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Studies on formulation and evaluation of muskmelon fruit powder incorporated ready - to - use products

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Abstract

An attempt was made to formulate ready - to - use products by utilizing muskmelon fruit powder. Muskmelon fruit powder was prepared by adopting optimized spray drying process. The TSS content of fruit pulp was adjusted to 25° brix and spray dried at a temperature of 180° C. The processed muskmelon fruit powder was used for the formulation of ready - to - use products viz., instant drink mix, instant milk shake powder, instant ice cream mix and instant health mix. Five combinations were tried in each mix by incorporating muskmelon fruit powder with suitable ingredients. The developed products were evaluated organoleptically by using 1-9 hedonic scale to select the best combination for commercialization. Results showed that for all the instant mixes, the selected combination secured the higher scores (94 to 100%) in organoleptic studies than the rest.

Keywords: Formulation and evaluation, muskmelon fruit powder

Introduction

Muskmelon (*Cucumis melo* L.) commonly called as cantaloupe is a member of Cucurbitaceae family. Consumer preference for this fruit is determined largely by its sweetness, flavor or aroma, texture and more recently as a rich source of phytonutrients. Muskmelon is a commercially important fruit cultivated throughout the world, comprising tropical and sub-tropical regions. Muskmelon is very popular in developed countries where the per capita consumption is high to beat the scorching summer heat. In India, muskmelon occupies an area of about 36.70 thousand hectare with annual production of about 760.81 thousand metric tonnes (Indian Horticulture Database, 2015). The fruit crop is cultivated widely by farmers in our country particularly during the summer season (April to July). The important varieties grown in India are 'Pusa Sarbati', 'Hara Madhu', 'Pusa Madhuras', 'Arka Rajhans', 'ArkaJeet', 'Durgapur Madhu', and 'Narendra Muskmelon-15'. The main areas of muskmelon cultivation are Punjab, Tamil Nadu, Lucknow, Safeda, Uttar Pradesh, Maharashtra and Andhra Pradesh. In Tamil Nadu, muskmelon is mostly grown in Tindivanam, Kanchipuram, Dharmapuri, Villupuram, Pudukottai and Theni districts. Muskmelon flesh contains 3.5 g carbohydrates, 0.3 g protein, 0.2 g fat, 3420 IU vitamin A, .6.0 mg ascorbic acid, 23 mg calcium, 1.4 mg iron, 14.0 mg phosphorus and 341 mg potassium. Muskmelon is relished as a desert fruit, low in calories and fats or cholesterol and is an excellent source of vitamin A and C and minerals. In melons there are many phytochemicals that may have a vast array of potential health benefits (Venkatesan, *et al.*, 2016) [8].

Dehydration is one of the feasible methods of preservation. The dehydrated product can be easily converted in to fresh - like form by rehydrating it and can be used throughout the year. Fruit powders are more convenient to use, easy to handle and can be used in the preparation of several products such as beverages, health foods, ice cream mix and milk shake powder. The distinctive flavors, colors and water binding properties of fruit powders make them an ideal ingredient in processed foods. The quality of the dehydrated product in terms of rehydration ratio, colour and flavor retention depends on the pretreatments applied and method of drying. Research needs to be done to explore the possibility of employing dehydration techniques for processing to minimize the losses and to make them available for consumption in the off - season. Therefore, the present research work was undertaken to process muskmelon fruit into powder form by using spray drier and develop ready - to - use products by incorporating muskmelon powder.

Methodology

A. Processing of muskmelon fruit powder: The standardized process for the production of muskmelon fruit powder by using spray drier is presented in the Figure 1. The nutrient content of the fresh and processed muskmelon fruit powder *viz.*, moisture, TSS, acidity, pH, reducing sugar, total sugar, ascorbic acid, β - carotene and total antioxidant activity were analyzed by using analytical procedure AOAC (1995) [1].

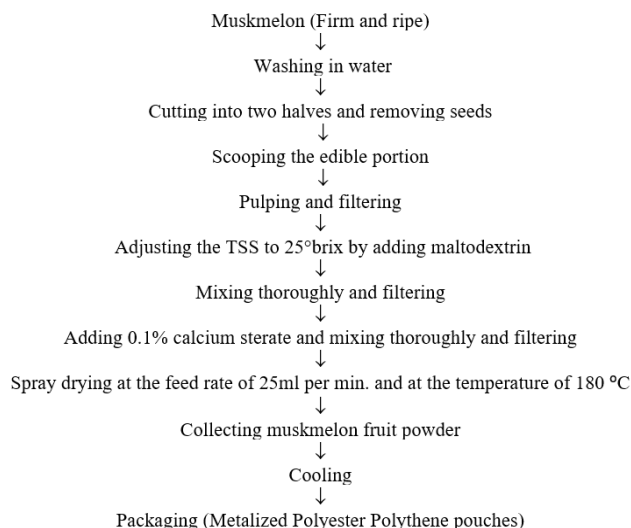


Fig 1: Preparation of muskmelon fruit powder

B. Formulation of muskmelon fruit powder incorporated ready - to - use products

The muskmelon fruit powder incorporated ready - to - use products such as instant drink mix, instant milk shake powder, instant ice cream mix and instant health mix was prepared. Five combinations were tried for each mix and the level of incorporation of muskmelon powder and other ingredients was varied depending upon the nature of product. The ingredients used for preparing each mix and the combinations are presented below:

Table 1: Formulation of muskmelon instant drink mix

Ingredients (g)	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Fruit powder	2.5	5.0	7.5	10.0	12.5
Powdered sugar	52.5	50.0	47.5	45.0	42.5
Citric acid	0.25	0.25	0.25	0.25	0.25
Pectin	0.25	0.25	0.25	0.25	0.25

Table 2: Formulation of muskmelon instant milk shake powder

Ingredients (g)	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Fruit powder	2.5	5.0	7.5	10.0	12.5
Powdered sugar	45.0	42.5	40.0	37.5	35.0
Skim milk powder	12.5	12.5	12.5	12.5	12.5

Table 3: Formulation of muskmelon instant ice cream mix

Ingredients (g)	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Corn flour	50	50	50	50	50
Fruit powder	20	40	60	80	100
Powdered sugar	600	580	560	540	520
Skim milk powder	300	300	300	300	300
Stabilizer (gelatin)	10	10	10	10	10
Emulsifier (GMS)	10	10	10	10	10
Carboxy methyl cellulose	10	10	10	10	10

Table 4: Formulation of muskmelon instant health mix

Ingredients (g)	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Fruit powder	2.0	4.0	6.0	8.0	10.0
Powdered sugar	40.0	40.0	40.0	40.0	40.0
Sprouted ragi flour	29.0	28.0	27.0	26.0	25.0
Sprouted green gram flour	14.0	13.0	12.0	11.0	10.0
Skim milk powder	15.0	15.0	15.0	15.0	15.0

C. Evaluation of muskmelon fruit powder incorporated ready - to - use products:

The products *viz.*, musk melon instant drink, muskmelon milk shake, muskmelon icecream and muskmelon health drink was prepared from each combinations of muskmelon powder incorporated ready - to - use products and evaluated organoleptically by using a panel of ten untrained judges with the score card of 1-9 hedonic scale (ASTM, 1968).The method for the preparation of products from each mix is given below:

Preparation of muskmelon instant drink: For preparing musk melon drink, 55.0 gram of instant mix was taken and dissolved in 200 ml cold water and stirred well. The drink was prepared from each combinations of instant drink mix and organoleptically evaluated for the acceptance.

Preparation of muskmelon milk shake drink: For preparing musk melon milk shake, 25 g of instant milk shake powder was taken; cold paste was prepared by adding little water (50 ml) and then added to 150 ml water. The contents were cooked for 3 minutes and cooled to room temperature. The cooled mass was whipped in mixie for one minute and chilled before serving. The drink was prepared from each combinations of milk shake mix and organoleptically evaluated for the acceptance.

Preparation of muskmelon ice cream: The other ingredients required for preparing ice cream was instant muskmelon ice cream mix - 800g, milk -1800ml, fresh cream - 400 gm, liquid glucose - 40 gm and condensed milk - 200g.

Method

- Fresh milk (1800ml) was taken in a heavy bottom vessel and heated to boil.
- The instant muskmelon ice cream mix was made into paste using boiled milk (250 ml) and added to the boiling milk followed by liquid glucose and stirred continuously for 2.0 minutes.
- The content was cooled and fresh cream and condensed milk was added and mixed again. The content was whipped in a mixie for 3.0 min. before freezing.
- The whipped sample was poured in an ice cream tray or cup and kept aside the freezer for 4 hours (freezing temperature – 20 °C).
- To obtain smooth and soft ice cream, the content was whipped at every ½ hour during the course of freezing. The prepared ice cream was stored at – 20°C in the freezer.

Preparation of muskmelon health drink: For preparing drink, 30 g of health drink mix was taken and cold paste was prepared by adding 50 ml of water and then added 150 ml of water. The content was cooked for 2-3 min. and cooled to lukewarm temperature (40 – 50 °C). The drink was prepared from each combinations of health mix and organoleptically evaluated for the acceptance.

Results and Discussion

Nutrient content of fresh muskmelon and processed muskmelon powder:

The nutrient content of the fresh and processed musk melon powder is presented in Table -5. Higher amount of all the nutrients were noted in the processed spray dried powder than in the fresh muskmelon pulp. The physio - chemical characteristic of the muskmelon fruit (locally available in the market) was studied. The results were viz., fruit weight-1160 gm, fruit length - 10.40cm, fruit width - 16.20cm, pulp weight - 649gm, percentage pulp yield - 55.96, moisture - 91.08 per cent, TSS - 6.0°brix, acidity - 0.128 per cent, pH -5.6, ascorbic acid - 33.32 mg /100g, β - carotene -1215 μg /100g, reducing sugar - 4.0 per cent, total sugar - 5.58 per cent and total Antioxidant activity - 68.36 μg / g. The freshly processed muskmelon fruit powder contained moisture - 4.19 per cent, pH - 5.39, acidity - 0.1 per cent, TSS - 55°brix, total sugar - 25.07, reducing sugar - 11.82 per cent, β - carotene - 988.99 μg /100g, ascorbic acid - 97.62 mg/100g and total antioxidant -14.34 (μg / g).

The fresh muskmelon fruit (100 g) contained 92.97 g of moisture, 0.42 g of protein, 0.52 g of ash, 0.35 g of total fat, 1.51 g of total fibre, 0.84 g of insoluble fibre, 0.67 g of soluble fibre, 4.24 g of carbohydrate, 98 KJ energy, 771 μg of β - carotene, 925 μg of total carotenoids, 9.80 mg of calcium and 0.18mg of iron (Longvah *et al.* 2017) [5].

Solval *et al.* (2012) [6] analyzed the chemical composition of spray dried cantaloupe juice powder. They found that the powder contained moisture - 4.19 ± 0.18 , vitamin C - 91.85 ± 5.23 , β - carotene - 127.94 ± 16.82 and colour values L^* - 89.06 ± 0.54 , a^* - 3.35 ± 0.29 and b^* - 22.71 ± 0.74 . The values given in the above studies were found to be more or less similar to that of the present investigation.

Table 5: Nutrient content of fresh muskmelon and spray dried powder (DWB)

Nutrients	Fresh muskmelon	Processed muskmelon powder
Moisture (per cent)	91.08	4.19
TSS (°brix)	6.0	55
Acidity (%)	0.128	0.1
pH	5.6	5.39
Ascorbic acid (mg/100g)	33.32	97.62
β - Carotene (μg /100g)	1215	988.99
Reducing sugars (%)	4.0	11.82
Total Sugars (%)	5.58	25.07
Total Antioxidant activity (mg/g)	68.36	14.34

B. Evaluation of muskmelon powder incorporated products:

Organoleptic evaluation of the prepared products was done by a panel of ten untrained judges using a score card with a nine point hedonic scale. The acceptability of prepared products was assessed and the results are given below:

Table 6: Organoleptic evaluation of muskmelon instant drink

Sensory characteristics	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Colour and Appearance	7.5	7.8	8.9	8.8	8.8
Flavour	6.6	7.0	8.8	8.8	8.8
Body	7.0	7.1	9.0	8.6	8.4
Taste	6.8	7.3	8.9	8.4	8.2
Overall acceptability	7.3	7.5	8.9	8.6	8.4

The data presented in Table - 6 pertaining to the average sensory scores of different parameters in muskmelon instant drink. It clearly indicates that combination C₃ had the highest

score for colour and appearance (99%), flavor (98%), body (100%), taste (99%) and overall acceptability (99%). Sivakumar (2004) developed instant fruit juice powder mix by utilizing the foam mat dried sapota powder. Sapota powder (72 g), powdered sugar (27g) and citric acid (1.0 g) were mixed thoroughly and passed through BS 60 sieve to obtain homogenous powder. The instant fruit juice powder mix (10 g) was mixed with water (200 ml) to get natural aroma and taste of the fresh juice. The reconstituted juice from instant juice powder mix was found to be highly acceptable.

Table 7: Organoleptic evaluation of muskmelon milk shake

Sensory characteristics	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Colour and Appearance	8.0	8.0	8.3	8.5	9.0
Flavour	6.6	6.9	7.6	8.0	9.0
Body	7.0	7.2	7.8	8.0	8.9
Taste	7.0	7.4	7.6	8.2	8.9
Overall acceptability	7.5	7.7	8.0	8.3	8.9

The average sensory scores of different parameters in combinations of muskmelon milk shake (Table -7), clearly indicates that combination C₅ had the highest score for colour and appearance (100%), flavor (100%), body (99%), taste (99%) and overall acceptability (99%). The milk shake prepared from banana milk shake mix had secured the highest score value for each quality attributes at the end of the storage period (Chitra, 2002) [4].

Table 8: Organoleptic evaluation of muskmelon ice cream

Sensory characteristics	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Colour and Appearance	7.9	8.0	8.3	8.6	9.0
Flavour	6.8	7.0	7.8	8.3	8.9
Texture	8.2	8.4	8.4	8.5	9.0
Taste	8.0	8.0	8.3	8.5	9.0
Overall acceptability	7.7	7.9	8.2	8.4	8.9

Table - 8 illustrates the average organoleptic score values of muskmelon powder incorporated ice cream and it indicates that combination C₅ had the highest score for colour and appearance (100%), flavor (99%), texture (100%), taste (100%) and overall acceptability (99%). Aruna *et al.*, 1998) [2] reported that ice cream prepared by incorporating cereal based papaya powder was acceptable and incorporation at 40 per cent was superior, followed by 60 and 80 per cent.

Table 9: Organoleptic evaluation of muskmelon health drink

Sensory characteristics	Combinations				
	C ₁	C ₂	C ₃	C ₄	C ₅
Colour and Appearance	8.0	8.0	8.1	8.3	8.7
Flavour	7.8	7.8	8.0	8.2	8.8
Body	8.0	8.0	8.1	8.3	8.5
Taste	7.9	8.0	8.0	8.4	8.8
Overall acceptability	7.9	8.0	8.1	8.3	8.6

The average sensory scores of different parameters in all combinations of muskmelon health drink (Table -9), clearly indicates that combination C₅ had the highest score for colour and appearance (97%), flavor (98%), body (94%), taste (98%) and overall acceptability (96%). Similar results were reported by Chitra (2002) [4].

From the results it was concluded that the for instant drink mix, the best combination (C₃) containing the ingredients 7.5 g muskmelon fruit powder, 47.5 g powdered sugar, 0.25 g

citric acid and 0.25g pectin. The best combination (C₅) of instant milk shake powder containing the ingredients, muskmelon fruit powder - 12.5 g, powdered sugar- 35g and skim milk powder - 12.5g; For instant ice cream mix, the best combination (C₅) containing the ingredients muskmelon fruit powder - 100 g, corn flour -50g, powdered sugar- 520g, skim milk powder - 300g, stabilizer (gelatin) - 10g, GMS -10g and CMC - 10g. For instant health mix, the best combination (C₅) containing the ingredients muskmelon fruit powder - 100 g, sprouted ragi flour -25g, sprouted green gram flour -10g, skim milk powder - 15g and powdered sugar - 40g.

Conclusions

On the basis of findings, it can be concluded that the muskmelon powder can be successfully incorporated into various products which are beneficial to health. The incorporation of muskmelon powder substantially increases the nutrient content of foods. The addition of muskmelon powder to processed foods will also of great benefit to the consumers of all age groups during the off seasons. The muskmelon fruit powder incorporated ready - to - use products are having high potential for commercialization and marketability not only in India but also in other countries too.

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