PANTAO
The International Journal of the Humanities and Social Sciences
Volume 5, Issue 1
ISSN 3028-0877 | DOI 10.69651/2022PIJHSS

Acceptability of vegetable flavored gummy candy (Malunggay, saluyot, okra, squash and tomato)

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ABSTRACT

The study tried to produce a vegetable flavored gummy candy. Specifically it aimed to: (1) describe the sensory qualities of the five flavors of the Vegetable Flavored Gummy Candy (Malunggay, Saluyot, Okra, Squash and Tomato in terms of appearance, aroma, taste and texture; (2) determine the general acceptability of the five flavors of the Vegetable Flavored Gummy Candy (Malunggay, Saluyot, Okra, Squash and Tomato) in terms of appearance, aroma, taste and texture; (3) find out if there is a significant difference in the sensory qualities of the five flavors of the Vegetable Flavored Gummy Candy (Malunggay, Saluyot, Okra, Squash and Tomato in terms of appearance, aroma, taste and texture; (4) find out if there is a significant difference in the general acceptability of the five flavors of the Vegetable Flavored Gummy Candy in terms of appearance, aroma, taste and texture; (4) submit the best treatment of the product to the DOST for proximate and microbial analysis; and, (6) determine the shelf-life of the product in terms or room temperature and chilling temperature. To analyze the result mean and One-Way Analysis of Variance was used and 1% or 0.01 level of significance was set. The result of the experimental developmental brought about the following findings: Considering the sensory quality of all the products and the treatments made, the result gains a positive review from the consumers which all vegetable flavored gummy candy was Extremely Appealing, Extremely Pleasant, Extremely Delicious and Extremely Chewable. Moreover, the vegetable flavored candy also gains a positive review which was "Extremely Liked" but saluyot flavored gummy candy has the highest score, followed by okra, squash and tomato which tied in their score and the lowest was malunggay flavored. There was a significant difference in the appearance of okra flavored and the rest of the product was considered the same. There was also significant difference in the aroma of squash flavored perhaps it still needs more refining and quality checking to ensure the ingredients freshness. There was also significant difference in the taste of malunggay and squash flavor that the consumers ask to do more refining and processing to ensure not to overcooked that affect the taste. There was also a significant difference in the texture of okra and tomato flavored gummy candy. This was because it needs more refining using state-of-the-art equipment. Furthermore, all the products were acceptable in the market and suggested to be mass produced since there were not critical qualities and deemed to be the same. The products can be stored 3-5 days in room temperature and 5-10 days in chilling temperature. Moreover, according to the DOST analysis report, the result was the product were safe to consume without harmful chemicals, bacteria and viruses that could create illness for those who consume the product.

DOI: http://doi.org/10.69651/PIJHSS0501814

Recommended citation:
Apolinario, A. M. F. (2026). Acceptability of vegetable flavored gummy candy (Malunggay, saluyot, okra, squash and tomato). Pantao (The International Journal of the Humanities and Social Sciences) 5 (1), 9085-9098. http://doi.org/10.69651/PIJHSS0501814

Keywords: Gummy candy, vegetable flavored candies, natural ingredients/additive

Date Submitted: January 17, 2026
Date Accepted: January 30, 2026
Date Published: February 17, 2026

INTRODUCTION

Nowadays, our country is facing with many problems due to economic crisis. Many Filipinos are starving because of the insufficient supply of food. As a result, pre-school, and high school students, and even adults are suffering from malnutrition brought by the improper intake of food.

A lot of children do not have enough knowledge about proper nutrition. They think that eating pasta or instant noodles could give them energy and proper nutrition especially when they are in a hurry going to school or to play.

Proper nutrition plays an important role on the growth and development of a child. The nutrients from the food consumed are processed by the body for their utilization. The combined effects of health and nutrition are vital to human development. Good health and proper nutrition enable individuals to acquire greater ability to learn and do more.

Nutrition and health problems affect the quality of bio-social organism and hinder the acquisition of skills and abilities necessary for processing satisfactory work in school.
Poor nutrition puts children at risk in terms of schoolwork and success. The child who experienced much illness at an early age may find learning a burden.

This study is anchored on the belief that the nutritional status among children is influenced by certain factors like, lack of foods, such vegetable like (Malunggay, Saluyot, Okra, Squash and Tomato) that gives vitamins and essential supplements to the body.

The researcher is inspired to produce a vegetable flavored gummy candy as concentrated and substitute nutritional candy as food intake of the children. Likewise, good health and good nutrition are pre-requisites to the attainment of good quality lifestyle and its sustained enjoyment. It is in this premise that this study will be conducted.

Statement of the problem

The study generally aimed to determine the extent of the Acceptability of Vegetable Flavored Gummy Candy (malunggay, saluyot, okra, squash and tomato). Specifically, it sought to attain the following objectives;

1. Describe the sensory qualities of the five flavors of the vegetable flavored gummy candy (malunggay, saluyot, okra, squash and tomato) in terms of appearance, aroma, taste and texture;
2. Determine the general acceptability of the five flavors of the vegetable flavored gummy candy (malunggay, saluyot, okra, squash and tomato) in terms of appearance, aroma, taste and texture;
3. Find out if there is a significant difference in the sensory qualities of the five flavors of the vegetable flavored gummy candy (malunggay, saluyot, okra, squash and tomato) in terms of appearance, aroma, taste and texture;
4. Find out if there is a significant difference in the general acceptability of the five flavors of the vegetable flavored gummy candy (malunggay, saluyot, okra, squash and tomato) in terms of appearance, aroma, taste and texture;
5. Determine the shelf-life of the product in terms of room temperature and chilling temperature.

6. Find out the best treatment of the product to the DOST for proximate and microbial analysis.

METHODOLOGY

This chapter presents the method of research, experimental design lists of ingredients, material, tools and equipment, experimental methods, treatments and proportions, experimental procedures, collection of data, scoring of variables, statistical tools, and cost analysis. The method used in this study was experimental developmental method of research. Experimental method focuses the study on the future (what will be) when the variables of the study are carefully controlled or manipulated (Calmorin, 2010). Experimental method was used to investigate the right proportion of vegetable extract, malunggay, saluyot, okra, squash, and tomato in making of vegetable flavored gummy candy. Developmental method was used for the formulation of gummy candy using malunggay, saluyot, okra, squash and tomato for potential gummy candy with vegetable flavor for product development and commercialization.

The materials, tools and equipment used in the study were one (1) piece non-stick pan, one (1) piece wooden spoon, one (1) clean cloth, five (5) pieces molder, fifteen (15) small container, one (1) piece weighing scale, eighteen (18) pieces bowl, one (1) piece measuring glass, five (5) pieces spoon, and one (1) unit stove. The experimental procedure began with the preparation of raw materials and vegetable extracts used in the production of vegetable flavored gummy candy. The process started with gathering and preparing materials, tools, and equipment used in the study. Malunggay and saluyot leaves were sorted, followed by washing of malunggay and saluyot leaves together with okra, squash, and tomato. After washing, malunggay and saluyot leaves were measured. The okra and squash were peeled. Okra, squash, and tomato were then chopped. The seeds of squash and tomato were removed and the squash and tomato were sliced. After slicing, the okra, squash, and tomato were measured. The vegetables consisting of malunggay, saluyot, okra, squash, and tomato were then boiled. After boiling, malunggay, saluyot, and okra were drained, while squash and tomato were strained using a clean cloth to obtain the extracts which served as the five vegetable flavored bases for the product.

In the preparation of malunggay extract, all tools, materials, and ingredients in making malunggay leaves extract were prepared. Two hundred twenty-five (225) grams of malunggay leaves were sorted out, measured, washed, boiled in 720 grams of distilled water for about 10 minutes and drained. Malunggay leaves extract was measured and set aside for later use. The preparation of saluyot extract followed the same procedure as in the preparation of malunggay extract. In the preparation of okra extract, all tools, materials, and ingredients in making okra extract were prepared. Two hundred twenty-five (225) grams of okra were washed, peeled, removing of seeds, chopped, measured, boiled in 720 grams of distilled water for about 10 minutes and drained. Okra extract was measured and set aside for later use. In the preparation of squash extract, all tools, materials, and ingredients in making squash extract were prepared. Two hundred twenty-five (225) grams of squash were washed, peeled, chopped, removing of seeds, sliced, measured, boiled in 720 grams of distilled water for about 10 minutes and strained in clean cloth. Squash leaves extract was measured and set aside for later use. In the preparation of tomato extract, all tools, materials, and ingredients in making tomato extract were prepared. Two hundred twenty-five (225) grams of tomato were washed, chopped, removing of seeds, sliced, boiled in 720 grams of distilled water for about 10 minutes and strained in clean cloth. Tomato extract was measured and set aside for later use.

After the preparation of the vegetable extracts, the procedure in making vegetable flavored gummy candy was carried out. The process began with preparing the ingredients

needed in making vegetable flavored gummy candy. Ten (10) grams of unflavored gelatin was poured in 120 grams of hot water and stirred until dissolved. Another 120 grams of water was boiled and mixed with 30 grams of glucose syrup and 50 grams of refined sugar in a non-stick pan. The vegetable flavored extract was poured into the mixture and stirred thoroughly. The mixture was continuously stirred and cooked until sticky. After reaching the desired consistency, the mixture was molded using the silicon molder and chilled for 3 to 4 hours until the product solidified. After chilling, the finished vegetable flavored gummy candy was removed from the molder and prepared as the final product.

The instrument used in the study was a score card for sensory evaluation which dealt with the quality attributes of the product as evaluated by experts in terms of appearance, aroma, taste, and texture when to Vegetable flavored gummy candy. The One hundred (100) evaluators of the study were composed of twenty (20) Food tech students from Capiz State University and Cuartero National Highschool, twenty (20) candy maker and candy vendors in Roxas City, Capiz and Cuartero Capiz, twenty-five (20) elementary students of Cuartero Elementary School, twenty (20) parents of Hermano, Punta Tabuc, Roxas City, Capiz, and twenty (20) consumers of Roxas City, Capiz. After the evaluation of the finished products, the evaluation sheets were gathered, tallied, summarized, and prepared for computation. The mean was used to determine the level of acceptability of vegetable flavored gummy candy for sensory qualities with five flavors namely malunggay, saluyot, okra, squash and tomato in terms of appearance, aroma, taste, and texture. Likewise, the mean was also used to determine the general acceptability of the product as a whole. To determine whether significant difference existed among the five products with three treatments each products, the One-Way Analysis of Variance (ANOVA) was computed at one percent or 0.01 level of significance.

In scoring the variables, the Nine (9) Point Hedonic Scale was used by the researcher. This method of scoring the variables required the respondents to rate the products based on their own judgement and the results were scored, weighted arithmetically, and categorized according to specific adjectival verbal interpretations, mean score ranges, and qualitative descriptions. For appearance of the product, a score of 9 corresponds to Extremely Appealing with mean score 8.12–9.00 and qualitative description Like Extremely, 8 corresponds to Very Much Appealing with mean score 7.23-8.11 and qualitative description Like Very Much, 7 corresponds to Moderately Appealing with mean score 6.34-7.22 and qualitative description Like Moderately, 6 corresponds to Slightly Appealing with mean score 5.45-6.33 and qualitative description Liked Slightly, 5 corresponds to Neither Appealing nor Unappealing with mean score 4.56-5.44 and qualitative description Neither Liked nor Disliked, 4 corresponds to Slightly Unpleasing with mean score 3.67-4.55 and qualitative description Disliked Slightly, 3 corresponds to Moderately Unpleasing with mean score 2.78-3.66 and qualitative description Disliked Moderately, 2 corresponds to Very Much Unpleasing with mean score 1.89-2.77 and qualitative description Disliked Very Much, and 1 corresponds to Extremely Unpleasing with mean score 1.00-1.88 and qualitative description Disliked Extremely. For aroma of the product, a score of 9 corresponds to Extremely Pleasant with mean score 8.12–9.00 and qualitative description Like Extremely, 8 corresponds to Very Much Pleasant with mean score 7.23-8.11 and qualitative description Like Very Much, 7 corresponds to Moderately Pleasant with mean score 6.34-7.22 and qualitative description Like Moderately, 6 corresponds to Slightly Pleasant with mean score 5.45-6.33 and qualitative description Liked Slightly, 5 corresponds to Neither Pleasant nor Unpleasant with mean score 4.56-5.44 and qualitative description Neither Liked nor Disliked, 4 corresponds to Slightly Unpleasant with mean score 3.67-4.55 and qualitative description Disliked Slightly, 3 corresponds to Moderately Unpleasant with mean score 2.78-3.66 and qualitative description Disliked Moderately, 2 corresponds to Very Much Unpleasant with mean score 1.89-2.77 and qualitative description Disliked Very Much, and 1 corresponds to Extremely Unpleasant with mean score

1.00-1.88 and qualitative description Disliked Extremely. For taste of the product, a score of 9 corresponds to Extremely Delicious with mean score 8.12–9.00 and qualitative description Like Extremely, 8 corresponds to Very Much Delicious with mean score 7.23-8.11 and qualitative description Like Very Much, 7 corresponds to Moderately Delicious with mean score 6.34-7.22 and qualitative description Like Moderately, 6 corresponds to Slightly Delicious with mean score 5.45-6.33 and qualitative description Liked Slightly, 5 corresponds to Neither Creamy nor Delicious with mean score 4.56-5.44 and qualitative description Neither Liked nor Disliked, 4 corresponds to Slightly Un Delicious with mean score 3.67-4.55 and qualitative description Disliked Slightly, 3 corresponds to Moderately Un Delicious with mean score 2.78-3.66 and qualitative description Disliked Moderately, 2 corresponds to Very Much Un Delicious with mean score 1.89-2.77 and qualitative description Disliked Very Much, and 1 corresponds to Extremely Un Delicious with mean score 1.00-1.88 and qualitative description Disliked Extremely. For texture of the product, a score of 9 corresponds to Extremely Chewable with mean score 8.12–9.00 and qualitative description Like Extremely, 8 corresponds to Very Much Chewable with mean score 7.23-8.11 and qualitative description Like Very Much, 7 corresponds to Moderately Chewable with mean score 6.34-7.22 and qualitative description Like Moderately, 6 corresponds to Slightly Chewable with mean score 5.45-6.33 and qualitative description Liked Slightly, 5 corresponds to Neither Chewable nor Not Chewable with mean score 4.56-5.44 and qualitative description Neither Liked nor Disliked, 4 corresponds to Slightly Not Chewable with mean score 3.67-4.55 and qualitative description Disliked Slightly, 3 corresponds to Moderately Not Chewable with mean score 2.78-3.66 and qualitative description Disliked Moderately, 2 corresponds to Very Much Not Chewable with mean score 1.89-2.77 and qualitative description Disliked Very Much, and 1 corresponds to Extremely Not Chewable with mean score 1.00-1.88 and qualitative description Disliked Extremely. For general acceptability of the product, a score of 9 corresponds to Extremely Acceptable with mean score 8.12–9.00 and qualitative description Like Extremely, 8 corresponds to Very Much Acceptable with mean score 7.23-8.11 and qualitative description Like Very Much, 7 corresponds to Moderately Acceptable with mean score 6.34-7.22 and qualitative description Like Moderately, 6 corresponds to Slightly Acceptable with mean score 5.45-6.33 and qualitative description Liked Slightly, 5 corresponds to Neither Acceptable nor Unacceptable with mean score 4.56-5.44 and qualitative description Neither Liked nor Disliked, 4 corresponds to Slightly Unacceptable with mean score 3.67-4.55 and qualitative description Disliked Slightly, 3 corresponds to Moderately Unacceptable with mean score 2.78-3.66 and qualitative description Disliked Moderately, 2 corresponds to Very Much Unacceptable with mean score 1.89-2.77 and qualitative description Disliked Very Much, and 1 corresponds to Extremely Unacceptable with mean score 1.00-1.88 and qualitative description Disliked Extremely.

Arithmetic Mean and One Way Analysis of Variance (ANOVA) were the statistical tools used in analyzing and interpreting the data. All data were subjected to Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

The results presented in this section are based on the evaluation of One hundred (100) respondents who participated in the sensory evaluation of the vegetable flavored gummy candy. The respondents were composed of twenty (20) Food tech students from Capiz State University and Cuartero National Highschool, twenty (20) candy maker and candy vendors in Roxas City, Capiz and Cuartero Capiz, twenty (20) elementary students of Cuartero Elementary School, twenty (20) parents of Hermano, Punta Tabuc, Roxas City, Capiz, and twenty (20) consumers

of Roxas City, Capiz. The study employed an experimental developmental research design in which five vegetable flavored gummy candy products were formulated using malunggay, saluyot, okra, squash, and tomato extracts, each with three treatments. Data were gathered through a sensory evaluation score card that assessed appearance, aroma, taste, and texture. The analysis of the data utilized the Arithmetic Mean and One Way Analysis of Variance (ANOVA) at an alpha level of significance of 0.01, and the results are interpreted directly in relation to the objectives of determining the sensory qualities, general acceptability, differences among treatments, shelf life, and microbial safety of the developed vegetable flavored gummy candy.

The sensory qualities of the vegetable flavored gummy candy were evaluated in terms of appearance, aroma, taste, and texture across the five product variants and their corresponding treatments. In terms of appearance, the results showed that the five products namely malunggay flavor, saluyot flavor, okra flavor, squash flavor, and tomato flavor were interpreted as Extremely Appealing within the mean score range of 8.12–9.00. The highest mean values were obtained by Okra in Treatment C 50g with a mean of 8.61, Squash in Treatment A 100g with a mean of 8.61, and Tomato in Treatment B 75g with a mean of 8.61. Saluyot in Treatment C 50g obtained a mean of 8.57, while Malunggay extract treatments recorded means of 8.54, 8.48, and 8.47. These findings indicate that the okra, squash, and tomato flavored gummy candies were evaluated as highly attractive in appearance by the panel of experts. Similar trends were observed in aroma evaluation where the products were rated as Extremely Pleasant within the same mean range of 8.12–9.00. The highest mean values were obtained by Squash in Treatment C 50g with 8.67 and Tomato in Treatment B 75g with 8.67. Saluyot in Treatment B 75g and Okra in Treatment C 50g obtained 8.62, while Malunggay recorded a mean of 8.59. The high mean scores for squash and tomato indicate that these variants possessed more favorable aromatic characteristics, possibly influenced by the inherent natural aroma compounds of the vegetable extracts used in the formulation.

Evaluation of taste likewise showed that all products were interpreted as Extremely Delicious within the mean range of 8.12–9.00. The highest mean value was obtained by Squash in Treatment C 50g with 8.68. Malunggay in Treatment B 75g, Saluyot in Treatment B 75g, and Tomato in Treatment B 75g each obtained a mean of 8.62, while Okra in Treatment C 50g obtained a mean of 8.59. These results suggest that the squash flavored gummy candy exhibited the most favorable taste profile among the five vegetable-based variants. The strong taste preference for squash may be attributed to the natural sweetness and palatable flavor compounds present in squash which are known to enhance sensory appeal in confectionery products. Texture evaluation further showed that the vegetable flavored gummy candies were interpreted as Extremely Chewable within the mean range of 8.12–9.00. The highest mean value was obtained by Tomato in Treatment B 75g with 8.72, followed by Okra in Treatment C 50g with 8.68, Saluyot in Treatment C 50g with 8.62, Squash in Treatment A 100g with 8.61, and Malunggay in Treatment A 100g with 8.58. The results indicate that tomato flavored gummy candy demonstrated superior chewability compared with the other variants. The favorable texture observed among the products may be attributed to the gelatin formulation and the smooth consistency of the vegetable extracts which contributed to the formation of a desirable gummy structure.

These findings align with the study of Bonsato et al. (2020) which reported that new variations of flavor such as saluyot were also evaluated as Extremely Liked even though the perception of evaluators differed due to the unusual inclusion of vegetable ingredients in confectionery products. The study further noted that innovative flavors derived from plant-based sources can still achieve high consumer acceptance provided that the sensory properties remain desirable. The current findings therefore support the idea that vegetable-based

ingredients can be successfully incorporated into gummy candy products without negatively affecting sensory appeal.

The general acceptability of the vegetable flavored gummy candy was also evaluated by the consumers in terms of appearance, aroma, taste, and texture. Results showed that the products were evaluated within the mean score range of 8.12–9.00 which corresponds to the qualitative description Like Extremely. In terms of appearance, Squash flavor obtained the highest mean of 8.59 followed by Tomato with 8.54, Saluyot and Okra with 8.51 each, and Malunggay with 8.50. These results indicate that the squash flavored gummy candy was perceived as the most visually appealing product among the variants. In terms of aroma, Okra and Squash both obtained the highest mean of 8.58, followed by Malunggay and Saluyot with 8.57 and Tomato with 8.55. For taste, Squash obtained the highest mean of 8.61 followed by Tomato with 8.55, Saluyot and Okra with 8.53, and Malunggay with 8.52. These results further reinforce the strong sensory appeal of the squash flavored gummy candy. Texture evaluation showed that Okra obtained the highest mean of 8.61 followed by Squash and Tomato with 8.56, Saluyot with 8.55, and Malunggay with 8.54. The overall grand mean ratings further indicated strong consumer acceptance, with Malunggay obtaining a grand mean of 8.54, Saluyot 8.58, Okra 8.56, Squash 8.56, and Tomato 8.56, all interpreted as Like Extremely.

The analysis of differences in sensory qualities using statistical testing further revealed important findings. In terms of appearance, the results showed that Product 1 recorded mean values of 8.54, 8.48, and 8.47 with STD values of 0.521, 0.502, and 0.502 respectively, with df = 299, t-value = 0.555, p-value = 0.575, and remarks ns. Product 2 recorded mean values of 8.48, 8.49, and 8.57 with STD values of 0.522, 0.559, and 0.498, df = 299, t-value = 0.876, p-value = 0.417, and remarks ns. Product 3 recorded mean values of 8.54, 8.39, and 8.61 with STD values of 0.540, 0.510, and 0.490, df = 299, t-value = 4.785, p-value = 0.009, and remarks s. Product 4 recorded mean values of 8.61, 8.57, and 8.59 with STD values of 0.530, 0.498, and 0.514, df = 299, t-value = 0.151, p-value = 0.860, and remarks ns. Product 5 recorded mean values of 8.53, 8.61, and 8.58 with STD values of 0.521, 0.490, and 0.496, df = 299, t-value = 0.646, p-value = 0.525, and remarks ns. These findings indicate that only Product 3 showed a significant difference in appearance since p-value = 0.009 is less than the alpha level of significance of 0.01.

In terms of aroma, Product 1 recorded mean values of 8.59, 8.57, and 8.56 with STD values of 0.514, 0.498, and 0.499, df = 299, t-value = 0.092, p-value = 0.912, and remarks ns. Product 2 recorded mean values of 8.48, 8.62, and 8.61 with STD values of 0.502, 0.488, and 0.490, df = 299, t-value = 2.505, p-value = 0.083, and remarks ns. Product 3 recorded mean values of 8.51, 8.60, and 8.62 with STD values of 0.502, 0.492, and 0.488, df = 299, t-value = 1.406, p-value = 0.247, and remarks ns. Product 4 recorded mean values of 8.59, 8.47, and 8.67 with STD values of 0.514, 0.512, and 0.473, df = 299, t-value = 4.002, p-value = 0.019, and remarks s. Product 5 recorded mean values of 8.54, 8.67, and 8.63 with STD values of 0.521, 0.473, and 0.485, df = 299, t-value = 1.822, p-value = 0.163, and remarks ns. These results show that only Product 4 demonstrated a significant difference in aroma.

The analysis of taste showed that Product 1 recorded mean values of 8.51, 8.62, and 8.42 with STD values of 0.522, 0.488, and 0.496, df = 299, t-value = 3.978, p-value = 0.020, and remarks s. Product 2 recorded mean values of 8.54, 8.49, and 8.62 with STD values of 0.501, 0.522, and 0.488, df = 299, t-value = 1.694, p-value = 0.186, and remarks ns. Product 3 recorded mean values of 8.53, 8.48, and 8.59 with STD values of 0.540, 0.522, and 0.494, df = 299, t-value = 1.125, p-value = 0.326, and remarks ns. Product 4 recorded mean values of 8.65, 8.49, and 8.68 with STD values of 0.480, 0.502, and 0.469, df = 299, t-value = 4.384, p-value = 0.013, and remarks s. Product 5 recorded mean values of 8.52, 8.67, and 8.61 with STD values of 0.522, 0.473, and 0.490, df = 299, t-value = 2.323, p-value = 0.100, and remarks ns.

In terms of texture, Product 1 recorded mean values of 8.58, 8.51, and 8.54 with STD values of 0.535, 0.502, and 0.501, df = 299, t-value = 0.468, p-value = 0.626, and remarks ns. Product 2 recorded mean values of 8.46, 8.56, and 8.62 with STD values of 0.521, 0.538, and 0.508, df = 299, t-value = 2.394, p-value = 0.093, and remarks ns. Product 3 recorded mean values of 8.45, 8.51, and 8.68 with STD values of 0.539, 0.522, and 0.469, df = 299, t-value = 5.455, p-value = 0.005, and remarks s. Product 4 recorded mean values of 8.61, 8.49, and 8.58 with STD values of 0.490, 0.502, and 0.496, df = 299, t-value = 1.584, p-value = 0.207, and remarks ns. Product 5 recorded mean values of 8.47, 8.72, and 8.64 with STD values of 0.521, 0.451, and 0.482, df = 299, t-value = 6.905, p-value = 0.001, and remarks s.

The analysis of general acceptability using ANOVA further revealed that there was no significant difference in appearance with F-value = 1.157 and p-value = 0.316. Similarly, aroma recorded F-value = 2.344 and p-value = 0.098, taste recorded F-value = 0.690 and p-value = 0.503, and texture recorded F-value = 2.661 and p-value = 0.079. Since all p-values were greater than the alpha level of significance of 0.01, the null hypothesis was not rejected. These findings indicate that the treatments did not significantly affect the general acceptability of the vegetable flavored gummy candy.

Shelf-life analysis further revealed that when the vegetable flavored gummy candy was stored at room temperature for 72 hours with observation intervals of 0–12 hours, 13–24 hours, 21–36 hours, 37–48 hours, 49–60 hours, and 61–72 hours, all treatments A, B, and C recorded negative results indicating no mold formation. When stored under chilling temperature for 360 hours with observation intervals of 0–120 hours, 121–240 hours, and 241–360 hours, all treatments also recorded negative results indicating no mold formation. These findings indicate that the vegetable flavored gummy candy exhibited microbial stability under both storage conditions.

Microbial analysis conducted by the DOST Regional Standard and Testing Laboratory Iloilo City further confirmed the safety of the product. Test Service Request No. R6-1022021-CHE-017-0337 was submitted on October 27, 2021 and analyzed from Nov.24,2021 to June 21, 2021. The proximate composition results showed Moisture 33.54 g/100g, Ash 0.20 g/100g, Crude Protein 3.76 g/100g, Total Fat 0.26 g/100g, Carbohydrate 62.24 g/100g, and Energy 266 kcal/100g. Environmental conditions during testing recorded Room Temperature 20.9 – 25.0 °C and Relative Humidity 41 – 60 %. Microbial testing results indicated that Salmonella spp. was Not Detected in 25g sample. Escherichia coli Count recorded < 1.8 MPN/g sample which is below the maximum value of 103 MPN/g sample. Molds and Yeast Count recorded 13 000 Cfu/g sample which is below the rejection level of 104 cfu/g sample. Environmental conditions during microbial testing recorded Room Temperature 21.3 °C – 22.8 °C and Relative Humidity 45.0 % – 48.0 %, and for the molds and yeast analysis Room Temperature 21.5 °C – 23.0 °C and Relative Humidity 40.0 % – 49.0 %.

Overall, the results demonstrate that the vegetable flavored gummy candy formulated using malunggay, saluyot, okra, squash, and tomato extracts achieved high sensory ratings and strong consumer acceptability. The statistical analyses confirmed that most treatments produced comparable sensory qualities while microbial and shelf-life evaluations verified the safety and stability of the product. These findings indicate that vegetable flavored gummy candy is a viable food product that can potentially contribute to the development of innovative functional confectionery products and provide an alternative means of incorporating vegetables into consumer-friendly food items. The results therefore provide empirical support for the feasibility of producing vegetable based gummy candy with acceptable sensory properties and safe microbial quality, thereby establishing a strong foundation for further product development, commercialization, and future research in functional confectionery innovations.

PANTAO
The International Journal of the Humanities and Social Sciences
Volume 5, Issue 1
ISSN 3028-0877 | DOI 10.69651/2022PIJHSS

CONCLUSION

The present study was conducted to determine the acceptability of vegetable flavored gummy candy developed from malunggay, saluyot, okra, squash, and tomato extracts. Specifically, the study aimed to describe the sensory qualities of the five flavors of vegetable flavored gummy candy in terms of appearance, aroma, taste, and texture, determine the general acceptability of the five flavors, examine whether significant differences exist in the sensory qualities of the products, determine differences in the general acceptability of the five flavors, submit the best treatment to the DOST for proximate and microbial analysis, and determine the shelf life of the product at room temperature and chilling temperature. The study involved One hundred (100) evaluators composed of twenty (20) Food tech students from Capiz State University and Cuartero National Highschool, twenty (20) candy makers and candy vendors in Roxas City, Capiz and Cuartero Capiz, twenty-five (25) elementary students of Cuartero Elementary School, twenty (20) parents from Hermano, Punta Tabuc, Roxas City, Capiz, and twenty (20) consumers of Roxas City, Capiz. The finished products were evaluated using a sensory evaluation score card and the results were analyzed using mean and One Way Analysis of Variance at 0.01 level of significance to determine the level of acceptability and the differences among treatments.

The findings of the study revealed that the vegetable flavored gummy candy products developed from malunggay, saluyot, okra, squash, and tomato extracts obtained highly favorable sensory ratings. In terms of appearance, the five products were evaluated as Extremely Pleasing, with Treatment C of okra gummy candy obtaining the highest score among the products, followed by Treatment A of squash, Treatment B of tomato, Treatment C of saluyot, and Treatment C of malunggay. These results indicate that the okra, squash, and tomato flavored gummy candies were more visually attractive according to the evaluation of the panel of experts. Similar patterns were observed in the evaluation of aroma where the five products were also rated as Extremely Pleasant. The highest mean ratings were obtained by squash in Treatment C (50g) and tomato in Treatment B (75g), followed by saluyot in Treatment B (75g), okra in Treatment B (50g), and malunggay in Treatment B. These findings indicate that squash and tomato flavors possessed more desirable aromatic characteristics which contributed to their positive sensory evaluation.

In terms of taste, the five-vegetable flavored gummy candy variants were evaluated as Extremely Delicious. The squash flavored gummy candy in Treatment C 50g obtained the highest mean score, followed by malunggay in Treatment B (75g), saluyot in Treatment B (75g), tomato in Treatment B (75g), and okra in Treatment C (50g). The higher mean score of the squash flavored gummy candy indicates that it was perceived as having the most appealing taste among the variants. This result may be attributed to the naturally pleasant flavor profile of squash which contributed to the favorable taste perception of the product. In terms of texture, all five products were evaluated as Extremely Chewable. The tomato flavored gummy candy in Treatment B (75g) obtained the highest score followed by okra in Treatment C (50g), saluyot in Treatment C (50g), squash in Treatment A (100g), and malunggay in Treatment A (100g). These results suggest that tomato flavored gummy candy exhibited superior chewability among the products, while all products demonstrated smooth and desirable texture due to the refined vegetable extracts used in the formulation.

The general acceptability evaluation further indicated that the vegetable flavored gummy candy received a highly positive response from the consumers with an overall interpretation of Liked Extremely. Among the products, the squash flavored gummy candy obtained the highest mean which indicates that it was perceived as the most attractive and acceptable product by the panel of consumers. Statistical analysis also revealed that there was

no significant difference in appearance among treatments for Product 1, Product 2, Product 4, and Product 5. However, a significant difference was observed in Product 3 which suggests that higher extract concentration may affect the appearance of the gummy candy in each batch. In terms of aroma, only Product 4 exhibited a significant difference among treatments which may be attributed to the lingering vegetable aroma that affected the perception of some evaluators. With respect to taste, significant differences were observed in Product 1 and Product 4 while the other products did not show significant differences. These results indicate that variations in vegetable ingredients may influence the taste perception of the evaluators and therefore require careful processing to preserve natural flavor while preventing over processing that may affect nutrient content. In terms of texture, Product 3 and Product 5 exhibited significant differences while the other products showed no notable variation. These results suggest that the different vegetable ingredients used in the formulation may influence the texture of the gummy candy and that further refinement of processing methods may improve consistency and product quality.

The shelf-life evaluation demonstrated that the vegetable flavored gummy candy-maintained product stability when stored under different temperature conditions. When stored at chilling temperature, no molds were observed for up to 360 hours with a 120-hour observation interval. This may be attributed to the preparation process which removed significant moisture from the raw materials, thereby reducing the likelihood of microbial growth. Based on the observations conducted, the product can be stored safely for up to 72 hours without refrigeration and up to 360 hours when placed in refrigeration at 5 degrees Celsius. Microbial analysis conducted by the DOST Regional Standard and Testing Laboratory Iloilo City further confirmed the safety and nutritional composition of the product. Test Service Request No. R6-012019-MIC-0091-0136 was submitted on May 11, 2021 and analyzed from May 11, 2021 to May 18, 2021. The proximate analysis of the sample packed in a glass bottle labeled Vegetable Flavored Candy (Gummy) showed Moisture of 33.54 g/100g, Ash of 0.20 g/100g, Crude Protein of 3.76 g/100g, Total Fat of 0.26 g/100g, Carbohydrate of 62.24 g/100g, and Energy of 266 kcal/100g. Environmental conditions during testing recorded room temperature ranging from 20.9 to 25.0 degrees Celsius and relative humidity ranging from 41 to 60 percent. Microbial testing revealed that Salmonella spp. was Not Detected in 25g sample. The Escherichia coli count registered a value of < 1.8 MPN/g sample which is below the maximum allowable value of 103 MPN/g sample. The molds and yeast count recorded 13 000 Cfu/g sample which is lower than the rejection level of 104 cfu/g sample. Environmental conditions during testing ranged from 21.3 to 22.8 degrees Celsius with relative humidity of 45.0 to 48.0 percent for Salmonella analysis, and from 21.5 to 23.0 degrees Celsius with relative humidity of 40.0 to 49.0 percent for molds and yeast analysis. Based on the comparison with the Revised Guidelines for the Assessment of Microbiological Quality of Processed Foods, the vegetable flavored gummy candy was determined to be acceptable and safe for human consumption.

Overall, the results of the study demonstrate that vegetable flavored gummy candy made from malunggay, saluyot, okra, squash, and tomato extracts can be successfully developed as a nutritious and unique confectionery product. Squash flavored gummy candy exhibited the most favorable sensory evaluation results in terms of appearance, aroma, taste, and texture, while all products received highly positive acceptability ratings from consumers. The products were found to be acceptable in the market and may be considered for mass production since the sensory qualities were generally consistent and acceptable across treatments. The findings also indicate that vegetable flavored gummy candy can serve as a novel food product that integrates vegetable ingredients into an appealing sweet treat that may contribute to improving dietary diversity and addressing nutrient deficiencies. Consequently, vegetables such as malunggay, saluyot, okra, squash, and tomato are recommended for use in

the development of vegetable flavored gummy candy products. Squash flavored gummy candy is particularly recommended for optimal sensory results. The product may also be exhibited during school food fairs and can serve as a reference for future researchers interested in developing innovative vegetable based confectionery products. Considering that the product is acceptable to consumers of various age groups, it may be introduced among sweet treat vendors in malls and small businesses as a healthier candy alternative. Moreover, the product may be considered for inclusion in public school canteens as part of programs that aim to address malnutrition and nutrient deficiency. The method and process involved in the development of the product may also be forwarded to research and development entities for further technological maturation and intellectual property protection. Further research may explore additional product variants, improved preservation techniques to extend shelf life, and the development of quality standards and cooking guides for dissemination to interested stakeholders and communities.

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