

# Development of Ice-cream from Soybean and Muskmelon Seed Milk with Incorporation of Kiwi and Strawberry and Evaluation of Their Acceptability and Nourishing Potentials

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**Abstract**—Nutraceuticals are "naturally derived bioactive compounds that are found in foods, dietary supplements and herbal products, and have health promoting, disease preventing and medicinal properties." Soybean and muskmelon seeds are rich source of protein as well as minerals mainly of iron in spite of their nutritional qualities, not consumed by a large number of people. Kiwi and Strawberries fruits contain disease-fighting phenol compounds like flavonoids and anthocyanins. The objective of the present study was to prepare nutritionally enhanced ice-creams by the incorporation of soy milk, muskmelon seeds milk with kiwi and strawberry pulp and evaluation of their acceptability and nourishing potential. Total ten different types of ice creams (five with kiwi pulp and five with strawberry pulp) were prepared from soymilk, watermelon seed's milk as whole and their blends with or without addition of kiwi and strawberry pulp. At 9 point hedonic scale products were evaluated for their appearance, flavor, mouth feel and overall acceptability in which most of the ice creams were liked moderately to very much and two ice creams from each were most acceptable i.e. blended milk (50% soymilk and 50% muskmelon seed milk) ice-cream with kiwi pulp and strawberry pulp. The nutritional analysis of most acceptable ice creams indicated that protein and fat value was found to be excellent and iron as well as vitamin C content was also found in good amount in comparison to standard cow's milk ice-cream. Thus these two ice creams would be highly nutritious and acceptable by the population.

**Keyword:** Nutraceuticals, icecreams, muskmelon seed milk, soy seed milk, kiwi, strawberry, nutritional quality

## 1. INTRODUCTION

Nutraceutical, a portmanteau of the words "nutrition" and "pharmaceutical", is a food or food product that reportedly provides health and medical benefits, including the prevention and treatment of diseases. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic diseases [1]. Nutraceuticals is expected to play a central role in preventative healthcare. The logic seems simple: an ageing population gives rise to lifestyle-related

diseases, whose impact can be lessened by making healthier choices earlier in life. This leads to a sharper focus on measures, such as a health-promoting diet, to prevent people from ever getting ill [2]. While some of the nutraceuticals serve essentially as therapeutics on patients of specific diseases, bulk of them are useful as health giving food supplements for general population [3].

Ice cream is a delicious and nutritious frozen dairy dessert [4]. Ice cream is a frozen dairy product made by freezing a mix with agitation to incorporate air and ensure uniformity of consistency [5]. The composition of ice cream varies depending upon the ingredients used in its preparation. The percentage composition of a good ice cream is milk fat 12 %; milk solids-not-fat; sugar 15%; stabilizer 0.2%; emulsifier 6.2% [6]. It is an important supplement to the normal diet, especially for children and other age groups. But it is treated as a junk food and deleterious for heart patients due to high calories and cholesterol [7]. Ice cream could be made more nutritious and health beneficial by adding fruits and other protein rich ingredients. For this purpose bovine milk in traditional ice creams could be replaced with other milks such as soy milk, muskmelon seeds milk and antioxidant rich kiwi and strawberries.

Soy milk is nutritious and is considered not only is a good source of vitamin and minerals but also as a cost effective source of energy and protein, it also has a great potential to solve the problem of protein energy malnutrition in India and many other developing countries [8]. WHO (1996) has recommended soy milk as a supplement of bovine milk. Its protein and oil contents are not only adequate but also rated as best in quality too. Soy milk does not contain cholesterol and has been successfully utilized for the preparation of indigenous sweets [9]. Soy based diets are becoming popular due to nutraceutical benefits that suit to lactose intolerant, hypercholesterolemic, diabetic, anemic people and lactating

mothers or postmenopausal women also [10] and could be adopted as a substitute for milk in the parts of the world where milk production is low and dairy products prices are exorbitant [11].

On the other hand, Melon seeds (*Cucurbitis melo*), another valuable non conventional food stuff contains 50% fat, 28% protein, 2-7% fibre, 3.6% ash and 8.2% carbohydrate [12]. Muskmelon seeds have long chain fatty acids among these palmitic acid, stearic acid, oleic acid, linoleic acid together constitute more than 80% of fatty acid content of oil [13]. The seeds are also rich in arginine, tryptophan, methionine, vitamins B1, B2 and minerals such as calcium, magnesium, potassium, iron, zinc, sulphur and phosphorous [14]. The seeds are a rich source of enzymes, particularly urease and are considered as a diuretic and beneficial in chronic or acute eczema [15]. These two seeds milk can be used to prepare ice-creams by incorporating them in different ratio.

Kiwi fruit is refreshing, delicate flavor with pleasing aroma and high nutritive value. It is mostly eaten as fresh or combined with other fruits in desserts and salads. Kiwi is a good source of vitamin C, vitamin K, vitamin E and rich in dietary fibre. The fruit and skin contain flavonoids, actinidain and adhered pollen. High vitamin C content is helps in boosting the immune system. It contains unique combination of antioxidants these helps to protect the all DNA from oxidative damage. On the other hand, Strawberries are an excellent source of vitamin C, vitamin K and phytochemicals that have been shown to be bioactive as well as providing a good dose of fibre, folic acid, manganese and potassium. They also contain a significant amount of phytonutrients and flavonoids. The fibre and fructose content in strawberries may help in regulating blood sugar levels by slowing digestion. Strawberries have been demonstrated as anticancer activity, blocking initiation of carcinogens, suppressing progression and proliferation of tumors [16].

Thus the challenge was to develop delicious, more nutritious and acceptable ice-creams from soy bean seed milk, muskmelon seed milk and also with the addition of kiwi and strawberries pulp with following objectives.

1. To prepare the soybean and muskmelon seed milk and to evaluate their proximate composition
2. To develop nutritionally enhanced ice creams by the incorporation of soybean seed milk, muskmelon seed milk, kiwi pulp and strawberry pulp
3. To evaluate the acceptability of the prepared ice creams through sensory evaluation methods
4. To conduct nutritional evaluation of the prepared ice creams

## 2. MATERIALS AND METHODS

### Procurement of seeds

Soybean seeds and muskmelon seeds used in the study were procured from Krishi Vigyan Kendra (K.V.K), Banasthali university and a retail shop of Jaipur City, Rajasthan respectively. While other materials were procured from market of Banasthali University.

### Development and Standardization of Milk

Soybean and muskmelon seed milk was prepared according to the procedure described by Chakrabarti and Gangopadhyay [17]. Preparation process involved the cleaning and dehulling of seeds. For preparation of seed's milk, seeds (100gm) were soaked in water containing 1% sodium hydroxide over night at a room temperature in the ratio of 1:4(w/v). After soaking husks were removed by rubbing with hands. Then soaked seeds were blanched for 15 minutes in boiling water. Seeds were taken out and remaining water was drained out. After that 400ml of water was added of seeds and blended in a grinder. The resulting suspension was then filtered through a double layer muslin cloth. At last cane sugar at 6% (w/v) was added in seed milk and boiled for 5 minutes with constant stirring.

### Nutrient analysis

Nutrient analysis was done for bovine milk, developed milk (soymilk and muskmelon seeds milk) and the most acceptable ice creams by sensory evaluation using standard methods of AOAC [22]. Moisture content was determined by drying of sample in an oven at 100° C for 24 h and is expressed in percentage basis. Crude protein was determined by estimating nitrogen content using 6.25 as the conversion factor by KELPLUS Pelican Equipment. Fat and ash contents were determined by Gerber method and dry ashing methods, respectively. Iron was estimated by Wong's method as given by Ranganna [19] and vitamin C by titrametric estimation following the AOAC methods [18].

### Food Product Development

Ten variant of ice creams were prepared by incorporating soy milk and muskmelon seeds milk alone and blended form with and without addition of kiwi pulp and strawberry pulp (Standard milk ice-cream (S), Soya milk ice-cream (A<sub>1</sub>), 100% Soya milk ice-cream with Kiwi pulp(A<sub>2</sub>), 100% Soya milk ice-cream with Strawberry pulp (A<sub>3</sub>), Muskmelon milk ice-cream (B<sub>1</sub>), 100% Muskmelon milk ice-cream with Kiwi pulp (B<sub>2</sub>), 100% Muskmelon milk ice-cream with Strawberry pulp (B<sub>3</sub>), 50% Soya milk & 50% Muskmelon milk ice-cream (C<sub>1</sub>), 50% Soya milk & 50% Muskmelon milk ice-cream with Kiwi pulp (C<sub>2</sub>), 50% Soya milk & 50% Muskmelon milk ice-cream with Strawberry pulp (C<sub>3</sub>) to modify standard ice cream and their composition is shown in table no. 1.

**Table 1: Composition of Standard Ice cream and their variants (with Kiwi pulp)**

Ingredient s	S	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>
Bovine milk (ml)	100	-	-	-	-	-	-	-	-	-
Soy milk (ml)	-	100	100	100	-	-	-	50	50	50
Muskmelon seed milk (ml)	-	-	-	-	100	100	100	50	50	50
Kiwi pulp (g)	-	-	50	-	-	50	-	-	50	-
Strawberry pulp (g)	-	-	-	50	-	-	50	-	-	50
Sugar (g)	20	20	20	20	20	20	20	20	20	20
GMS (g)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
CMC (g)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Corn flour (g)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Cream (g)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Kiwi essence (drops)	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4

S-Standard milk ice-cream (S)

Soya milk ice-cream (A<sub>1</sub>), 100% Soya milk ice-cream with Kiwi pulp (A<sub>2</sub>), 100% Soya milk ice-cream with Strawberry pulp (A<sub>3</sub>)

Muskmelon milk ice-cream (B<sub>1</sub>), 100% Muskmelon milk ice-cream with Kiwi pulp (B<sub>2</sub>), 100% Muskmelon milk ice-cream with Strawberry pulp (B<sub>3</sub>)

50% Soya milk & 50% Muskmelon milk ice-cream (C<sub>1</sub>), 50% Soya milk & 50% Muskmelon milk ice-cream with Kiwi pulp (C<sub>2</sub>), 50% Soya milk & 50% Muskmelon milk ice-cream with Strawberry pulp (C<sub>3</sub>)

### Sensory Evaluation

The sensory evaluation of recipes was carried out using 9-point Hedonic rating scale by 15 semi-trained panel members selected by triangle difference test. Appearance, flavor, mouth feel and overall acceptability were considered for evaluation [20].

### Statistical Analysis

The data were processed for the analysis of mean and standard deviation by Microsoft office excel.

## 3. RESULTS AND DISCUSSION

### Proximate composition of soya and muskmelon milk

**Moisture Content:** The results of the moisture content are shown in table 2. The moisture contents of bovine milk (BM), soy milk (SM) and muskmelon seeds milk (WSM) were 87.05, 87.44 and 81.76% respectively. The moisture content of muskmelon seeds was found to be slightly lower than bovine milk whereas that of soy milk was slightly higher than bovine milk.

**Protein Content:** The results reveals that the protein content of soymilk seed milk was found 4.23g/100g which was higher than the standard cow's milk that contain 3.50g/100g protein content. There was a significant difference in protein content of soymilk seed milk in comparison to standard cow's milk. Since soybean seeds contain 40% protein and its protein and oil content are not only high in quantity but also rated as best in quality too, all the essential amino acids [21].

**Table 2: Proximate composition of Soya milk and Muskmelon seed milk**

Proximate composition	Standard milk	Soy milk	Muskmelon seed milk
Moisture (%)	87.05±0.40	87.44±0.90	81.76±0.35
Protein (g/100g)	3.50±0.20	4.23±0.41	2.92±0.28
Fat ((g/100g)	4.10±0.32	3.20±0.30	8.83±0.47
Ash (g/100g)	0.72±0.03	0.84±0.04	0.86±0.02

<sup>a</sup>Mean value of a three triplicate samples ± standard deviation

**Fat Content:** The results show that fat content of soymilk was 3.20g/100g which was slightly lower than the standard cow's milk that contain 4.10g/100g fat and muskmelon seed milk contain 8.83g/100g fat which was higher than the standard cow's milk fat content. Since soybean seed contain 13-25% oil while muskmelon seeds contain fatty acids among palmitic, stearic, oleic, linoleic together constituted more than about 80% of the fatty acid content of oil [13].

**Ash Content:** Ash content of soymilk and muskmelon seed milk were 0.84g/100g and 0.86g/100g respectively found to be higher in comparison to standard cow's milk which contains 0.72g/100g ash. This is because soybean is a good source of iron, potassium, calcium, magnesium and phosphorus and melon seeds are also rich in minerals such as calcium, magnesium, potassium, iron, zinc, sulphur and phosphorus [14].

### Sensory analysis of Ice-cream

Sensory analysis results show (table. 3) that the mean scores of the 100% soy milk ice cream and 100% muskmelon seed milk ice cream made by soy milk was found slightly varied at all attributes like appearance, flavor, mouth feel and overall acceptability as compared to 100% bovine milk standard ice cream (S). 100% soy milk ice cream was liked slightly to

moderately (6.36-6.88). 100% muskmelon seed milk ice cream was liked slightly to moderately (6.39-6.95).

The results of ice cream made by 50% soy milk and 50% muskmelon seeds milk was liked slightly to liked very much in attributes like appearance, flavor and overall acceptability (6.80-6.96), whereas in mouth feel attribute it was liked moderately (7.72) as compared to standard ice cream.

The mean scores of sensory evaluation of ice cream made of 100% soy milk with 50g kiwi pulp and 100% soy milk with 50g strawberry pulp was in the range of liked moderately to liked very much in attributes like appearance, flavor and mouth feel (7.28-7.74) and (7.76-8.14) respectively, whereas in flavor attribute both ice creams was liked very much. On the other hand, the mean scores of sensory evaluation of ice cream made of 100% muskmelon seed milk with 50g kiwi pulp and 100% muskmelon seed milk with 50g strawberry pulp was in the range of liked moderately to liked very much

in attributes like appearance, flavor and mouth feel (7.33-7.77) and (7.87-8.20) respectively, whereas in flavor attribute both ice creams was liked very much.

Ice cream made of 50% soy milk and 50% muskmelon seeds milk with 50g kiwi pulp and another with 50g strawberry pulp was in the ranges of liked very much to liked extremely in all attributes like appearance, flavor, mouth feel and overall acceptability (8.40-8.56) and (8.40-8.56) respectively as compared to bovine standard ice cream (S).

Therefore it can be seen from the results of the mean scores of the sensory evaluation that ice creams and made of 50% soy milk and 50% muskmelon seeds milk with 50g kiwi pulp and 50g strawberry pulp is the most acceptable ice cream and the standard milk ice-cream got highest scores among the all samples and liked extremely by the semi trained panel members on 9 point hedonic scale.

**Table: 3 Mean scores of sensory attributes of ice-creams**

Attributes	S	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>
Appearance	8.84±0.37	6.88±0.83	6.95±0.85	6.80±0.81	7.28±0.58	8.02±0.65	7.33±0.58	8.20±0.68	8.44±0.50	8.50±0.55
Flavor	8.72±0.45	6.76±1.05	6.69±1.02	6.80±0.76	7.74±0.76	8.14±0.88	7.65±0.74	8.18±0.88	8.40±0.64	8.48±0.71
Mouth feel	8.80±0.40	6.36±1.11	6.39±1.13	7.72±0.33	7.48±0.56	7.81±0.59	7.43±0.55	7.87±0.60	8.40±0.64	8.45±0.54
Overall Acceptability	8.84±0.37	6.80±0.86	6.79±0.86	6.96±0.88	7.68±0.55	7.76±0.61	7.77±0.69	7.91±0.65	8.56±0.72	8.60±0.55

S, A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> as in table no. 1

### Nutrient analysis of Ice-creams

Ten variants ice creams were developed. Out of which, ice cream made of 50% soy milk and 50% muskmelon seeds milk with 50g kiwi pulp ice cream (C<sub>2</sub>) and on the other hand ice cream made of 50% soy milk and 50% muskmelon seeds milk with 50g strawberry pulp ice cream (C<sub>3</sub>) was the most acceptable in all attributes like appearance, flavor, mouth feel and overall acceptability. Therefore, the proximate composition of standard ice cream (100% cow milk) and most acceptable ice-cream i.e. blended milk ice-cream with kiwi pulp and with strawberry pulp-C<sub>2</sub> and C<sub>3</sub> respectively (50% soy milk and 50% muskmelon seed milk) were analyzed and shown in table no. 4.

**Moisture:** The moisture content of most acceptable ice cream was given in table 4. The moisture content of bovine milk standard (S) ice cream and 50% soy milk with 50% muskmelon seeds milk with kiwi pulp and strawberry (C<sub>2</sub> and C<sub>3</sub>) ice cream were 89.29, 80.20 and 81.55% respectively. Thus moisture content of both sample (C<sub>2</sub> and C<sub>3</sub>) was found to be lower than sample S.

**Table 4: Proximate composition of three most acceptable Ice-creams**

Nutrient composition	S	C <sub>2</sub> (with Kiwi)	C <sub>3</sub> (with Strawberry)
Moisture (g/100g)	89.29	80.20	81.55
Protein (g/100g)	3.83	12.14	11.12
Fat (g/100g)	5.83	7.81	8.76
Ash (g/100g)	1.4	2.62	1.91
Iron (mg/100g)	1.27	1.44	1.58
Vitamin C (mg/100g)	0	89.92	91.20

S- Standard cow's milk ice-cream.

C<sub>2</sub> and C<sub>3</sub>- 50% Soymilk and 50% Watermelon seed milk ice-cream with kiwi pulp and with strawberry pulp

<sup>c</sup> Mean value of a three triplicate samples ± standard deviation

**Protein:** The protein content of bovine milk standard (S) ice cream was lower than 50% soy milk with 50% muskmelon seeds milk and kiwi pulp (C<sub>2</sub>) and strawberry pulp (C<sub>3</sub>) ice cream i.e 3.83, 12.14% and 11.12% respectively. High protein content of ice-cream (C<sub>2</sub> and C<sub>3</sub>) is due to high protein content found in both soy milk as well as muskmelon seed milk.

**Fat:** In addition to their nutritional and functional value, fats have other uses which derive principally from their distinct physical properties. They contribute to the tenderness, flavor, color and texture of food product. The results of fat content have been illustrated in table 5. The fat content of bovine milk standard (S) ice cream and 50% soy milk with 50% muskmelon seeds milk and kiwi pulp (C<sub>2</sub>) and strawberry pulp (C<sub>3</sub>) ice cream were 5.83, 7.81% and 8.76% respectively. This shows that fat content of sample C<sub>3</sub> was found to be higher than sample C<sub>2</sub> and S. This may be due to the reason that soymilk and muskmelon seed milk are a good source of unsaturated fatty acids which are helpful in preventing cardiovascular diseases.

**Ash:** Ash is an indication of its mineral status, the higher the mineral content, higher would be ash content of the product. The ash content of bovine milk standard (S) ice cream and 50% soy milk with 50% muskmelon seeds milk and kiwi pulp (C<sub>2</sub>) and strawberry pulp (C<sub>3</sub>) ice cream were 1.4, 2.62% and 1.91% respectively. The ash content of sample C<sub>2</sub> scored highest value than sample C<sub>3</sub> and S.

**Iron:** The iron content of bovine milk standard (S) ice cream and 50% soy milk with 50% muskmelon seeds milk and kiwi pulp (C<sub>2</sub>) and strawberry pulp (C<sub>3</sub>) ice cream were 1.27, 1.44% and 1.58% respectively. The iron content of sample C<sub>3</sub> was found to be higher than sample C<sub>2</sub> and S.

**Vitamin C:** Standard cow's milk ice-cream contain negligible amount of vitamin C content. The vitamin C content of bovine milk standard (S) ice cream and 50% soy milk with 50% muskmelon seeds milk and kiwi pulp (C<sub>2</sub>) and strawberry pulp (C<sub>3</sub>) ice cream were 0, 89.92% and 91.20% respectively. This reveals that vitamin C content of C<sub>3</sub> sample was found to be higher than sample C<sub>2</sub> and S.

#### 4. CONCLUSION

Ten variants of nutritious ice creams were prepared from soymilk, muskmelon seed milk kiwi pulp and strawberry pulp. This effort was done to ensure the quality of nourishment to the masses facing economic and availability constraints. Mean scores of overall acceptability of ice creams reveals that among all samples of ice creams, blended milk ice cream (50% soymilk and 50% watermelon seed milk) with kiwi pulp and with strawberry pulp were most acceptable at 9 point hedonic scale.

Nutrient analysis of most acceptable ice creams indicated that protein and fat content were found to be excellent as compared to standard ice cream and iron and vitamin C were also found to be high. Ice creams made out of soy milk and muskmelon seeds milk can be easily used in community as these are highly acceptable and free from beany flavor. More over protein content is high among these ice creams as compared to

bovine milk standard ice cream. The results of the present study goes to emphasis that the ice creams prepared were not only rich in protein but also in other nutrient such as iron and vitamin C.

#### REFERENCES

- [1] Bhowmik, D., Gopinath, H., Kumar, B. P., Duraivel, S., and Kumar, K. P. S., "Nutraceutical- a bright scope and opportunity for Indian healthcare market", *The Pharma Innovation*, 1, 11, January 2013, pp. 29-41.
- [2] Striling, C., and Kruh, W., "Nutraceuticals: the future of intelligent food", *KPMG International*, 2015, pp. 1-17.
- [3] Pandey, N., Meena, R. P., Rai, S. K., and Rai, S. P., "Medicinal plants derived nutraceuticals- a re-emerging health aid", *International Journal of Pharma and Biosciences*, 2, 4, December 2011, pp. 419-441.
- [4] Khillari, S. A., Zanjad, P. N., Rathod, K. S., and Raziuddin, M., *Journal of Food Science and Technology*, 44, June 2007, pp. 391-393.
- [5] Arbuckle, W.S., *Ice cream*, The Avi Pub Co, New York, USA, 1986, 4th Edn.
- [6] Manay, N. S., and Shadaksharaswamy, M., "Food facts and principle", New Age International (P) Ltd, New Delhi, 1987, 2nd Edn.
- [7] Minnhas, K.S., Sidhu, J.S., Mudahar, G.S., and Singh, A.K., *Journal of Food Science and Technology*, 2000, 37, pp. 602-608.
- [8] Bisla, G., Archana, Verma, P., and Sharma, S., "Development of ice creams from soymilk and watermelon seedmilk and evaluation of their acceptability and nourishing potentials", *Advances in Applied Science Research: Pelagia Research Library*, 3, 1, 2012, pp. 371-376.
- [9] Biswas, P. K., Chakraborty, R., and Choudhuri, U. R., *J Food Sci Technol*, 2002, 39, pp. 702-704.
- [10] Kumar, V., Rani, A., and Tiwari, P., *The Ind J Nutri Dieteti*, 2001, 38, pp. 437-440.
- [11] Nsofor, L. M., and Anyanwu, K. B., *J Food Sci Technol*, 1992, 29, pp. 331-332.
- [12] Oyenuga, V. A., and Fetuga, B. L., *J Sci Food Agric*, 1975, 26, pp. 843-854.
- [13] Bhatia, I. S., Gupta, B. K., Yaspal, and Sikhija, P.S., *Biochem J Food Sci*, 1977, 4, pp. 47.
- [14] Akubor, P. I., *J Food Sci Technol*, 1998, 35, pp. 93-95.
- [15] Teotia, M. S., and Ramakrishna P., *J Food Sci Technol*, 1984, 21, pp. 332-340.
- [16] <https://www.organicfacts.net/healthbenefits/fruits/strawberries.html>, 2014.
- [17] Chakarbarti, S. R., and Gangopadhyay, S. K., *J Food Sci Technol*, 1990, 27, pp. 242-243.
- [18] AOAC, "*Official Methods of Analysis*". Association of Official Analytical Chemists, Washington DC, 1980, 13<sup>th</sup> Edn.
- [19] Ranganna, S., *Handbook of analysis and quality control for fruit and vegetable products*, McGraw Hill Publishing Co Ltd, New Delhi, 1986, 2nd Edn.
- [20] Stone, H., and Sidel, J. L., "Sensory evaluation practices", Elsevier Publisher, U S A, 2004, 3rd Edn.
- [21] O'kenedy, B.T., Reilly, C. C., Titus, J. S., and Splittstoesser, W. E., *Canad J Bot*, 1979, 57, pp. 2044-2049.