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Studies on standardization and quality evaluation of RTS beverage from muskmelon (*Cucumis melo* L.) variety Sarda

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Abstract
Ready-to-Serve beverage (RTS) was prepared from muskmelon variety "Sarda". RTS studied as nectar is a value-added product that was developed from *Cucumis melo* L. which was further subjected to physicochemical analysis and organoleptic evaluation during a storage period of 90 days. The result of research study showed an increasing trend in pH, total soluble solids, total sugars and reducing sugars while there was a declining trend in acidity, ascorbic acid and non-reducing sugars noticed during the storage period of muskmelon RTS (nectar). Muskmelon nectar prepared with the formulation of N_2T_1 (15% pulp and 10°Brix total soluble solids) was rated superior for overall acceptability during the 90 days storage period.

Keywords: RTS, value-added product, overall acceptability, nectar

Introduction
Muskmelon (*Cucumis melo*. L) Commonly known as 'kharbooj' in India is an annual belonging to the family Cucurbitaceae (Bailey and Bailey, 1976) [4]. It is a dessert vegetable cultivated throughout the world under both tropical and subtropical climatic conditions. Asia is considered to be the centre of origin of muskmelon (Schaeffer *et al*., 2009) [29]. China, Iran, Turkey and USA are the major muskmelon producing countries in the world (Salari *et al*., 2012) [28]. In India, Uttar Pradesh is the major muskmelon growing state followed by Andhra Pradesh, Punjab, Madhya Pradesh, Haryana, Tamil Nadu, Chhattisgarh and Karnataka (Horticulture Statistics Division, 2016-17). In Punjab, the main muskmelon producing districts are Jalandhar, Kapurthala & Patiala. Muskmelon produced in these districts is marketed in different parts of the country like Kolkata, Mumbai and Jammu & Kashmir (Kaur *et al.*, 2017) [18]. The varieties of muskmelon recommended for cultivation in different agro ecological zones are 'Pusa Sarbati', 'Hara Madhu', 'Pusa Madhuras', 'Arka Rajhans', 'Arka Jeet', 'Durgapur Madhu', and 'Narendra Muskmelon-15' (Rai *et al*., 2006) [26]. Fruit of muskmelon is called 'pepo' and edible portion of fruit contains 90% water & 10% carbohydrates. (Selvakumar, 2014) [32]. Muskmelon is an excellent source of vitamin A (100 g provides 3382 IU or about 112% of recommended daily levels) one of the highest among cucurbit fruits which helps in lowering risk of metabolic syndrome. In addition, it is also an excellent source of sugars, carbohydrates, proteins, vitamin C, traces of vitamin K, vitamin B6, vitamin B1, vitamin B2, niacin and also contains water which is in between 90-94 % (Anonymous, 2002) [3] with large number of other human health-bioactive compounds (Lester and Hodges, 2008) [20]. *Cucumis melo* L. is a delicious vegetable more appreciated as salad that belongs to family cucurbitaceae where it contributes to various cultivated varieties and wild species (Sekhar *et al*. 2018; Jeffrey, 1980 & Jeffrey, 1990) [30, 14, 15]. Muskmelon fruit outer skin consists of ribbed, smooth, furrowed, yellowish-brown colour and has yellow or pink flesh. Ripened melons are generally rounded, yellow-green having rough texture. Pericarp which is the fleshy edible part of cantaloupe or honeydew melons is generally sweet in taste (Gebhardt *et al*., 1982; Haytowitz and Matthews, 1984) [8, 10]. Muskmelon roots have properties of both purgative and emetic (Thamburaj and Narendra Singh, 2005) [39]. Teotia *et al*., (1997) [37] cited the physical characteristics of muskmelon fruit & gave their composition as average weight of fruit which is 695 g, peel (10.7 %), seeds (4.3 %) & edible portion (82.3%) on wet weight basis. Win *et al*. (2018) evaluated the nutritional composition of fresh honeydew melon that contains 90 % moisture, 0.64 % ash, 2.48 % vitamin C, 3224 IU vitamin A, 10 mg Phosphorous, 271 mg Potassium, 10 mg Sodium, 1.09 mg Magnesium, 6 mg Calcium, 0.10 %

fat, 9.20 % carbohydrate and 0.50% protein. The average content of dry matter ranges between 11.46-23.12 mg/100g (Sharma and Lal, 2004) [33]. Melons have β carotene in rich amount as this compound synthesizes within the fruit itself during the period of ripening at the time when chloroplasts changes to chromoplasts (Goodwin and Goad, 1970) [9].

Muskmelon seeds contains not only considerable amount of carbohydrate, protein, fat, ash & moisture but also it is non rancid and edible. Golden / canary melon seeds constitute of higher crude fibre percentage (33.94%), lower carbohydrate percentage (3.14%), high iron value (136.5ppm), zinc (48.35ppm), manganese (25.70ppm), copper (15.40ppm) and lower calcium value (0.023± 0.001%) (Oluwatoyin and Oluwaseun, 2014). The iodine value of oil is higher in golden melon seeds i:e 117.43 mg KOH/g than in desert melon having 124.0 and also higher from Tsama melon i:e 95.8 (Mabaleha *et al*., 2007) [22]. The by-products such as melon peels and seeds are rich in phytochemicals like carotenoides and polyphenols that influence a positive role on health as well as helps in preventing aging effects (Vouldoukis *et al*., 2004 and Ismail *et al*., 2010) [40, 12]. Melon seeds are known for excellent source of dietary oil which has 41-56.6% oil content alongwith higher content of fat as well (Nwokolo and Sim, 1987; Madaan and Lai, 1984) [24, 23].

Material & Methods

Present investigation on the development of value added product from muskmelon (*Cucumis melo* L.) was carried out in the food processing laboratory , Department of Agricultural Sciences, at DAV University, Jalandhar during the year 2018-2019.

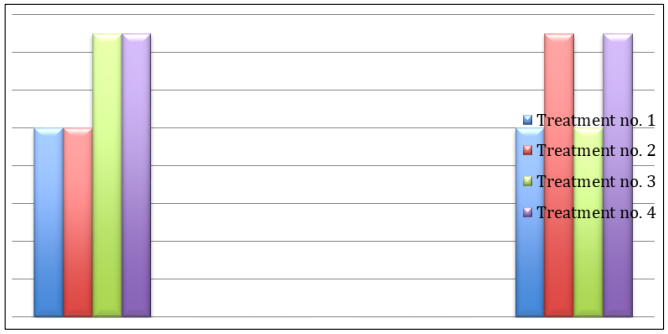
Collection of Muskmelon fruits

The muskmelon fruits were procured from local market of Jalandhar. Well matured and uniform shaped fruits were selected for experiment purposes which are free from bruises.

Extraction of Pulp

Fresh melons were selected and washed properly for product preparation. After that, with the help of peeler, fruit peel was removed & with the help of stainless steel knives, fruit was cut into two halves. Now the seeds were separated from the central cavity & other fibrous material if any. Then again with help of stainless steel knives fruit slices will be cut into small pieces. Further it is blended by using a mixer or blender so that pulp was mashed into proper fine texture, homogenized & filtered. The extracted pulp then can be used for preparing value added nectar (RTS).

Recipes for nectar (RTS)



Development of value added nectar

Muskmelon Nectar

Selection of fresh fruit
↓
Washing of fruit
↓
Preparation of fruit
(Removal of peel, seeds & slicing)
↓
Extraction of pulp
↓
Extraction of juice
↓
Preparation of product according to different treatments
T_1: 10% juice + 10° B TSS + 0.30 % acidity
T_2: 10% juice + 15° B TSS + 0.30 % acidity
T_3: 15% juice + 10° B TSS + 0.3 % acidity
T_4: 15% juice + 15° B TSS + 0.3 % acidity
↓
Heating the product for 5 minutes
↓
Addition of preservative
KMS @ 70 ppm of finished product
↓
Filling the product in sterilized bottles & crown corking
↓
Pasteurization of product for 30 minutes in water bath
↓
Cooling & labelling
↓
Store the product at a cool and dry place.

Results & Discussions

pH: During storage period, an upward trend in pH was noticed in muskmelon nectar. The pH of nectar exhibited an increasing trend during storage period of 90 days. The maximum pH of 4.18 was recorded in the treatment N_2T_2 (15% pulp, 15°B) whereas minimum pH 4.09 found in the treatment N_1T_2 (10% pulp, 15°B) at 90 days of storage as shown in table no. 1. The combination of recipes and storage period exhibited significant effect on pH. The increase in pH is due to corresponding decrease in the acidity. Comparable observations were noticed by Akala *et al*. (2003) [2] in guava juice, Teotia *et al*. (1997) [37] in nectar prepared from enzyme clarified muskmelon juice, Rehman *et al*. (2014) [27] in fruit juice, Sherzad *et al*. (2017) [34] in strawberry blended nectar.

Table 1: Effect of ph on muskmelon nectar during 90 days storage period.

Treatments	pH				
	Storage period (Days)				
	Fresh	30 Days	60 Days	90 Days	Mean
N_1T_1	3.89	3.96	4.03	4.12	4.00
N_1T_2	3.87	3.94	4.02	4.09	3.98
N_2T_1	3.91	4.02	4.09	4.14	4.04
N_2T_2	3.93	4.04	4.11	4.18	4.06
Mean	3.90	3.99	4.06	4.13	

LSD (P< 0.05) for Treatment (A) = 0.01; Storage period (B) = 0.01 and Treatment (A) × Storage period (B) = NS

Total soluble solids: Muskmelon nectar showed an increasing trend of TSS throughout storage period of 30, 60 & 90 days. The maximum TSS of 16.93 was recorded in treatment N_2T_2 (15% pulp, 15°B) whereas minimum TSS of 11.58 was recorded in treatment N_2T_1 (15% pulp, 10°B). The effect of treatments & storage period was found to be significant for total soluble solid (Table 2).The total soluble solids content of stored muskmelon nectar depicts increasing trend with prolongation of three months storage period which may be due to increase in soluble solids and total soluble sugars caused by hydrolysis of carbohydrates that convert it into simpler substances. This demonstrated that in products there was change in composition of pulp during storage of three months. Analogous results were recorded in papaya-pineapple blended nectar (Sindhumati *et al*., 2013) [36], in litchi and pineapple juice (Singh *et al*., 2016), in RTS from blend of amla, aloe vera, ginger & sweet lime (Lokesh *et al*., 2017) [21], amla juice (Gajanana 2002) [7], in guava and mango nectar (Kalra and Tandon, 1984) [17], in fruit juice (Rehman *et al*., 2014) [27] and Bal *et al*. (2014) [5] in guava nectar.

Table 2: Effect of TSS on muskmelon nectar during 90 days storage period.

Treatments	TSS (°Brix)				
	Storage period (Days)				
	0 Days	30 Days	60 Days	90 Days	Mean
N_1T_1	10.00	10.31	10.82	11.63	10.69
N_1T_2	15.00	15.28	15.92	16.81	15.75
N_2T_1	10.00	10.29	10.78	11.58	10.66
N_2T_2	15.00	15.32	15.98	16.93	15.80
Mean	12.50	12.8	13.37	14.23	

LSD (P< 0.05) for Treatment (A) = 0.01; Storage period (B) = 0.01 ad Treatment (A) × Storage period (B) = 0.02

Acidity: Declining trend of acidity was observed in muskmelon nectar during storage period which was of 90 days. The maximum acidity 0.23 was noticed in treatment N_1T_1 (10% pulp, 10°B) whereas minimum acidity of 0.22 was noticed in rest of the treatments N_1T_2 (10% pulp, 15°B), N_2T_1 (15% pulp, 10°B), N_2T_2 (15% pulp, 15°B). There was non-significant interaction of recipe and storage period for acidity (Table 3).Observation of decreasing trend in acidity in product of muskmelon nectar was recorded throughout the storage period. The reduction of acidity in nectar may be due to hydrolysis of carbohydrates and non-reducing sugars in which utilization of acids for converting it into reducing sugars confirmed by Gajanana (2002) [7] in amla juice. Decrease in acidity might be due to interactions of chemicals between chemical constituents or secondary metabolites of juice that is induced by enzymatic action and temperature. The similar observations were reported by Teotia *et al*. (1992) [38] in RTS of muskmelon, Ladaniya *et al*. (2004) [19] in mandarin orange juice & by Bawa & Saini (1987) [6] in carrot juice under ambient temperature, Sherzad *et al*. (2017) [34] in strawberry blended nectar.

Table 3: Effect of acidity on muskmelon nectar during 90 days storage period.

Treatments	Acidity (%)				
	Storage period (Days)				
	0 Days	30 Days	60 Days	90 Days	Mean
N_1T_1	0.30	0.28	0.25	0.23	0.26
N_1T_2	0.30	0.27	0.24	0.22	0.25
N_2T_1	0.30	0.27	0.25	0.22	0.26
N_2T_2	0.30	0.28	0.25	0.22	0.26
Mean	0.30	0.27	0.24	0.22	

LSD (P< 0.05) for Treatment (A) = NS; Storage period (B) = 0.01 ad Treatment (A) × Storage period (B) = NS

Ascorbic acid: The data analyzed on the ascorbic acid of muskmelon nectar treatment depicts that during storage period there was a decline trend. The maximum ascorbic acid of 2.58 was recorded in the treatment N_2T_2 (15% pulp, 15°B) whereas minimum ascorbic acid of 1.64 was recorded in treatment N_1T_2 (10% pulp, 15°B). The effect of recipe and storage period recorded significant differences for ascorbic acid (Table 4).The concentration of ascorbic acid of muskmelon nectar depicted as declining trend during storage period of three months which might be due to subsequent oxidation as it is sensitive to oxygen or due to thermal degradation as it is highly volatile in nature. The highest ascorbic acid was recorded in treatment that's having maximum level of pulp because even in spite of the degradation ascorbic acid was totally dependent on amount of pulp used. This illustrated in nectar with 15% pulp (Jan and Masih, (2012) [13] in pineapple blended with carrot and orange juice and Jothi *et al*. (2014) [16] in mixed fruit squash).

Table 4: Effect of ascorbic acid on muskmelon nectar during 90 days storage period.

Treatments	Ascorbic acid (mg/100g)				
	Storage period (Days)				
	0 Days	30 Days	60 Days	90 Days	Mean
N_1T_1	2.82	2.39	2.08	1.72	2.25
N_1T_2	2.74	2.36	2.04	1.64	2.19
N_2T_1	4.34	3.62	3.06	2.43	3.36
N_2T_2	4.41	3.58	2.94	2.58	3.37
Mean	3.57	2.98	2.53	2.09	

LSD (P< 0.05) for Treatment (A) = 0.01; Storage period (B) = 0.01 ad Treatment (A) × Storage period (B) = 0.02

Overall acceptability: The data depicts significant score difference for interaction effect of pulp & TSS in relation to overall acceptability. The highest score of 4.4 was given to treatment N_2T_1 (15% pulp, 10°B). Treatment N_1T_2 (10% pulp, 15°B) was listed in lowest score of 3.3. A significant change was observed in overall acceptability among the treatments and storage days (Table 5). Muskmelon nectar recipe with 15 % pulp and 10°B was rated superior among all other recipes as depicted in fig.1. This might be due to better taste, palatability and compatibility of total soluble solids and pulp. The similar results were described by Shrivastava *et al.* (2013) [35] in custard apple nectar preparation with 20% pulp + 25% TSS + 0.3% acidity rated the best recipe containing highest TSS, acidity, total sugars, reducing sugars, moderate sugar- acid ratio & considerable amount of non-reducing sugars. Ahmad *et al.* (2016) [1] prepared nectar from different varieties of mango with 20% pulp, 20°B & 0.3% acidity from which Dashehari variety was rated high score for nectar preparation. Gajanana (2002) [7] amla nectar with 14% aonla juice + 0.5% ginger +1% lime juice + spices (cardamom @ 0.25%, cumin @ 0.25% and black pepper @ 0.1%) and TSS of 15^0B was rated best for overall acceptability.

Table 5: Effect of overall acceptability on muskmelon nectar during 90 days storage period.

Treatments	Overall Acceptability				
	Storage period (Days)				
	0 Days	30 Days	60 Days	90 Days	Mean
N_1T_1	4.10	4	3.8	3.5	3.85
N_1T_2	3.80	3.7	3.5	3.3	3.57
N_2T_1	4.90	4.8	4.6	4.4	4.67
N_2T_2	4.40	4.3	4.1	3.9	4.17
Mean	4.30	4.2	4	3.77	

LSD (P< 0.05) for Treatment (A) = 0.01; Storage period (B) = 0.01 ad Treatment (A) × Storage period (B) = 0.02

Fig 1: Muskmelon nectar prepared with N_2T_1 (15% pulp, TSS level of 10°Brix and 0.3 % acidity).

Conclusion

Muskmelon juice/pulp may be blended with other suitable juices as blending is a commercial alternative which not only make nutritional value added products but also increases energy value. Mixed fruit jam of muskmelon with other suitable fruits can be envisaged to attain nutritious aspects.

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