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Effect of blanching time on quality parameter of blanched carrot slices

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Abstract
Carrot (*Daucus carota* L.) is a healthy and nutritious root vegetable. Carrots have an important place in human diet due to its significant health promoting properties. Blanching plays important role in retention of nutritive value as it inactivates enzymes that cause off-flavour and changes in colour. Therefore, blanching experiment was carried out by varying time for water and steam blanching. Blanched carrot slices along with control were evaluated for different quality attributes such as moisture, colour, texture (firmness) and sensory parameters. The significant increase and non-significant decrease in moisture content with blanching time was observed for water and steam blanched slices respectively. A reduction in firmness up to 0.74 and 0.82 in water and steam blanched samples, respectively. Maximum beta carotene content was retained in one minute steam blanched slices. Higher a* value were recorded for steam blanching than water blanching while decreasing trend in L* value was more in steam blanched carrot slices than water blanched samples.

Keywords: Blanching, carotene, firmness colour

Introduction
Carrot is a seasonal and most popular vegetable crop grown in the world. The global carrot production was about 44.3 million metric tons (Anonymous, 2020) [4]. In India, area and production of carrot was 114 thousand ha and 1996 thousand MT, respectively during 2018-19 (Anonymous, 2019) [3]**.** In Maharashtra, area and production of carrot for the year 2017-18 was 1.24 thousand ha and 14.20 thousand MT, respectively (Anonymous, 2018) [2]**.** Carrot intake may also enhance the immune system, protect against stroke, high blood pressure, osteoporosis, cataracts arthritis, heart diseases, bronchial asthma and urinary tract infection (Sun *et al*. 2001; Seo and Yu 2003) [20, 18]. Orange coloured carrots are rich in carotene; a precursor of vitamin A. It has good nutritional value with 42 kcal of energy, 1.1g protein, 1100 IU vitamin A, 8 mg ascorbic acid, 0.06mg thiamine, Ca 37 mg, P 36 mg and iron 0.7 mg per 100 g of fresh sample (Thamburaj and Singh, (2005) [21]. Drying is a most popular technique which not only extends the shelf life but also provides a wide range of foods for consumers. Some pre-treatments such as blanching, osmotic dehydration, and microwave are used for improving the quality of dehydrated fruit and vegetable products and also helps in reducing energy consumption (Levent and Ferit, 2011).

Blanching process involves briefly precooking of fruits and vegetables either in boiling water or steam. It also helps to slow down or stop the enzymatic activities which may cause undesirable changes in flavour and texture during storage. It also helps to retain the product vitamins and colour Blanching treatment stabilizes color, texture, flavor and nutritional quality of the product, and inactivates peroxidase (POD) and pectin methylesterase (PME) which catalyzes deleterious changes (Duygu Bas *et. al.* 2015) [8]. Blanching can also cause adverse effect on nutritional compounds like vitamins and phenolic compounds when subjected to heat treatments (Prochaska *et. al.*, 2000) [17]. Therefore it is necessary to determine the optimum blanching time for water and steam blanching of carrot slices. Steam blanching is usually used for cut and small products and requires less time than water blanching because the heat transfer coefficient of steam is greater than hot water (Gill and Gupta, 2017) [9]. Hence the present study was undertaken to evaluate the effect of blanching time on quality of water and steam blanched carrot slices.

Materials and Methods

Sample preparation

The carrots were washed and sliced into circular discs of 3 mm thickness. For water blanching, carrot slices in muslin cloth were immersed into boiling water in the vessel. The proportion of water to carrot slices was maintained as 5:1 by weight (Patras *et al.*, 2011) [16]. Steam blanching was carried out in a deep steel pot with tight fitting lid. Blanching time was selected as 2, 3 and 4 min and 1, 2 and 3 min for water and steam blanching respectively (Congcong Xu *et al.*, 2015; Gupta and Shukla, 2017) [7, 10]. The blanched slices were immediately cooled to room temperature under ice cold water and then spread on a sieve for the removal of surface moisture (Gill and Gupta, 2017) [9].

Peroxidase test

Peroxidase inactivation is taken as index of blanching as it is the most heat resistant enzyme. The peroxidase test was carried out for determining the adequacy of blanching treatment. Steam and water blanched carrot slices at different blanching time were tested for peroxidase inactivation. During the test, if reddish brown colour of carrot slices developed within 3 minutes, the peroxidase activity was taken as positive indicating insufficient blanching. If no such colour developed in 3 minutes, carrot slices were considered as adequately blanched (Singh, 2005).

Quality assessment of blanched carrot slices

Steam and water blanched carrot slices along with control (un-blanched) were evaluated for different quality attributes such as moisture content, colour, texture (firmness), and beta carotene content.

Moisture content

The moisture content of fresh carrot was determined according to hot air oven method described by AOAC (2005).

Beta carotene

Beta carotene was determined by measuring optical density in Spectrophotometer (Double beam) at 452 nm (Gupta and Shukla, 2017) [10].

Texture (firmness) of RTE carrot slices

Texture in terms of firmness was determined by measuring the force needed to compress the blanched carrot slices using a Texture Analyzer (Model: TA-XT plus, Stable Micro System, UK).

Colour of RTE carrot slices

The colour of the fresh and blanched carrot slices was measured in terms of L*, a* and b* values using a Hunter lab Colour Analyzer- Labscan-2 (Hunter Associates Laboratory, Inc. Virginia, USA).

Result and Discussion

Peroxidase test

Carrot slices were blanched in water and steam for 2, 3 and 4 min and 1, 2 and 3 min respectively. The different time period of water and steam blanching under present investigation were found to be adequate to inactivate the peroxidase enzyme.

Effect of blanching method on quality attributes of blanched carrot slices

Steam and water blanched carrot slices along with control (Un-blanched) were evaluated for different quality attributes such as moisture, colour, texture (firmness) and sensory parameters.

Moisture content (%)

Water blanched carrot slices showed maximum moisture content for 4 minute while lowest was found for 3 minute steam blanched slices. Water blanching significantly increased the moisture content with increased blanching time. Similar increase in moisture content with blanching time was observed by Alicia *et al.*, (2006) [1] for turnip. This increase in moisture content after blanching might be due to absorption of water by damaged cells and adhesion of water to the surface of product (Carbonell *et al.*, 1985) [6]. A non-significant decrease in moisture content was observed for steam blanched samples with blanching time. The reduction in moisture content of steam blanched carrots might be due to exit of cellular fluid by diffusion from damage cell membrane when exposed to heat during blanching.

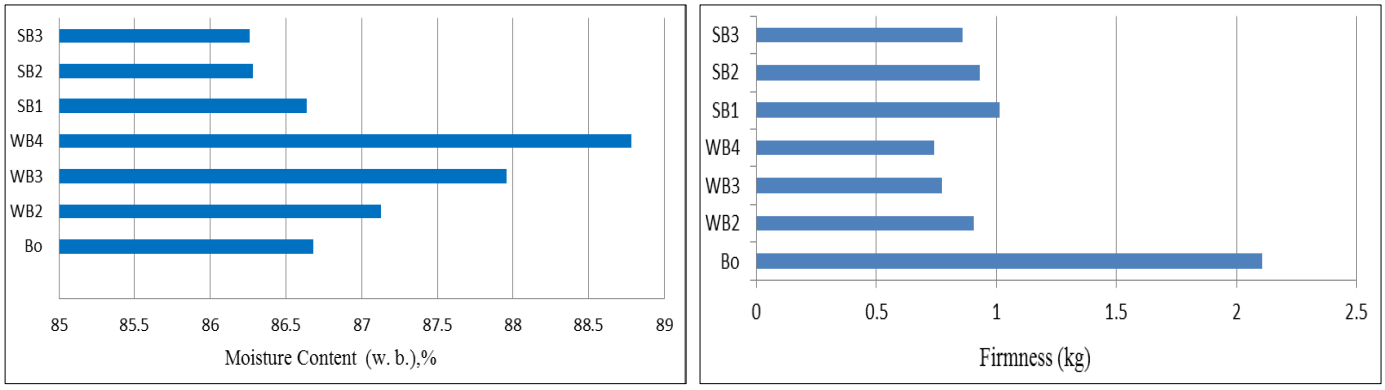

Fig 1: Effect of steam and water blanching on moisture content and firmness of blanched carrot slices for different blanching time

Table 1: Effect of steam and water blanching on moisture content, texture and colour of blanched carrot slices for different blanching time

Blanching Method	Moisture Content (%)	Firmness (kg)	Beta Carotene (mg/100 g)	Colour Values		
				L*	a*	b*
B_o	86.68	2.11	24.75	54.75	38.44	40.62
WB_2	87.13	0.91	23.13	54.67	38.29	42.36
WB_3	87.96	0.77	22.36	53.68	37.52	42.98
WB_4	88.78	0.74	19.85	53.40	36.94	43.60
SB_1	86.64	1.02	23.83	53.39	38.43	41.78
SB_2	86.28	0.93	23.19	52.51	38.41	42.48
SB_3	86.26	0.82	21.64	52.49	37.95	42.67
SE	0.036	0.037	0.421	0.181	0.035	0.288
CD	0.107*	0.113*	1.289*	0.556*	0.102*	0.863*

*- 5% --level of significance

B_o	:	Control (unblanched) sample,	SB_1	:	1 min steam blanched sample
WB_2	:	2 min water blanched sample,	SB_2	:	2 min steam blanched sample
WB_3	:	3 min water blanched sample,	SB_3	:	3 min steam blanched sample
WB_4	:	4 min water blanched sample			

Firmness (kg)

Blanching treatments caused a significant reduction in firmness for both water and steam blanched slices when compared with fresh carrot slices. While non-significant difference was observed in the steam blanched samples for 1 and 2 minutes time duration. A significant decrease in hardness (up to 60–70% in respect to the fresh samples) of water blanched carrots was also observed by Buggenhout *et al.*, (2006) [5] due to turgor loss of the vegetative cells. Maximum loss firmness was observed for water blanched slices than steam blanched. It might be due to more extended cell separation in water blanched carrots than steam blanched. Paciulli *et al*., (2016) [15] also observed similar results of highest retention of firmness in steam blanched carrot samples than water blanched.

Beta Carotene (mg/100g)

The beta carotene content of fresh carrot slices was noted as 24.75 mg/100g. Significant reductions in beta carotene content of all blanched samples were observed for water and steam blanching with increased blanching time. However beta carotene content of steam blanched carrot slices were found significantly higher than that of water blanched carrot slices. Higher retention in total carotenoids content of steam blanched samples than water blanched pumpkin slices were also observed by Manjaree Bhagya *et al.*, (2014) [13]. Maximum beta carotene content was retained in one minute steam blanched slices and non-significant difference was noted for 1 and 2 minutes steam blanched carrot slices. Huang and Edirisinghe (2016) [11] illustrated that boiled water could lead to cellular structure disruption increasing release of soluble bioactive phytochemicals from cells into the water. Hence, steam blanching resulted in better retention of beta carotene as compared to water blanching.

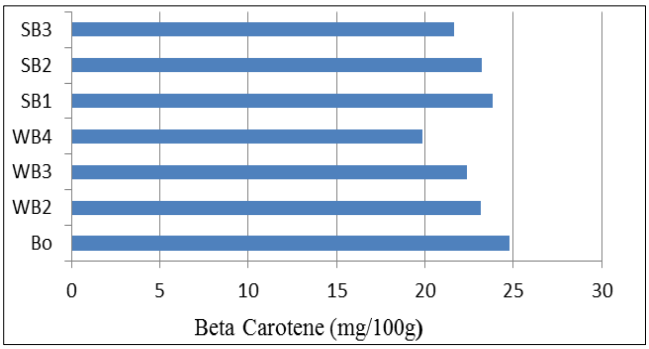

Fig 2: Effect of water and steam blanching on Beta Carotene (mg/100g) of carrot slices for different blanching time

Colour value L*, a*, b*

The initial Hunter colour L*, a* and b* values of un-blanched carrot slices (control) were 54.75, 38.44 and 40.62, respectively. During steam blanching, carrot slices became darker, corresponding to a decrease in the L* values to 52.49 with increased blanching time. But this decreasing trend in L* value was more in steam blanched carrot slices than water blanched. However, non-significant reduction was observed when blanching time increased from 3 to 4 and 2 to 3 min for steam and water blanching, respectively.

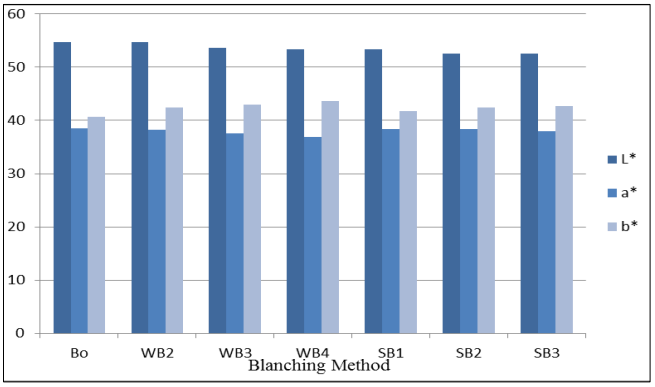

Fig 3: Effect of water and steam blanching on colour of carrot slices for different blanching time

General decreasing and increasing trend was observed in a* and b* values, respectively as a result of increase in blanching time. However higher a* value and b* value were recorded for steam blanching and water blanching respectively. There was non-significant different in a* value for 1 and 2 min of steam blanching. Miglio *et al.*, (2008) [14] stated that the decrease of L* values was as an indication of darkening, while the reduction of a* indicated a general colour loss mainly related to a decrease in α- and β-carotene and their isomerisation for cooked carrots.

Conclusion

From the present investigation, it is concluded that steam blanching for two minute retained maximum amount of beta carotene and also maintained better colour and firmness than water blanching.

References

1. Alicia Del Carmen Mondrago N-Portocarrero, BeleN Pena-Martı Nez, Encarnacio N Ferna Ndez-Ferna Ndez, Angeles Romero-Rodrı Guez, Lourdes Va Zquez-Ode Riz. Effects of different pre-freezing blanching procedures on the physicochemical properties of *Brassica rapa* leaves (turnip greens, grelos). International Journal of Food Science and Technology. 2006;41:1067-107.2
2. Anonymous. Horticulture statistics– At a glance, Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture and Farmers' Welfare, Government of India; c2018.
3. Anonymous. Horticulture Crops Category Wise 2018-19 (1st Adv.Est.); c2019.
4. Anonymous. Global Carrots and Turnips Market-Growth, Trends, and Forecast (2020 - 2025), 2020. www.mordorintelligence.com › industry-reports › carrot.
5. Buggenhout S, Van M Lille, Messagie I, Van Loey A, Hendrickx M. Impact of pretreatment and freezing conditions on the microstructure of frozen carrots: quantification and relation to texture loss. European Food Research and Technology. 2006;222(5-6):543-553.
6. Carbonell JV, Pinaga F, Pena JL, Garcıa MJ. Deshidratacion de frutasy hortalizas conaire ambiente. V Ensayos con nabos (*Brassica rapa*, L). Revista de Agroquı´mica y Technologı´a de Alimentos. 1985;25:257-266.
7. Congcong Xu, Chi Yu, Li Yunfei. Effect of blanching pretreatment on carrot texture attribute, rheological behavior, and cell structure during cooking process. LWT - Food Science and Technology. 2015;62:48-54.
8. Duygu Bas¸ Kaya Sezer, Aslihan Demirdöven. Effect of microwave blanching conditions on carrot slices : optimization and comparison, Journal of Food Processing And Preservation. 2015;39:2188–2196. Doi:10.1111/Jfpp.12463
9. Gill Gurnaz Singh, Satish Gupta K. Effect of various blanching pre-treatments on colour characteristics of carrots (*Daucus carota* L.). International Journal of Chemical Studies. 2017;5(5):1228-1231.
10. Gupta N, Shukla RN. Preparation and quality evaluation of dehydrated carrot and onion slices. J Food Process Technol. 2017;8:692.
11. Huang Yancui, Indika Edirisinghe. Chemical changes of bioactive phytochemicals during thermal processing. In Reference Module In Food Science; c2016. Https://Doi.Org/10.1016/B978-0-08-100596-5.03055.
12. Lewicki Piotr, Renata Porzecka-Pawlak. Effect of osmotic dewatering on apple tissue structure. Journal of Food Engineering. 2005;66:43-50.
13. Manjaree Bhagya, Gunawardena Sanja, Ismail Marliya. Effect of pretreatment methods on the quality of dehydrated pumpkin slices; c2018. Corpus Id: 2095057
14. Miglio C, Chiavaro E, Visconti A, Fogliano V, Pellegrini N. Effects of different cooking methods on nutritional and physicochemical characteristics of selected vegetables. J Agric Food Chem. 2008;56:139-147.
15. Paciulli Maria, Tommaso Ganino, Eleonora Carini, Nicoletta Pellegrini Alessandro Pugliese, Emma Chiavaro. Effect of different cooking methods on structure and quality of industrially frozen carrots. J Food Sci Technol. 2016;53(5):2443-2451.
16. Patras A, Tiwari BK, Brunton P. Influence of blanching and low temperature preservation strategies on antioxidant activity and phytochemical content of carrots, green beans and broccoli. LWT - Food Science and Technology. 2011;44:299-306.
17. Prochaska LJ, Nguyen XT, Donat N, Piekutowski WV. Effects of food processing on the thermodynamic and nutritive value of foods: literature and database survey. Medical Hypotheses. 2000;54(2):254e262.
18. Seo A, M Yu. Toxigenic fungi and mycotoxins, Hand book of industrial mycology (Andrea, Zed.) Academic Press London; c2003. p. 233-246
19. Singh Bahadur. Osmo-convective dehydration of carrots (*Daucus carota* L.) Unpublished Ph. D. Thesis. Department of Food Science and Technology, PAU, Ludhiana, Punjab, 2005.
20. Sun MS, Mihyang K, Song JB. Cytotoxicity and quinine reductase induced effects of Daucas carrot leaf extracts on human cancer cells. Kor. Journal of Food Science. 2001;30:86-91.
21. Thamburaj S, Singh N. Textbook of Vegetables, Tuber Crops and Spices. Indian Council of Agriculture Research, New Delhi; c2005. p. 151.