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Preparation of Tomato (*Solanum Lycopersicum*) as a Main Ingredient in Making Candy

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The primary focus of this study is to develop and utilize tomato (Solanum lycopersicum) from the local market as the main ingredient in making candy. Also, the research used tomato as the main ingredient to avoid wastage of oversupplied tomato all over the country and to promote an affordable and delicious snack that is also healthy and available in local markets. The study also determined the acceptability of tomato (Solanum lycopersicum) in terms of appearance, taste, texture, color, and aroma.The acceptability of tomato (Solanum lycopersicum) as the primary ingredient in making candy was delimited if the fruit vegetable is not fermented properly and spoiled. This study was also delimited when the proper storage does not meet the temperature standard which is 25°C – 30 °C.This research was also delimited by only 50 respondents due to lack of time while conducting the research inside the school premises. Findings showed that tomato is a good ingredient in making candy. Tomato candy is acceptable in terms of appearance. It is likely delicious and better in terms of taste, acceptable in terms of texture, favorite in terms of color, likely fresh and acceptable in terms of aroma, and a favorite sweet delicacy offered as a healthy product for consumers.

Keywords: aroma, appearance, sweet delicacy, texture, tomato,

Introduction

Considered as one of the world's most abundant and highly-consumed fruit-vegetables, tomato (*Solanum lycopersicum*) is also famous for being a frequently-imported spice (Geisenberg& Stewart, 1986). This popularity is partly attributed to its availability all year round.

A tomato (*Solanum lycopersicum*), which belongs to the *Solanaceae* or the nightshade family, has a diameter of 60-180 cm or 24-72 in. Its leaves are hairy and can grow up to 45 cm or 18 in long. Also, it has five petals of a flower which is color yellow and 2 cm long (Duignan, et al., 2007).

Tomato (*Solanum lycopersicum*) is best planted in fertilized loam soil (BAS MINA Report, 1994). It can only withstand a temperature between 21 and 23 Celsius wherein below or above the said temperature may affect its growth. During watering period, too much water and less water may cause dryness that can cause the flowers and buds to fall off (Naika, et al., 2005). Harvesting is done by picking during summer months. The fruits can be harvested every other day because it can easily mature. During wet months, harvesting is at intervals of one week (BAS MINA Report, 1994).

Tomato (*Solanum lycopersicum*) is one of the most abundant and nutritious vegetables in most tropical countries such as the Philippines. But then again, overproduction causes many tomatoes to just be dumped. According to a story published by abs-cbnnews.com, local farmers lost as much as P4 million because of a supposed oversupply of tomatoes bringing down the

farm gate price to P2.50 to P5 a kilo depending on size. In line with this problem, the researchers came up with the idea to use tomato (*Solanum lycopersicum*) as the main ingredient in making candy. The review of related literature focuses on the (1) botanical description of tomato (*Solanum lycopersicum*), (2) nutritional value of tomato (*Solanum lycopersicum*), 3) other food products from tomato (*Solanum lycopersicum*), and 4) the phytochemical properties of tomato (*Solanum lycopersicum*).

Since tomato was introduced in Europe during the 16th century, early botanists recognized the close relationship of tomatoes with the genus *Solanum*, commonly identified as *S. pomiferum* (Sabine, 1820; Luckwill, 1943). Anguillara (1561) identified the newly-introduced tomato as a plant named Lycopersicon, which means “wolf peach” by the Greek naturalist Galen 14 centuries earlier. However, the actual plant described by Galen is unknown, and it certainly did not refer to any form of tomato because all tomato species are not native of the Old World. Tournefort (1694) was the first to consider cultivated tomatoes within a distinct genus under the early name *Lycopersicon*. He used the multilocular character of the fruit as a criterion to differentiate *Lycopersicon* from *Solanum*. Tournefort listed nine taxa but only seven of them correspond to fascinatedfruited varieties that differed in the color and size of their fruits, and the other two described taxa belong to different *Solanaceae* (Luckwill, 1943).

It was also found out that the tomato (*Solanum lycopersicum*) has a variety of phytochemicals such as carotenoids (phytoene, phytofluence and provitamin A) and polyphenols. It also contains lycopene (Campbell et al., 2004). Other nutrients found in tomatoes include potassium, folate, and vitamins C and E.

Given its nutritional value, this fruit-vegetable was discovered to have the ability to decrease the chances of having various conditions such as cancer, osteoporosis, and cardiovascular diseases. Those who regularly eat tomatoes (*Solanum lycopersicum*) have drastically reduced their risk of having cancer-related diseases (lung, prostate, stomach, cervical, breast, oral, colorectal, esophageal, pancreatic) (Bhowmik, et al., 2012).

Despite its many benefits and good attributes, one thing to be considered with regards to tomatoes would be their abundance. According to a report by the Laguna Provincial Agriculture (2018), Filipino farmers from Kalayaan, Laguna lost approximately 10 tonsof tomato, which is equivalent to P4 million revenue last October 2018 because of oversupply in Manila, Quezon City, and other nearby towns. It is in this light that the researchers formulated a product that may provide an opportunity to prevent such unwanted occurrence, saving people their time, effort, capital, and revenue. To solve the problem, the researchers thought of a way of formulating a candy that has tomato as the main ingredient.

The primary goal of this study is to formulate and utilize locally-available tomato (*Solanum lycopersicum*) that is in abundance in the Philippine local market. Specifically, it sought to answer the following questions:

1. How may the tomato (*Solanum lycopersicum*) as an ingredient in making candy be prepared?
2. How may the product be assessed in terms of its sensory characteristics in terms of:

2.1 Appearance
2.2 Aroma
2.3 Texture
2.4 Color

2.5 Taste

3. What is the consumer acceptability of the tomato candy?
4. How may the return of investment in making tomato candy be computed?

This study would be helpful especially for the consumers who are looking for an affordable and a healthy candy that promotes and satisfies their sensory acceptability in terms of appearance, taste, texture, color, and aroma. For the businessmen, this study would give them information that may help and provide opportunities of selling the product in the food industry/market and provide growth in the economy along the way. And for children, this study would be helpful for the future generation especially the kids because the product has a lot of nutritional benefits.

Method and Procedure

The study employed research and development. According to Bowen (2012), Research and Development (R&D) plays an important role in the flow of market-based innovations through a complex system that leverages the combined talents of scientists and engineers, entrepreneurs, business managers and industrialists. These funds have led to everything from small entrepreneurial initiatives to growth in high technology industries with the concomitant employment of millions of workers. The large impact on employment results from innovation impacts not only in high tech enterprises, but also other industries that benefit from increased capabilities and productivity. Mutual reinforcement and complementary investments in R&D by both private and public sectors work in concert to support the development, production, and commercialization of new products and processes. In the process, the researchers described the sensory characteristics of tomato (*Solanum lycopersicum*) as the primary ingredient in a candy in terms of appearance, taste, texture, color, aroma, and general acceptability.

The researchers described the sensory acceptability of tomato (*Solanum lycopersicum*) as the primary ingredient in a candy in terms of appearance, taste, texture, color, aroma, and general acceptability. The researchers used a consumer type panel to determine the product's acceptability using the 9-point Hedonic scale by David Peryam. Implications for Technical Teacher Education formulated on the basis of the results of the study.

This study was conducted at City College of Angeles - Institute of Education, Arts, and Sciences on November 8, 2019. The Institute offers seven programs, namely: Bachelor of Physical Education, Bachelor of Performing Arts, Bachelor of English Language Studies, Bachelor of Special Needs Education, Bachelor of Technical Vocational Teacher Education, Bachelor of Mathematics, and Bachelor of Psychology.

A total of fifty (50) first- and second-year students taking up Bachelor of Technical-Vocational Teacher Education from the Institute of Education, Arts, and Sciences from City College of Angeles were randomly selected to rate the product. These were the students who were present during the data gathering last November 14, 2019.

The researchers utilized the questionnaire as the main research instrument. Items in the questionnaire are: appearance (appropriate, approaching, unacceptable), taste (sweet, bitter, bland), texture (dry, soft, chewy), color (dark red, red, pale red), aroma (mild, moderate, odorless), and general acceptability for the purpose of measuring the food preferences of the respondents. Related literature and studies with the objectives of this study were used in designing and preparing the questionnaire. This was shown to the researcher's adviser and the BTTE Program Coordinator for their suggestions in order to improve it. There were changes and

revisions made before the questionnaires were administered to the respondents. Further enhancements in form and language were also included. The questionnaire was modified on the basis of the pre-test results in accordance with the objectives of the study.

The researchers used consumer type panel to know the acceptability of the product utilizing the 9-point Hedonic scale by David Peryam. The scale was adopted by the food industry and used for measuring the acceptability of foods.

On November 8, 2019, the researchers asked permission from the Dean of the Institute of Education, Arts, and Sciences to allow them to conduct the assessment on the sensory acceptability of tomato (*Solanum lycopersicum*) in making candies in terms of appearance, taste, texture, color, aroma, and general acceptability. To ensure the high percentage of participation, the respondents were assured of anonymity.

The questionnaire of each respondent was hand scored. Data were classified, tallied, tabulated, analyzed, and interpreted. Data collected were analyzed and interpreted using descriptive statistics in order to describe and to summarize the data in a meaningful and useful manner, including frequency and percentage distribution, weighted and composite mean.

Results and Discussion

This details the process on how to prepare the Tomato (*Solanum lycopersicum*) Candy.

The ingredients used in making tomato (*Solanum lycopersicum*) candy are as follows:

- ¼ kilo of tomato
- Drops of red food color
- 25 grams of gelatin powder
- Pinch of oil
- 500 grams of sugar
- 100 grams glucose syrup
- 2 teaspoon lemon/*calamansi*
- Water

The tools and materials used in making tomato (*Solanum lycopersicum*) candy are as follows:

- Knife
- Chopping board
- Blender
- Glass/plastic container (for fermentation)
- Measuring cup
- Wooden spatula
- Sauce pan
- Bowl
- Mini bowl
- Container (for shaping the candies)
- Stove

The procedure for the preparation of the Tomato (*Solanum lycopersicum*) Candy is as follows:

1. Gather all the ingredients for making tomato candy, namely: -tomato, gelatin power, oil, sugar, red food color, glucose syrup, and calamansi/lemon syrup.

2. Rinse/wash the tomato and calamansi/lemon.

3. Ready the sauce pan and put it on the stove. Add water and let it boil.

4. While waiting for the water to boil, put an x-like slice on the tomatoes.

5. Turn off the stove and put the tomatoes in the pan with boiled water.Wait for 5-7 minutes.

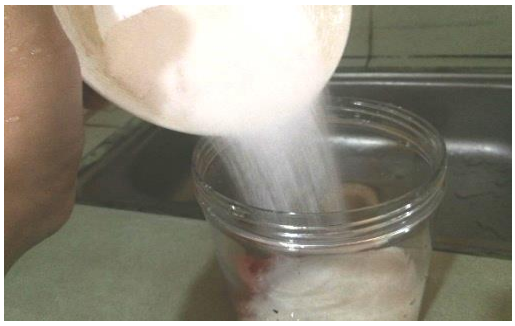
6. Peel the tomatoes.

7. Cut the tomatoes into four.

8. Remove the juice and the seeds.

9. Put the tomatoes in the container.

10. Add 200 grams of sugar.



11. Add water.

12. Let it sit in room temperature for 24 hours. Make sure no air gets inside the container.

13. After 24 hours, put the tomatoes in the blender. Blend until the tomatoes turn into liquid.

14. Put the liquidized tomato in the bowl.

15. Put 25 grams of gelatin powder in the mini bowl and add 100 ml of warm water. Leave for 5-7 minutes.

16. Put 200 grams of sugar in the sauce pan that is on the stove.

17. Add the liquidized tomato.

18. Add water.

19. Add 2 teaspoons of lemon/calamansi.

20. Add the gelatin powder and water.

21. Put a drop of red food color.

22. Let it boil.

23. Brush a pinch of oil to the container.

24. Put the mixture in the container. Leave it for 3-4 hours.

25. Cut using your desired shapes.

26. Serve.

Sensory Acceptability of the Tomato (Solanum Lycopersicum) Candy

Table 2. Sensory acceptability of tomato (Solanum lycopersicum) candy in terms of appearance

Appearance	WM	DR
Appearance	8.6	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 2 presents the sensory acceptability of the tomato (*Solanum lycopersicum*) candy in terms of appearance. The product's appearance obtained a weighted mean of 8.6. The score was given a descriptive rating of "like very much." It indicates that the tomato (*Solanum lycopersicum*) candy was accepted by the respondents. According to the respondents, the appearance of the tomato candy is fine and it wasprepared in bite size. Thus, the tomato candy is acceptable in terms of appearance.

Table 3. Sensory acceptability of tomato (Solanum lycopersicum) candy in terms of taste

Taste	WM	DR
Sweet	8.2	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 3 presents the sensory acceptability of the tomato (*Solanum lycopersicum*) candy in terms of taste. As shown in the table, the product's taste obtained a weighted mean of 8.2

(like very much). This indicates that the tomato candy is likely delicious and better in terms of taste. The candies were prepared to perfection. According to the respondents, the taste of the tomato candy could be determined. This means that the tomato candy is acceptable in terms of taste.

Table 4. Sensory acceptability of tomato (Solanum lycopersicum) candy in terms of texture

Texture	WM	DR
Texture	8.02	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 4 presents the sensory acceptability of the tomato (*Solanum lycopersicum*) candy in terms of texture. As can be gleaned from the table, texture obtained a weighted mean of 8.02 (like very much). This indicates that the tomato candy has a distinct, luscious, melt-in-your-mouth tang. Respondents like the texture of the tomato candy. It was also commented that the product cannot be distinguished from the commercially-produced candies. This means that the tomato candy is acceptable in terms of texture.

Table 5. Sensory acceptability of tomato (Solanum lycopersicum) candy in terms of color

Color	WM	DR
Color	8.28	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 5 presents the sensory acceptability of the tomato (*Solanum lycopersicum*) candy in terms of color. As can be gleaned from the table, color obtained a weighted mean of 8.28 (like very much). This indicates that the tomato candy is likely delicious and better in terms of color. According to the respondents, the tomato candy's color is a favorite color. This means that the tomato candy is acceptable in terms of color.

Table 6. Sensory acceptability of tomato (Solanum lycopersicum) candy in terms of aroma

Aroma	WM	DR
Aroma	7.8	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 6 presents the sensory acceptability of the tomato (*Solanum lycopersicum*) candy in terms of aroma. As can be gleaned from the table, aroma obtained a weighted mean of 7.8 (like very much). This indicates that the tomato candy is likely fresh and better in terms of aroma. According to the respondents, the tomato candy's aroma is appropriate. This means that the tomato candy is acceptable in terms of aroma.

Table 7. Consumer acceptability of tomato (Solanum lycopersicum) candy

Consumer Acceptability	WM	DR
Appearance	8.06	LVM
Aroma	7.8	LVM
Color	8.28	LVM
Taste	8.2	LVM
Texture	8.02	LVM
Over-all Rating	8.07	LVM

Legend: 8.50 – 9:00 - Like Extremely (LE)
7.50 – 8.49 - Like Very Much (LVM)
6.50 – 5.49 - Like Moderately (LM)
5.50 – 6.49 - Like Slightly (LS)
4.50 – 5.49 - Neither Like nor Dislike (NL/D)
3.50 – 4.49 - Dislike Slightly (DS)
2.50 – 3.49 - Dislike Moderately (DM)
1.50 – 2.49 - Dislike Very Much (DVM)
1.00 – 1.49 - Dislike Extremely (DE)

Table 7 presents the consumer acceptability of the tomato (*Solanum lycopersicum*) candy. The table reflects that appearance obtained a weighted mean of 8.06, aroma obtained a weighted mean of 7.8, color obtained a weighted mean of 8.28, taste obtained a weighted mean of 8.2, and texture obtained a weighted mean of 8.02. All parameters were given a descriptive rating of "like very much." The overall rating is 8.07 with a descriptive rating of "like very much." This indicates that the tomato candy is a favorite sweet delicacy of the respondents. After the tasting activity, most of the respondents requested for more. According to them, the tomato candy offered nutritious ingredients that are acceptable for everyone. Since tomato is rich in phytochemicals, the candy could be offered as a healthful product for consumers. This means that the tomato candy is accepted as a new flavor for the respondents.

Return of investment (ROI) of tomato (Solanum lycopersicum) candy

A. Input

Ingredients	Unit Price
• ¼ kilo tomato	P15.00
• 25 grams of gelatin powder	P12.00
• Pinch of oil	P5.00
• 500 grams of sugar	P15.00
• 100 grams glucose syrup	P10.00
• 2 teaspoon lemon/calamansi	P12.00
Total Amount: P69.00	

B. Output

35 pieces of tomato (*Solanum lycopersicum*) candy
Price per piece – P 3.00
Total – 35 pcs x P 3.00 = P 105.00

C. Net Income

P 105.00 – P 69.00 = P 36.00

D. Return of Investment (ROI)

P 36.00 / P 69.00 x 100 = 52.17%

Conclusions and Recommendations

Findings showed that tomato is a good ingredient in making candy. Tomato candy is acceptable in terms of appearance. It is likely delicious and better in terms of taste, acceptable in terms of texture, favorite in terms of color, likely fresh and acceptable in terms of aroma, and a favorite sweet delicacy offered as a healthy product for consumers. Based on the findings and conclusions of the study, the following recommendations are offered: Tomato (*Solanum lycopersicum*) could be used as a substitute in making candy; more tests of the product in terms of shelf life could be conducted; another formulation using tomato could be tested; and utilization of tomato (*Solanum lycopersicum*) in making different food products in consideration of its nutritious and healthful value could be conducted.

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