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Sharavati MB
Department of Vegetable Science. College of Horticulture, Mudigere University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Srinivasa V
Department of vegetable science, College of Horticulture, Mudigere, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Ramachandra Naik
AICRP on Vegetables & Tuber crops, ZHRS, Kumbapur farm, Dharwad, University of horticulture sciences, Bagalkot, Karnataka, India

Kanthraj Y
Department of Postharvest Technology, College of Horticulture, Mudigere, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka

Devaraju
Department of vegetable science, college of horticulture, Mudigere, University of agricultural and horticultural sciences, Shivamogga, Karnataka, India.

Shashikala Kolakar
Department of genetics and plant breeding, college of horticulture, Mudigere, University of agricultural and horticultural sciences, Shivamogga, Karnataka, India.

Correspondence
Sharavati MB
Department of Vegetable Science. College of Horticulture, Mudigere University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Evaluation of different sweet potato [*Ipomoea batatas* (L.) Lam] genotypes for suitability of chips preparation

Sharavati MB, Srinivasa V, Ramachandra Naik, Kanthraj Y, Devaraju and Shashikala Kolakar

Abstract
The present study was conducted at Post Harvest Technology Department, College of Horticulture, Mudigere, Karnataka during the year 2017, to find out the suitable genotypes for the preparation of quality sweet potato chips. Sweet potato (*Ipomoea batatas* (L.) Lam) is a major economical and healthy food crop in developing countries which is consumed as boiled tubers. Although sweet potato is cheaper than any other tubers crops, this abundant resource is still poorly utilized. Therefore, thirty sweet potato genotypes were taken for investigation, the fresh pulp of sweet potato were analyzed for its nutritional composition like reducing sugars, non-reducing sugars, total sugars, crude proteins, beta-carotene content and dry matter content. Chips recovery percentage was calculated for chips made from different genotypes of sweet potato and sensory evaluation was performed with 5 hedonic scales. Among the 30 genotypes pulp were analyzed, the genotype BSP-23 recorded maximum reducing sugars (1.34 %), non-reducing sugars (1.83 %), total sugars (3.17 %), crude proteins (11.37 %), beta-carotene content (0.92 mg/100g) and dry matter content (61.85 %) followed by BSP-21 (reducing sugars 1.20 %, non-reducing sugars 1.56 %, total sugars 2.76 %, crude proteins 8.99 %, beta-carotene content 0.88 mg/100g, dry matter content 61.38 %). The highest chips recovery percentage recorded in BSP-23 (93.60 %) followed by BSP-21 (93.20 %), BSP-18 (92.40 %) and BSP-28 (92.00 %). Organoleptic tests were performed on fried sweet potato chips, out of them the genotype BSP-23 was rated the maximum score with respect to colour (4.25), mouth feel (4.18), flavour (4.25), appearance (4.38), texture (4.25) and overall acceptance (4.19) followed by BSP-21. Although there is a similar recovery percentage obtained in other genotypes, BSP-23 and BSP-21 were considered as the most favourite for chips preparation based on the sensory and nutritional characters.

Keywords: Recovery percentage, sensory characters, mouth feel and texture.

Introduction

Sweet potato (*Ipomoea batatas* L.) is a major economical and healthy food crop in developing countries (Wolfe, 1992), which is mainly consumed as boiled roots. Sweet potato is positioned as the seventh most major food crop in the world, fourth in tropical countries and fifth most essential food crop on a fresh weight basis in developing countries after rice, wheat, maize and potato(Karyeija *et al.*, 1998) [7] with annual production of 141.54 million tonnes (FAO, 2005) [3]. Sweet potato could be a better competitor as food, feed and industrial raw material (Tsou *et al.*, 1997) [10]. Although sweet potato is cheaper than other crops, this abundant resource is still poorly utilized. Sweet potato roots can be processed into products with improved characteristics and longer shelf life.The carbohydrate content of the sweet potato tubers varies from 25 to 30 per cent, while the rest is composed of water (58 to 72 %). Sweet potatoes being good sources of vitamin C, vitamin E, dietary fiber, calcium, potassium and iron, and are low in fat and cholesterol. However, they also contain moderate quantities of thiamine (B_1), riboflavin (B_2), niacin, pantothenic acid (B_5), pyridoxine (B_6) and folic acid. Moderate quantities of sodium, magnesium, manganese and zinc are also present. The tubers are used as subsidiary food after boiling, baking and frying, moreover tubers also form an industrial raw material for the production of starch, alcohol, pectin, *etc*. Being rich in β-carotene, the orange-fleshed sweet potato is gaining importance as the cheapest source of antioxidant having several physiological attributes like anti-oxidation, anti-cancer and protection against liver injury and is most suiting as a biofortified crop to combat malnutrition in small and marginal farming community. Sweet potato is, no doubt, an important food for the future and requires greater attention from both consumers and researchers in this part of the world.

Sweet potato is becoming increasingly popular as an alternative raw material for the production of chips and french fries (Garcina and Walter, 1998) [8], and sweet potato chips is gaining wide acceptability too. Sweet potato chips are potential nutritional snack foods when produced from cultivars high in pro vitamin A and ascorbic acid.

Development of appealing processed products, such as chips, from sweet potato would appear to be a way of increasing awareness among consumers as well as expanding the utilization of the root crop.Consequently, the objective of this study was to evaluation of different sweet potato genotypes for suitability of chips preparation.

Materials and Methods

Thirty genotypes of sweet potatoes were procured from AICRP on Tuber crops, Dharwad, UHS, Bagalkot have been taken for investigation (Table 1). The experiment was conducted at the experimental block of the Department of Vegetable Science, College of Horticulture, Mudigere, Karnataka during 2017-18.The experiment was laid out in a randomized complete block design (RCBD) with thirty treatments and two replications. The plot size of 3m×2m with a row to row distance of 60cm and plant to plant distance of 30 cm was maintained. Standard cultural practices were followed as per the package of practice. Observations such as Reducing Sugar by DNSA method; Non Reducing Sugar; Total Sugar and Starch by Anthrone method by Ranganna 1979; Beta-carotene by Acetone-Hexane method and Crude protein by Micro-Kjeldhal method by Jackson, 1958 [5] (Table 2).

Frying Process: Sweet potatoes were selected, washed and brushed thoroughly in running water to remove dirt. Then, they were all peeled with stainless steel knife and manual peeler. A known amount (1 kg) of refined sunflower oil was placed in a stainless steel pan fryer (60 cm diameter x 30 cm height) and heated at 180 ± 5 °C, then chips (2 mm thickness) of different sweet potato genotypes previously soaked in NaCl solution (10 % w/v) were fried and placed on oil-absorbing sheets to soak up oil and packed in Low-density polyethylene (LDPE). Mean values of peel weight, quantity of slices and chips yield were presented in the table 3.

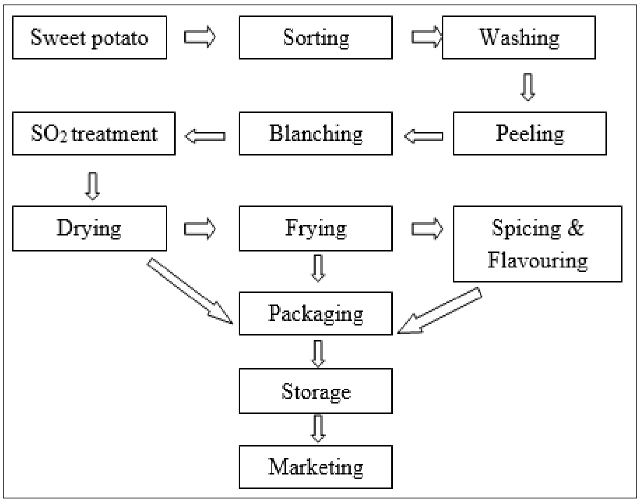

Fig 1: Flowchart for sweet potato chips preparation

Determination of chips recovery percentage

$$\text{Chips recovery percentage (\%)} = \frac{\text{Quantity of slices}}{\text{Initial weight of tuber}} \times 100$$

Sensory evaluation of sweet potato chips

The fresh tubers, which are brought from an experimental plot in each treatment were boiled in a pressure cooker and kept to sensory evaluation for the assessment of quality parameters. The organoleptic test was conducted for skin colour, flesh colour, taste, flavor, texture, tuber size and overall acceptability of tubers. The tubers were evaluated byassigning different numericals using 5 hedonic scale as the score value based on their quality. A panel of ten members from College of Horticulture, Mudigere was performed to judge the organoleptic quality of the tubers. Mean values for sensory evaluation of tubers were presented in table 4.

Table 1: List of sweet potato genotypes used for the study.

No	Name of the genotype	No	Name of the genotype	No	Name of the genotype
1	BSP-1	11	BSP-13	21	BSP-23
2	BSP-2	12	BSP-14	22	BSP-24
3	BSP-3	13	BSP-15	23	BSP-25
4	BSP-6	14	BSP-16	24	BSP-26
5	BSP-7	15	BSP-17	25	BSP-27
6	BSP-8	16	BSP-18	26	BSP-28
7	BSP-9	17	BSP-19	27	BSP-29
8	BSP-10	18	BSP-20	28	BSP-30
9	BSP-11	19	BSP-21	29	Vikram
10	BSP-12	20	BSP-22	30	Sree Bhadra

Table 2: Mean performance of sweet potato genotypes for quality parameters

S. No	Genotypes	*RS (%)	*NRS (%)	*TS (%)	Crude protein (%)	Beta-carotene (mg/100g)	Tuber dry matter content (g)
1	BSP-1	0.55	0.95	1.50	4.00	0.18	49.04
2	BSP-2	0.72	1.04	1.75	3.32	0.16	41.64
3	BSP-3	0.85	0.71	1.55	8.35	0.14	42.54
4	BSP-6	0.57	0.81	1.38	5.50	0.14	55.39
5	BSP-7	0.56	0.77	1.33	3.53	0.11	32.77
6	BSP-8	1.04	1.34	2.37	6.44	0.70	33.76
7	BSP-9	0.50	0.76	1.25	4.70	0.18	30.97

8	BSP-10	0.62	0.92	1.53	5.12	0.38	51.79
9	BSP-11	0.59	0.79	1.37	5.28	0.27	41.15
10	BSP-12	0.50	0.75	1.24	3.06	0.17	30.82
11	BSP-13	0.58	0.84	1.42	4.43	0.24	36.33
12	BSP-14	0.39	0.53	0.92	3.06	0.34	52.50
13	BSP-15	0.67	0.99	1.66	4.33	0.37	38.67
14	BSP-16	0.61	0.90	1.51	4.48	0.50	28.47
15	BSP-17	0.51	0.74	1.24	3.57	0.26	28.53
16	BSP-18	0.97	1.22	2.18	3.22	0.41	56.81
17	BSP-19	0.44	0.60	1.03	4.11	0.32	51.64
18	BSP-20	0.37	0.67	1.03	3.11	0.20	46.19
19	BSP-21	1.20	1.56	2.76	8.99	0.88	61.38
20	BSP-22	0.70	0.92	1.62	5.36	0.13	31.00
21	BSP-23	1.34	1.83	3.17	11.37	0.92	61.85
22	BSP-24	0.60	0.90	1.50	6.22	0.44	29.92
23	BSP-25	0.50	0.67	1.16	5.83	0.20	46.07
24	BSP-26	0.39	0.71	1.10	6.80	0.17	35.04
25	BSP-27	0.31	0.56	0.86	4.31	0.11	37.67
26	BSP-28	0.35	0.51	0.85	8.52	0.19	44.79
27	BSP-29	0.84	1.12	1.96	7.31	0.47	38.93
28	BSP-30	0.31	0.45	0.75	5.76	0.13	30.53
29	Vikram	0.63	0.84	1.47	5.30	0.31	30.96
30	Sree Bhadra	0.63	0.92	1.54	5.42	0.11	35.59
Mean		0.63	0.88	1.50	5.36	0.30	41.09
S.Em±		0.02	0.03	0.02	0.06	0.004	3.38
C.D @ 1%		0.006	0.08	0.08	0.21	0.015	13.21

Table 3: Mean performance of different sweet potato genotypes on peel weight, quantity of slices, chips yield and chips recovery percentage

Genotypes	Initial weight of tubers (g)	Peel weight (g)	Quantity of slices (g)	Chips yield (g)	Chips recovery percentage (%)
BSP-1	500	55	445	144	89.00
BSP-2	500	140	360	126	72.00
BSP-3	500	120	380	116	76.00
BSP-6	500	90	410	134	82.00
BSP-7	500	70	430	150	86.00
BSP-8	500	85	415	136	83.00
BSP-9	500	80	420	140	84.00
BSP-10	500	80	420	152	84.00
BSP-11	500	42	458	156	91.60
BSP-12	500	92	408	128	81.60
BSP-13	500	92	408	140	81.60
BSP-14	500	90	410	144	82.00
BSP-15	500	64	436	122	87.20
BSP-16	500	72	428	152	85.60
BSP-17	500	78	422	142	84.40
BSP-18	500	38	462	160	92.40
BSP-19	500	104	396	114	79.20
BSP-20	500	116	384	150	76.80
BSP-21	500	34	466	165	93.20
BSP-22	500	82	418	132	83.60
BSP-23	500	32	468	180	93.60
BSP-24	500	156	344	156	68.80
BSP-25	500	62	438	148	87.60
BSP-26	500	128	372	140	74.40
BSP-27	500	44	456	136	91.20
BSP-28	500	40	460	150	92.00
BSP-29	500	178	322	138	64.40
BSP-30	500	92	408	142	81.60
Vikram	500	100	400	128	80.00
Sree Bhadra	500	80	420	138	84.00

Table 4: Mean performance of sweet potato genotypes for sensory evaluation of chips

Genotype	Colour	Mouth feel	Flavour	Appearance	Texture	Overall acceptability
BSP-1	3.25	2.75	2.25	2.75	3.50	3.00
BSP-2	1.50	1.75	2.00	2.00	2.75	2.00
BSP-3	2.25	2.25	2.75	2.75	3.75	3.00
BSP-6	4.25	3.50	3.25	3.75	3.75	3.50
BSP-7	4.00	2.75	2.50	3.50	3.75	3.37
BSP-8	3.25	2.50	2.00	3.25	3.25	3.00
BSP-9	2.75	2.25	2.00	3.25	3.00	2.87
BSP-10	3.00	2.25	2.12	3.25	3.75	3.13
BSP-11	3.25	3.00	2.50	2.50	3.50	3.00
BSP-12	3.25	2.75	2.25	3.25	2.88	3.06
BSP-13	3.12	1.75	1.88	2.62	2.00	2.37
BSP-14	2.50	1.88	1.50	2.75	2.62	2.00
BSP-15	3.50	3.50	2.00	3.50	4.13	3.63
BSP-16	3.50	3.00	3.25	2.75	3.25	3.00
BSP-17	3.25	2.25	2.25	3.00	3.25	3.00
BSP-18	2.25	1.50	1.75	2.00	3.25	2.63
BSP-19	2.25	2.75	3.25	2.25	3.00	2.75
BSP-20	2.13	1.50	2.00	2.25	2.00	2.00
BSP-21	4.13	4.13	4.00	4.00	4.19	3.75
BSP-22	1.75	2.00	2.00	1.75	1.75	2.00
BSP-23	4.25	4.18	4.25	4.38	4.25	4.19
BSP-24	2.25	2.00	1.50	2.38	2.50	3.00
BSP-25	2.25	1.63	1.38	2.88	3.37	2.31
BSP-26	2.63	1.94	1.88	2.00	3.50	2.13
BSP-27	1.50	1.38	1.63	1.75	2.88	1.81
BSP-28	2.63	2.75	2.63	2.50	3.00	2.75
BSP-29	2.63	2.25	2.13	2.50	2.63	2.94
BSP-30	3.00	2.50	2.50	3.13	2.75	2.88
Vikram	3.00	2.38	2.13	3.00	3.50	2.94
Sree Bhadra	2.75	3.50	3.00	3.25	3.75	3.50

Result and Discussion

Among the thirty genotypes studied, it is evident from the results presented in the table 2. That there was significant differences were observed among the genotypes with respect to quality parameters, chips preparation and sensory evaluation of chips. Genotype BSP-23 recorded maximum reducing sugar (1.34%), non-reducing sugar (1.83%) and total sugar (3.17%) which was followed by BSP-21(1.20%) for reducing sugar, non-reducing sugar (1.56%) and total sugar (2.76%). whereas minimum reducing sugar (0.30%) recorded in genotype BSP-27 and BSP-30.Genotype BSP-30 showed minimum non-reducing (0.45%) and total sugar (0.75%). The maximum crude protein was found in genotype BSP-23 (11.37%) followed by BSP-2 (8.99%) and was minimum in BSP-12 and BSP-14 (3.06%). The highest beta-carotene was recorded in genotype BSP-23(0.92mg/100g) which was followed by BSP-21 (0.88mg/100g). Whereas minimum was observed in BSP-21 and BSP-27 (0.11mg/100g). Maximum dry matter content was observed in BSP-23 (61.85%) followed BSP- 21(61.38%) and minimum was recorded in BSP-16 (28.47%). Significant variations in quality parameters among different genotypes of sweet potato may be due to the inherent genetic makeup of the genotype and influence of environmental conditions. Results are in accordance with the findings of Allolli *et al.* (2012) [2] and Kapinga *et al*. (2011) [6].

Sweet potato genotype BSP-23 (93.60 %) followed by BSP-21 (93.20 %) recorded higher chips recovery percentage (table 3) because of higher chips yield (180 and 165 g, respectively), highest quantity of slices (468 and 466g respectively.,) and lesser peel weight (32 and 34 g, respectively) and also due to high dry matter content (61.85 %). Results are similar to the findings of Ali *et al.* (2012) [1].

Plate 1: BSP-23

Plate 2: BSP-21

The acceptability scores of chips prepared out of sweet potato genotypes is given in table 4. Genotype BSP-23 showed higher score for colour (4.25) followed by BSP-21 (4.13) because of high beta-carotene content. Thus, the appearance and brightness of colour might be depends on pulp quality and texture of different genotypes. Whereas, BSP-2 and BSP-27 (1.50) showed lower score. Genotype BSP-23 (4.18) showed the higher score for mouth feel followed by BSP-21 (4.13) and BSP-18 (1.50) showed lower score. The higher score for flavour was exhibited by BSP-23 (4.25) due to high sugar content (reducing sugars and non-reducing sugars are used to predict the material behaviour used during the preparation of chips and they also considered as the limiting factor in colour depreciation) followed by BSP-21 (4.00) and BSP-25 (1.38) showed lower score for flavour. BSP-23 (4.38) showed maximum score for appearance followed by BSP-21 (4.00) and the minimum was observed in BSP-22 and BSP-27 (1.75). The maximum score for texture was observed in BSP-23 (4.25) followed by BSP-21 (4.18) which might be due to its porosity, whereas the minimum score was exhibited by BSP-22 (1.75). The overall acceptability score was found to be maximum in BSP-23 (4.19) followed by BSP-21 (3.75) because of high colour, taste, flavour and mouth feel whereas, BSP-27 (1.81) showed lower score for overall acceptability. Results are in conformity with the findings of Evoor *et al.* (2008) [4].

Conclusion

The present investigation revealed that considerable degree of variability exists among the different genotypes of sweet potato for quality traits, sensory evaluation of chips, peel weight, quantity of slices, chips yield and chips recovery percentage. The genotype BSP-23 followed by BSP-21 were found best suited for chips preparation over the other genotypes with respect to quality parameters and sensory evaluation of chips prepared out of different sweet potato genotypes.

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