Effect of Sensory Attributes on Acceptance of Soy nuts by College Students

A Departmental Honors Thesis (HONRS 499)

By

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ABSTRACT

The purpose of this study was to determine acceptability and preference of five flavors of soy nuts: candy coated, yogurt, salted, unsalted, and unsalted. The consumption of soy foods has been associated with many health benefits. Currently, soy nuts are marketed as a snack food item. Since college students have strong food preferences, acceptance of soy nuts by this population would be a way of incorporating soy into their diet. Texture, appearance, and flavor of a 5 gram portion of each flavor of soy nuts were evaluated by 616 (219 males, 397 females) untrained college students who were between 17 and 30 years of age. The products were rated on a nine point hedonic scale, with 1 being "dislike extremely" and 9 being "like extremely". Overall acceptability of the nuts was based on average ratings obtained for appearance, texture and flavor. An analysis of variance was conducted. Candy coated and yogurt soy nuts received high ratings i.e. "liked very much" and "liked moderately" for overall acceptability by college students. Sour cream, salted, and unsalted followed with lesser ratings ranging from "like slightly" and "neither like nor dislike". Unlike gender, age influenced college student’s overall acceptability of soy nuts.
ACKNOWLEDGEMENTS

I would like to show my greatest appreciation to Dr. Jay Kandiah for her role in the completion of this paper. Dr. Kandiah has been a wonderful mentor and has provided me many valuable experiences involving research and publications. In addition to her mentorship, she has readily provided guidance, knowledge, and encouragement that push me to reach for the stars on a daily basis. It has been a sincere privilege to work under Dr. Kandiah’s mentorship.

Additionally, I would like to thank Mr. Lloyd Bookmyer for completion of the statistical analysis. Mr. Bookmyer has been very helpful, meticulous and patient with assisting me with the result portion of this research. Many thanks to Dr. Kandiah and Mr. Bookmyer.
INTRODUCTION

Legumes, such as soybeans, have played an important role in the traditional diets of Asian cuisines for many centuries. Soy food consumption is highest in Japan but it is not commonly included in the Western diet (1). Despite the fact that soybeans are excellent sources of protein, dietary fiber, several micronutrients (e.g. calcium, zinc, iron) and phytochemicals, their biological effects in humans have only been investigated during the last decade (2). The high content of isoflavones in soybeans and soy products have been associated to aid in bone health (3,4), lower blood cholesterol levels (5,6), and reduce the risk of various cancers (7-10).

Studies conducted in the United States and Europe have revealed that college students consume large amounts of salty and sweet snack items(11). The total daily energy intake as snacks varied between countries and was dependent on the frequency of snacking (current, Europe, etc). In the United States, a vast majority of college students snacked away from home. Snacking was attributed to the accessibility of vending machines in most college buildings and the convenience of these items. Taste, health and nutrition were the three most important qualities considered by students when selecting a snack (11). With the numerous benefits associated with soy products, soy nuts are currently marketed as a snack food item. Since college students have strong food preferences, acceptance of soy nuts by this population would be a way of incorporating soy into their diet. Therefore, the purpose of this study was to determine acceptability and preference of five favors of soy nuts.

METHODS

Five flavors of soy nuts, candy coated, yogurt, sour cream, salted and unsalted were obtained from a soy product manufacturing plant in the United States. Upon arrival, the soy nuts
were stored at room temperature in tightly sealed containers. Six hundred and sixteen (males = 219, females = 397) college students between 17-30 years were recruited from a large metropolitan state university in the Mid-West during UniverCity (a week long educational and entertainment program). The students were untrained taste panelists and were informed that they would taste a snack food, but were not given any detailed information, such as the products contained soy. Individuals who had food allergies were encouraged not to participate in this research.

Before administration of the taste test, the soy nuts were coded with five randomly selected designs. At the tasting sessions that took place at room temperature and under bright light, each panelist was offered a sample of approximately 0.16 oz (5 grams) of each of the five flavors of soy nuts. Each panelist evaluated all 5 flavors of nuts on one occasion. Taste panelists were given all samples of soy nuts simultaneously and in random order. To avoid biases of sensory evaluation, panelists were encouraged to take a few sips of cool water between tasting. To ensure accuracy in data collection panelists were seated in individual cubicles and no communication was permitted between the panelists during the study.

A 9-point hedonic scale was used to rate each sample on appearance, texture, and flavor. The 9 choices on the hedonic scale were like extremely, like very much, like moderately, like slightly, neither like nor dislike, dislike slightly, dislike moderately, dislike very much, and dislike extremely. Each point on the hedonic scale was assigned a point value ranging from 9 (like extremely) to 1 (dislike extremely). Other information collected were panelist’s age, gender, status in school, ethnicity and if they would purchase each of the flavors of soy nuts.

The research design for the study was a 2x2x5 ANOVA with repeated measures on the nuts. This was done separately for appearance, texture, flavor and overall acceptability. Overall
acceptability of the nuts was based on average ratings obtained for appearance, texture and flavor. Statistical analysis was performed using the Statistical Package for the Social Sciences (version 10, 1999, SPSS, Chicago, IL). A p-value of \( \leq 0.05 \) was considered statistically significant. The research was reviewed and approved by the University Institutional Committee on Investigations Involving Human Subjects.

**RESULTS**

Because of incomplete information or age criteria, evaluations from 41 panelists were excluded from the research. Thus data was analyzed for 575 panelists who ranged from ages 17-30 years. There were 335 panelists (males =109, females =226) between 17-20 years and 240 panelists between 21-30 years (males =99, females =141). Fig 1 shows the overall acceptability of soy nuts by age and gender. Candy coated nuts were “liked very much” by males and females of both age groups. As would be expected, unsalted soy nuts were the least accepted and received a rating of “neither like nor dislike”.

Regardless of gender, mean ratings by the panelists on appearance for all nuts are shown in Table 1. There was a significant difference among the appearance ratings of the nuts \( F (4,2284) = 239.99, P < 0.001 \) and the Tukey HSD showed that all nuts were different from one another. There was a statistically significant difference in the way gender and age influenced the overall appearance rating of the nuts. Females (mean = 6.47, like slightly) rated the overall appearance of the nuts higher than the males [mean=6.20, like slightly, \( F (1,571) = 11.35, P = 0.001 \)]. The older students (mean = 6.50, like moderately) rated the overall appearance of the nuts higher than the younger students [mean = 6.28, like slightly, \( F (1,571) = 4.99, P = 0.026 \)].

Because of an interaction between age and nut for both texture \( [F (4,2284) = 3.97, P = \)
0.003] and flavor [\( F(4,2284) = 3.28, P = 0.011 \)], individual performance of simple effects tests revealed ratings of the nuts were significantly different for the younger [texture \( F(4,2292) = 223.77, P < 0.001 \); flavor \( F(4,2292) = 267.84, P < 0.001 \)] and the older age groups [texture \( F(4,2292) = 107.95, P < 0.001 \), flavor \( F(4,2292) = 141.01, P < 0.001 \)]. Tukey HSD showed that for both texture and flavor, salted and sour cream soy nuts were rated the same by both age groups. The two age groups “neither liked nor disliked” the flavor but “liked slightly” the texture of the salted and sour cream nuts. The texture and flavor of all other nuts were different for both age groups (Table 1).

Although the two age groups rated overall acceptability of all five nuts in the same order, the ANOVA showed that there was a significant difference in nut acceptability between the 2 age groups [\( F(14, 2284) = 4.32, P = 0.002 \)]. Simple effects tests performed on overall acceptability within each age group, showed there were differences in nut acceptability within each age group \( (P < 0.001) \). A post-hoc multiple comparison test using the Tukey HSD procedure was used to determine the pairwise mean differences among the five flavors of nuts in each age group. Within the 17-20 years age group mean differences for acceptability of nuts varied from one another. In the older age category, both the sour cream and salted nuts had equal acceptability. The mean differences for acceptability for the other three nuts were different from one another and from the sour cream and salted nuts (Fig 1).

To evaluate the nut preference a question was asked from the panelists if they would purchase the nuts. The results indicated irrespective of gender and age the soy nuts were preferred in the following order: candy coated (75%), yogurt (53%), sour cream (20%), salted (18%), and unsalted (7%).
DISCUSSION

This study found that candy coated and yogurt soy nuts received high ratings i.e. liked very much and liked moderately for overall acceptability by college students. Sour cream, salted and unsalted followed with lesser ratings ranging from “like slightly” and “neither like nor dislike”. The order in which college students stated that they would purchase the nuts (preference) was similar to overall acceptability. Unlike gender, age influenced college student’s overall acceptability of soy nuts.

Information on nutrient composition obtained from the manufacturer showed that the two flavored nuts with the highest ratings (candy coated and yogurt) were highest in sugars and lowest in protein and total fat. A serving (1 oz or 28 grams) of candy coated nuts had 4 grams of sugar, 2 grams of protein, and 6 grams of total fat. Amount of sugar, protein and total fat in a serving of yogurt soy nuts were 12 grams, 1 gram, and 5 grams respectively. The popularity of the nuts for overall acceptability and preference may have been because of the high sugar, low total fat and protein content. Since college students tend to like sweet snacks (11), this may explain why they preferred nuts with sweeter coating.

In conclusion, the results of this research suggest that college student’s acceptability of soy nuts is based on flavor, texture, appearance and to a lesser extent on nutrient composition. In this population, age influenced overall acceptability of flavored soy nuts.

APPLICATIONS

* Dietitians and food service managers who wish to choose alternative snacks for their patients or clients could use these findings to make wise purchasing decisions.
Food technologists and manufacturers of food products can use these findings to develop innovative uses for soy nuts as additional snack items.

Researchers can use this information to predict how nutrient composition of other foods will influence acceptability and preferences of college students.

Future research in the United States should be conducted to study how other ethnic and age groups accept soy nuts.
Figure 1: Overall acceptability of soy nuts by age and gender
Table 1: Mean hedonic scale ratings\(^1\) for texture, flavor, and appearance by age

<table>
<thead>
<tr>
<th></th>
<th>Texture(^2)</th>
<th>Flavor(^2)</th>
<th>Appearance(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 17-20</td>
<td>Age 21-30</td>
<td>Age 17-20</td>
</tr>
<tr>
<td>Candy-coated</td>
<td>7.7±1.1</td>
<td>7.6±1.1</td>
<td>7.7±1.6</td>
</tr>
<tr>
<td>Yogurt</td>
<td>6.9±1.5</td>
<td>7.0±1.6</td>
<td>6.8±2.0</td>
</tr>
<tr>
<td>Sour cream</td>
<td>5.7±1.8</td>
<td>6.0±1.8</td>
<td>5.1±2.2</td>
</tr>
<tr>
<td>Salted</td>
<td>5.5±1.8</td>
<td>5.9±1.8</td>
<td>5.1±2.1</td>
</tr>
<tr>
<td>Unsalted</td>
<td>5.1±1.8</td>
<td>5.4±1.8</td>
<td>4.0±1.9</td>
</tr>
</tbody>
</table>

\(^1\) 9 = like extremely; 8 = like very much; 7 = like moderately; 6 = like slightly; 5 = neither like nor dislike; 4 = dislike slightly; 3 = dislike moderately; 2 = dislike very much; 1 = dislike extremely.

\(^2\) Means for both age groups are shown because of an interaction between nuts and age.

\(^3\) No interaction between age and nuts was found.
April 27, 2001

Dr. James Ruebel
Dean of Honors College
CA 104

Dear Dr. Ruebel:

Ms. Jennifer Laird and I are in the midst of submitting our manuscript entitled "Effect of sensory attributes on acceptance of soynuts by college students" for publication in a refereed journal. We would deeply appreciate if our work was not placed in the Special Collections in the Library till our manuscript has been accepted. I will call or E-mail you once our paper has been accepted. Please do not hesitate to contact me if you have any questions.

Thank you very much.

Sincerely,

Jay Kandiah, Ph.D., R.D., C.D.


11. Cross AT, Babicz D, Cushman LF. Snacking patterns among 1,800 adults and children.