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Effect of storage period on ascorbic acid and β-carotene content of dehydrated chickpea leaves

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Abstract
The present research was carried out to study the effect of storage on ascorbic acid and β-carotene content of dehydrated chickpea leaves. Ten genotypes of chickpea leaves including Phule G-1216-12, Phule G-1107-5, Phule G-171103, Phule G-171105, Phule G-171104, Phule G-1010-14, Phule G-1231-10, Phule G-15109, Digvijay, Vishal were selected for the present study. Chickpea leaves without blanching was selected and dehydrated in tray dryer at the temperature of 55 ºC for time of 7-8 hours. These dehydrated leafy vegetables were packed in low density polyethylene bags and stored at (30+2 ºC) ambient temperature for a period of 3 months. The stored samples were chemically analyzed for ascorbic acid and β-carotene content at monthly intervals. The ascorbic acid content of dehydrated chickpea leaves was recorded minimum in Phule G-1010-14 (3.85 mg/100g) and maximum in Vishal (6.86 mg/100g). The β-carotene content was observed highest in Phule G-15109 (2.28 mg/100g) and lowest in Phule G-171104 (1.21 mg/100 g).

Keywords: Storage period, tray dryer, dehydration, LDPE

Introduction
Green leafy vegetables are important part of our balanced diet as they are main natural sources of vitamins like ascorbic acid, folic acid, tocopherols, β-carotene, riboflavin and minerals like iron, calcium, magnesium and phosphorous. They increase the resistance power and improve health of human beings. Their consumption provides taste, palatability, increases appetite and provides fibre for digestion and prevents constipation (Seidu, 2012) [12]. Role of ascorbic acid in human body is necessary for the growth, development and repair of all body tissues. It's involved in many body functions, including formation of collagen, absorption of iron, the proper functioning of the immune system, wound healing, and the maintenance of cartilage, bones, and teeth. In the human body β-carotene converts into vitamin A (retinol). We need vitamin A for good vision and eye health, for a strong immune system and for healthy skin and mucous membranes. Taking big doses of vitamin, A can be toxic, but your body only converts as much vitamin A from β-carotene as its needs. Young chickpea leaves, on the other hand, are cooked and eaten as a vegetable green in some areas of the world and they might be a good source of nutrition for malnourished people. Moisture (73.4%), Protein (7.0%), Fat (1.4%), Mineral (2.1%), Crude Fiber (2%), Carbohydrates (14.1%), Calories (97 Kcal), Calcium (340 mg), Iron (23.80 mg) and Phosphorus (120 mg) are all present in fresh chickpea leaves (Gopalan *et al.*, 2011) [2]. Chickpea leaves, like other green leafy vegetables like as spinach, mustard leaves, mint, coriander leaves and others, provide a good quantity of micronutrient minerals (Ibrikei *et al.*, 2003) [3] that are needed to battle hidden hunger, which affects 1/3rd of our country's population. Green leafy vegetables are seasonal and extremely perishable due to the high-water content in their plant tissues and a plentiful supply during peak season leads to large scale spoiling. At the home level, increasing usage and reducing waste necessitates the adoption of appropriate preservation procedures that are both user-friendly and long-lasting. The need for easy processing and procedures to maintain nature's stock of nutrients exists. As a result, dehydration appears to be the most straightforward and cost-effective method of preserving vegetables (Makobo *et al.*, 2010) [7]. Locally available green leafy vegetables rich in micronutrients are highly perishable and are cheapest source of raw materials. Production of those leafy greens is seasonal and market will be over flooded during peak seasons at particular period resulting in spoilage of large quantity. The market glut and huge wastage can be prevented by preserving the vegetables. Considering the lower bulk density of dried leafy greens, drying is considered as most suitable and easy method of preservation providing nutrients in concentrated form throughout the year (Singh *et al.* 2007) [10].

To a large population of the world, balanced diets are not accessible and this is particularly seen in developing countries. The health of vulnerable groups of population is severely affected by malnutrition and micronutrient deficiency. Rehydrating dehydrated veggies returns them to a fresh like state and they may be used for throughout year (Karva, 2010) [4]. Keeping this in view, present research was undertaken to study effect of storage duration on ascorbic acid and β-carotene content in dried chickpea leaves samples.

Materials and Methods

Study area

The study was carried out in the Department of Food Science and Technology at Post Graduate Institute of Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2020-21.

Sample collection and preparation

The chickpea leaves genotypes were collected from Pulse Research Scheme, MPKV, Rahuri for further research study. Chickpea leaves were dehydrated at the temperature of 55 ºC for time of 7-8 hours in tray dryer. After dehydration, chickpea leaves samples were packed in low density polyethylene bags and stored for 3 months duration for further study. The samples were chemically analyzed for ascorbic acid and β-carotene content at 30 days interval.

Chickpea leaves of ten genotypes selected for study are

V_1 = Phule G-1216-12 V_2 = Phule G-1107-5
V_3 = Phule G-171103 V_4 = Phule G-171105
V_5 = Phule G-171104 V_6 = Phule G-1010-14
V_7 = Phule G-1231-10 V_8 = Phule G-15109
V_9 = Digvijay V_{10} = Vishal

Pretreatments of chickpea leaves

Table 4.1: Selection of pretreatments

Treatments	Blanching		Chemicals	Drying Temperature (°C)
	Temp (°C)	Time (sec)		
T_0	45	30	Without blanching (Control)	55
T_1	45	30	Blanching with plain water	55
T_2	45	30	Blanching with chemicals (KMS, MgO, Citric Acid, $NaHCO_3$, NaCl)	55

The results presented in Table 4.1 indicated that chickpea leaves of Phule G-171103 genotype was used for testing the blanching treatment. All ten genotypes were given pre-treatments which were named as T_0 (Without blanching), T_1 (Blanching with plain water), T_2 (Blanching with chemicals). T_0 blanching treatment was found very good according organoleptic characteristics (Table 4.2). This treatment (Without blanching) was used for further study.

Table 4.2: Organoleptic evaluation of chickpea leaves dried by different pretreatments

Treatments	Colour and appearance	Texture	Flavour	Taste	Overall acceptability	Rank
T_0	8.5	8.5	8.7	8.7	8.6	1
T_1	8.3	8.4	8.5	8.5	8.42	2
T_2	8.3	8.1	8.4	8.3	8.27	3

All values are mean of ten replications. Maximum score out of 9-point hedonic scale.

Where

T_0: Without blanching.
T_1: Blanching with plain water.
T_2: Blanching with chemicals.

The results presented in table 4.2 indicate effects of pretreatments on the sensory characteristics of dehydrated chick pea leaves. It can be seen that the leaves dried without blanching treatment exhibited the highest overall acceptability score (8.6). Hence, leaves samples of all the ten types of genotypes were dehydrated at 55 °C without blanching treatment. All the ten dehydrated leaves samples were stored at ambient temperature conditions in packaging materials (LDPE) for storage studies.

Determination of vitamin content

Vitamins and minerals are considered essential nutrients because acting in concert, they perform hundreds of roles like normal growth and nutrition in the body. Vitamins are required in small quantities in diet because they cannot be synthesized by the body.

Determination of ascorbic acid content

Amount of ascorbic acid observed in dehydrated leafy vegetables was estimated by using 2,6-dichlorophenol indophenol dye as described by Ranganna *et al.* (1986) [9] as follows:

Reagents

1. **Metaphosphoric acid (3%):** 3g metaphosphoric acid was suspended into 100 ml distilled water.
2. **Dye solution:** Sodium salt of 2,6-dichlorophenol indophenol dye (50 mg) and 42 mg sodium bicarbonate were dissolved in about 150 ml distilled water making the final volume of 200ml by adding and mixing distilled water.
3. **Standard ascorbic acid solution (0.1 mg/ml):** L-ascorbic acid (100 mg) was dissolved in 100 ml volume of 3% metaphosphoric acid. From this stock solution, 10 ml was diluted with 3% metaphosphoric acid to 100 ml.

Procedure

Standardization of dye

5 mm standard ascorbic acid solutions were taken in conical flask and added 5 millimetre three per cent metaphosphoric acid taken. These solutions were titrated against dye solution till pink colour persisted for fifteen seconds. Dye factor was determined by the following formula:

Formula

$$\text{Dye factor} = \frac{0.5}{\text{Titre}}$$

Sample preparation

1g of vegetable sample was crushed with 3% HPO_3 in mortar

and pestle and final volume was adjusted to 100 ml with 3% HPO_3. The sample was centrifuged in the centrifuge machine for five minutes after that content were strained through Whatman No. 4 filter paper.

Evaluation of ascorbic acid: 10 mm aliquot was pipetted out in conical flask. Titrated against dye solution till pink colour persisted for 15 seconds. The volume of dye solution required for titration was recorded.

Formula

$$\text{Ascorbic acid} = \frac{\text{Titre x dye factor x Volume of extract made}}{\text{Volume of sample taken for titration (ml) x Weight of sample taken (g)}} \times 100 \text{ (mg/100 mg)}$$

Determination of β-carotene content

β-carotene content of the selected samples was determined by the method of A. O. A. C. (1980) [1].

Reagents

Water and n-butanol were mixed in the ratio 6: 2 and shake well and then allowed to stand till it separates into two phases and the upper clear layer with bubbles was used as water saturated n-butanol.

Procedure

1. One gm of dehydrated vegetable sample was mixed with 50 ml of water saturated n-butanol to make a homogenous suspension.
2. It was shaken gently and allowed to stand for overnight (16 hours) at room temperature in dark.
3. The suspension was stirred over again then strained through Whatman filter paper no. 1.
4. 100 ml of filtrate volume was made by adding water saturated n-butanol solution.
5. The absorbance (A) of the clear filtrate was measure at 440 nm in spectronic-20 using saturated n-butanol as a blank.

Formula

β-carotene content (ppm) = 0.0105 + 23.5366 × A.

Where,
A = Optical density at 440 nm.

Results and Discussion

The dehydrated chickpea leaves samples were packed in low density polyethylene bags and stored for 3 months storage study at ambient temperature conditions. The results pertaining the studies on effect of storage duration on ascorbic acid and β-carotene content of dehydrated chickpea leaves for ten genotypes are discussed under this topic.

Effect of storage period on ascorbic acid content of dehydrated chickpea leaves for ten genotypes

The result presented in Table 5.1 shows the changes in the chemical composition of the chickpea leaves ten genotypes. During the 90-day storage period, the product was kept in LDPE packaging at room temperature. The statistical results showed that the ascorbic acid content of the LDPE packaging material non-significant during the storage trial. The genotypes had a non-significant effect on ascorbic acid. The ascorbic acid content decreased in Phule G-1216-12 about 6.59 to 5.80 (mg/100 mg), in Phule G-1107-5 about 6.76 to 5.94 (mg/100 mg), in Phule G-171103 about 5.90 to 5.08 (mg/100mg), in Phule G-171105 about 5.97 to 5.15 (mg/100 mg), in Phule G-171104 about 5.69 to 4.85 (mg/100 mg), in Phule G-1010-14 about 4.68 to 3.85 (mg/100 mg), in Phule G-1231-10 about 5.82 to 5.01 (mg/100 mg), in Phule G-15109 about 6.70 to 5.85 (mg/100 mg), in Digvijay about 6.64 to 5.81 (mg/100 mg), in Vishal about 6.86 to 6.03 (mg/100 mg) in LDPE was observed within a storage period of 90 days. During storage period of 0 to 90 days, initially at 0 days storage period of Vishal had highest ascorbic acid content 6.86 mg/100 mg whereas, at end of the storage on 90th days Phule G-1010-14 had lowest ascorbic acid content 3.85 mg/100 mg packaged in LDPE bags (Table 5.1).

Similar findings were given by Singh *et al*. (2006) [11]. They assessed that the retention of ascorbic acid content for treated and untreated samples of *methi* was maximum in microwave drying (51.19 and 67.84 mg/100 mg) followed by tray drying (14.8 and 42.24 mg/100 mg), open sun drying (10.23 and 17.93 mg/100 mg) and vacuum oven drying (23.68 and 63.36 mg/100 mg), respectively. Retention of ascorbic acid in mustard, mint and spinach recorded higher as 13-38% by Kaur *et al*. (2009) [5].

Table 5.1: Ascorbic acid content of dehydrated chickpea leaves for ten genotypes

Ascorbic acid (mg/100 mg)					
Verities	**Storage Period (days)**				**Mean**
	0	**30**	**60**	**90**	
V_1	6.59	6.35	6.09	5.80	6.21
V_2	6.76	6.51	6.23	5.94	6.36
V_3	5.90	5.68	5.37	5.08	5.51
V_4	5.97	5.72	5.44	5.15	5.57
V_5	5.69	5.44	5.15	5.18	5.37
V_6	4.68	4.43	4.15	3.85	4.28
V_7	5.82	5.57	5.30	5.01	5.43
V_8	6.70	6.43	6.15	5.85	6.28
V_9	6.64	6.39	6.11	5.81	6.24
V_{10}	6.86	6.61	6.31	6.25	6.51
Mean	6.16	5.91	5.63	5.39	5.77
	V	S	V × S	CV (%)	
S.Em (±)	0.03	0.03	0.06	1.85	
CD@5%	0.09	0.09	NS		

All values are mean of three replications.

Where

V_1 = Phule G-1216-12
V_2 = Phule G-1107-5
V_3 = Phule G-171103
V_4 = Phule G-171105
V_5 = Phule G-171104
V_6 = Phule G-1010-14
V_7 = Phule G-1231-10
V_8 = Phule G-15109
V_9 = Digvijay
V_{10} = Vishal
V = Variety
S = Storage period
V × S = Interaction

Effect of storage period on β-carotene content of dehydrated chickpea leaves for ten genotypes

The result presented in Table 5.2 shows the changes in the chemical composition of the chickpea leaves ten genotypes. During the 90-day storage period, the product was kept in

LDPE packaging at room temperature. The statistical results showed that the β-carotene content of the LDPE packaging material significant during the storage trial. The genotypes had a significant effect on β carotene. The β carotene content decreased in Phule G-1216-12 about 2.08 to 1.41 (mg/100 mg), in Phule G-1107-5 about 2.25 to 1.56 (mg/100 mg), in Phule G-171103 about 2.16 to 1.45 (mg/100 mg), in Phule G-171105 about 2.04 to 1.37 (mg/100 mg), in Phule G-171104 about 1.89 to 1.21 (mg/100 mg), in Phule G-1010-14 about 2.09 to 1.41 (mg/100 mg), in Phule G-1231-10 about 2.11 to 1.42 (mg/100 mg), in Phule G-15109 about 2.28 to 1.59 (mg/100 mg), in Digvijay about 2.14 to 1.43 (mg/100 mg), in Vishal about 2.23 to 1.57 (mg/100 mg) in LDPE was observed within a storage period of 90 days. During storage period of 0 to 90 days, initially at 0 days storage period of Phule G-15109 had highest β-carotene content 2.28 mg/100 mg whereas, at end of the storage on 90th days Phule G-171104 had lowest β-carotene content 1.21 mg/100 mg packaged in LDPE bags (Table 5.2).

Similar changes were recorded in leafy vegetables by Negi and Roy (2001a) [8]. Khatoon *et al*. (2011) [6] reported 5.29 mg/100 mg β-carotene in dehydrated curry leaves.

Table 5.2: β-carotene content of dehydrated chickpea leaves for ten genotypes

β-carotene (mg/100 mg)					
Verities	**Storage Period (days)**				**Mean**
	0	**30**	**60**	**90**	
V_1	2.08	1.80	1.65	1.41	1.74
V_2	2.25	2.05	1.82	1.56	1.92
V_3	2.16	1.96	1.73	1.45	1.83
V_4	2.04	1.85	1.62	1.37	1.72
V_5	1.89	1.69	1.46	1.21	1.56
V_6	2.09	1.91	1.66	1.41	1.77
V_7	2.11	1.91	1.67	1.42	1.78
V_8	2.28	2.07	1.84	1.59	1.95
V_9	2.14	1.93	1.69	1.43	1.80
V_{10}	2.23	2.03	1.81	1.57	1.91
Mean	2.13	1.92	1.69	1.44	1.79
	V	S	V × S	CV (%)	
S.Em (±)	0.01	0.01	0.01	0.98	
CD@5%	0.01	0.01	0.01		

All values are mean of three replications.

Where

V_1 = Phule G-1216-12
V_2 = Phule G-1107-5
V_3 = Phule G-171103
V_4 = Phule G-171105
V_5 = Phule G-171104
V_6 = Phule G-1010-14
V_7 = Phule G-1231-10
V_8 = Phule G-15109
V_9 = Digvijay
V_{10} = Vishal
V = Variety
S = Storage period
V × S = Interaction

Conclusion

The studies on effect of storage period on ascorbic acid and β-carotene content of dehydrated chickpea leaves revealed that all the ten genotypes without blanching treatment showed better organoleptic properties. Significant effect of storage was found in context to ascorbic acid content as well as β-carotene content in case of all ten genotypes. Higher ascorbic acid content was found in Vishal with 6.86 mg/100 mg while β-carotene content was found higher in Phule G-15109 with 2.28 mg/100 mg. It can be also concluded that ascorbic acid and β-carotene content were better preserved by low density polyethylene packaging material in dried form of chickpea leaves.

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References

1. AOAC. Official Methods of analysis. Association of official Analytical Chemist Howitz (cd) 1980, 734-740.
2. Gopalan C, Ramasastri BV, Balasubramanian SC, Rao BS, Narsinga Deosthale YG. Nutritive Value of Indian Foods, National Institute of Nutrition, Hyderabad, India 2011.
3. Ibrikei H, Knewtson JS, Grusak AM. Chickpea leaves as a vegetable green for humans' evaluation of mineral composition. Journal of Food Science and Agriculture 2003;83:945-950.
4. Karva S, Bharti P, Bharti C. Post-harvest processing of green leafy vegetables for iron security. Karnataka Journal of Agriculture Science 2010;23(2):306-310.
5. Kaur P, Kumar S, Arora S, Chawla N, Singh M. Influence of different drying techniques on quality of spearing (*Mentha spicata* L.). Journal of Food Science and Technology 2009;46(5):440-444.
6. Khatoon J, Verma A, Chacko N, Sheikh S. Utilization of dehydrated curry leaves in different food products. Indian Journal of Natural Products and Resources 2011;2(4):508-511.
7. Makobo ND, Shoko MD, Mtaita TA. Nutrient content of vegetable Amaranth (*Amaranthus cruentus* L.) at different harvesting stages. World Journal of Agriculture Science 2010;6(3):285-289.
8. Negi PS, Roy SK. Effect of drying conditions on quality of green leaves during long term storage. International Journal of Food Research 2001(a);34(4):283-287.
9. Ranganna S. Handbook of Analysis and Quality Control of Fruits and Vegetables Products. II Edition. Tata McGraw Hill. New Delhi 1986, 7-12.
10. Singh L, Yadav N, Kumar AR, Gupta AK, Chacko J, Parvin K *et al*. Preparation of value-added products from dehydrated bathua leaves. Nat Prod Radiance 2007;6:6-10.
11. Singh U, Sagar VR, Behera TK, Kumar SP. Effect of drying conditions on the quality of dehydrated selected leafy vegetables. Journal of Food Science and Technology 2006;43(6):579-582.
12. Seidu JM, Bobobee EYH, Kwenin WKJ, Frimpong R, Kubge SD, Tevor WJ *et al*. reservation of indigenous vegetables by solar drying, ARPN Journal of Agricultural and Biological Science 2012;7:407-415.