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Acceptability of Radish *(Raphanus sativus)* Candy as Vitamin C Supplement

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Abstract:

This study intends to ascertain the acceptability of Radish Candy as Vitamin C supplement in terms of its sensory qualities such as appearance, aroma, taste, and texture. Different steps such as peeling, grinding, extracting, mixing and packaging are followed to make the radish candy. The results gathered from the two groups of respondents revealed that radish candy in terms of its sensory qualities such as appearance, aroma, taste, and texture, was "Very Acceptable". They claimed that the finished product had very presentable appearance, very pleasant aroma, very zesty taste and very fine texture.

The experimental and descriptive methods of research were used for this study. It was presented to two groups of respondents: five (5) selected housewives and five (5) storeowners who are residents of Brgy. Kanlurang Bukal Liliw, Laguna. The acceptability of Radish Candy was judged according to its appearance, aroma, taste and texture. The presence of ascorbic acid on the product was performed in the laboratory using the titration method.

As a conclusion, there is no significant difference among the ratings of selected housewives and storeowners in the acceptability of radish candy. Since the radish plant is abundant in Liliw, Laguna,

this research is considered valuable to maximize the benefits of the radish plant in alleviating malnutrition among Liliw residents, particularly children. More so, the process of manufacturing radish candy will be beneficial to farmers and capitalists as source of additional income.

Key words: Acceptability, Radish Candy, Arithmetic Mean, Mann-Whitney U, Sensory Qualities, Appearance, Aroma, Taste, Texture

1. INTRODUCTION

Foods are the building blocks of every cell in the body, and health depends on what is consumed daily since body cells are accountable for the appropriate functioning of the whole body. However, one cannot expect himself/herself to be healthy if devoid of adequate nutrition which comes from what we eat and drink. It is of great consequence, consequently, to be acquainted with what is good for the body and what is not. [1]

In this day and age, scientists from different places struggle to conceive possible medications to alleviate diseases. Surely, most are expensive and not everybody can afford. As a substitute through the exploit of herbal plants, various diseases and body malfunction such as increased in blood pressure, high cholesterol levels, pulmonary deficiency, jaundice, urinary disorders, cancer, insect bites, fever and constipation may be given remedy. Lofty costs of branded medicines are the reasons why Filipinos look for cheaper alternatives, such as indigenous materials which can be found in the local environment. Several researchers are engrossed to ascertain valuable manufactured goods that will be an immense help to the triumph of our community.

Liliw, a small municipality in the province of Laguna, was found to encompass extensive grounds that were utilized for planting. Because of its temperature, various plants were

able to grow such as tomatoes, ampalaya, petsay, talong and dominantly radish. Another observation in Liliw is the number of children of thin physique with big abdomens, generally considered malnourished. Since the radish is abundant in the area, the researchers decided to focus on this plant for this study and maximize its nutritional potential.

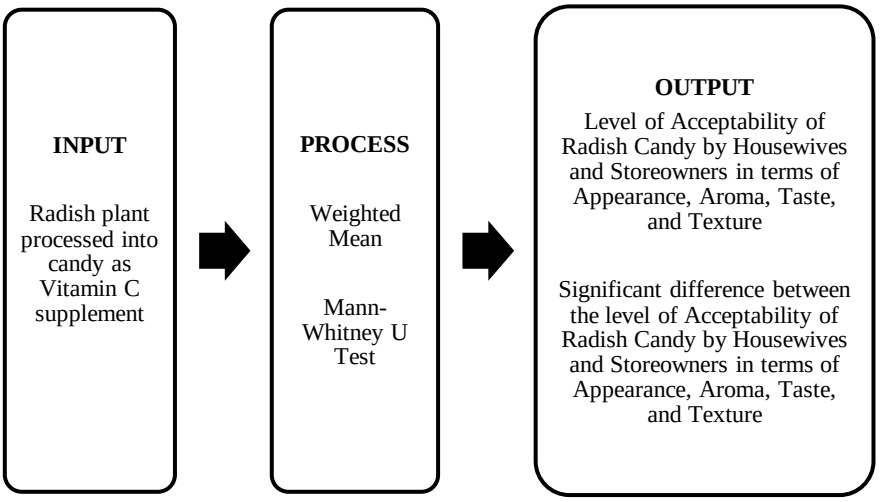
Radish Plant is a coarse, annual crop plant that is said to contain different nutritive values, most especially vitamin C. An adequate amount of Vitamin C may lead to increase body resistance to fight stress and infections, to hasten the healing of wounds, to meet the augmented needs during pregnancy and lactation, infection, prolonged illness, operation and convalescence, and to support the formation of red blood cells. Through this research, people begin to learn another way on how to utilize an alternative but from harm and natural solution for sufficient vitamin C supply on the body. Radish is easily located in the area based on some enquiries and analysis that showcase the nutritive worth of radish explicitly on its vitamin C content. The researchers acquired the scheme of utilizing radish plant as the major component on an additional savor of candy that will amplify the vitamin C supply for every individual.

1.1 Objective of the Study

The researchers aim to determine the Level of Acceptability of Radish *(Raphanus sativus)* Candy as Vitamin C Supplement in terms of appearance, aroma, taste, and texture. The level of acceptability of radish candy in terms of its sensory qualities is to be obtained using the Weighted Mean. Significant difference of how the storeowners and housewives perceive the Radish Candy in terms of its sensory qualities will be evaluated by using Mann-Whitney U Test. This paper will help the municipality of Liliw maximize the uses of radish plant to lessen malnutrition and provide additional income.

1.2 Research Paradigm

To undertake the objective of the study, the researchers follow a research paradigm which includes the inputs, the processes utilized, and the expected outputs.



The research paradigm explains the acceptability of radish candy as vitamin C supplement in terms of its sensory qualities (i.e. aroma, appearance, taste and texture). It comprises the independent variables which include the methods of preparation in making Radish Candy such as peeling, grinding, extracting and mixing. It also includes the dependent variables constituting the acceptability of Radish Candy's sensory qualities such (i.e. aroma, appearance, taste and texture) and the ascorbic acid it contains.

1.3 Statement of the Problem

This study intends to ascertain the acceptability of Radish Candy as Vitamin C supplement as rated by five (5) selected housewives and five (5) storeowners who are residents of Brgy. Kanlurang Bukal Liliw, Laguna. This study sought answers to the following questions:

1. What are the methods in the preparation of Radish Candy?

2. What is the mean level of acceptability of Radish Candy as rated by selected housewives and storeowners in terms of:

2.1 appearance;
2.2 aroma;
2.3 taste; and
2.4 texture?

3. Is there a significant difference among the ratings of selected housewives and storeowners in the acceptability of Radish Candy in terms of:

3.1 appearance;
3.2 aroma;
3.4 taste; and
3.4 texture?

1.4 Scope and Limitation

This paper aimed to determine the acceptability of Radish (R*aphanus sativus)* candy and as Vitamin C Supplement. In line with this, the research focuses on the use of radish plant as a main ingredient in the Vitamin C Supplements. Furthermore, the study is performed among Liliw, Laguna's, housewives and storeowners' acceptability of the product in terms of appearance, aroma, taste, and texture.

The presence of ascorbic acid in the product was performed under laboratory controlled conditions and is not examined in this study.

2. REVIEW OF RELATED STUDIES AND LITERATURE

This chapter presents the literature and studies which are found to have significant bearing on the present study. Hough they are limited, theories and findings of the authors serve as guide of the current study.

2.1. Related Literature

2.1.1. Acceptability

Crocker claims that the way food looks really affect how it tastes. With just a smidgen of effort, food will make a fabulous first impression. The garnish is the finishing touch, so add it right before serving. [1]

Several factors may be considered in the evaluation of a product's acceptability depending on its ability to meet individual's approval level.

2.1.2. Sensory Qualities

Sensory evaluation was defined by the Basic Foods for Filipino, as a scientific discipline used to cook, measure, analyze, and interpret reactions based on a characteristic of foods and materials as they are perceived by the sense of taste. The palatability factors or eating qualities of food are judged by human senses that include the taste sensation. Taste sensation is attributed to chemical components of foods that stimulate the taste buds of tongue. Young children also have taste buds on the pharynx and the palate of the oral cavity which number decreases with aging. [2]

Different sensory qualities such as appearance, aroma, taste and texture plays a vital role on the present study in which it will be determined to know if it is accepted or not.

2.1.3. Appearance

Alford stated that appearance is the act of emerging, arriving or coming into existence the way somebody looked or seemed to the outward aspect which created the particular comparison. [3]
Fletchner defined appearance as the act of opening looks, and general beating on the outlook of the product. An initial reaction to an object depends mainly on the observation without the sense of touch. Appearance is the act of fact of appearing, as

to the eye or mind or before the public and the state condition, manner, or style in which a person or object appears.[4]

Lechner D. E. et al. stated that different persons have different varied ways of reviewing the appearance of an object which some considered the size or shape while others are attracted by the visual defect; still others are mesmerized by the color. Appearance may also refer to the initial reaction to an object of touch and much less of taste.[5]

2.1.4. Aroma

Aroma of food is experienced first in the nasal passages and then combines with the taste sensation in the mouth to result odors that may alienate some people. The aroma of a meal should mingle to stimulate appetite. The impact of aromas is part of the pleasure of a fine meal. Aroma is a factor that can be used to add interest to a meal. However, its impact may be less dramatic than that achieved by the effective choice of colors in a menu, Coronado [6]

Hernandez stated that the sense that distinguishes the sweet, sour, salty and bitter qualities of dissolved substances in contact with the taste buds on the tongue, together receive a sensation of the substance in the mouth.[7]

The product's aroma receives considerable importance in the evaluation of the product's acceptability.

2.1.5. Taste

Taste which is also called as smatch or gestation, is one of the traditional five senses which refers to the ability to detect the flavor of substances such as food, certain minerals, poisons, etc, Chiraz.[8]

Taste varies from person to person which may accept, like, approve, reject, or disapprove the taste of the product depending on their individual taste buds.

2.1.6. Texture

Texture is the structure of good substance, such as food and is, especially concerned with how it feels when it was touched or the feel of appearance of the surface especially how rough or smooth it is. It is also the physical structure given or the arrangement of the parts of anything with respect to the quality of the surface, Winston.[9]

According to Sanchez texture is the physical structure given to a material by arrangement of this part and the visual quality of the surface.[10]

Texture is the physical composition or structure of something. The texture of the product may differ from one another depending on the materials or ingredients utilized.

2.1.7. Ascorbic Acid

Curnow, B. et al discussed that Vitamin C or L-ascorbic acid is an essential nutrient for humans, in which it functions as vitamins. Ascorbate (an ion of ascorbic acid) is required for a range of essential metabolic reactions in all animals and plants. It is utilized internally by almost all organisms; notable mammalian exceptions are most or all of the order chiroptera (bats), and the entire suborder Anthropoidea (Haplorrhini) (tarsiers, monkeys and apes). It is also needed by guinea pigs and some species of birds and fish. Deficiency in this vitamin causes the disease scurvy in humans. It is also widely used as a food additive.[11]

The uses and recommended daily intake of vitamin C are matters of on-going debate, with RDI ranging from 45 to 95 mg/day. Proponents of mega dosage propose from 200 to upwards of 2000 mg/day. A recent meta-analysis of 68 reliable antioxidant supplementation experiments, involving a total of 232,606 individuals, concluded that consuming additional ascorbate from supplements may not be as beneficial as thought.

Bjelakovic, G, et.al. stated that Vitamin C is necessary for healthy skin, scar tissue, tendons, ligaments, bones, cartilage, and blood vessels, and for the healing of wounds and injuries. Shortage of vitamin C causes scurvy in human beings. Fortunately, vitamin C deficiency is very rare among people who eat a reasonably balanced diet.[12]

2.1.8. Radish

A Source Book of Edible Plants explained that radish is extremely variable specie of garden vegetable. Cornucopia II: A Source Book of Edible Plants lists a sampling of 82 different cultivars available in the US. Some radishes are annuals, little more than 4 in (10cm) tall at maturity, and some are biennials, going to seed in their second growing season, and topping out at over 6 ft (1.8m) in height. Most radish types are grown for their enlarged roots, and there is great variation in size, shape and color. Some are small "salad radishes" with red skins or pure white throughout. These are mostly cool-season annuals, harvested young and usually eaten raw. Other radishes get huge, up to 60 lbs (27kg). Most of these "daikon" types are biennials, harvested after a longer growing season and cooked before eating. Some radish roots have black or green skins. Some have pink flesh. Some radishes cultivars are grown just for the seed pods which are delicious when raw, pickled or stir fry. [13]

Radishes have high contents of vitamin C, which is a well-known cancer-preventing antioxidant element. It is also a good source of potassium, folic acid, molybdenum, and it helps in relieving constipation as it contains high amount of carbohydrates, Mandora.[14]

Sandhyarani in an article "Radishes Nutritional Value" stated that radishes have antibacterial and antifungal properties. It is used for treating several medical problems ranging from coughs, abnormal bowel movements, gastric

problems and intestinal parasites. In alternative medicine, radishes are mentioned as an effective remedy for liver disorders, respiratory troubles, kidney stones, gall stones and even cancer.[15]

Murray, M. et al in a book entitled "The Encyclopedia of Healing Foods" stated that radishes and their greens provide an excellent source of vitamin C. Daikons provide a very good source of potassium and copper. Radishes, like other member of the cruciferous family contain cancer-protective properties. Throughout history radishes have been effective when used as a medicinal food for liver disorders. They contain a variety of sulfur-based chemicals that increase the flow of bile, therefore, they help maintain a healthy gallbladder and liver, and improve digestion.[16]

Vandermark in an article "What is the Nutritional Value of Radishes" cited that Centers for Disease Control report that 1 cup of radishes provide approximately 1/3 of the recommended daily allowance of vitamin C. An antioxidant, vitamin C also helps with brain function, the transport of fat within the body and cholesterol metabolism, according to the Linus Pauling Institute in Oregon. Since the body cannot produce vitamin C, we must be sure to get what we need through our food intake, and radishes can help with that.[17]

2.1.9. Candy

Scott-Thomas define candy as a preparation of sugar, honey, or other natural or artificial sweeteners in combination with chocolate, fruits, nuts or other ingredients or flavorings in the form of bars, drops, or pieces. Candy shall not include any preparation containing flour and shall require no refrigeration.[18]

Moore defined candy specifically as sugar candy, as a confectioner made from a concentrated solution of sugar in water, to which flavorings and colorants are added. Candies

come in numerous colors and varieties and have a long history in popular culture.[19]

Related Studies

2.1.10. Acceptability

Roman A. conducted a study about the "Acceptability of Chocolate Rice Snacks" to the students of BS Entrepreneurship major in Marketing at Laguna State Polytechnic University Sta. Cruz Campus. The process involved was preparing the materials, measuring, washing, boiling, and mixing. This study is accepted in terms of appearance, aroma, taste as well as its texture.[20]

Manaman C. studied about the "Acceptability of Choco Squash Cupcake" which according to her research was highly accepted by the evaluators.[21]

Maralit K. made a research about the "Acceptability of Malunggay Seed Tea". Based on her research, it was accepted in terms of taste, color and aroma.[22]

The acceptability of a product is commonly evaluated through its sensory qualities which may vary in the manner of preparation of ingredients.

2.1.11. Appearance

Rana, A. in her study entitled "Acceptability of Malunggay Yema" stated that the product yielded a positive result, which means that Malunggay is good in the production of yema. Her findings were proven "Very Good" in terms of its appearance.[23]

De Leon studied on the "Aratiles Candy". The study found out that 40% of the respondents said that it was "Highly Acceptable" and 60% said that it was "Moderately Acceptable" in terms of appearance.[24]

Castillion on her research entitled "Evaluation of Nutritional Sensory Qualities of Labong Flour" assured that

bamboo shoot could be utilized as flour could be made into cookies. This study yielded positive result which means that bamboo shoot flour is good in the production of cookies. Her study was accepted by the evaluators and experts in terms of sensory qualities such as appearance.[25]

2.1.12. Aroma

Dela Cruz and Emma conducted a study about "Lagundi Candy". The results were good because the respondents indicated the aroma of Lagundi Candy as "Acceptable".[26]

Irlandez made a research about "Corn and Cheese Candy". It was rated "Acceptable" in terms of aroma.[27]

Ranada also formulated a study regarding "Chayote Candy". The study found out that chayote extracts can be used as the main ingredient in making candy. As a result, his findings proved "Accepted" by the respondents in terms of sensory quality which is aroma.[28]

The products were assessed by the respondents in terms of aroma and puts into record different acceptability level due to different ingredients utilized.

2.1.13. Taste

Arroyo made a research about "Radish (Raphanus sativus) Pudding". Based on the evaluation, the finished product which is pudding has a very good taste garnering 4.60 weighted mean with a verbal interpretation of "Highly Acceptable". [29]

Apuada also conducted a study about "Sweet Guava Corn Ice Cream". Guava and Sweet Corn as main ingredients were made into ice cream through simple processes. The scorecard was used to evaluate the study in terms of taste as evaluated by professors, co-HRM students and the local consumers. The product was proven acceptable with regards to taste with a recorded rating of "Highly Acceptable" from different respondents. [30]

Lintag made a research regarding "Carrot (Daucus carota) Pastillas" and the findings were good in terms of taste. The different groups of respondents rated the carrot pastillas as "Highly Acceptable" in terms of taste. [31]

2.1.14. Texture

De Leon conducted a study on "Aratiles Candy". The study of De Leon yielded positive results which mean that Aratiles is good in the production of candy. His findings were rated "Moderately Acceptable" in terms of texture.[24]

Monteza on his research paper entitled "Luyang Dilaw (Zingiber officinale) Candy", showed the acceptance of respondents with respect to the texture of the finished product with majority rating of "Highly Acceptable".[32]

Rivera, Serrano and Puma formulated a study entitled "Acceptability of Radish Macaroons", and found out that the texture of the product was rated "Excellent" by the respondents.[33]

The products made from different raw materials such as radish smoothen and enhance the texture of the finished candy product.

2.1.15. Candy

Monserrat completed a research paper entitled "Coconut Sprout Candy". Her study focused on utilizing coconut sprout as a main ingredient on making another flavor of candy that will surely capture the taste buds of the consumers.[34]

Bermudez, N. et. al. completed a research study entitled "Coconut Sapal Candies" in which they maximized the use of coconut sap. Instead of disposing the sap after extracting the coconut milk, they innovate and made it as another candy flavor.[35]

Intas, A. et. al. performed an experimental candy product which utilized cassava and pineapple as another flavor. Their research was entitled "Cassava-Pineapple Candy".[36]

2.1.16. Methods of Preparation

Jose conducted a research study entitled "Crab Shell Pulvoron" which followed a systematic way of preparation. It involves the preparation of ingredients, utensils and equipment, drying, blending, cooking, molding, wrapping, and packing.[37]

Manalo in his study entitled "Savory Chocolate" revealed that the methods of preparation he utilized were preparing, simmering, mixing, molding, cooling and packing.[38]

Based on the study conducted by Manguerra, he utilized the following methods as preparation, mixing, heating, baking, cooling and packaging before arriving at the end product which was "Macapuno Pie".[39]

2.1.17. Peeling

Molina, Jr. conducted a research paper entitled "Sweet Potato Cracker". His study included the peeling process on the flow diagram. On preparing the Sweet Potato Cracker, he first boiled the sweet potato before peeling the raw material.[40]

On the other hand, Irlandez in his study "Carrot Catsup" stated that upon making the product he first peeled the carrot with the use of commercial peeler.[27]

Monteza in his research paper entitled "Luyang Dilaw (Zingiber officinale) Candy" cited that peeling is also included on the process needed to come up with the product. Monteza boiled the luyang dilaw first then cooled for a minute then peel with the use of knife.[32]

2.1.18. Grinding

Anca conducted a research paper entitled "Jackfruit Seed Yema Balls". Her study included the grinding process on the methods

of preparation. By the use of mortar and pestle, the jackfruit seeds were then grinded.[41]

Conde in his study entitled "Acceptability of Cucumber Soap" cited that he used electronic blender to grind the main ingredients such as cucumber to separate its extract from its sap.[42]

2.1.19. Extracting

Revelo performed a research study entitled "Acceptability of Lanzones-Salay Leaves as Scented Candle Mosquito Repellant" which showcased the effectiveness of scented candle as repellent. His study revealed that extracting was included in the methods of its preparation. The extraction process was made by cutting the raw materials into pieces and placed then on white cloth.[43]

Magsino in her study entitled "Oregano (Coleus aromaticus) Flavored Ice Cream" revealed that she used the process of extracting by the use of sifter and measuring cups.[44]

Based on the study conducted by Senagonia, she used blender to extract the leaves of acapulco that was used as the main ingredient in another scent of soap.[45]

2.1.20. Mixing

Roman on her research paper entitled the "Acceptability of Chocolate Rice Snacks" stated that the preparation method comprised mixing in making chocolate rice snacks. Roman mixed different ingredients such as glutinous rice, condensed milk, chocolate powder, coconut milk, pinipig and sugar to come up with the end product. [20]

Based on the research studied by Flores, he mixed the malunggay leaves and grated cassava along with other ingredients to come up with the product which is "Cassava Malunggay Nuggets". [46]

Dreo conducted a research entitled "Radish Body Soap". Her study revealed that she involved the process of mixing on the preparation stage. Upon mixing, he used wooden ladle or bamboo stick.[47]

3. METHODOLOGY

This chapter encompasses the research design, population and sampling, preparation procedures, data gathering procedures, materials (ingredients and utensils), cost analysis, tryouts and revisions, and the statistical treatment of data.

3.1. Research Design

The experimental and descriptive methods of research were used for this study. The experimental research study as discussed by Calderon, et. al., was the procedure in making the output involving the control and manipulation of conditions for the purpose of studying the relative effects of various treatments applied to members of a sample, or the same treatment applied to members of a sample, or the same treatment applied to members of different samples.[48]

The product was made experimentally and was evaluated descriptively by the respondents. The data gathered to determine the acceptability of Radish Candy's sensory qualities were appearance, aroma, taste and texture.

3.2. Population and Sampling Technique

This study shows how Radish can be made in the form of candy. It was evaluated by two groups of respondents. The two groups of respondents consist of five (5) selected housewives and five (5) storeowners who are residents of Brgy. Kanlurang Bukal Liliw, Laguna. The acceptability of Radish Candy was judged according to its appearance, aroma, taste and texture. The

presence of ascorbic acid on the product was performed in the laboratory using the titration method.

Random sampling technique was used since it utilized respondents with vitamin C deficiency from the residents of Brgy. Kanlurang Bukal Liliw, Laguna. The random sampling technique is a technique of drawing a sample whereby each element in the population has the equal chance of being taken into sample. [Cruz, 2007][49]

3.3. Data Gathering Procedures

After the proposed topic was favored, the information needed to perform the experiment were gathered. Then, the authorization from the Barangay Captain to operate interviews regarding the study was entreated. Canvassing for the cost of materials needed and the construction of the questionnaires and the experimentation on the preparation of radish candy were done simultaneously. The target respondents were groups from residents of Brgy. Kanlurang Bukal Liliw, Laguna. Five (5) housewives and five (5) storeowners were the chosen respondents who tasted and evaluated the end product. They were oriented on the content of the product and were requested to taste at least two (2) to three (3) pieces of radish candy. Distribution and retrieval of the questionnaires followed. The appropriate statistics were made and evaluation and analysis were done to complete the research.

3.4. Supplies and Materials

The different materials, tools and equipment used to achieve the desired product were included in the table below.

Table 3.4
Materials, Tools and Equipment

Ingredients	Tools	Equipment
Radish Sugar Condensed milk Butter	Knife Measuring cup Measuring spoon Pan Strainer Grinder	Gas stove

Construction Procedure	
 **Figure 1. Preparation of Materials Needed**	1. Organize all the materials, tools and equipment needed.
 **Figure 2. Peeling of the main ingredient.**  **Figure 3. Grinding of Radish**	2. Peel off the skin of the radish.

 **Figure 4. Ground Radish.**	3. Using a grinder, grind the radish to get the sap and its extract.
 **Figure 5. Extraction of Radish**  **Figure 6. Ground radish and its sap.**	4. With the use of strainer, strain the grinded radish making the extract to be separated from its sap.
 **Figure 7. Cooking**	5. Preheat the pan. Place all the ingredients needed except for the radish extract because too much heat may cause ascorbic acid content loss.

Figure 8. Addition of radish extract.

6. When the mixture became hick, slightly lower the heat, then turn off the stove. Add the radish extract to the mixture. Avoid boiling the mixture because the ascorbic acid content of the candy may be lost.

Figure 9. Addition of butter.

7. Add butter to the consistency of the product. Continuously mix the radish mixture under very low heat until the mixture becomes thick. When it becomes thick, turn off the stove and remove the mixture from the pan

Figure 10. Unpacked radish candy.

8. Set aside the finished candy. Let it cool. Pack the radish candy on a cellophane with its desired form.

Figure 11. Packaging

3.5. Try-Outs and Revisions

In preparing Radish Candy, the researcher faced difficulties to enhance the product. Trials and revisions were employed by the researcher to come with preferred results. The different try-outs and revisions executed by the researcher are provided.

Table 3.5.1 Trials and Revisions of the Product

Trial	Defects	Revisions
1	Using evaporated milk that caused inconsistency.	Usage of condensed milk.
2	Too sweet	Lessen the sugar
3	Perfectly done	No revisions applied

Before arriving at the best product, the researcher underwent different trials and then applied necessary revisions. On the first trial, instead of using condensed milk, the researcher used evaporated milk making the mixture so soft. On the second trial too much sweetness was the problem of the researcher. On the third trial all of the revisions were considered by the researcher then arrived at the perfect production of the desired product was then reached.

3.6. Construction Time Frame

Table 3.6.1
Construction Time Frame

	Time (Minutes)				
Procedures	**5**	**10**	**15**	**20**	**25**
Preparation					
Peeling					
Grinding					
Extracting					
Cooking					
Mixing					
Packaging					

Total Time Consumed: 1 hour and 12 minutes

The table shows the total time disbursed upon making the radish candy which took 72 minutes or 1 hour and 12 minutes upon completion.

3.7. Cost of Production

To find whether the products experimented are of economic value, cost analysis of the product was presented.

Table 3.7.1
Cost of Production

Quantity	Unit	Description	Unit Price
800	Grams	Radish	30.00
22.5	ml	Sugar	0.00
300	ml	Condensed Milk	49.00
3.7	ml	Butter	0.00

Unit Total: Php79.00
Total Servings:55 pcs
Price: Php 1.50

3.8. Research Instrument

In executing this study, scorecards were used to evaluate the sensory qualities of the radish candy and its acceptability in terms of aroma, taste and texture. The housewives and the store owners who were involved as the respondents validated and evaluated the product. The scorecard was adopted from the studies of the researchers. The interpretation of the scores was based on the Likert scale and verbal interpretation with the corresponding weights as follows:

Table 3.8.1
Likert Scale and Verbal Interpretation

Scale	Appearance	Aroma	Taste	Texture
4.20-5.00	Very Presentable	Very Pleasant	Very Zesty	Very Fine
3.40-4.19	Presentable	Pleasant	Zesty	Fine
2.60-3.39	Moderately Presentable	Moderately Pleasant	Moderately Zesty	Moderately Fine
1.80-2.59	Less Presentable	Less Pleasant	Less Zesty	Less Fine
1.00-1.79	Poorly Presentable	Poorly Pleasant	Poorly Zesty	Poorly Fine

3.9. Statistical Treatment of Data

Arithmetic mean and Mann-Whitney U test formulas were employed in determining the respondent's awareness on the acceptability of radish candy and determining the level of significance respectively.

3.9.2. Arithmetic Mean

The arithmetic mean, also called the average or average value, is the quantity obtained by summing two or more numbers or variables and then dividing by the number of numbers or variables.

$$A = \frac{S}{N}$$

Where:

A = average (or arithmetic mean)
N = number of terms (e.g. the number of items or numbers being averaged)
S = the sum of the numbers in the set of interest (e.g. the sum of the numbers being averaged)

3.9.3. Mann-Whitney U Test

Mann-Whitney U is a non-parametric alternative test to the independent sample t-test. It is a non-parametric test that is used to compare two sample means that come from the same population, and used to test whether two sample means are equal or not. Usually, the Mann-Whitney U test when the data is ordinal or when the assumptions of the t-test are not met.

$$\boldsymbol{U = n_1\, n_2\ + \frac{n_2\,(n_2+1)}{2} - \sum_{i=n_1+1}^{n_2} R_1}$$

Where:

U = Mann-Whitney U test
n_1 = sample size one
n_2 = sample size two
$\mathbf{R_1}$ = rank of sample size

4. RESULTS AND DISCUSSION

This section mounts the processes used in the experimental product which were evaluated descriptively. All tables show the sensory qualities like appearance, aroma, taste and texture based on the evaluation results on the study of Radish Candy as Vitamin C supplement.

4.1. Results of Descriptive Evaluation

4.1.2. Appearance

Table No. 4.1.1.1
Acceptability of Radish Candy in terms of Appearance by the Housewives

Appearance	Respondents						
	Housewives						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation
1. The outward look of the product is presentable.	0	0	0	1	4	4.800	Very Presentable
2. It can be associated to mercantile candies.	0	0	0	2	3	4.600	Very Presentable
3. The product is good and has an amusing taste.	0	0	0	3	2	4.400	Very Presentable

$\bar{x}$ = 4.600 Very Presentable

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its appearance as rated by five (5) housewives. The housewives rated the radish candy in terms of its appearance through the following statements. Statement number one which is "The outward look of the product is presentable" was rated **4.800** with a verbal interpretation of **Very Presentable** Statement number two which is "It can be associated to mercantile candies" was rated **4.600** with a verbal interpretation of **Very Presentable**. Statement number three which is "The product is good and has an amusing taste" was rated **4.400** with a verbal interpretation of **Very Presentable**.

The overall result with respect to appearance as rated by the housewives with the computed mean of **4.600** was interpreted as **Very Presentable**.

Table No. 4.1.1.2
Acceptability of Radish Candy in terms of Appearance by the Storeowners

Appearance	Respondents						
	Storeowners						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation
1. The outward look of the product is presentable.	0	0	0	3	2	4.400	Very Presentable
2. It can be associated to mercantile candies.	0	0	0	3	2	4.400	Very Presentable
3. The product is good and has an amusing taste.	0	0	0	5	0	4.000	Presentable

$\bar{x}$ **= 4.267 Very Presentable**

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its appearance as rated by five (5) storeowners. The storeowners rated the radish candy in terms of its appearance through the following statements. Statement number one which is "The outward look of the product is presentable" was rated **4.400** with a verbal interpretation of **Very Presentable**. Statement number two which is "It can be associated to mercantile candies" was rated **4.400** with a verbal interpretation of **Very Presentable**. Statement number three which is "The product is good and has an amusing taste" was rated **4.000** with a verbal interpretation of **Presentable**.

The overall result with respect to appearance as rated by the storeowners with the computed mean of **4.267** was interpreted as **Very Presentable**.

4.1.3. Aroma

Table No. 4.1.2.1

Acceptability of Radish Candy in terms of Aroma by the Housewives

Aroma	Respondents						
	Housewives						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation
1. The scent of the product is identical to mercantile candies.	0	0	0	3	2	4.400	Very Pleasant
2. The product conceals the foul scent of radish extract.	0	0	0	0	5	5.000	Very Pleasant
3. The product's scent is thirst-quenching.	0	0	0	2	3	4.600	Very Pleasant

$\bar{x}$ **= 4.667Very Pleasant**

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its aroma as rated by five (5) housewives. The housewives rated the radish candy in terms of its appearance through the following statements. Statement number one which is "The scent of the product is identical to mercantile candies" was rated **4.400** with a verbal interpretation of **Very Pleasant**. Statement number two which is "The product conceals the foul scent of radish extract" was rated **5.000** with a verbal interpretation of **Very Pleasant**. Statement number three which is "The product's scent is thirst-quenching" was rated **4.600** with a verbal interpretation of **Very Pleasant**.

The overall result with respect to appearance as rated by the housewives with the computed mean of **4.667** was interpreted as **Very Pleasant**.

Table No. 4.1.2.2
Acceptability of Radish Candy in terms of Aroma by the Storeowners

Aroma	Respondents						
	Storeowners						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation
1. The scent of the product is identical to mercantile candies.	0	0	1	0	4	4.600	Very Pleasant
2. The product conceals the foul scent of radish extract.	0	0	1	4	0	3.800	Pleasant
3. The product's scent is thirst-quenching.	0	0	1	3	1	4.000	Pleasant

$\bar{x}$ **= 4.133Pleasant**

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its aroma as rated by five (5) storeowners. The storeowners rated the radish candy in terms of its aroma through the following statements. Statement number one which is "The scent of the product is identical to mercantile candies" was rated **4.600** with a verbal interpretation of **Very Pleasant**. Statement number two which is "The product conceals the foul scent of radish extract" was rated **3.800** with a verbal interpretation of **Pleasant**. Statement number three which is "The product's scent is thirst-quenching" was rated **4.000** with a verbal interpretation of **Pleasant**.

The overall result with respect to appearance as rated by the housewives with the computed mean of **4.133** was interpreted as **Pleasant**.

4.1.4. Taste

Table No. 4.1.3.1

Acceptability of Radish Candy in terms of Taste by the Housewives

Taste	Respondents						
	Housewives						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation
1. The finished product is scrumptious.	0	0	0	1	4	4.800	Very Zesty
2. The product conceals the foul taste of radish.	0	0	0	3	2	4.400	Very Zesty
3. The product's flavor is exceptional.	0	0	0	1	4	4.800	Very Zesty

$\bar{x}$ **= 4.667 Very Zesty**

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its taste as rated by five (5) housewives. The housewives rated the radish candy in terms of its taste through the following statements. Statement number one which is "The finished product is scrumptious" was rated **4.800** with a verbal interpretation of **Very Zesty**. Statement number two which is "The product conceals the foul taste of radish" was rated **4.400** with a verbal interpretation of **Very Zesty**. Statement number three which is "The product's flavour is exceptional" was rated **4.800** with a verbal interpretation of **Very Zesty**.

The overall result with respect to taste as rated by the housewives with the computed mean of **4.667** was interpreted as **Very Zesty.**

Table No. 4.1.3.2

Acceptability of Radish Candy in terms of Taste by the Storeowners

Taste	Respondents						
	Storeowners						
	1	2	3	4	5	Weighted Mean	Verbal Interpretation

1. The finished product is scrumptious.	0	0	0	2	3	4.600	Very Zesty
2. The product conceals the foul taste of radish.	0	0	0	3	2	4.400	Very Zesty
3. The product's flavor is exceptional.	0	0	0	2	3	4.600	Very Zesty

$\bar{x}$ = 4.533 Very Zesty

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its taste as rated by five (5) storeowners. The storeowners rated the radish candy in terms of its taste through the following statements. Statement number one which is "The finished product is scrumptious" was rated **4.600** with a verbal interpretation of **Very Zesty**. Statement number two which is "The product conceals the foul taste of radish" was rated **4.400** with a verbal interpretation of **Very Zesty**. Statement number three which is "The product's flavour is exceptional" was rated **4.600** with a verbal interpretation of **Very Zesty**.

The overall result with respect to taste as rated by the housewives with the computed mean of **4.533** was interpreted as **Very Zesty.**

4.1.5. Texture

Table No. 4.1.4.1

Acceptability of Radish Candy in terms of Texture by the Housewives

Texture	**Respondents**						
	Housewives						
	1	**2**	**3**	**4**	**5**	**Weighted Mean**	**Verbal Interpretation**
1. The product liquefies easily.	0	0	0	2	3	4.600	Very Fine
2. The product's quality is identical to mercantile chewy candies.	0	0	0	2	3	4.600	Very Fine

3. It has a consistent quality.	0	0	0	1	4	4.800	Very Fine

$\bar{x}$ = 4.667 Very Fine

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its texture as rated by five (5) housewives. The housewives rated the radish candy in terms of its texture through the following statements. Statement number one which is "The product liquefies easily" was rated **4.600** with a verbal interpretation of **Very Fine**. Statement number two which is "The product's quality is identical to mercantile chewy candies" was rated **4.600** with a verbal interpretation of **Very Fine**. Statement number three which is "It has a consistent quality" was rated **4.800** with a verbal interpretation of **Very Fine**.

The overall result with respect to texture as rated by the housewives with the computed mean of **4.667** was interpreted as **Very Fine.**

Table No. 4.1.4.2
Acceptability of Radish Candy in terms of Texture by the Storeowners

Texture	**Respondents**						
	Storeowners						
	1	**2**	**3**	**4**	**5**	**Weighted Mean**	**Verbal Interpretation**
1. The product liquefies easily.	0	0	1	2	2	4.200	Very Fine
2. The product's quality is identical to mercantile chewy candies.	0	0	0	3	2	4.400	Very Fine
3. It has a consistent quality.	0	0	0	2	3	4.600	Very Fine

$\bar{x}$ = 4.400 Very Fine

This table presents the weighted mean to determine the level of acceptability of radish candy in terms of its texture as rated by five (5) storeowners. The storeowners rated the radish candy in terms of its texture through the following statements. Statement number one which is "The product liquefies easily" was rated **4.200** with a verbal interpretation of **Very Fine**. Statement number two which is "The product's quality is identical to mercantile chewy candies" was rated **4.400** with a verbal interpretation of **Very Fine**. Statement number three which is "It has a consistent quality" was rated **4.600** with a verbal interpretation of **Very Fine**.

The overall result with respect to texture as rated by the housewives with the computed mean of **4.400** was interpreted as **Very Fine.**

4.2. Composite Table of its Sensory Qualities of Housewives and Storeowners

	Sensory Qualities			
Housewives	**Appearance**	**Aroma**	**Taste**	**Texture**
1	4.800	4.400	4.800	4.600
2	4.600	5.000	4.400	4.600
3	4.400	4.600	4.800	4.800
$\bar{x}$	**4.600 Very Presentable**	**4.667 Very Pleasant**	**4.667 Very Zesty**	**4.667 Very Fine**
	Sensory Qualities			
Storeowners	**Appearance**	**Aroma**	**Taste**	**Texture**
1	4.400	4.600	4.33	4.00
2	4.400	3.800	4.00	4.00
3	4.000	4.000	4.67	5.00
$\bar{x}$	**4.267 Very Presentable**	**4.133 Pleasant**	**4.533 Very Zesty**	**4.400 Very Fine**
TOTAL MEAN	**4.434 VERY PRESENTABLE**	**4.400 VERY PLEASANT**	**4.600 VERY ZESTY**	**4.534 VERY FINE**

The table shows the composite table of acceptability of radish candy in terms of its sensory qualities such as appearance, aroma, taste and texture. In terms of the product's **appearance**, the ratings given by the housewives is **4.600** and

is **Very Presentable**, while the storeowners rated the appearance of radish candy with a mean score of **4.267** and was interpreted as **Very Presentable**. All in all, the appearance of radish candy as rated by the two (2) groups of respondents is **4.434** and has a verbal interpretation of **Very Presentable**. In terms of radish candy's **aroma**, the ratings given by the housewives is **4.667** and is **Very Pleasant**, while the storeowners rated the aroma of radish candy with a mean score of **4.133** and was interpreted as **Pleasant**. All in all, the aroma of radish candy as rated by the two (2) groups of respondents is **4.400** and has a verbal interpretation of **Very Pleasant**.

On the other hand, the respondents rated the product's **taste** too. The ratings given by the housewives is **4.667** and is **Very Zesty**, while the storeowners rated the taste of radish candy with a weighted mean **4.533** and was interpreted as **Very Zesty**. All in all, the taste of radish candy as rated by the two (2) groups of respondents is **4.600** with a verbal interpretation of **Very Zesty**.

The texture of the product was the last sensory quality being rated by the respondents. The ratings given by the housewives is **4.667** with a verbal interpretation of **Very Fine**, while the storeowners rated the texture of radish candy with a weighted mean of **4.400** and was interpreted as **Very Fine**. All in all, the appearance of radish candy as rated by the two (2) groups of respondents is **4.534** and has a verbal interpretation of **"Very Fine"**.

4.2.2. Mean Level of Acceptability of Radish Candy in terms of its Sensory Qualities

Table 4.2.1

	Appearance	Aroma	Taste	Texture	Total
Housewives					
Questions Count	3	3	3	3	12
Sum	13.800	14.000	14.000	14.000	55.800

Average	4.600	4.667	4.667	4.667	4.650
Variance	0.531	0.530	0.530	0.530	0.530
Storeowners					
Questions Count	3	3	3	3	12
Sum	12.800	12.400	13.600	13.200	52.000
Average	4.267	4.134	4.533	4.400	4.333
Variance	0.533	0.535	0.531	0.532	0.533

The table shows the mean level of acceptability of radish candy in terms of its sensory qualities. In terms of the product's **appearance**, the ratings given by the housewives is **4.600** and is **Very Presentable**, while the storeowners rated the appearance of radish candy with a mean of **4.267** and was interpreted as **Very Presentable**. All in all, the appearance of radish candy as rated by the two (2) groups of respondents is **4.434** and has a verbal interpretation of **Very Presentable**.

In terms of radish candy's **aroma**, the ratings given by the housewives is **4.667** and is **Very Pleasant**, while the storeowners rated the aroma of radish candy with a mean of **4.134** and was interpreted as **Pleasant**. All in all, the aroma of radish candy as rated by the two (2) groups of respondents is **4.400** and has a verbal interpretation of **Very Pleasant**.

On the other hand, the respondents rated the product's **taste** with a mean of **4.667** and verbal interpretation of **Very Zesty**, while the storeowners rated the taste of radish candy with a mean of **4.533** and was interpreted as **Very Zesty**. All in all, the taste of radish candy as rated by the two (2) groups of respondents is **4.600** and has a verbal interpretation of **Very Zesty**.

The texture of the product was the last sensory quality being rated by the respondents. The ratings given by the housewives is **4.667** and is **Very Fine**, while the storeowners rated the texture of the radish candy with **4.400** and was interpreted as **Fine**. All in all, the appearance of radish candy

as rated by the two (2) groups of respondents is **4.534** and has a verbal interpretation of **Very Fine**.

4.2.3. Significant difference between the perception of the housewives and the storeowners

Table 4.2.2

	Mann-Whitney U	P-Value	Decision Rule	Remarks/Interpretation
Appearance	1.000	0.105	Fail to Reject H_o	Not Significant
Aroma	1.500	0.184	Fail to Reject H_o	Not Significant
Taste	2.500	0.361	Fail to Reject H_o	Not Significant
Texture	1.000	0.105	Fail to Reject H_o	.Not Significant

Level of Significance: 0.05

The table illustrates the level of significant difference of radish candy as rated by five (5) housewives and five (5) storeowners. Since the *p-value* for the appearance is 0.105 and is more than 0.05, there is no significant difference between the perception of housewives and storeowner in terms of appearance. For the aroma, the *p-value* is 0.184, is more than 0.05, it means that there is no significant difference between the perception of housewives and storeowner in terms of aroma. In terms of taste, the *p-value* is 0.361, is more than 0.05, it means that there is no significant difference between the perception of housewives and storeowner. And for the texture, the *p-value* is 0.105, it means that there is no significant difference between the perceptions of housewives and storeowner in terms of texture.

5. CONCLUSION

The acceptability of radish (*Raphanus sativus)* candy as vitamin C supplement has gone through the basic process in making candy: preparation of needed materials, peeling, grinding, extracting, cooking, mixing and packaging. Radish

may be utilized as main ingredient in making delicious candy and its acceptability in terms of its sensory qualities such as appearance, aroma, taste and texture. As a conclusion, there is no significant difference among the ratings of selected housewives and storeowners in the acceptability of radish candy.

6. RECOMMENDATIONS

The results and conclusions of this study further indicate the feasibility of the radish plant candy as a vitamin C supplement which is well accepted by the respondents. The researchers recommend further studies to innovate the scent of the finished product, a research on the effectivity of radish candy, and another isolated study to test the ascorbic content of the product. Innovative packaging of the end product which would be recommended depending on the convenience of the user. Lastly, locals are encouraged to plant more radish in their locality to serve not only as candy but of many great uses as well.

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