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DEVELOPMENT AND EVALUATION OF CAROTENE RICH CARROT POWDER

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ABSTRACT

Carrot is one of the nutritious and economical vegetable. It has high carotene with abundant vitamins, dietary fibre and minerals. To extend carrot's utilisation during off-season, carrot was oven-dried at 50 °C for 4-5 hours in dark and evaluated for proximate value, vitamin content, functional property and its shelf-life. Values were analysed using SPSS version 16 at 0.05% level. Results indicated that moisture content was 87.02% in fresh carrot and 4.2% in dry carrot powder. The mean protein value of fresh carrot was 4.8gm/100gm whereas dried carrot had 3.7 gm/100gm protein on dry basis with significant difference at 0.05% level. Fibre content in fresh carrot was 8.2 which increased significantly on drying to 13.0 gm/100gm. Dried carrot powder contain less carbohydrate (7.4%), ash (12.8%) and energy (14%) than fresh carrot. Fresh carrot contains beta–carotene and ascorbic acid content in the range of 37.09 µg/100gm and 63.19mg/100 respectively which reduced upon drying by16%(beta-carotene) and 21% (ascorbic acid)due to their heat labile nature. The anti-oxidative activity was declined by 14% reaching to 83.50% of DPPH inhibition in dry carrot powder. The total poly-phenolic content was found to be higher in dried carrot (1.3%, *db*) than fresh carrot (0.8%*db*). Microbial analysis indicates steadily increase in the bacterial count, although the count was within the limit during 90 day of the shelf life study. The fungal and coliform count showed negligible presence in the powdered carrot up to three months thus, guarantees its suitability under hygienic condition. The developed carrot powder contains high beta-carotene, fibre, phenolic compounds and low in calorie could be employed as a raw ingredient in production of supplementary food.

Keywords: Carrot, hot-air oven drying, beta-carotene, shelf-life

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INRODUCTION

Carrot is one of the most nutritious and economical vegetable. It is becoming more popular due to its high carotene content which has anti-oxidative and anti-cancer property with abundant vitamins, dietary fibre

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and various minerals. B-carotene is converted into vitamin A in our body and plays key role in the maintenance of integrity of epithelial tissue and immune system. Carotenoid in carrot have inhibitory mutagenic activity thus lowers the risk of cancer also; they are potent anti-oxidants which helps to neutralise the effect of free radicals (Ibidapo Olubunmi Phebean *et al.,* 2017). Carrot has abundant calcium pectate content which reduces the risk of heart diseases, high blood pressure, and cholesterol (Adeleye A.S. *et al*, 2016). To extend carrot's utilisation during off-season with maximum retention of b-carotene, oven-drying is a low-cost conventional method. It is also suitable for adopting by local companies as the demand for ready-to-use and quality food products has been increased in today's convenience-oriented market. Dehydrated foods extend the shelf life of food with reduced weight and bulk that further lowers transport and storage cost thus provides variety to the consumers. Hot-air drying methods could results in a quality product characterised by uniform, hygienic and attractive colour of dried fruit and vegetables powder (Roongruangsri W & Bronlund J.E, 2016).Dried powdered carrot has been used in several items in Indian culinary and offers healthy alternative without much sacrificing in nutritive value. To obtain dehydrated carrot powder with optimum bioactive level and characteristic of unprocessed food, it is of prime concern to assess drying effect on functional property. Purpose of this study was to develop and evaluate carrot powder for proximate value, vitamin content, functional property and its shelf-life.

MATERIAL AND METHODS

Experimental Material

Carrot was procured from the local market, washed, peeled and cut into small cubes and blanched prior of dehydration. Blanching was doneby putting small cubes of carrot into hot water for five minute to inactivate polyphenol oxidase enzyme. After

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five minute small cubes were dipped into tap water.

Dehydration Process

Post blanching small cubes were grated and dried at 50 °C in hot air-oven(Fisher Scientific model 230) for 4-5 hours in dark until no further change in weight was observed and finely powdered by food Processor(Murphy Richards, SKU:640080). The grounded powder was passed through 0.40mm mesh sieve and kept in air-tight polybags for analysis.

Proximate Analysis

Proximate values of carrot viz.as moisture, protein, fat, fibre, ash and energy content were evaluated by AOAC(1984)method.

Vitamin & Functional Properties

Beta–carotene in carrot was assessed according to the method given by Howe and Sherry, (2006) using Ultra-Violet spectrophotometer at 450nm. Thiamine was determined by the method of United States Pharmacopoeia (2000).Ascorbic acid was assessed by titration method, Indian pharmacopoeia, (1996).The total polyphenolic content and anti-oxidative activity was estimated by Folin-Ciocalteau and DPPH (2,2-diphenyl-1-picrylhydrazyl) method respectively.

Shelf- life Evaluation of Developed Carrot Powder

The prepared carrot powder packed in air tight jars was analysed for microbial load according to the methods described by IS i.e. total viable count (IS 5402:2002), yeast and mould count (IS 5403:1999) and total coliforms (FSSAI, 2012)at 15 day interval over 90 days of storage to ensure its edibility and over-all quality.

Statistical Analysis

Three replicates were obtained per nutrient of fresh and dry carrot powder sample. Values were analysed using SPSS version 16 at 0.05% level of significance.

RESULTS AND DISCUSSION

Carrot was dehydrated in hot-air ovenat 50 °C for 4-5 hour to make carrot powder as food ingredient which can be stored up to few months. Both fresh and dried sample were assessed for the

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proximate composition is presented in Table 1. The results reveal that carrot proximate value changes significantly at 0.05% level for all comparison. Moisture content was found to be 87.02% in fresh carrot which decreased until constant weight reached during drying, dried carrot powder contain 4.2 % moisture. In powder and flour, moisture higher than 14% will affect storage quality as mould growth, bacteria infestation and agglomeration could occur (Roongruangsri W & Bronlund J.E, 2016). Also, low moisture content in food samples increases the storage periods of the food products (Alozie *et al.*, 2009).The mean protein value was 4.8gm/100gm on dry basis whereas dried carrot had 3.7 gm/100gm protein and the difference was significant at 0.05% level.

Fibre content in fresh carrot was 8.2 which increased on drying to 13.0 gm/100gm attributed to concentration due to moisture removal. The similar results were reported by M.S.Alam *et al.,* (2013) and Adeleye A.S.*et al.,* (2016). Carbohydrate, ash and energy content were in range of 9.4mg/100gm, 7.0mg/100gm and 57Kcal respectively on dry basis. Dried carrot powder was found to contain reduced carbohydrate (8.7gm/100gm), ash (6.1gm/100gm) and energy 49 kcal/100gm respectively.

Beta-carotene, ascorbic acid content and functional property (anti-oxidative activity, total poly-phenolic content) of carrot illustrated in Table no. 2. The results indicates that in fresh carrot beta–carotene and ascorbic acid content were in the range of 37.09mg/100gm and 63.19mg/100 on dry weight basis which shows that fresh carrot is a rich source of beta carotene and ascorbic acid. This result is in agreement with those reported by Kaur and Sharma (2013), Bystricka*et al.* (2015) and Sabry Z.A *et al.,(*2016). Dried carrot powder was analysed and found to contain 31.72(mg/100gm) of beta-carotene and 29.84(mg/100gm) of ascorbic acid. Thus, showing

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reduction in beta-carotene by 16% and 57% in ascorbic acid upon drying as these are heat sensitive and coincide with the results of M.S. Alam et al. (2013) and Adeleye A.S.et al. (2016). Heat and oxidation during drying causes their loss and chemical changes.

However, the developed carrot powder by hot-air oven drying has good retention of beta-carotene (86%) which makes it suitable to be used as an ingredient in the production of beta-carotene rich supplementary food or as functional food. Also, it could serve as an easiest mean of tackling vitamin A deficiency.

The anti-oxidative activity was reduced by 14% with significant difference ($p \geq 0.05$) reaching to 83.50% of DPPH inhibition in dry carrot powder. This could be due to 16% decline in beta-carotene which contributes to anti-oxidative activity of carrot. The total polyphenolic content in dried carrot was analysed to contain 1.3% on dry weight basis which was higher than fresh carrot content (0.8%db). The increased total poly-phenolic content (TPC) might be due to release of bound phenolics, hydrolysis of complex phenolics (M. Lutz*et al.*, 2015). Therefore, increased phenolic content with anti-oxidative property and high fiber content makes it suitable to be used as functional food.

Microbial load in the developed carrot powder was studied over a time period of three months, results depicted in table no. 3 indicates that there was steadily increase in the bacterial count during 90 day of the shelf life study, although the count was within the limit given by Food Safety and Standard Authority of India (FSSAI, 2012) of less than 10,000 per gram. The total viable count of the carrot powder was found to be within the specified safe limit.

According to FSSAI (Food Safety and Standard Authority of India), yeast and mould should be absent in 1 gm of sample. The coliform count showed negligible presence in the powdered carrot upto three

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months of the storage time period which guarantees its suitability upto three months under hygienic condition.

CONCLUSION

The present work describes the possibility of producing carrot powder by hot-air drying method. The fibre and total poly-phenolic content were found to be higher in dried carrot powder than fresh carrot with high beta-carotene and ascorbic acid retention. The result proves that carrot powder with high fibre and phenolic compounds and low calorie content could be employed as an ingredient in the production of beta-carotene rich supplementary food with a shelf – life of 6 months.

Table 1: Proximate Value of Fresh and Dried Carrot

S.No.	Nutrient (g/100 gm d.b.)	Fresh Carrot (mean±SD)	Dried Carrot (mean±SD)
1	Moisture	87± 0.02	4.2± 0.13
2	Protein	4.8± 0.01	3.7±0.03
3	Fiber	8.2	13±0.60
5	Carbohydrate	9.4	8.7±0.71
6	Ash	7.0	6.1±0.04
7	Energy	57	49± 0.01

Table 2 Vitamin & Functional Property of Fresh and Dry Carrot

S.No.	Nutrient	Fresh Carrot *(d.b)*	Dried Carrot *(d.b)*
1	Beta Carotene(mg/100gm)	37.09±0.3	31.72±1.12
3	Ascorbic Acid(mg/100gm)	43.19±0.01	29.84±0.24
4	Anti-Oxidative Activity (%)	97.21±0.21	83.50±0.40
5	Total Poly-phenolic Content(mg/100gm)	0.8±0.05	1.3±0.12

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Table 3 Shelf-Life of Developed Carrot Powder

Day	Total Viable Count (cfu/gm)	Fungal Count (cfu/gm)	Coliform Count (cfu/gm)
0	-	-	-
15	1×10^{-3}	-	-
30	1×10^{-3}	-	-
45	2×10^{-3}	-	-
60	3×10^{-3}	-	-
75	3×10^{-3}	-	-
90	3×10^{-3}	-	-

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