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Studies on development and organoleptic evaluation of sweetener-based carrot preserve

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Abstract

The study was conducted to develop sweetener-based carrot preserve with sugar and sweetener (stevia) in various proportions such as (99.5:0.5), (99:1) and (98.5:1.5) were used for T₁, T₂ and T₃ respectively and evaluated with reference sugar-based carrot preserve alone (100:0) T₀. T₂ was found to be the most preferred variant with respect to the sensory quality such as colour, flavour, taste and overall acceptability. Overall, it can be concluded that sweetener up to 1% in preparation of carrot preserve exhibits good sensory attributes.

Keywords: Sweetener, stevia, preserve, calories, carrot

Introduction

Carrots are healthy vegetables but this agricultural product have low value when they are sold as a raw commodity. To become value-added agricultural products, the value of raw carrots has to be increased through the addition of ingredients or processes that make them more attractive to the buyer. Increasing the added value of the carrots requires the development of food products that considering the voice of the customer. The aim of the research was to design food products based on carrots desired by the customer.

Sugar substitutes are the food additives used in very small quantities to sweeten foods which provide zero or few calories and offer attractive dietary options for diabetics and people who are trying to limit calorie intake and reduce the risk of tooth decay (Meister and Kava 2006) [19].

The leaves of *Stevia Rebaudiana Bertoni*, a South American shrub of the *chrysanthemum* family that is commonly called stevia, contain intensely sweet substances that are 250 to 300 times sweeter than sugar. A variety of terms have been used to refer to the sweetening agent extracted from this plant, including stevia, stevioside and steviol glycosides. The JECFA has concluded that the most appropriate name to be used for this extract is steviol glycosides (JECFA 2004a) [13].

Stevia, a heat stable sweetener with little or no aftertaste, is an extract from the herb *Stevia Rebaudiana Bertoni* (Cardello *et al.*, 1999) [5]. The extracted active ingredient is a white crystalline material. Its sweetness potency is many times greater (200–300) than sucrose. Stevia is calorie-free and non-cariogenic. The herb is native to Central and South America and has been used by the indigenous peoples of this area for centuries as a sweetener (Lewis 1982) [17]. It has been used extensively in China, Brazil, and Japan, and to a lesser extent in Germany, Malaysia, and Israel, for many years as a sweetener in numerous food categories (Nabors and Gelardi 1991) [20]. Originally banned by the FDA, the use of stevia was approved in 1995, as a dietary supplement but not as an additive. The argument to approve stevia as a food additive was heated, and it remained approved only as a food supplement for an extended period of time. However, in December 2008, the FDA responded International Journal of Dentistry 5 favourably to GRAS status for the chemically refined derivative of stevia, the extract Rebaudioside A (Rebiana), to be used as a general-purpose sweetener (GRAS 2012) [11]. Rebiana is also available in combination with dextrose and as an extract from stevia leaves. Stevia has been shown to be safe for use by diabetics and has not been shown to be mutagenic (Chan *et al.*, 2000) [6] and (Matsui *et al.*, 1996) [18].

Many indigenous peoples of South America have used stevia as a sweetener for centuries, and it has been in use in Japan for more than 30 years. In addition to Japan, other countries where steviol glycosides are used as a sweetener include China, Russia, Korea, Brazil, Paraguay, Argentina, Indonesia, and Malaysia; as of late 2005, approval was also being sought in

Australia and New Zealand (FSANZ 2005) [9]. Stevia has a very low acute toxicity, and no allergic reactions to it seem to exist (Geuns 2003) [10].

Carrot is a popular cool season crop grown throughout India. It is used as raw as well as cooked form. It is made in to pickles. Gajar halwa is delicious dish. The preservation methods such as dehydration, canning, and pickling can be successfully adopted to preserve carrot for off-season. Dehydrated carrot in the form of grating can be used in the preparation of halwa, discs made in to chips. Dehydration is one of the important methods of value addition of vegetables to make them available during the off-season. (Kukanoor *et al.*, 2014) [15]. Carrots are processed into products such as canned, dehydrated, juice, beverages, candy, preserves, intermediate moisture products and halwa (Kalra *et al.*, 1987) [14]. Carrot candy or preserve can be prepared by covering small whole carrots or slices of carrots with sugar or heavy sugar syrup so that total soluble solids content increases to 70–75°B (Beerh *et al.*, 1984) [2]. Carrots have been processed to obtain intermediate moisture foods containing about 55% moisture (Jayaraman and Dasgupta 1978) [12], (Bhatia and Mudhar 1982) [3] and (Sethi and Anand 1982) [24].

Preserve and candy are prepared from mature (tender green fruit), hole or large pieces of fruits in which sugar is impregnated till it becomes tender and transparent minimum fruit portion and minimum total soluble solids in preserves should be 55 and 70%, respectively (Lal *et al.*, 1960) [16]. Fruits in general contain more than 75% water and get spoiled quickly if not stored properly. Removal of water from fruits is known to help in longer period of storage. The osmotic dehydration techniques not only enable the storage of fruits for a longer period but also preserve the flavour, colour and texture of the product to a great extent and prevents its microbial spoilage (Bongirwar 1997) [4].

China is the major carrot producing country in the world. The area under carrot in India is 22,538 ha with an annual production of 4.14 lakh tons (Thamburaj and Singh 2005) [29] with Uttar Pradesh, Assam, Karnataka, Andhra Pradesh, Punjab and Haryana being the major producing States. In recent years, the consumption of carrot and its products have increased steadily due to their recognition as an important source of natural antioxidants besides, anticancer activity of β-carotene being a precursor of vitamin A (Dreosti 1993) [7] and (Speizer *et al.*, 1999) [25].

Carrots (*Daucus carota*) are among the most popular root vegetables and have been identified as the main dietary sources of carotenoids (O'Neill *et al.*, 2001) [21]. Carrot is the diverse coloured crop grown annually for the edible purpose belonging to *Apiaceae* (previously *Umbelliferae*) family grown throughout the world. The cultivation of the crop is favoured during the months of September to November in tropical and subtropical regions whereas the temperate conditions offer a wide option of cultivation throughout the

year. The crop needs a cool temperature for the production of seeds. Carrot is the lonely coloured root crop with different types of pigments in the form of carotenoids and flavonoids that impart antioxidant properties in addition to colour (Rodriguez-Amaya 2001) [23].

Carrots are noted for their rich antioxidants, especially β-carotene. In recent years, worldwide consumption of carrots has been steadily increasing because of their nutritional benefits. Carrots have potentially beneficial health effects, anti-carcinogenic, antioxidant, and immune boosting properties, as well as the pro-vitamin activity of some carotenoids (Fiedor and Burda 2014) [8] and (Tanaka *et al.*, 2012) [28].

Materials and Methods

Materials

The fresh carrot were obtained from local village market, Parbhani. The proposed research was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani.

Methods

Preparation of sugar-based carrot preserve

Carrot preserve is prepared by boiling the carrot slices in sugar syrup until the total soluble solids of the product reaches 55-70%. Preserve is an intermediate moisture food and involves osmotic concentration. Carrot preserve has been made by pre-treating boiled carrots with 40°Brix for 12 hrs, followed by dipping in 60°Brix for the same time and finally in the 70°Brix concentrations with sample to syrup ratio as 1:4 whereas solution with sugar, water, glycol, acid and preservative for the preparation of intermediate moisture carrot slices.

Standardized recipe for carrot preserves prepared by slow Syruping method

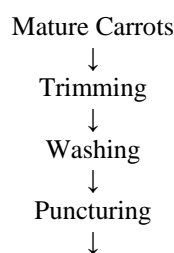
Table 1: Standardized recipe for carrot preserve

Ingredient	Slow syruping method
Carrot pieces (g)	1000
Sugar (g)	1000
Citric acid (g)	10

Organoleptic evaluation of turmeric based orange RTS beverage

Organoleptic evaluation of sweetener-based carrot preserve for colour and appearance, flavour, after taste and overall acceptability was carried out by using standard method of (Amerine *et al.*, 1965) [1]. For these 10 semi-trained judges were used and 1 to 9-point hedonic scale was used for rating the quality of the sweetener-based carrot preserve. The mean of ten judges was considered for evaluating the quality.

Preparation of carrot preserve (Srivastava and Kumar, 1994a; 1994b) [26, 27].



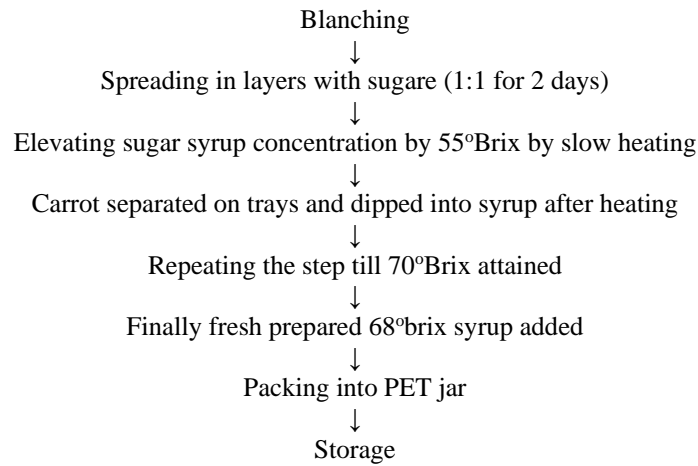


Fig 1: Process flowchart for preparation of carrot preserve

Result and Discussion

Table 2: Mean sensory score values for the carrot preserve

Samples	Appearance	Colour	Flavour	After Taste	Mouth feel	Overall Acceptability
T ₀	8.7	9	8.5	9	9	8.8
T ₁	7.5	8.0	8.0	8.5	8.5	8.1
T ₂	8.5	8.7	8.5	9	8.5	8.6
T ₃	7.5	7.6	7.9	8.0	8.0	7.8
SE +	0.069	0.096	0.054	0.070	0.084	0.052
CD at 5%	0.209	0.290	0.076	0.212	0.253	0.158

Data indicated in above table 1. Showed that sweetener-based carrot preserve with 99:1 sugar to stevia received highest sensory score (i.e., 8.6) in case of all sensory attributes followed by sweetener-based carrot preserve having 99.5:0.5 scored (i.e., 8.1) compared to rest of the samples. The effect of sweetener on sweetener-based carrot preserve was significantly affected by different recipe and treatment combinations the results found close to that of (Raj *et al.*, 2011)^[22].

sugar to sweetener (stevia) received highest sensory score (i.e., 8.6) in case of all sensory attributes.

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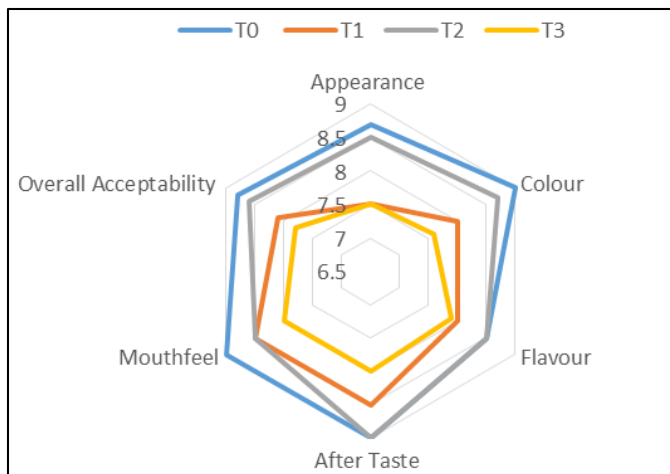


Fig 2: Sensory Evaluation of Carrot preserve

Conclusion

In present investigation efforts were made to develop carrot preserve with various proportions of added sweetener. The study revealed that the organoleptic characteristics of carrot preserve *viz.*, colour, flavour, taste, and overall acceptability were significantly influenced by different recipe treatments. It can be finally concluded that carrot preserve with 99:1 (T₂)

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