond as flowery (2.38%), burnt (1.19%), sweet (1.19%), or sour (1.19%). Just over half of the panelists (51.19%) described the mouthfeel of the almond as crunchy while 34.52% described the mouthfeel as gritty, 4.76% described the mouthfeel as sticky, and another 4.76% described the mouthfeel as smooth (see Table 3).

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Flavor</th>
<th>Texture</th>
<th>Aroma</th>
<th>Consistency</th>
<th>Mouthfeel</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.88% sunken</td>
<td>47.62% sweet</td>
<td>30.12% chewy</td>
<td>38.82% fruity</td>
<td>58.33% chewy</td>
<td>53.57% sticky</td>
</tr>
<tr>
<td>22.35% dry</td>
<td>36.91% fruity</td>
<td>26.51% gummy</td>
<td>31.76% sweet</td>
<td>30.95% gummy</td>
<td>13.10% smooth</td>
</tr>
<tr>
<td>16.47% sticky</td>
<td>4.76% bitter</td>
<td>10.84% lumpy</td>
<td>8.24% nothing/burnt</td>
<td>7.14% rubbery</td>
<td>11.90% slimy/gritty</td>
</tr>
</tbody>
</table>

Table 3: Evaluation of Top 3 Descriptive Term Responses of an Almond by Nutrition 205 Students

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Flavor</th>
<th>Texture</th>
<th>Aroma</th>
<th>Consistency</th>
<th>Mouthfeel</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.07% dry</td>
<td>65.48% nutty</td>
<td>38.55% hard</td>
<td>94.05% none</td>
<td>47.56% thick</td>
<td>51.19% crunchy</td>
</tr>
<tr>
<td>16.28% rough</td>
<td>19.05% flat</td>
<td>19.28% firm</td>
<td>2.38% flowery</td>
<td>41.46% chewy</td>
<td>34.52% gritty</td>
</tr>
<tr>
<td>13.95% golden brown</td>
<td>14.29% stale</td>
<td>13.25% crunchy</td>
<td>1.19% burnt/sweet/sour</td>
<td>9.76% rubbery</td>
<td>4.76% sticky/smooth</td>
</tr>
</tbody>
</table>
When panelists were asked to describe the appearance of the marshmallow, majority (82.56%) responded puffy while 8.14% responded smooth and 4.65% responded dry. When panelists were asked to describe the flavor of the marshmallow, majority (76.00%) responded sweet while 17.33% responded floury and 4.00% responded flat. When panelists were asked to describe the texture of the marshmallow, 29.73% responded springy, 25.67% responded gummy, and 13.51% responded velvety. Majority of the panelists (85.71%) described that the aroma of the marshmallow as sweet while 13.10% described the aroma as nothing and 1.19% described the aroma as flowery. When panelists were asked to describe the consistency of the marshmallow, 45.33% responded gummy, 28.00% responded chewy, and 12.00% responded rubbery. When panelists were asked to describe the mouthfeel of the marshmallow 49.33% responded smooth, 28.00% responded sticky, and 17.33% responded slimy (see Table 4).

Table 4: Evaluation of Top 3 Descriptive Term Responses of a Marshmallow by Nutrition 205 Students

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Flavor</th>
<th>Texture</th>
<th>Aroma</th>
<th>Consistency</th>
<th>Mouthfeel</th>
</tr>
</thead>
<tbody>
<tr>
<td>82.56% puffy</td>
<td>76.00% sweet</td>
<td>29.73% springy</td>
<td>85.71% sweet</td>
<td>45.33% gummy</td>
<td>49.33% smooth</td>
</tr>
<tr>
<td>8.14% smooth</td>
<td>17.33% floury</td>
<td>25.67% gummy</td>
<td>13.10% nothing</td>
<td>28.00% chewy</td>
<td>28.00% sticky</td>
</tr>
<tr>
<td>4.65% dry</td>
<td>4.00% flat</td>
<td>13.51% velvety</td>
<td>1.19% flowery</td>
<td>12.00% rubbery</td>
<td>17.33% slimy</td>
</tr>
</tbody>
</table>

**Difference Tests**

**Paired Comparison Test**

Majority of the panelists (97.67%) were able to correctly identify the sample with 1% citric acid added while very few (2.33%) were unsuccessful (see Figure 18).
Triangle Test

Majority of panelists (96.51%) were able to identify the one odd sample (112H9) from the two identical samples (777C1 and 542E2) while the remaining did not. These 3.49% incorrectly identified 542E2 as the odd sample (see Figure 19).
**Duo-Trio Test**

For this particular difference test, seventy-eight of the eighty-six panelists participated. Majority of panelists (90.50%) were able to correctly identify that vanilla wafer cookie sample 1108 differed from the standard sample 8175. The remaining 9.50% incorrectly identified sample 6104 as being different from the standard sample 8175 (see Figure 20).

![Figure 20:](image)

**Discussion**

Results from this test agree with the findings of Garber and other. Color and the way an individual perceive that color controls the way an individual perceives flavor. A preconceived idea of how a beverage may taste is likely to color by the way the beverage looks. It is probable that panelists have been previously exposed to beverages of similar color and determined the parameters of sweetness, sourness, artificiality, and naturalness based on such. Its unusual brightness may have turned panelists away from wanting to taste this is particular beverage.

Panelists preferred cold beverages overall. A few panelists reported being interested in tepid temperature beverages, but the cold temperature persisted as the favorite regardless of
color. Perhaps, the temperature would be preferred warm or hot if panelists from a different region in the world. As the test was conducted in San Diego, many locals tend to prefer cold drinks to balance out the warmer weather.

Majority of panelists were able to identify the correct sample during the paired comparison test and the different sample of the triangle test. There is a possibility that the samples used for this test were too obvious and not challenging for the panelists. However, 100% accuracy was not achieved for this test. To check validity and accuracy of the data collected, these tests should be repeated more than once with the order mixed. Due to dietary restrictions, not all panelists were able to participate in these tests.

Most of the panelists scored the apple juices with 10% citric acid and 5% citric acid are the most sour. It is common for panelists to possess different taste sensation, especially for the scoring test. Results were not completely in agreement with one another. Due to sampling five levels of acidic concentration, taste fatigue could be a reason for this. Sufficient drinking water should have been given to panelists to cleanse the pallet after each and every sample.

Panelists were easily able to choose appropriate descriptive terms to describe appearance flavor, texture, aroma, consistency, and mouthfeel for a goldfish cracker, a raisin, an almond, and a marshmallow. The goldfish cracker’s appearance was most commonly reported to be golden grown and grainy. The goldfish cracker could have been viewed from different angles which could have possibly influenced a panelist to choose one descriptive term over another. A more uniform shaped cracker could be used in the future. Consistency, mouthfeel and texture also varied on responses.

Errors may have occurred in this sensory evaluation lab as a result of a distracting testing setting, failing to pay attention to the instructor’s exact directions, failure to report answers and
rankings honestly, and taste fatigue. Because the panelists’ seats were in such close proximities of each other, lingering eyes may have influenced some results which may have been different if each panelist was completely clear from each other’s sight. Students have eaten prior to the sensory evaluation causing their senses of taste to be altered. The process of refilling water should also be more organized. The least amount of distractions among the panelists should result in overall improvement to the quality of this study and future studies of similar natures.
References


