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Evaluation of temperate carrot genotypes for quality attributes

V.R. Sagar* and Pritam Kalia**
Division of Food Science and Post Harvest Technology, ICAR-Indian Agricultural Research Institute, New Delhi 110 012

ABSTRACT

Carrot roots having high dry matter content and rich in carotene are generally considered for dehydration purposes. High degree of β-carotene is very essential to retain better flavour in dehydrated products. Based on the different nutrient parameters such as β-carotene, lycopene, ,ascorbic acid, sensory score in respect of colour, flavour and texture of the dried product as well as drying and rehydration ratio, the genotype NS-16 followed by genotypes SH and Pusa Yamdagini were found to be superior for the preparation of dehydrated carrot slices, among the thirteen different genotypes of carrot analyzed.

Key words: β-carotene, genotypes, quality attributes, temperate type carrot.

INTRODUCTION

Carrot (*Daucus carota* L.) is a popular root vegetable, known for its high nutritive value, especially for β-carotene and other carotenoids. Temperate or European carrot roots are orange coloured and rich in β-carotene a precursor of vitamin 'A.' In general carrots are also rich source of dietary fibre, antioxidants, and minerals. It is used in various forms as raw or cooked. Besides, it has uses in pickles, vegetable soups, sauces, curries, pies, canning etc. Among the roots and other vegetables, carrot is the best source of β-carotene, an essential nutrient for maintaining health. The supply of 5.2-6.0 mg β-carotene/day can prevent cancer, as carotenoids may act as antioxidant by quenching singlet oxygen and triplet excited states (Palozza and Krinsky, 4). Demand for fresh and dehydrated carrots is increasing considerably day by day. To meet this challenge there is need to develop new varieties/ genotypes superior for processing. The available varieties generally have low solids, short shelf-life and low in caroteneoid pigments.

These characteristics limit their suitability for dehydration. Preservation of carrots enhances the availability period and for preservation dehydration is one of the most important methods, because it lowers the cost of packaging, storage and transportation by reducing both weight and volume of the final product. The present investigation was therefore, undertaken to analyze new varieties/ hybrids of temperate carrot for various nutritional parameters as well as their suitability for dehydration purposes.

MATERIALS AND METHODS

Fresh suitable roots of different carrot genotypes were obtained from the IARI Regional Station, Katrain, Himachal Pradesh (2010-11) for conducting the experiment at IARI, New Delhi. The roots of carrot selected for study were washed with running tap water and peeled by scrapping with a sharp stainless steel knife and washed again to remove scrapped material and finally they were cut into 0.5 cm thick slices with the help of vegetable slicer. The prepared slices were blanched in boiling water (1:2 ratio, slice: water) for 7 min. (pre-standardized time) to inactivate the peroxides enzymes. Blanched and cooled slices were immersed in solution containing 0.25% potassium meta-bi-sulphite (KMS) for 20 min. in equal quantity of water. After 20 min., the slices were drained through sieve and spread in the form of thin layer @ 2.5 kg/ aluminium tray (40 cm × 80 cm) for drying in a air cross flow cabinet dryer (Kilburn – model-0248) at a temperature of 58 ± 2°C. During drying the samples were turned periodically for every two hours to ensure uniform drying. Fresh as well as dehydrated samples were analyzed for different quality parameters. The moisture content was determined by drying a known weight of the sample in a hot air oven at 60 ± 5°C to a constant weight and expressed as per cent. The titratable acidity, total carotenoids, β-carotene, ascorbic acid, lycopene, and reducing & total sugars were determined according to the method described by Ranganna (6). Five gram of the dehydrated sample was taken into a beaker and 50 ml of warm (60°C) water was added into it. After one hour, the drained weight of the rehydrated material was taken. Sensory evaluation of reconstituted dehydrated carrot slices was done by a panel of 7 judges comprising of scientific staff from the laboratory. All the judges were conversant with the factors governing the quality of the product and attributes were scored by

*Corresponding author's E-mail: vidyaram_sagar@yahoo.com
**Head, Division of Vegetable Science, IARI, New Delhi

a using 9- point Hedonic scale. A score of 5.5 and above was rated acceptable (Amerine *et al*., 1). The data obtained were statistically analyzed following methods of Panse and Sukhatme (5).

RESULTS AND DISCUSSION

The moisture content varied from 86.76% (NS-16) genotype to 94.44% (NO-501) genotype (Table 1). A wide variation in moisture content might be due to variation in dry matter content among the different genotypes. The acidity was higher (0.14%) in NO-501 followed by (0.13%) in SH genotype and it was minimum (0.06%) in Nantes, CR-59, NS-505, 240607 × N × 10160. Similar patterns have been reported by Sagar *et al*. (7). The ascorbic acid content ranged from 1.22 mg/100 g (95 × N × 1061) to 2.10 mg/100 g in (CR-59) followed by 1.79 mg/100 g in SHAUC 108 & NS-16. The variation in ascorbic acid may be due to differentiate in moisture content, available dry matter content and activity of ascorbic acid oxidizing enzymes in particular genotype (Kumar and Sreenarayanan, 3). The reducing sugar was minimum (2.38%) in SHAUC-108 and it was higher (3.30%) in 28 × PY1 × 1060 followed by (3.25%) in NS-16 & Nantes. The total sugars varied from (4.03 mg/100 g) in SHAUC-108 to (6.7 mg/100 g) in NS-16. This might be due to variation in degree of hydrolysis of polysaccharides to invert sugar (Sagar *et al*., 8). Lycopene content was minimum (3.25 mg/100 g) in 95 × N × 1061 and it was higher (8.27 mg/100 g) in Nantes Seclet. The highest (8.91 mg/100 g) total carotenoids were estimated in NS-16 and it was minimum (5.2 mg/100 g) in 95 × N × 1061. β-carotene was higher (8.65 mg/100 g) in NS-16 followed by (7.81 mg/100 g) in Pusa Yamdagini and it was low (1.76 mg/100 g) in 95 × N × 1061 followed by (4.89 mg/100 g) in New Kunda. This might be due to rate of degradation of carotenoids and presence of SO_2, which might have reduced rate of carotenoids destruction (Arya *et al.*, 2). Sensory score was maximum (8.5) in the dehydrated carrot slices prepared from NS-16 and it was minimum (5.0) in SHAUC-108 followed by (5.6) in NO-501.

The physico-chemical characteristics of different carrot genotypes are given in Table 2. The highest recovery of slices was observed in NS-16 (20.43%), whereas, it was constant in 240607 × N × 1060, (17.30%). The yield of recovery might vary due to availability of dry matter content and peeling loss in different genotypes. The drying ratio was least (6.73:1) in NS-16 and highest (8.91:1) in NO-501. The variation in drying ratio may be due to variation in dry matter content. The moisture content ranged from (4.37%) in SHAUC -108 to (5.26%) in New Kunda. The reconstitution ratio was minimum (1:2.41) in NO-501, and maximum (1:2.75) in NS-16. This might be due to variation in sugar content of the cell walls and causing more puffiness texture for faster rehydration (Sagar *et al*., 8).

The perusal of analysis of variance (Table 2) showed significant differences among genotypes for all characters studied. This indicates sufficient

Table 1. Chemical characteristics of temperate carrot genotypes.

Genotype	Moisture (%)	Acidity (%)	Ascorbic acid (mg/100 g)	Reducing sugar (%)	Total sugars (%)	Lycopene (mg/100 g)	Total carotenoids (mg/100 g)	β-carotene (mg/100 g)	Sensory evaluation (9)
SHAUC-108	88.57	0.12	1.79	2.32	4.03	6.57	7.79	7.74	5
No-501	94.44	0.14	1.31	3.2	4.8	6.8	7.37	6.46	5.6
Nantes	90.2	0.06	1.7	3.25	4.72	6.75	7.21	5.73	6.33
CR-59	88.68	0.06	2.1	3.1	4.5	5.78	6.33	7.54	6.36
NS -505	88.2	0.06	1.33	3.11	4.5	7.31	7.93	6.54	7.5
240607XNX1060	90.11	0.06	1.32	2.58	5.1	7.32	7.46	6.58	6.1
SH	87.82	0.13	1.73	3.15	5.1	7.4	8.45	7.76	8.1
NS -16	86.76	0.06	1.79	3.25	6.7	7.69	8.91	8.65	8.5
95XNX1061	89.29	0.06	1.22	2.77	4.16	3.25	5.2	1.76	6
New Kunda	88.07	0.05	1.61	2.84	5.33	4.84	5.74	4.89	6
Nantes Seclet	89.98	0.06	1.56	3.03	4.83	8.27	7.35	6.67	6.1
28XPY1X1060	88.97	0.06	1.5	3.3	5.27	6.05	6.33	6.37	7.23
Pusa Yamdagini	90.39	0.06	1.5	2.8	5.36	7.3	8.17	7.81	7.6
CD at 5%	0.95	0.008	0.12	0.129	1.36	0.29	0.113	0.15	0.39

Table 2. Physico-chemical characteristics of different temperate carrot genotypes.

Genotype	Recovery of dried slices (%)	Moisture (%)	Dehydration ratio	Rehydration ratio	Colour	Overall acceptability
SHAUC-108	17.24	4.37	7.52	2.88	5.47	5.22
No-501	17.32	5.10	8.91	2.41	5.51	5.25
Nantes	18.27	4.61	8.61	2.54	6.10	5.62
CR-59	17.72	4.54	7.28	2.66	4.00	4.49
NS -505	17.72	5.14	7.51	2.56	4.14	4.37
240607XNX1060	17.30	5.10	8.33	2.59	5.03	5.27
SH	19.60	4.47	6.72	2.74	7.14	7.29
NS -16	20.43	4.54	6.73	2.76	8.60	8.64
95XNX1061	17.62	5.14	7.65	2.64	4.04	4.26
New Kunda	18.68	5.26	7.50	2.53	4.21	4.21
Nantes Seclet	17.81	5.06	7.75	2.57	5.10	5.31
28XPY1X1060	18.39	4.83	7.82	2.59	4.05	4.05
Pusa Yamdagini	18.87	4.65	7.47	2.68	7.12	7.29
CD at 5%	0.255	0.274	0.064	0.24	0.114	0.023

genetic variability in drying ratio, rehydration ratio and sensory score. In the organoleptic evaluation of colour attributes, genotypes NS-16 (8.60) ranked foremost followed by CR-59(4.0). However, the overall acceptability of dehydrated carrot slices indicated maximum (8.64) score in case of NS-16 and minimum (4.05) in 28 × PY1 × 1060.

Carrot is a rich source of β-carotene, fibre and many essential micronutrients and functional ingredients. Carrot being perishable and seasonal, it is not possible to readily make it available throughout the year. Hence, dehydration of carrot during the main growing season is one of the important alternatives of preservation to further develop value-added products throughout the year.

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