Original Research Article

**Sensory Evaluation of Value Added Products of Cashew (*Anacardium occidentale* L.) apple**

.

**ABSTRACT**

|  |
| --- |
| **Aims:** The cashew apple is the fleshly part of the cashew fruit that is attached to the cashew nut. It is considered as a nutritional powerhouse but is often discarded during the processing of nut. Cashew, *Anacardium occidentale* L., belongs to the *Anacardiaceae* family. It is an evergreen tree native from northeast region of Brazil that expanded spontaneously in South American countries. This study aims at the sensory analysis of the value added product made by incorporating the extract of the cashew apple, since cashew apples are left unused, discarded as waste or feed animals.  **Study design:** Descriptive Experimental Design.  **Place and Duration of Study:** Department of Food and Nutrition, College of Community Science, Central Agricultural University, Tura, Meghalaya.  **Methodology:** 9 point hedonic rating scalewas used to check the acceptability of the products. Descriptive statistics and kruskal-wallis test were used to analyze the data  **Results:** There is a significant (*P*=0.05) difference in the samples in their appearance, texture, aroma and taste. The significant difference of the sensory attributes shows that there is a difference in their scores. Homogenity of the samples subset 1 and subset in both the product has no influence on each other. However, each subset samples are important to one another.  **Conclusion:** Sensory evaluation indicates that 10% of cashew apple powder added to the cookie was the most acceptable product where in cakes 15% of addition dehydrated cashew apple powder show the dominant result of acceptance comparing to the other samples. According to the experiment, it has been found out that the formulation of addition of cashew apple powder enhance acceptability product. |

*Keywords: Cashew apple, value addition, acceptability, sensory evaluation, mean scores, kruskal-wallis test*

**1. INTRODUCTION**

Food product development requires a measure whether certain product formulation is accepted by the consumer. Nine points hedonic is a part of rating scales developed for measuring degree of product in terms of like or dislike in sensory evaluation. It helps to understand and to control the important factor of consumer acceptance of the product [1]. Sensory techniques are mainly used in quality control, product development and research. It indicates the acceptance of the product and adds to the value to the assessment of the quality [2].

Cashew, *Anacardium occidentale* L., belongs to the *Anacardiaceae* family. It is an evergreen tree native from northeast region of Brazil that expanded spontaneously in South American countries. It is one of the major crops in India, Brazil, Nigeria and Vietnam [3]. In the 16th century, Portuguese traders introduced it to coastal India to stop the soil erosion. It is then dispersed out to the nearby region as wild tree and formed into extensive forests. India is one of the top list countries in production and cultivation of cashew. The major state includes Kerela, Karnataka, Goa, Maharastra, Tamil Nadu, Andra Pradesh, Orissa and West Bengal [4].

Cashew apples are elongated, round and pear-shaped fibrous fruit. It is about 5-10 cm long with a fleshy nature. The fully matured fruits are soft, full of moisture and turns into red or yellow fruit when they are ripe. It is a non-climacteric fruit that can be consumed raw as well as processed goods due to its fleshy pulp, and high sugar content [5]. Ripe cashew apple is juicy and spongy due to high moisture content. It has a unique flavor and odor. The tannin in cashew apple produce unpleasant and astringency in taste which limits the utilization of fruit [6]. The estimation of cashew apple being produced in yearly basis is about 30 million metric tons across the world and 20lakh tons in India [7].The cashew apples are under utilized in India despite of high nutrient content and therapeutic properties. Only 10 percent of the fruit is being consumed or processed and the rest is wasted as garbage in the fields of cashew cultivation area after the nut is separated from its peduncle swollen fruit [8].

Under Meghalaya, the major cultivation of cashew trees is grown mostly in the district of West Garo Hills and South Garo Hills. During 2009-10, West Garo Hills recorded a total production of 10468 MT with an average production of 2380 Kg per Ha while in South Garo Hills production was recorded as 3348 MT with a yield of 977 Kg per Ha [9].Despite being one of the regions for the cultivation of varieties of cashews in West Garo Hills district, lack of proper training, knowledge and skills results in the wastage of the pseudo fruit. It has been dumped or left like that to get rotten on the ground with no value addition.

**2. material and methods**

The proposed study was conducted in the Department of Food Science and Nutrition at the College of Community Science, Tura, West Garo Hills district, Meghalaya. The development of the products was done in Food Science and Nutrition laboratory and Food Analysis Lab was used for the biochemical analysis. For the development of the value added product, the process of dehydration of the cashew apple powder have been performed in order to acquired the most suitable powder. For the dehydration process, three different methods were used to acquire the most acceptable powder based on which the sensory analysis were performed to choose the most appropriate powder to be used in the development of the product for value addition. The products such as cashew apple cake and cashew apple cookie were developed from cashew apple powder. Cashew apple cake and cookie were formulated, one control of each product and replication of three each which was made with incorporation of cashew apple powder. After undergoing the different methods of dehydration process, the cashew apple powder was chose to incorporate in percentage of 5, 10 and 15 for the replications.

**2.1 Procurement of Ingredients**

The fresh cashew (*Anacardium Occidentale* L.) apples used for this research study were collected from Wakagre, Garobadha and Darengre, under the West Garo Hills district of Meghalaya state. The other ingredients which are used along with the cashew apples were being procured from the local market of Tura under the same district of Meghalaya state.

**2.2 Sample Preparation of the cashew apple powder**

In order to make the cashew apple powder, three different methods of dehydration process were used. Sorting and cleaning were done in all the three methods in the same way but the pretreatment process acquiring the powder form differs in its own way.

**Method I:** In this method of dehydration process, the cashew apples are sorted, washed with clean water. 1kg of cashew apple was soaked in 2 to 10 percent of salt solution for 5 days. On the sixth day it was washed and sliced. The apples are blanched for 30 minutes, then the excess water is removed and it is solar dried for 6 hours each day for a week. After solar dehydration it is powdered and sieved and stored for product development.

**Method II:** The cashew apples are washed and sorted out for the pretreatment for 3 days in 5 percent salt solution. Then they are further treated in KMS for 2days more. After two days, they are washed and sliced and are blanched for 20 minutes and solar dry for 3days. Further, it has been dried in convection oven for 8 hours at 150°C. The dried slices are then made into powder in blender and are sieved.

**Method III:** 1kg of fresh cashew apple is washed, soaked in 2 percent salt solution for 10 minutes. The process involves rinsing, surface dry and slicing of the apples. Then the samples are pressure cooked and sulphuring came into processing. Blending of cashew apples and straining of juice were done before solar drying for 3days. Once dried it is powder and sieved.

**2.3 Formulation of value added product**

This study was designed to assess the consumer acceptability of cashew apple powder in different products. The product which is prepared without the involvement of cashew apple powder is known as control. The replication were being made into three different percentage of incorporation of cashew apple powder. The standardization of cashew apple cake and cookie is represented in fig 1 and fig 2 respectively. Table 1 and table 2 draw the variety of percentage of incorporation of cashew apple in powder form at 5, 10 and 15 percent marking up to the total of 6 formulated aliquots.

Preheat the oven for 10 minutes at 180°C

Beat sugar and butter together till it is soft and fluffy

Beat the egg till it form foam and mix the mixture of butter and sugar with egg foam

Add the vanilla essence to the mixture

Sieve refined wheat flour and baking powder and mix all the ingredients together

Bake the cake batter in the preheated oven at 180°C

**Fig 1. Formulation of cashew apple cake.**

**Table 1: Ingredients used for the formulation of cake with different proportion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ingredients (g)** | **Control** | **5%powder** | **10%powder** | **15%powder** |
| Refine wheat flour  Cashew apple powder  Sugar | 100  -  50 | 95  5  50 | 90  10  50 | 85  15  50 |
| Egg  Baking powder | 3no.s  2.5 | 3no.s  2.5 | 3no.s  2.5 | 3no.s  2.5 |
| Vanilla essence | 2drops | 2drops | 2drops | 2drops |
| Butter | 100 | 100 | 100 | 100 |

Sieve the flour and leave aside

Mix the sugar and butter until fluffiness

Mixture of sugar and butter is mixed with flour and milk powder.

Knead the dough till it hold together

Keep the dough inside the refrigerator for 15 minutes

Roll out the dough and cut into shapes

Bake the cookie for 30 minutes at 150°C

**Fig. 2. Formuation of cashew apple cookie.**

**Table 2: Ingredients used for the formulation of cookie with different proportion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ingredients (g)** | **Control** | **5%powder** | **10%powder** | **15%powder** |
| Refine wheat flour  Cashew apple powder  Milk powder  Sugar | 100  -  5  50 | 95  5  5  50 | 90  10  5  50 | 85  15  5  50 |
| Butter | 80 | 80 | 80 | 80 |

**2.4 Sensory Analysis**

The value added product such as cashew apple cookie and cashew apple cake were evaluated to determine the consumer acceptance of the samples. The incorporation of cashew apple powder was taken by considering several trials done to achieve desirable product. The cashew apple powder was incorporated in cakes and cookies at 5, 10 and 15 percent. The samples were being assessed by twenty-five numbers of semi-trained panel members from Food Science and Nutrition Department, Community Science College, Tura. The panel members carried out the five major sensory attributes such as appearance, texture, taste, aroma and overall acceptability. Each sample was coded randomly. A nine-hedonic rating test was used to measure the acceptability of the product on a scale that consist of nine points ranging from nine that denotes like extremely and one referring to dislike extremely.

**2.5 Statistical Analysis**

The summarization of the sensory analysis data were analyzed by using Microsoft Office Excel 2007. The comparison of the data of the samples were depicted by Kruskal-Wallis test. The statistical significance is render at 0.05 level.

**3. results and discussion**

**3.1 Sensory Evaluation**

The organoleptic characteristics of the cashew fruit products were evaluated using hedonic rating scale of nine where the mean score is treated as the acceptability of the products. The presentation of the mean score for the acceptability of products are given in the table 3, 4 and 7.

**Sensory evaluation of the cashew apple powder**: In table 3, the sensory scores of the cashew apple powder is depicted. For the formulation of value added products, three different of processing of dehydration were used. An alternative way to increase the shelf life of fruits is dehydration where the fruit is dried and made into powder to improve storage life that leads to value addition of product. The standardization of the methods used for processing of powder to be incorporated in value added products is being selected by sensory mean scores given in table 3. Pre-treatments and drying conditions influence changes in the sensory attributes of the sample. According to table 3, appearance wise method III has the lowest approval rating by the panel members. Method II is satisfactory as compared to method III. Among the different methods of treatment, method I was the most acceptable processing of powder based on the sensory evaluation given in table 3.

**Sensory evaluation of the cashew apple cake:** Sensory characteristics of formulated products are important quality attributes to be considered. The mean scores of sensory attributes of cashew apple cake are summarized in table 4. The table 4 clearly shows that 15 percent of cashew apple incorporated in the cake is the most acceptable product. It shows that it is highly palatable according to the sensory evaluation where control product is the least palatable according to the overall acceptability. Appearance wise 10 per cent of cashew apple powder is the least acceptable where as aroma wise both the control and 5 per cent cashew apple powder are at the least according to the semi –trained panel members.

**Sensory evaluation of the cashew apple cooki**e: Sensory scores of cashew apple corporate cookie are depicted in table 7. Mean scores of the samples revealed that 10 per cent or 10g of cashew apple powder added reducing the content of refined wheat flour to 90g show the most acceptances in appearance, texture, taste, aroma and overall acceptability of the product. The least acceptance of the product in table 7 points at the 5g or 5 percent of the cashew apple powder addition in aroma, where 15 percent of cashew apple cookie shows the least acceptability as overall and in appearance in cookie due to its dark brown color appearance.

**Table 3. Sensory Evaluation of Cashew apple powder**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Appearance** | **Texture** | **Taste** | **Aroma** | **Overall Acceptability** |
| Method I  Method II  Method III | 8.6±0.34  8.3±0.66  8±0.32 | 8.8±0.35  8.2±0.33  7.7±0.3 | 7.9±0.31  7.6±0.3  7.3±0.29 | 9±0.36  8.4±0.33  8.2±0.33 | 8.6±0.7  8±0.32  8±0.32 |
|  |  |  |  |  |  |

**Table 4. Sensory Evaluation of Cashew apple cake**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Appearance** | **Texture** | **Taste** | **Aroma** | **Overall Acceptability** |
| Control  5% cashew apple powder  10% cashew apple powder  15% cashew apple powder | 8.2±0.33  8±0.32  7.9±0.3  8.4±0.33 | 8±0.33  8±0.12  8.1±0.32  8.6±0.34 | 8.4±0.33  8.2±0.33  8.2±0.33  8.6±0.34 | 7.9±0.29  7.9±0.32  8.2±0.32  8.6±0.35 | 8±0.32  8.1±0.32  8.3±0.34  8.6±0.34 |

**Table 5. KW Significance Test for cashew apple cake**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Median Ranks** | **KW Statistics** | **Significance** |
| Control  5% cashew apple powder  10% cashew apple powder  15% cashew apple powder | 8  8.2  8  8.5 | 66.534 | ˂0.05 |

**Table 6. Homogenity Test for cashew apple cake**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Subset** | |  | |  | |
| **Sample** |  | | **1** | | **2** | |
|  | | 5%  10%  Control  15% | | 216.936a  220.300ab  225.488abc | | 339.276d | |

**Table 7. Sensory Evaluation of Cashew apple cookie**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Appearance** | **Texture** | **Taste** | **Aroma** | **Overall Acceptability** |
| Control  5% cashew apple powder  10% cashew apple powder  15% cashew apple powder | 8±0.32  8±0.32  8.5±0.31  7.5±0.3 | 8.2±0.33  8.1±0.32  8.6±0.34  8.6±0.32 | 8±0.32  8.1±0.32  8.9±0.36  8.1±0.32 | 8.1±0.32  7.9±0.29  8.6±0.34  8.1±0.32 | 8±0.33  7.7±0.32  8.8±0.35  7.5±0.3 |

**Table 8. KW Significance Test for cashew apple cookie**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Median Ranks** | **KW Statistics** | **Significance** |
| Control  5% cashew apple powder  10% cashew apple powder  15% cashew apple powder | 8  8  8.8  8 | 138.268 | ˂0.05 |

**Table 9. Homogenity Test for cashew apple cookie**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Subset** | |  | |  | |
| **Sample** |  | | **1** | | **2** | |
|  | | 15%  5%  Control  10% | | 195.408a  213.184ba  216.100abc | | 377.308d | |

**3.2 Statistical Analysis**

The data analysis for the formulated cashew apple samples is given table 5, 6, 8 and 9. Table 5 and 8 represents the statistical analysis of the data from the formulate cashew apple cake and cookie acquired by using kruskal-wallis test respectively. Table 5 and 8 shows the significant (*P*=.05) difference in terms of appearance, color, texture and aroma. The significant difference of the sensory attributes shows that there is a difference in their scores. As shown in table 5, 10 percent addition of cashew apple powder has the highest median rank among the samples. Similarly in table 8 given for the cashew apple cookie, 10 per cent addition of cashew apple powder cookie has the highest median rank. The cashew apple general acceptability and self stability can be enhanced further by dehydration. It was shown that adding more cashew apple powder to formulations produce the highest outputs [10]. The sensory evaluation findings of different product development demonstrated the product’s high level of acceptability. However, addition of less than 10g of cashew apple powder did not result in any discernable changes [11]. Sponge cake and bread were successfully prepared from cashew apple powder which is an achievement of the utilization of the fruit for value addition with consumer acceptability [12]. The organoleptic scoring of cake prepared by 30g of maida and 20g of cashew apple powder gives the different taste and acceptance. The batter made by mixing condensed milk showed the maximum acceptability comparing to mixing of egg [13].

Samples denoted by one or more alphabetical letters are used to identify the product according to the number of samples. In every subset, all of the samples in that subset share a single alphabet signifying the resemblance to one another. As shown in table 6, the subset 1 (5%, 10% and control) and subset 2 (15%) had no bearing on one another when evaluating the homogeneity of the samples. However, each subset samples are important to one another. Also in table 9, when assessing the homogeneity of the samples subset 1 (control, 5% and 15%) and subset 2 (10%) has no influence on each other. According to the tests, out of all the samples in both the products, cashew apple cake and cookie in subset two is the most acceptable.

**4. Conclusion**

Sensory qualities were used to evaluate the formulated products of cashew apple powder samples. The result indicates that cashew apple cake with 15 percent of cashew apple powder incorporation and 10 percent of cashew apple cookie is the most desirable product. Among the cake, all the other samples such as control and 10 per cent have more or less acceptance. However, 5 percent cashew apple cookie shows comparatively good acceptance compared to other two samples and in the variety of cookie sample control, 5 and 15 percent are least desired. According to the experiment, it has been found out that the formulation of addition of cashew apple powder enhance the taste and quality of the products.

In general, cashew apples are not a popular fruit in Meghalaya. In cashew growing tracts, cashew apple processing can be profitable business where women self help group can successfully take up the enterprise and support the cause of women’s empowerment specially in a matrilineal society. Cashew apple is a high dense nutrient fruit. To make use of this nutrient-dense fruit, efforts should be made to analyzed the biochemical makeup, formulate and market food products that have high nutritional value. There are windows of opportunity to improve the public acceptability, consumption and to produce variety of products. These steps will go long way to address the underutilization of cashew apple in Meghalaya.

**References**

1. Sirangelo TM. (2019). Sensory descriptive evaluation of Food Products: A review. Journal of Food Science and Nutrition Research, 2(4):345-363. DOI: 10.26502/jfsnr.2642-11000034.
2. Carbonell-Barachinna AA. (2007). Application of sensory evaluation of food to quality control of food to quality control in Spanish food industry. Pol J. Food Nutr. Sci., 57(4A): 71-76.
3. Bhagirathi L and Asna U. (2018). Phytochemicals profile and antimicrobial activity of cashew apple (*Anacardium occidentale* L.) extract. GSC Biological. Pharma. Sci., **5**(3): 95-98.
4. Suganya P and Dharshini R. (2011).Value added products from cashew apple-an alternate nutritional source. Int. J. Cur. Res.*,***3**(7): 177-180.
5. Garruti DS, Franco MRB, da Silva MAAP, Janzantti NS, Alves GL. (2003). Evaluation of volatile flavour compounds from cashew apple (*Anacardium occidentale* L.) juice by the Osmo gas chromatography/ olfactometry technique.J. Sci. Food Agri., **83**:1455–1462.
6. Sobhana A. (2019). Cashew apple utilization-generating wealth from waste. Adv. Nutr. Food Sci., 4 (4): 1-5.
7. Mandal RC, Dhandar DG and Dhume CV. (1985). Cashew apple liquor industry in Goa. Acta Hort (ISHS)., **108**: 172-175. https//:doi.org/10.17660/ActaHortic.1985.108.32.
8. Jadhav JP. (2015). Fermentation of Cashew Apple (*Anacardium occidentale*) Juice into wine by different Saccharomyces Cerevisiae strains: A comparative study. Indian J. Res., **4**(3): 6-10
9. Institute of Livelihood Research and Training (ILRT). (2014) Sun sector study of cashew nut in Meghalaya. Meghalaya Basin Development Authority.
10. Kusashalya WKDN and Weerasooriya MKB. (2017). Development of value added product from cashew apple using dehydration processes. Indian Journal of Scientific and Industrial Research, 76: 105-109.
11. Falade KO, Akinwale TO and Adedokun OO. (2003). Effect of drying methods on osmotically dehydrated cashew apples. Eur Food Res Technol, 216:500-504. DOI 10.1007/s00217-003-0673-8.
12. Babu Ray RM, Vijayalakshmi D and Jamuna KV. (2006). Formulation and utilization of cashew apple powder in selected foods. Karnataka J. Agric. Sci., 19(2):455-457.
13. Sobhana A, Mathew J, Raghavan CM and Appukutan AA. (2015). Development of value added products from cashew apple powder. International Journal of Tropical Agriculture., 33 (2): 1635-1639.