

Sensory Acceptability of Squash (*Cucurbita Maxima*) in Making Ice Cream

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Abstract - This experimental research was conducted to determine the sensory acceptability of mashed squash (*Cucurbita Maxima*) of different proportions in making ice cream in terms of appearance, aroma, texture, taste and general acceptability. Five treatments were formulated in the study—four of which utilized mashed squash at various proportions and one treatment was used as the control variable which contains no mashed squash at all. The respondents of the study were the 20 Food Technology students and 10 faculty members of West Visayas State University Calinog Campus who were selected through random sampling. The respondents evaluated the finished products using a modified sensory evaluation score sheet based on Six Point Hedonic Scale. The statistical tools used were the means, standard deviation, Wilcoxon Signed Rank Test. The 0.01 alpha level was used as the criterion for acceptance or rejection of the null hypothesis. The result of the study led to the conclusion that there is a significant difference that existed in the level of acceptability of mashed squash in making ice cream in terms of appearance, aroma, and general acceptability, therefore the null hypothesis is rejected. However, no significant difference in the level of acceptability of using mashed squash in making ice cream in terms of taste and texture.

Keywords: Sensory, Acceptability, Squash, Ice Cream

INTRODUCTION

Ice cream is a frozen dessert made from dairy products such as milk and cream combined with flavorings and sweeteners such as sugar. In some cases, artificial flavorings and colorings are added instead of natural ingredients. It is considered to be a junk food that children love to eat. Mostly, they eat this kind of food which is high in sugar and fats, the less they like fresh and natural foods like fruit and vegetables.

The ice cream industry in the Philippines is composed of only a few ice cream companies who supply ice cream and dairy products in the country. The proliferation of smaller companies offering lower-priced branded products in the market has been snatching sales from major brands of ice cream resulting the Philippine government to implement Ice Cream Deregulation Law (RA 8479-M) which is a policy to liberize and deregulates the ice cream industry in order to ensure a truly competitive market under a regime of fair prices, adequate and continuous supply of environmentally clean and high quality frozen products. To this end, the State shall promote and encourage the entry of new participants in the ice cream product industry and introduce adequate

measures to ensure the attainment of these goals (Chan Robles Virtual Library ©1998-2006).The researcher utilized squash in making ice cream to add new variety to the existing products hence, this study is being conducted.

Squash (*Cucurbita maxima*) commonly known in the Visayan language as *kalabasa*, have long been used in the Philippines as fleshy vegetables. They belong to the plant family that includes melon and cucumber, come in many varieties. Some varieties of squash also produce edible flowers. While each variety may have a distinct shape, color, size and flavor, all varieties share some common characteristics. Regardless of variety, all parts of the squash are edible, including the flesh, seeds and skin or rind. Like other cucurbits, squash is recognized as an important source of vitamins and minerals just like vitamins A and C; it also contains calcium and iron. It has very low calories, ideal to be a component in the diet plan. These fleshy vegetables are protected by a hard rind and grown in the country throughout the year. To gain the full nutritional benefits of this vegetable, the green skins or rinds must be eaten. It is usually grown in backyard and it is also marketable for its immature fruits, young shoots, flowers, and

seeds. In some places, intercropping squash with other crops like corn, sugarcane and coconut is practiced (Pears, 2004; Sas, 1984; Dagoon, 2001; Shepherd, 2011; Kubo et.al, 2010).

According to the World Cancer Research Fund/American Institute for Cancer Research, Food, Nutrition, Physical Activity and the Prevention of Cancer (2007), Murray, M.N., (2005), Musa-Veloso, et al., (2009), this tender tendril-bearing and vine-like plant producing fruits is considered to be one of the most delicious vegetables. It is a kind of vegetable that is commonly raised throughout the year in abundance. It is also an excellent source of alpha carotene, beta carotene and other beneficial nutrients which may have benefits of cancer prevention. Recently, some related studies and researches documented just how incredible squash especially the summer squash can be when it comes to these key antioxidants.

There are related studies on Preparation and Acceptability of Ice Cream which are being conducted and developed throughout the world using different resources. Aikwad et al. (2012), conducted a study to ascertain the acceptability of ice cream by using coconut powder at different levels. Ice cream was prepared using different levels of coconut powder i.e. I1 (5%), I2 (7%), I3 (9%) and I4 (11%). The sample I2 was accepted and appreciated due to its smooth and uniform texture with pleasant mouth feel. Addition of coconut powder does not only enhance the flavor but also helped to increase melting resistance power of ice cream.

Another study entitled *Acceptability of Ice Cream Made with Processed Wheys and Sodium Caseinate* conducted by Parsons et al. (1985) was developed to determine the acceptability of using dry sweet whey, whey protein concentrate, and sodium caseinate to replace the nonfat dry milk in ice cream. Either whey protein concentrate, a blend of whey protein concentrate and dry sweet whey, or a blend of dry

sweet whey and sodium caseinate were used to replace the milk solids-not-fat at 50 or 100 percent.

Furthermore, all the experimental ice creams were compared to control ice creams using nonfat dry milk to increase the milk solids-not-fat. All mixes were manufactured to produce an ice cream having 10.5 percent fat, 22 percent total milk solids, 13 percent sucrose, 3 percent corn syrup solids, and 0.3 percent stabilizer-emulsifier. No significant differences were found in the consumer flavor ratings among the ice creams made with dry sweet whey, whey protein concentrate — dry sweet whey blend (at both the 50 percent and 100 percent replacement levels), and the control. The ice cream made with the dry sweet whey-sodium caseinate blend received a significantly higher hedonic rating, indicating a poorer quality product.

OBJECTIVE OF THE STUDY

The primary reason of the researcher in conducting this study is to know the sensory acceptability of using of different proportions of mashed squash in making ice cream in terms of appearance, aroma, texture, taste and general acceptability. The squash as an available resource beyond the backyard can be utilized to enhance the appearance, aroma, texture and taste of ice cream as well as a good source of nutrients. It is an intension of the researcher to use accessible and nutritious resources to develop and improve product.

Considering the sensory acceptability of mashed squash in making ice cream as a main ingredient, this study aims to determine the level of sensory acceptability of mashed squash in making ice cream in terms of appearance, aroma, texture taste and general acceptability, and; find out the significant differences in the level of acceptability in five different proportions of mashed squash in making ice cream in terms of appearance, aroma, texture, taste and general acceptability.

Conceptual/Logical Framework

Schematic Diagram Illustrating the Framework of the Study

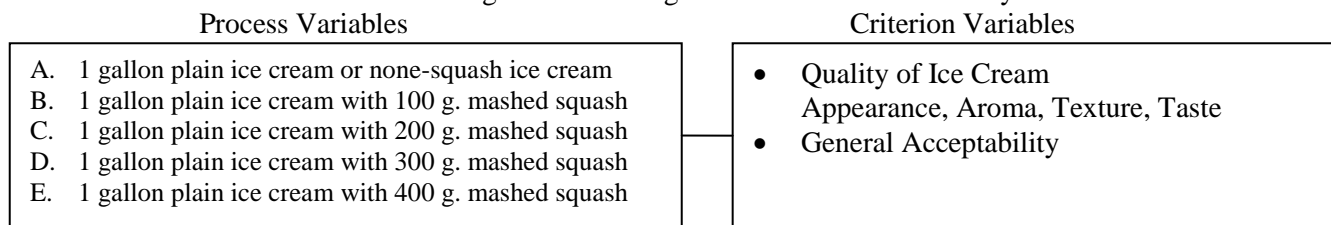


Figure 1. The Sensory Acceptability of using mashed squash in making ice cream in terms of appearance, aroma, texture, taste and general acceptability.

MATERIALS

Tools: The tools used in the conduct of the study were mixing bowl, measuring cups, electric mixer, masher, plastic container and freezer.

Standardized Recipe:

Mashed squash (varies in proportion for each treatment)

- ¼ kg cassava flour
- 3 pcs. coconut (grated)
- ½ kg skimmed milk
- 1 ½ kilos refined sugar
- 2.5 cups water (for grated coconut)
- 1 Tbps. Egg yellow food color powder (for coloring)
- Imported rock salt/ iodized salt (for freezing)
- Crushed ice

Procedures:

Boil water at medium sized kettle. Put cassava flour in a gallon and 2.5 cups water then mix. Add boiled water and mix again. Extract and strain coconut in a separate gallon. Mix sugar and skimmed milk in another gallon then mix them together with cassava flour mixture. Put food coloring and mix until the color is well blended. Let it cool. When it is already cool, put it in a container for 30 minutes. After 30 minutes, transfer it in another container. For freezing, crush the ice and put around the container, surround and sprinkle salt to lengthen the coldness of the ice and prevent the ice cream from melting.

METHODS

This study was an experimental research. The experimental research is designed in which evaluators manipulates and controls one independent variable for the variation concomitant to the manipulation of the dependent variable. In this study the ice cream mixture was prepared and the amount of mashed squash will be added in different proportions as variations such as Treatment 1 (1 gallon plain ice cream or none-squash ice cream), Treatment 2 (1 gallon plain ice cream with 100 g. mashed squash), Treatment 3 (1 gallon plain ice cream with 200 g. mashed squash), Treatment 4 (1 gallon plain ice cream with 300 g. mashed squash and Treatment 5 (1 gallon plain ice cream with 400 g. mashed squash).

Random sampling design was employed in the selection of the respondents of this study. The modified sensory evaluation score sheet based on Six-Point Hedonic Scale was used to gather data. Each

replication of the five treatments were evaluated with the following scores and their description: Six (6) as liked very much; five (5) as liked moderately; four (4) as liked slightly; three (3) as disliked slightly; two (2) as disliked moderately and one (1) as disliked very much. These scores were assigned for evaluating the products as to appearance, aroma, texture, taste and general acceptability.

The given scale was used to interpret the result of the sensory acceptability level of ice cream: 5.18 - 6.00: Liked very much; 4.36 - 5.17: Liked moderately; 3.51 - 4.35: Liked slightly; 2.68 - 3.50: Disliked slightly; 1.84 - 2.67: Disliked moderately; 1.00 - 1.83: Disliked very much.

RESULTS AND DISCUSSIONS

The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of appearance of treatments 1, 2, 3 and 4 were "*liked moderately*" ($M_s=4.70, 5.07, 5.00$ and 5.07 ; $SD_s=1.06, 0.94, 0.95$, and 0.87) while treatment 5 was "*liked very much*", ($M_s=5.33$; $SD_s=0.61$) respectively.

Table 1. Sensory Acceptability Level of Ice Cream Enriched with Different Proportions of Mashed Squash in terms of Appearance

| Appearance | Mean | Description | Std. Deviation |
|-------------|------|------------------|----------------|
| Treatment 1 | 4.70 | Liked moderately | 1.06 |
| Treatment 2 | 5.07 | Liked moderately | 0.94 |
| Treatment 3 | 5.00 | Like moderately | 0.95 |
| Treatment 4 | 5.07 | Like moderately | 0.87 |
| Treatment 5 | 5.33 | Liked very much | 0.61 |

The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of aroma of treatments 1, 2, 3 and 4 were "*liked moderately*" ($M_s=4.43, 5.13, 5.17$ and 4.93 ; $SD_s=1.28, 0.94, 0.83$ and 0.83) while treatment 5 was "*liked very much*", ($M_s=5.20$; $SD_s=0.76$) respectively. Result reveals that the respondents liked moderately the aroma of four treatments- three of which utilized mashed squash at various proportions and one treatment contained no mashed squash while treatment five with leading grams of mashed squash the respondents liked it very much. Thus, the respondents' acceptability level of mashed squash ice cream in terms of aroma is closer to the treatment with prevalent grams of mashed squash compared to three other treatments with lower grams of mashed squash and the other one treatment used as the control variable which contains no mashed squash.

Table 2. Sensory Acceptability Level of Ice Cream Enriched with Different Proportions of Mashed Squash in terms of Aroma

| Aroma | Mean | Description | Std. Deviation |
|-------------|------|------------------|----------------|
| Treatment 1 | 4.43 | Liked moderately | 1.28 |
| Treatment 2 | 5.13 | Liked moderately | 0.94 |
| Treatment 3 | 5.17 | Liked moderately | 0.83 |
| Treatment 4 | 4.93 | Liked moderately | 0.83 |
| Treatment 5 | 5.20 | Liked very much | 0.76 |

The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of texture were “*liked moderately*”, (Ms=4.50,5.00,4.73,4.4.87 and 5.17; SDs=1.33, 0.95,0.74,0.86 and 0.53) respectively. This means that the respondents liked the texture of all five treatments- four of which utilized mashed squash at various proportions and one treatment was used as the control variable which contains no mashed squash at all. Furthermore, the presence of mashed squash did not affect the acceptability level of the said treatments in terms of their texture.

Table 3. Sensory Acceptability Level of Ice Cream Enriched with Different Proportions of Mashed Squash in terms of Texture

| Texture | Mean | Description | Std. Deviation |
|-------------|------|------------------|----------------|
| Treatment 1 | 4.50 | Liked moderately | 1.33 |
| Treatment 2 | 5.00 | Liked moderately | 0.95 |
| Treatment 3 | 4.73 | Liked moderately | 0.74 |
| Treatment 4 | 4.87 | Liked moderately | 0.86 |
| Treatment 5 | 5.17 | Liked moderately | 0.53 |

The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of taste of treatment 1 was “*liked moderately*” (Ms=4.80;SDs=1.27) and treatments 2,3,4 and 5 were “*liked very much*”, (Ms=5.37,5.47,5.23 and 5.57; SDs=0.96,0.90,0.94 and 0.63) respectively. This simply shows that the respondents liked very much the treatment five with leading grams of mashed squash compared to the other four treatments- three of which utilized mashed squash at various proportions and one treatment contained no mashed squash. Thus, treatment with a prevalent level of mashed squash has closer sensory acceptability level in terms of taste compared with the four remaining treatments.

Table 4. Sensory Acceptability Level of Ice Cream Enriched with Different Proportions of Mashed Squash in terms of Taste

| Taste | Mean | Description | Std. Deviation |
|-------------|------|------------------|----------------|
| Treatment 1 | 4.80 | Liked moderately | 1.27 |
| Treatment 2 | 5.37 | Liked very much | 0.96 |
| Treatment 3 | 5.47 | Liked very much | 0.90 |
| Treatment 4 | 5.23 | Liked very much | 0.94 |
| Treatment 5 | 5.57 | Liked very much | 0.63 |

The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of its general acceptability of treatments 1 and 4 were “*liked moderately*” (Ms=4.97 and 5.13; SDs=1.07 and 0.82) while treatments 2,3 and 5 were “*liked very much*”, (Ms=5.23,5.33 and 5.57; SDs=0.97,0.61 and 0.63) respectively. Results reveal that most of the respondents have closer general acceptability level for the treatment with highest grams of mashed squash compared to four treatments- three of which utilized mashed squash at various proportions and the other one treatment was used as the control variable which contains no mashed squash at all. This means that mashed squash ice cream is acceptable and even marketable as a vegetarian ice cream in the market not mentioning its nutritional benefits to the human health.

Table 5. Sensory Acceptability Level of Ice Cream Enriched with Different Proportions of Mashed Squash in terms of General Acceptability

| General Acceptability | Mean | Description | Std. Deviation |
|-----------------------|------|------------------|----------------|
| Treatment 1 | 4.97 | Liked moderately | 1.07 |
| Treatment 2 | 5.23 | Liked very much | 0.97 |
| Treatment 3 | 5.33 | Liked very much | 0.61 |
| Treatment 4 | 5.13 | Liked moderately | 0.82 |
| Treatment 5 | 5.57 | Liked very much | 0.63 |

Wilcoxon Signed Rank Test

Table 6 shows the pair-wise comparison of the different proportions revealed that no significant differences in the acceptability level in terms of appearance between treatment 1 and treatment 3, $z=2.065$, $p=0.039$; treatment 1 and treatment 4, $z=1.932$, $p=0.053$; treatment 2 and treatment 3, $z=0.577$, $p=0.564$; treatment 2 and treatment 4, $z=0.000$, $p=1.000$; treatment 2 and treatment 5, $z=1.208$, $p=0.227$; treatment 3 and treatment 4, $z=0.443$, $p=0.658$; treatment 3 and treatment 5, $z=1.475$,

$z=0.140$ and treatment 4 and treatment 5, $z=1409$, $p=0.159$. This means that treatment 1 and treatment 3, treatment 1 and treatment 4, treatment 2 and treatment 3, treatment 2 and treatment 4, treatment 2 and treatment 5, treatment 3 and treatment 3 and treatment 4, treatment 3 and treatment 5, and treatment 4 and treatment 5 have the same sensory acceptability level in terms of appearance.

A significant difference existed between treatment 1 and treatment 2, $z=2.668$, $p=0.008$ and treatment 1 and treatment 5 $z=2.815$, $p=0.05$. This means that treatment 1 and treatment 2, and treatment 1 and treatment 5 don't have the same sensory acceptability level in terms of appearance.

Table 6. Differences in the Sensory Acceptability Level of Ice Cream Enriched With Different Proportions of Mashed Squash in Terms of Appearance

| Compared Variables | Z | Sig |
|---------------------------|--------|-------|
| Treatment 1 - Treatment 2 | 2.668* | 0.008 |
| Treatment 1 - Treatment 3 | 2.065 | 0.039 |
| Treatment 1 - Treatment 4 | 1.932 | 0.053 |
| Treatment 1 - Treatment 5 | 2.815* | 0.005 |
| Treatment 2 - Treatment 3 | 0.577 | 0.564 |
| Treatment 2 - Treatment 4 | 0.000 | 1.000 |
| Treatment 2 - Treatment 5 | 1.208 | 0.227 |
| Treatment 3 - Treatment 4 | 0.443 | 0.658 |
| Treatment 3 - Treatment 5 | 1.475 | 0.140 |
| Treatment 4 - Treatment 5 | 1.409 | 0.159 |

* $p < 0.01$

Table 7 shows the pair-wise comparison of the different proportions revealed that no significant differences in the acceptability level between treatments. This means that treatment 1 and treatment 4, treatment 2 and treatment 3, treatment 2 and treatment 4, treatment 2 and treatment 5, treatment 3 and treatment 3 and treatment 4, treatment 3 and treatment 5, and treatment 4 and treatment 5 have the same sensory acceptability level in terms of aroma.

A significant difference existed between treatment 1 and treatment 2, $z=3.216$, $p=0.001$; treatment 1 and treatment 3, $z=2.888$, $p=0.004$ and treatment 1 and treatment 5 $z=2.617$, $p=0.009$. This means that treatment 1 and treatment 2, treatment 1 and treatment 3, and treatment 1 and treatment 5 are not the same in the sensory acceptability level in terms of aroma. This shows that there is greater acceptability level in terms of aroma for treatments with various proportions of mashed squash compared to the other one treatment

used as the control variable which contains no mashed squash.

Table 7. Differences in the Sensory Acceptability Level of Ice Cream Enriched With Different Proportions of Mashed Squash in Terms of Aroma

| Compared Variables | Z | Sig. |
|--------------------------|--------|-------|
| Treatment 1-Treatment2 | 3.216* | 0.001 |
| Treatment 1-Treatment3 | 2.888* | 0.004 |
| Treatment 1-Treatment4 | 2.091 | 0.037 |
| Treatment 1- Treatment5 | 2.617* | 0.009 |
| Treatment 2- Treatment3 | 0.176 | 0.860 |
| Treatment 2- Treatment4 | 1.177 | 0.239 |
| Treatment 2- Treatment5 | 0.121 | 0.904 |
| Treatment 3 -Treatment4 | 1.384 | 0.166 |
| Treatment 3 -Treatment5 | 0.065 | 0.948 |
| Treatment 4 - Treatment5 | 0.948 | 0.199 |

* $p < 0.01$

Table 8 shows the pair-wise comparison of the different proportions revealed that no significant differences in the acceptability level between treatments. This means all five treatments have the same sensory acceptability level in terms of their texture. The existence of the different proportions of mashed squash in four (4) other treatments did not cause any differences to the sensory level of acceptability in terms of texture.

Table 8. Differences in the Sensory Acceptability Level of Ice Cream Enriched With Different Proportions of Mashed Squash in Terms of Texture

| Compared Variables | Z | Sig |
|-----------------------|-------|-------|
| Treatment1-Treatment2 | 2.283 | 0.022 |
| Treatment1-Treatment3 | 0.936 | 0.349 |
| Treatment1-Treatment4 | 1.091 | 0.275 |
| Treatment1-Treatment5 | 2.276 | 0.023 |
| Treatment2-Treatment3 | 1.556 | 0.120 |
| Treatment2-Treatment4 | 0.577 | 0.564 |
| Treatment2-Treatment5 | 0.698 | 0.485 |
| Treatment3-Treatment4 | 1.027 | 0.305 |
| Treatment3-Treatment5 | 2.168 | 0.030 |
| Treatment4-Treatment5 | 1.552 | 0.128 |

Table 9 shows the pair-wise comparison of the different proportions revealed that no significant differences between treatments. This means that the treatments are the same in the sensory acceptability level in terms of taste. The presence of the different proportions of mashed squash in the treatments did not affect the level of their acceptability in terms of

taste. Furthermore, this simply shows that those treatments having different proportions of mashed squash and the other one treatment used as the control variable which contains no mashed squash were both liked by the respondents in terms of their taste.

Table 9. Differences in the Sensory Acceptability Level of Ice Cream Enriched With Different Proportions of Mashed Squash in Terms of Taste

| Compare Groups | Z | Sig. |
|-----------------------|--------|-------|
| Treatment1-Treatment2 | 3.082* | 0.002 |
| Treatment1-Treatment3 | 2.841* | 0.004 |
| Treatment1-Treatment4 | 1.513 | 0.130 |
| Treatment1-Treatment5 | 2.601* | 0.009 |
| Treatment2-Treatment3 | 0.728 | 0.467 |
| Treatment2-Treatment4 | 0.564 | 0.573 |
| Treatment2-Treatment5 | 0.649 | 0.516 |
| Treatment3-Treatment4 | 1.213 | 0.225 |
| Treatment3-Treatment5 | 0.269 | 0.788 |
| Treatment4-Treatment5 | 1.854 | 0.064 |

*p < 0.01

Table 10 shows the pair-wise comparison of the different proportions revealed that no significant differences between treatments. This means that all five treatments have the same sensory acceptability level in terms of general acceptability. The presence of the different proportions of mashed squash in the four (4) other treatments did not make any differences in general acceptability level of all five treatments. Thus, mashed squash ice cream is also acceptable just like with other existing ice cream flavors in the market today.

Table 10. Differences in the Sensory Acceptability Level of Ice Cream Enriched With Different Proportions of Mashed Squash in Terms of General Acceptability

| Compared Variables | Z | Sig |
|-----------------------|--------|-------|
| Treatment1-Treatment2 | 1.814 | 0.070 |
| Treatment1-Treatment3 | 1.693 | 0.090 |
| Treatment1-Treatment4 | 0.920 | 0.358 |
| Treatment1-Treatment5 | 2.621* | 0.009 |
| Treatment2-Treatment3 | 0.243 | 0.808 |
| Treatment2-Treatment4 | 0.513 | 0.608 |
| Treatment2-Treatment5 | 1.496 | 0.135 |
| Treatment3-Treatment4 | 1.355 | 0.175 |
| Treatment3-Treatment5 | 1.507 | 0.132 |
| Treatment4-Treatment5 | 3.127* | 0.002 |

*p < 0.01

CONCLUSIONS

On the basis of the findings, it can be concluded that the sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of appearance of treatments 1, 2, 3 and 4 were liked moderately while treatment 5 was liked very much. While the sensory acceptability level of its aroma of treatment 1, 2, 3 and 4 were liked moderately while treatment 5 was liked very much. The sensory acceptability level of its texture was liked moderately. Another one is the sensory acceptability level of its taste of treatment1 was liked moderately and treatments 2, 3, 4 and 5 were liked very much. The sensory acceptability level of ice cream enriched with different proportions of mashed squash in terms of its general acceptability of treatments 1 and 4 were liked moderately while treatments 2, 3 and 5 were liked very much, respectively.

There is a significant difference in the acceptability of mashed squash in making ice cream in terms of appearance, aroma and general acceptability. There is no significant difference in the acceptability of mashed squash in making ice cream in terms of texture and taste. Treatment E got the highest acceptability level in terms of appearance, aroma, texture, taste and general acceptability.

RECOMMENDATIONS

In making ice cream, it is important to consider the taste, texture, aroma, appearance and its nutritional benefits at the same time. It is recommended that the local ice cream makers will use mashed squash in making ice cream because it is acceptable and it contains high nutritional value. Farmers are encourage to plant more squash because aside from using it as vegetable it can be used also in developing new products like ice-cream, etc. While for educators and parents it is highly suggested to serve squash ice cream for children as an alternative nutritional ice cream and try to develop more recipes using squash as a main ingredient. It is recommended also that a study shall be conducted focusing on the nutritional value of squash ice cream.

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