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# Formulation and Standardization of Different Milk Ice-Cream Fortified with Pink Guava Pulp

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## ABSTRACT

Ice-cream is one of the most important pleasant and charming frozen dessert foods to most the people of India. So, the present study was carried out on physico-chemical, nutritional quality and sensory evaluation of different milk Ice-cream fortified with guava pulp. Guava is rich source of ascorbic acid. According to the aim, the study was divided in to 3 phases. First phase deals with the collection of different types of milk, guava and preparation of ice-cream. Second phase deals with the physico-chemical analysis of different milk and nutritional analysis of pink guava pulp. Third phase deals with development of ice-cream with different milk and fortified with guava pulp and physico-chemical, nutritional and sensory evaluation of ice-cream. Total five control, A, B, C, D ice-cream were prepared with buffalo milk, cow milk, cow milk and guava pulp, coconut milk and guava pulp. Physico-chemical parameter like pH, ash, titrable acidity, total solid, moisture and nutritional parameter like fat, protein, asorbic acid, iron, calcium, carbohydrates and energy were assessed in all ice-cream sample prepared by different milk with guava pulp. So, it can be concluded that the product (ice-cream) prepared using sample B; cow milk and guava pulp and sample C; coconut milk and guava pulp was contained higher nutrient followed by buffalo milk. Sample B contained higher amount of ascorbic acid content 196.28 mg % and titrable acidity content 1.53%, energy 172.31 kcal, total solid 65.8 g %, moisture 62.6 g %, Fat 5.16 g %, protein 3.33 g %, iron 0.9 mg %, calcium 132.82 mg %, CHO 28.11 g % and pH value 6.78. And sample C contained higher amount of energy 215.48 kcal, total solid 73.7 g %, fat 10.83 g %, iron 1.57 mg %, ascorbic acid 185.17 mg %, calcium 65.17 mg %, CHO 26.08 g %, protein 3.41 g %, moisture 61.84 g % and pH value is 6.98. Regarding sensory point of view, sample B mixture of cow milk and guava pulp ice-cream obtain higher score followed by other sample.

**Key words:** Ice-cream, formulation, different milk, fortified, pink guava pulp

## INTRODUCTION

Ice-cream is normally defined as a frozen mixture of milk components, sweeteners, stabilizers, flavorings and other ingredients. Wangcharoen (2012), ice cream is a very popular frozen confectionary dairy product consumed in India and other countries as well. Ice cream industries have developed a variety of ice cream, which can mitigate some of the health concerns. The changes of texture and flavor profile of such ice cream can provide the satisfaction to the consumers (Nande, 2013a).

The nutrient component of the ice cream depends on the type of ice cream as well as the ingredients that are used in the manufacture of ice-cream. On an average, the ice cream contains three times more fat and slightly more protein than that is present in milk. It is a rich source of calcium, phosphorous and other minerals important for bodybuilding (www.organicfacts.net/nutrition-facts/animal-products).

In most coconut producing countries, the current capacity for local production of cow's milk is very small and the majority of cow milk and other dairy products are manufactured from imported milk. Over the years, the importation of extremely large quantities of milk to satisfy the consumer demands for milk and other dairy products has been the source of genuine concern for the governments, processors and consumers alike because the imported milk is expensive and it drains large sums of foreign exchange reserves. It is therefore regarded as urgent and timely to develop dairy-type products from less expensive alternative sources of indigenous raw materials, such as coconuts, to compliment the locally produced milk and to develop new dairy foods with minimum use of the imported dairy ingredients (Sringam, 1993).

Buffalo milk is white, non-transparent liquid produced by the mammary animal, buffalo. It is a healthy and nutritious daily drink and can be consumed by people of all ages. It is rich in a variety of minerals and vitamins and therefore, has nutritional value. Buffalo milk is extremely rich in calcium. It also has a good amount of magnesium, potassium and phosphorus. It also contains iron, sodium, zinc, copper and manganese in small amounts. Buffalo milk is a rich source of Riboflavin and vitamin B12. Vitamin A, vitamin C and thiamin are also found in significant amounts. Small amounts of folate, pantothenic acid, vitamin B6 and niacin are also found in buffalo milk. Buffalo milk is good for healthy bones, dental health, cardiovascular health and weight gain (www.organicfacts.net/nutritionfacts/animal-products). Cow milk is beneficial for healthy bones, dental health, obesity reduction in children, protection from thyroid and protection of the heart. Coconut milk is an excellent source of medium chain fatty acids and possesses many health promoting properties. Medium chain fatty acids can be digested rapidly for use as energy and improve the absorption of other nutrients such as minerals, vitamins and amino acids (Nande, 2013b).

Guava pink guajava (*Psidium guajava* L.) has excellent digestive and nutritive value, pleasant flavor, high palatability and availability in abundance at moderate price. It is a rich source of certain minerals like calcium, phosphorus and iron which are necessary for human health. Guava (*Psidium guajava*), a vitamin C enrich fruit plant is grown abundantly, throughout western Nigeria. It is an important fruit in many parts of the world, where the climate is suitable for its production. Guava is one market price are falling and cause a great threat to of the leading fruits of Mexico. The guava fruits contain moisture (85%), proteins (7%) and carbohydrate (11%). Guava fruits are processed into guava paste and guava cheese, which are staple sweets and guava jelly, which is almost universally marketed. It is made into fruit leather and syrup for use on waffles, ice cream, puddings and in milk shakes. Guava juice and nectar are among the numerous popular canned or bottled fruit beverages of the Caribbean area (Amusa *et al*., 2005).

During each season, the guava tree bears numerous round, ovoid or pear-shaped fruits that are about 5-10 cm long and weigh around 50-200 g. Different cultivar types of guava grown all over the world, which vary widely in flavor, pulp color and seeds. The fruit is soft, when ripe with sweet musky aroma and creamy in texture. Internally, its flesh varies in color depending up on the cultivar and may be white, pink, yellow or red. Ripe fruits have rich flavor with sweet-tart taste. Each fruit contains numerous tiny, semi-hard edible seeds, concentrated especially, at its center (www.nutritionandyou.com).

Ice-cream can be prepared using buffalo milk, cow milk and coconut milk. The quality of ice-cream is determined by its raw materials, composition, body and texture, flavoring and coloring, processing. Addition of fruits bring more nutrients, flavour and taste to ice creams (Nande, 2013a). Fruits like guava can be added to enhance beta carotene content of ice cream. Guava can be added in the form of pulp. Therefore, the present study has been contemplated to formulate and evaluate sensory quality of ice creams using, buffalo milk, cow milk, coconut milk and guava pulp.

## MATERIALS AND METHODS

**Materials:** The raw material, such as; buffalo milk, cow milk, coconut milk, guava fruit, sugar, CMC, GMS powder, corn flour, cream, essence were purchased from local market sojitra Gujarat India.

**Preparation of coconut milk:** Fresh matured coconuts were purchased from the open market in Sojitra, Gujarat. The dehusked nuts were cracked open into halves. The split nuts were de-shelled to separate the coconut "meat" (kernel). Coconut meat of 300 g was washed and comminuted using an electric blender with 250 mL of water. This was then pressed through a linen cloth and strained to obtain coconut milk.

**Preparation of guava pulp:** The selected fruits are washed with clean water to remove dirt then made in to medium size pieces and blanched for 5 min, then sieve the fine pulp.

Ice-cream making process below Fig. 1.

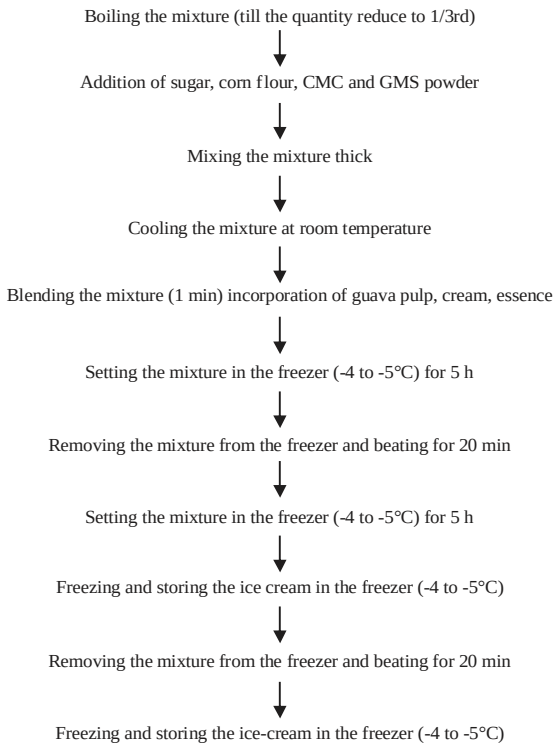


Fig. 1: Flow chart of ice cream making process

Table 1: Composition of standard ice cream and their variants

| Ingredients | Control | A | B | C | D |
|---|---|---|---|---|---|
| Buffalo milk (mL) | 100 | - | - | - | - |
| Cow milk (mL) | - | 100 | 100 | - | 50 |
| Coconut milk (mL) | - | - | - | 100 | 50 |
| Guava pulp (g) | - | - | 50 | 50 | 50 |
| Sugar (g) | 20 | 20 | 20 | 20 | 20 |
| GMS (g) | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| CMC (g) | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Corn flour (g) | 2 | 2 | 2 | 2 | 2 |
| Cream (g) | 25 | 25 | 25 | 25 | 25 |
| Vanilla essence | 2-3 drops | 2-3 drops | - | - | - |

CMC: Carboxymethylcellulose, GMS: Glycerol monostearate

Composition of standard ice cream and their variants using buffalo milk, cow milk, coconut milk and guava pulp is tabulated as below Table 1.

**Physico-chemical analysis:** The ice-cream sample Control, A, B, C, D were analyzed for their different physico-chemical properties. pH was measured by electronic pH meter. Directly used M. Tronic digital-225 pH meter. Ash, total solid, moisture, titrable acidity content of the sample was determined according to AOAC. (1984, 1990, 2000).

**Nutritional analysis:** The ice sample control, A, B, C, D were analyzed for their different nutritional properties. Fat were estimated by Garber Method (routine) or by gravimetric method (reference method). Protein estimation is done by the Kjeldhal method (Bradstreet, 1965). Ascorbic acid was determine by volumetric of Harris and Ray (1935), iron was estimated by the Bipyridyl method. Calcium was estimated by the titrametric method of Clark and Collip (1925). The CHO was estimated by BIS (1997) method. Energy content was calculated for Ice-cream by factorial method of AOAC (1995) on dry using formula.

**Sensory analysis:** Sensory evaluation of control and experimental ice-cream was done in three palatability trials by 15 trained judges for taste, colour, flavor, mouth feel, appearance, consistency and over all acceptability. Scoring was done for maximum score 20 to a minimum score of 10 for all the seven attributes. Composite score card using for sensory evaluation (Fig. 2).

**Statistical analysis:** All result were expressed as Mean±SD. All statistical analysis were perform using single factor one, way analysis of variance (ANOVA) (M.S. office, Excel). The significant is separated by $^{**}p \leq 0.001$ and $^{*}p \leq 0.05$ level.

## RESULTS AND DISCUSSION

Proximate composition of buffalo milk, cow milk and coconut milk is tabulated as below Table 2.

The pH content of buffalo milk, cow milk and coconut milk were 7.49, 6.8 and 7.67, respectively. The pH content of cow milk was found to be slightly lower than buffalo milk, as that of coconut milk was slightly higher than buffalo milk.

The titrable acidity content of buffalo milk, cow milk and coconut milk were 1.66, 1.8 and 0.4%, respectively. The titrable acidity of cow milk was found to be slightly higher than buffalo milk were as that of coconut milk was slightly lower than buffalo milk.

The total solid content of buffalo milk, cow milk and coconut milk were 82.46, 86.45 and 86.48 g %, respectively. The total solid of buffalo milk was found to be slightly lower then cow milk were as coconut milk was slightly higher than cow milk.


Fig. 2(a-e): (a) Control; Buffalo milk ice cream (100% BM), (b) Cow milk ice cream (100% CM), (c) Cow milk+guava pulp ice cream (100% CM+50% pulp), (d) Coconut milk+guava pulp ice cream (100% CM+50% pulp) and (e) Coconut milk+cow milk+guava pulp ice cream (50% CM+50% CM+50% pulp)

Table 2: Proximate composition of buffalo milk, cow milk and coconut milk

| Samples | pH | Titrable acidity (%) | Total solid (g %) | Moisture (g %) | Fat (g %) |
|---|---|---|---|---|---|
| Buffalo milk | 7.49±0.06$^{a}$ | 1.66±0.11$^{a}$ | 82.46±1.28$^{a}$ | 75.44±8.73$^{a}$ | 8.46±0.05$^{a}$ |
| Cow milk | 6.80±0.01$^{b}$** | 1.80±0$^{b}$** | 86.45±2.71$^{bNS}$ | 78.41±11.27$^{b}$* | 5.56±0.87$^{b}$** |
| Coconut milk | 7.67±0.21$^{c}$** | 0.40±6.8E-17$^{c}$** | 86.48±10.43$^{cNS}$ | 94.98±2.17$^{c}$* | 3.96±0.05$^{c}$** |

NS: Non significant, values sharing a common superscript are different from each other, Significant difference at *p≤0.05, **p≤0.001

Table 3: Proximate composition of guava pulp

| Parameters | Guava pulp |
|---|---|
| Ash (g %) | 1.00±1.00 |
| Iron (mg %) | 0.37±0.61 |
| Ascorbic acid (mg %) | 629.62±61.1 |

The moisture content of buffalo milk, cow milk and coconut milk were 75.44, 78.41 and 94.98 g %, respectively. The moisture of buffalo milk was found to be slightly lower than cow milk were as coconut milk was slightly higher than cow milk.

The fat content of buffalo milk, cow milk and coconut milk were 8.46, 5.56 and 3.96 g %, respectively. The fat of coconut milk was found to be slightly lower than cow milk were as buffalo milk slightly higher than cow milk.

The composition of fresh guava pulp ash, iron and vitamin c recorded in Table 3.

The results reveals that the total ash content of pink guava pulp 1.00 g %. The iron content of pink guava pulp 0.37 mg %. The ascorbic acid content of pink guava pulp 629.62 mg %.

Table 4: Sensory evaluation

| Attributes | Control | A | B | C | D |
|---|---|---|---|---|---|
| Taste | 15.73±2.86$^{a}$ | 14.46±3.88$^{bNS}$ | 16.20±2.80$^{cNS}$ | 14.46±3.37$^{dNS}$ | 13.80±3.60$^{eNS}$ |
| Color | 15.46±3.94$^{a}$ | 15.00±3.38$^{bNS}$ | 17.20±2.21$^{cNS}$ | 14.06±2.89$^{dNS}$ | 14.06±2.71$^{eNS}$ |
| Flavor | 15.80±2.83$^{a}$ | 14.33±3.41$^{bNS}$ | 17.13±2.19$^{cNS}$ | 15.00±2.20$^{dNS}$ | 14.13±3.46$^{eNS}$ |
| Mouth feel | 7.46±1.59$^{a}$ | 6.46±1.80$^{bNS}$ | 7.60±2.02$^{cNS}$ | 6.86±1.12$^{dNS}$ | 6.40±1.54$^{eNS}$ |
| Appearance | 7.66±1.44$^{a}$ | 6.60±1.68$^{b}$* | 7.93±1.48$^{c}$* | 6.93±1.22$^{d}$* | 6.53±1.45$^{e*}$ |
| Consistency | 7.06±1.48$^{a}$ | 6.26±1.62$^{bNS}$ | 7.60±1.40$^{cNS}$ | 7.00±1.25$^{dNS}$ | 6.80±1.32$^{eNS}$ |
| Overall acceptability | 7.6±1.84$^{a}$ | 6.53±1.30$^{b}$** | 8.40±1.45$^{c}$** | 6.93±1.27d** | 6.60±1.35$^{e**}$ |

NS: Non significant, values sharing a common superscript are different from each other, Significant difference at *p≤0.05, **p≤0.001

Table 5: Physico-chemical analysis results of ice-cream sample

| Sample | pH | Titrable acidity (%) | Total solid (g %) | Moisture (g %) | Fat (g %) |
|---|---|---|---|---|---|
| C | 7.30±0.01$^{a}$ | 0.93±0.11$^{a}$ | 72.26±1.94$^{a}$ | 64.00±1.37$^{a}$ | 6.66±0.28$^{a}$ |
| A | 6.80±0.05$^{bNS}$ | 1.40±2.72$^{b}$** | 69.04±2.94$^{b}$* | 58.80±2.28$^{b}$* | 7.50±0$^{b}$** |
| B | 6.78±0.26$^{cNS}$ | 1.53±0.11$^{c}$** | 65.80±0.23$^{c}$* | 62.60±0.65$^{c}$* | 5.16±0.28$^{c}$** |
| C | 6.98±0.15$^{dNS}$ | 0.40±6.86$^{d}$** | 73.70±0.51$^{d}$* | 61.84±4.69$^{d}$* | 10.83±0.28$^{d}$** |
| D | 6.80±0.04$^{eNS}$ | 1.00±0$^{e}$** | 61.60±8.51$^{e}$* | 68.04±74.6$^{e}$* | 7.16±0.28$^{e}$** |

Mean value of four observation±SD, NS: Non significant, values sharing a common superscript are different from each other, Significant difference at *p≤0.05, **p≤0.001

Fat content of soymilk was 3.20/100 g, which was slightly lower than the standard cow's milk that contain 4.10/100 g fat and watermelon seed milk contain 8.50/100 g fat which was higher than the standard cow's milk fat content. Since soybean seed contain 13-25% oil, while watermelon seeds contain fatty acids among palmitic, stearic, oleic, linoleic together constituted more than 80% of the fatty acid content of oil (Bisla *et al*., 2012).

**Sensory analysis guava pulp of ice-cream:** Sensory analysis results show (Table 4) that the mean scores of the 100% cow milk (A) ice-cream made by cow milk was found slightly varied at all attributes like taste, color, flavor, mouth feel, appearance, consistency and overall acceptability as compared to 100% buffalo milk (control) ice-cream.

The result of ice-cream (B) made by 100% cow milk with guava pulp was slightly liked very much in attributes like taste, color, flavor and overall acceptability. Where as in mouth feel, appearance and consistency attributes is was liked moderately as compared to control.

The result of ice-cream (C) made by 100% coconut milk and 50 g guava pulp was slightly liked in attributes in mouth feel, appearance, consistency and over all acceptability. Where as in taste, color and flavor attributes was liked very much as compared to control.

The result of ice-cream (D) made by 50% cow milk, 50% coconut milk and 50 g guava pulp was slightly liked in mouth feel, appearance, consistency and overall acceptability. Where as in taste, color and flavor attributes is was liked moderately as compared to control.

Therefore, it can be seen from the result of the mean scores of the sensory evaluation that ice-cream (B) made from 100% cow milk and 50 g guava pulp is the most acceptable ice-cream got highest score among the all sample and liked extremely by the semi trained panel members on composite score card.

The sensory evaluation of ice cream made from 50% soy milk and 50% watermelon seeds milk with 50 g guava pulp is the most acceptable ice cream got highest score (Bisla *et al*., 2012).

Physico-chemical analysis results of ice-cream sample is tabulated, as below in Table 5.

The pH value of control ice-cream was found 7.3, which was higher than A, B, C, D that contain pH 6.80, 6.78, 6.98 and 6.80, respectively. There was a highly significant difference in control and experimental ice-cream.

Table 6: Nutritional analysis of ice-cream sample

| Sample | Protein (g %) | Ascorbic acid (mg %) | Iron (mg %) | Calcium (mg %) | CHO (g %) | Energy (kcal) |
|---|---|---|---|---|---|---|
| C | 3.52±0.04$^{a}$ | 144.44±19.24$^{a}$ | 1.42±0.12$^{a}$ | 144.92±24.82$^{a}$ | 25.33±1.66$^{a}$ | 175.42±4.13$^{a}$ |
| A | 3.79±0.04$^{b}$** | 137.03±6.41$^{b}$** | 0.97±0.12$^{b}$** | 160.32±4.76$^{b}$** | 29.42±2.48$^{b}$** | 199.91±9.28$^{b}$** |
| B | 3.33±0.04$^{c}$** | 196.28±6.41$^{c}$** | 0.90±0.00$^{c}$** | 132.82±8.25$^{c}$** | 28.11±0.76$^{c}$** | 172.31±2.92$^{c}$** |
| C | 3.41±0.03$^{d}$** | 185.17±6.41$^{d}$** | 1.57±0.00$^{d}$** | 65.17±13.09$^{d}$** | 26.08±0.18$^{d}$** | 215.48±1.96$^{d}$** |
| D | 3.73±0.02$^{e}$** | 181.47±12.82$^{e}$** | 0.82±0.13$^{e}$** | 83.32±8.25$^{e}$** | 20.53±0.85$^{E}$** | 161.55±2.32$^{e}$** |

Mean value of four Observation±SD, values sharing a common superscript are different from each other with a column, *p≤0.05, S: Significant difference, **p≤0.001, HS: Highly significant difference, p>0.05, NS: Non significant

The acidity content of sample B ice-cream was found 1.53%, which was higher than control, A, C, D that contain 0.93, 1.4, 0.4 and 1%, respectively. There was a highly significant difference in control and experimental ice-cream.

The total solid content of sample C ice-cream was found 73.7 g %, which was higher than control, A, B, D that contain 72.26, 69.4, 65.8 and 61.84 g %, respectively. There was a non significant difference in control and experimental ice-cream.

The moisture content of sample D ice cream was found 110.92 g %, which was higher than control, A, B, C that contain 64.0, 58.8, 62.6 and 61.84 g %, respectively. There was a non significant difference in control and experimental ice-cream.

The fat content of sample C ice-cream was found 10.83 g %, which was higher than control, A, B, D that contain 6.66, 7.5, 5.16 and 7.16 g %, respectively. There was highly significant difference in control and experimental ice-cream.

The result of pH 6.56, acidity 0.15%, moisture 60.42 g % and fat 4.53% in pitaya fruit incorporated ice cream (Mufas and Perera, 2013).

Nutritional analysis results of ice-cream sample is tabulated as below Table 6.

The protein content of sample A ice-cream was found 3.79 g %, which was higher than control, B, C, D that contain 3.52, 3.33, 3.41 and 3.73 g %, respectively. There was highly significant difference in control and experimental ice-cream.

The ascorbic acid content of sample B ice-cream was found 196.28 mg %, which was higher than control, A, C, D that contain 144.44, 137.03, 185.17 and 181.74 mg %, respectively. There was a highly significant difference in control and experimental ice-cream. The content of vitamin-C in fresh guava 228 mg/100 g (Chandrika *et al*., 2009).

The iron content of sample C ice-cream was found 1.57 mg %, which was higher than control, A, B, D that contain 1.42, 0.97, 0.9 and 0.82 mg %, respectively. There was a highly significant difference in control and experimental ice-cream.

The calcium content of sample B ice-cream was found 160.32 mg %, which was higher than control, A, C, D that contain 144.92, 132.82, 65.17 and 83.32 mg %, respectively. There was a highly significant difference in control and experimental ice-cream.

The CHO content of sample A ice-cream was found 29.42 g %, which was higher than control, B, C, D that contain 25.33, 28.11, 26.08 and 20.53 g %, respectively. There was a highly significant difference in control and experimental ice-cream.

The energy value of sample C ice-cream was found 215.48 kcal, which was higher than control, A, B, D that contain 175.42, 199.91, 172.31 and 161.55 kcal, respectively. There was a highly significant difference in control and experimental ice-cream.

The result of protein 11.12 g %, iron 1.56 mg %, vitamin-C 89.92 mg % content in 50% soy milk and 50% watermelon seeds milk with 50 g guava pulp ice cream (Bisla *et al*., 2012).

The result of CHO 30.93 and 31.46 g % and energy 153.35 and 156.29 kcal in reduced fat milk based ice cream enriched with selected herb centella+green tea and gac fruit (Limsuwan *et al*., 2014).

## CONCLUSION

The proximate composition of regarding milk quality buffalo milk was contained higher amount of titrable acidity and fat. Compared to cow milk and coconut milk. Cow milk was contained slightly lower amount of pH, titrable acidity as compared to buffalo milk and coconut milk. Coconut milk was contained higher amount of pH, total solid, moisture. As compared to buffalo milk and cow milk. Guava pulp was contained higher amount of ascorbic acid. And slightly lower iron and ash content. Five variants of nutritious ice-creams were prepared from buffalo milk, cow milk, coconut milk and guava pulp. A new variety of ice-cream particularly with sweet sensation and appetizing flavor notes can be manufactured by utilizing as such ratio of guava pulp. It is felt that use of different milk and guava pulp may result in product, which has better acceptance. So, on the above summarization it can be concluded that the product (ice-cream) prepared using cow milk and guava pulp was content higher nutrition followed by buffalo milk and coconut milk. Regarding sensory point of view mixture of sample B like cow milk and guava pulp ice-cream obtained higher score followed by other sample. Nutrient analysis of most acceptable ice-cream sample C indicated that total solid, fat content were found to be excellent as compare to control ice-cream and iron and energy were also found to be high. After summarization of the present study it can be concluded that nutrition present in prepared different product using different milk and guava pulp was significantly different with each other.

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