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Seabuckthorn Squash

Seabuckthorn (Hippophae rhamnoids L.), locally known as "Chharma and Surch" in Himachal Pradesh, India, grow naturally under quite adverse climatic conditions prevailing at upper reaches of the state. The present article describes the formulation of squash developed from seabuckthorn pulp and from its blends with mango pulp in which mango pulp replaced seabuckthorn pulp at 25 and 50 percent levels of replacement and enforced changes in keeping quality of the squash upon storage for 120 days.

Seabuckthorn belonging to the family *Elaegnaceae*, is a nitrogen fixing plant, grows very widely in dry temperate Himalayas. The genus *Hippophae* grows naturally in cold regions of countries like Russia, Britain, Germany, Finland, France, Central Asia, China, Nepal, Pakistan, Bhutan and India. In India, it grows on high altitudes (2000-4300m) areas of Himachal Pradesh, Jammu and Kashmir, Uttrakhand, Sikkim and Aruanchal Pradesh. In Himachal Pradesh, Seabuckthorn grows on river sides and sun facing slopes of Lahaul-Spiti, parts of Chamba, Kinnaur, Kullu and Shimla. Plant bears foliage from April to November, flowers in June and July and red, yellow and orange coloured berries from mid August to April. Berries are picked up in September and October. Fruit berries are rich source of vitamin C, organic acids, (malic acid) bio-active substances, (sugars, amino acids) Vitamin E, K, B, P, carotenoids and flavnoids. The pulp and seed oil contains vitamin E and K, carotenoids such as lycopene, β-carotene and steroids. This makes seabuckthorn an ideal choice for the beverage, squash and pharmaceutical industries. Commercial potential of the fruit is needed to be exploited in the form of its use in the preparation of value added products. This can boost the economical status of the tribal people of Himachal Pradesh and the country as a whole.

Materials and Methods

Seabuckthorn

The ripened berries of the Seabuckthorn are harvested and collected. The fruits are spread over aluminium trays and small leaves, stalks, spoiled fruits and other contaminants are removed by picking and washing in the running water. The cleaned berries are separated.

Seabuckthorn Pulp

Seabuckthorn pulp is extracted with the help of a mechanical pulper by subjecting a batch of 15 Kg. berries for the extraction process. Pulp is utilized in the preparation of squash.

Squash

Squash formulations are developed from seabuckthorn pulp and from its blends with mango pulp in which mango pulp replaced seabuckthorn pulp at 25 and 50 percent levels of replacement. Squash is prepared according to FPO specifications with 25 per cent pulp, 45 per cent sugar, 1.5 per cent citric acid, 600ppm sodium benzoate and required quantity of water. Calculated quantity of sugar is dissolved in water and pulp is mixed with the resultant solution. Citric acid and sodium benzoate are dissolved in little quantity of squash and added to the rest of the squash. Squash samples so prepared are poured into sterilized 650 ml glass bottles, crown corked and stored at room temperature for further analysis and sensory evaluation.

Chemical characteristics

Seabuckthorn

Mean pulp recovery is 64.60 per cent whereas the proportions of seed and skin is 10.69 and 24.71 per cent respectively. Whole berries contain 75 per cent moisture and 25 per cent dry matter, whereas pulp contains 77.1 per cent moisture and 22.9 dry matter. Seed and skin contain relatively lower moisture contents (42.06 and 48.5%) and higher dry matter contents (57.94 and 51.5%). The protein content of seabuckthorn seeds is observed to be the highest (18.5%) followed by the skin (10.9%), whole berries (4.8%) and pulp (3.2%), respectively. The crude fat content is the highest (9.52%) in seeds followed by skin (7.3%), whole berry (8.2%) and pulp (6.5%), respectively. The mean ash content varies from 1.2 to1.9 per cent among different anatomical parts of seabuckthorn berries.

The analysis of different anatomical parts for β-carotene, anthocyanin and lycopene proves that whole berries are rich in β -carotene (26.99 mg/100g) followed by skin (22.75 mg/100g) and seed (2.73 mg/100g). The anthocyanin contents among whole berries, seed and skin varies from 4.96 to 8.02 mg/100g, respectively. The whole berries and skin are also found to be rich in lycopene (43.69 and 32.77 mg/100g). Whereas seed contained very low content of lycopene (1.87 mg/100g).

Table

Proportions, proximate compositions and pigment contents of seabuckthorn and its different anatomical parts

Parts	Proximate compositions								
	Proportions (%)	Moisture (%)	Dry matter (%)	Protein (%)	Fat (%)	Ash (%)	β-carotene (μg/100g)	Antho-cyanin (mg/100 g)	Lycopene (mg/100 g)
Whole berry	100	75.00	25.00	4.8	8.2	1.7	26985	8.02	43.69
Pulp	64.60	77.10	22.90	3.2	6.5	1.2	-	-	-
Seed	10.69	42.06	57.94	18.5	9.52	1.9	2736	6.53	1.87
Skin	24.71	48.50	51.50	10.9	7.3	1.7	22752	4.96	32.77

*Data presented are averages of triplicate determinations

Squash

Ascorbic Acid, Total Soluble Solids, Titrable Acidity, pH and Brix Acid Ratios

Blending of seabuckthorn with mango pulp results in significant reduction in the ascorbic acid content of the squash. Fresh squash prepared from seabuckthorn pulp contains 111.7 mg/100g of ascorbic acid which decreases to 13.9 mg/100g when the seabuckthorn pulp is completely replaced by mango pulp in the squash. After 120 days of storage the ascorbic acid content in pure seabuckthorn squash decreases from an initial content of 111.7 mg/100g to 75.3 mg/100g, whereas, in case of mango squash it decreases from an initial content of 13.9 mg/100g to 7.2 mg/100g during the same period. Blending of seabuckthorn with mango pulp for the preparation of squash and enhancement of storage duration of squash were detrimental to the retention of ascorbic acid content of a squash. Significant and substantial losses of ascorbic acid during storage are due to its oxidation to dehydro-ascorbic acid. The changes in TSS as affected by blending and duration of storage and also the interactions between these two were found to be in significant ($P \leq 0.05$). Blending does not affect the acidity of the squash, whereas storage produces significant ($P \leq 0.05$) changes in acidity values of squash beverages. While the acidity decreases with the increase in storage periods, contrary to this, the Brix acid ratios increases during storage. Slight decrease in the titrable acidity and corresponding increase in Brix acid ratio values of the squash samples may be attributed to the participation of organic acids in the hydrolysis of sugars and its interactions with other constituents of the squash thereby resulting in neutralization of acid during storage.

Total, Reducing and Non-reducing Sugars

Total sugar contents in the seabuckthorn squash as well as in the squashes prepared by blending are almost as identical (43.19 %). However, slight but significant ($P \leq 0.05$) reduction in total sugars content of the squashes is observed. The mean initial sugars content (43.19 %) decreases to 42.91 per cent after 120 days of storage. Reducing sugars in the squashes are also identical (10.38%) initially. Simultaneous changes with storage in the non-reducing sugars due to the effects of blending are also there.

Sensory Characteristics

The squash prepared from seabuckthorn pulp is adjudged to be least acceptable and that from pure mango pulp is adjudged to be highly acceptable. The acceptability increases with the increase in the proportion of mango pulp in the blends and decreases with the increase in the proportion of seabuckthorn in the blended pulp. The lower acceptability of seabuckthorn squash compared to the mango based formulation is attributable to the presence of some organic constituents in the natural seabuckthorn pulp which probably affects the sensory attributes of the squash samples.

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