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ORIGINAL ARTICLE

Pretreatments and method of drying influence Ascorbic Acid and Carotenoid content of red chilli cultivars

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ABSTRACT
Red chilli has been recognised as an excellent source of antioxidants, being rich in ascorbic acid and other phytochemicals. Selection of proper drying conditions is necessary for minimizing thermal stress, over-drying and maintenance of relevant compounds which determine the quality of the product. The quality of dried red chilli powder in terms of colour and chemical parameters was studied on two different varieties of chilli. Three blanching method hot water, sodium chloride (2%) solutions and gum acacia (0.2%) and four drying methods solar drying , hot air oven drying, shade drying and were tried for the powder of chilli. Out of various drying methods and pre-treatments the best chilli powder was obtained in blanching and then soaked in gum acacia solution in hot air oven drying. The most acceptable powder had Carotenoid content 356.00 mg/100g, ascorbic acid 54.37 mg/100g, with improved organoleptic analysis was found in hot air oven drying pretreated with gum acacia solution..

Keywords: *Blanching, drying, organoleptic, powder*

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INTRODUCTION

Fresh red chillies are perishable in nature and a considerable amount of the produce is wasted due to lack of post harvest processing facilities. The initial moisture content of fresh red chillies ranges from 80 to 88%, which is very high for processing and storage. Therefore, reduction of moisture content of chilli to a safe level of 8-9% becomes necessary before their processing and storage [2]. Drying is the most widely used primary method of food preservation. Blanching is done before drying blanching is carried out to inactivate natural enzymes in order to improve colour and texture of the product. Blanching has been found to enhance the drying rate of chillies due to cell wall destruction. There are some other chemical / blanching treatments which improves the quality of final product and reduce drying time e.g. if these blanched sample are soaked in gum acacia solution (0.2%) for 15 min at room temperature, the physical appearance will improve. Gum acacia has excellent film forming property, uniform solubility and has been widely used as the surface finishing agent in food processing industry, [3].

Chilli is a seasonal and annually grown cash crop. It's sowing starts after monsoon showers commencement i.e., from first week of August and extends till October. Growth period is around 4-5 months depending upon varieties cultivated. Harvesting commences from the month of December. Arrivals start hitting the market from February and continue till April. The arrivals from Karnataka and Madhya Pradesh hit during middle of February.

In Malwa region of Madhya Pradesh farmers grow hybrid varieties of chilli of multinational company mainly for green chilli production. Farmers are not much aware about the drying technology. Peak harvesting season create glut of green chillies in the market. This reduces the selling cost and creates economic loss to growers. Some growers use open sun drying, which takes around 14-21 days depending on the weather conditions. As no perfect platforms or matting is used, the chilli gets contaminated with dirt, dust, and other infections. Moreover, sun drying is weather dependent and generally it does not yield good quality product.

Drying of chilli is an important aspect for its valve addition. The farmers generally practice open sun drying but it takes around 14-21 days, depending upon the weather conditions. The product from open sun drying is generally of poor colour and full of contaminations/ physical impurities. As discussed, there are some chemical and blanching methods in the literature, which not only reduces the drying time, but also the product gets good colour after drying. The retention of red colour is very important during drying as red coloured chilli fetches high prices in the market. Application of solar driers and mechanical driers further increases the quality of the final product and the drying took place in much shorter time [4]. Thus, an investigation was undertaken to study the pre-treatments and methods of drying of chillies on two different locally available varieties of chillies *US-622* and *Sitara*.

MATERIAL AND METHODS

An experiment was conducted in the Department of Post Harvest Management, College of Horticulture, Mandsaur in Jawaharlal Nehru Krishi Vishva Vidayala, Jabalpur during 2008-2009. For different treatment combinations, three levels of pre-treatments, two level of varieties, three level of pre-treatment, and four levels of method of drying and one control. Thus 25 treatment combinations were dried in the present investigation.

Freshly harvested red chilli and powder of dried red chillies was used for the study. The red chilli of two varieties (US-622, *SITARA*) was harvested from the field of a progressive farmer Shri Virendra Singh Shaktawat of Mandsaur district. Damaged, diseased, and unripe pods were sorted out. The produce was then thoroughly washed with running tap water and wiped with dry cloth. The sample of 250g was weighed for different treatments after initial chemical analysis of fresh red chilli pods. For single replication nearly 5 kg of each variety was harvested out of which 3 kg of each variety were actually used in the experiment.

Varieties

Two varieties were used (a) US-622 (V_1) and (b) *SITARA* (V_2), 12 samples of 250gm of each variety was made i.e. a total of 24 samples were made.

Pre-treatments

Three samples were treated with three different pre-treatments.

I. For a single replication four samples of each variety were blanched at 90°C for 3 minutes i.e. a total of eight samples were used.
II. Four samples of each variety were blanched at 90°C for 3 min. and then soaked in gum acacia (0.2%) for 15 min., i.e. a total of eight samples were used.
III. Four samples of each variety were soaked in (2% Sodium chloride) for 30min and blanch i.e. a total of eight samples were used.

Methods of Drying

Four method of drying were used in the experiment *viz.* open sun drying, solar drying, shade drying and mechanical drying.

Ascorbic acid

The ascorbic acid content of the product was determined by (A.O.A.C., 1984) method. Grinding the known quantity of the dried product with 4% metaphosphoric acid and filtered through filter paper and titrating with 2, 6-dichlorophenol indophenol dye solution until the stable light pink colour was obtained. Standardization of 2, 6-dichlorophenol indophenol dye solution was done by titrating it against standard ascorbic acid solution. For this purpose 100mg of ascorbic acid was dissolved in 4% metaphosphoric acid and the volume was made to 100 ml from this 10 ml of ascorbic acid solution was used for titration. The result was expressed in ascorbic acid, (vitamin C) for 100g of fruit.

Calculation:

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titer x dye equivalent X dilution x 100}}{\text{Weight of sample}}$$

Carotenoids

The carotenoid content of the product was determined by weight 50 mg of finely cut and well mixed fruit sample into a clean mortor, then grind the tissue to a fine pulp/ powder with addition of 5ml of 80% acetone. Centrifuge and transfer the supernatant to a volumetric flask. Repeat this process until the residue is colourless. Wash the pestle and mortar thoroughly with 80% acetone and collect the clean washing in the flask. Read the absorbence of solution at 480 and 510nm against the solvent (80% acetone as blank).

Calculation:

Mg Carotenoids tissue = 7.6 (A480)- 1.499 (A510) x V/1000 x10

Where,

A= Absorbance of specific wave length
V= Final volume of chlorophyll and carotenoids in 80% acetone
W= Fresh weight of the tissue extracted

RESULTS AND DISCUSSION

Carotenoid content

The results pertaining to the carotenoid content of dried red chillies as affected by different pre-treatments, drying methods, and varieties are presented in Table 1. The minimum carotenoid content of (348.87mg/100gm) was recorded in T1 whereas the maximum carotenoid content of (356.87mg/100gm) was recorded in T2. Carotenoid content was significantly affected by drying methods. Maximum carotenoid content of (354.50mg/100g) in D4 and minimum of (344.00mg/100g) in D1 treatments were recorded.

Table 1: Effect of pretreatments and methods of drying on carotenoid and ascorbic acid content of dried red chilli cultivars

Treatment	Carotenoid Content mg/100g	Ascorbic acid content mg/100g
Control	**225.00**	**45.00**
Blanching (at 90°C for 3min.) (T1)	343.87	51.00
Blanching and soaking in gum acacia (0.2%) for 15 min (T2)	356.00	54.37
Soaking in 2% sodium chloride for 30min. followed by blanching (T3)	349.75	53.37
S. Em. **CD at 5 %**	**0.408** **1.159**	**0.408** **1.159**
Open Sun drying (D1)	344.00	48.50
Solar drying (D2)	352.00	51.66
Shade drying (D3)	349.00	54.00
Mechanical drying (D4)	354.50	57.50
S. Em. **CD at 5 %**	**0.471** **1.339**	**0.471** **1.339**
US-622 (V1)	344.83	51.08
SITARA (V2)	354.91	54.75
S. Em. **CD at 5 %**	**0.333** **0.946**	**0.333** **0.946**

The carotenoid content of dried chillies was also significantly affected in the two varieties. In present investigation, between two varieties, the maximum carotenoid content of (354.91mg/100g) in V2 and minimum (344.83 mg/100g) in V1 were recorded. However, all the treatments showed significantly higher carotenoid content over control (225mg/100g). The maximum carotenoid content of (362.25mg/100g) was obtained in V2T2 while it was minimum of (339.70mg/100g) in V1T1 combinations.

The effect of treatment combinations of variety and drying methods on carotenoid content of dried red chillies was found to be significant (Table 2). The maximum carotenoid content of (364.67mg/100g) was obtained in V2D4, while it was minimum (342.00mg/100g) in V1D1. The carotenoid content of dried chilli was non significantly affected by treatment combination of pre-treatment and drying methods (Table 4.15). The maximum carotenoid content of 362.00mg/100g was obtained in T2D4 while it was minimum 338.50mg/100g in T1D1. Further, all the treatment combinations of variety, pre-treatment, and methods of drying exhibited non-significant effect. The maximum carotenoid content of 375.00mg/100g was obtained in V2T2D1 while it was minimum of 337.00mg/100g in V1T1D1.

Maximum carotenoid content found in the sample when blanched and soaked in gum acacia and in drying methods, mechanical dried chillies had maximum carotenoid content. Among the varieties, V2 had

maximum carotenoid content. The present findings are supported by Park *et al*. [5]. They observed that the level of carotenoids in red chilli powder were 187-355mg/100g.

Ascorbic acid content

An examination of Table 1 reveals that pre-treatment significantly affected the ascorbic acid content of dried chillies. The minimum ascorbic acid content of (51mg/100gm) was recorded in T1, whereas, the maximum ascorbic acid content of (54.37mg/100gm) was recorded in T2.

Ascorbic acid was significantly affected by drying methods. Maximum ascorbic acid content of 57.50mg/100g in D4 and minimum of 48.50mg/100g in D1 treatments were recorded. The ascorbic acid content of dried red chilli was also significantly affected due to two varieties. In present investigation, between two varieties, the maximum ascorbic acid content of 54.75mg/100g at V2 and minimum 51.08 mg/100g in V1 were recorded. The maximum ascorbic acid content of (57mg/100g) was obtained in V2T2 while it was minimum of (49.25mg/100g) in V1T1 combinations. The effect of treatment combination of variety and drying methods on ascorbic acid content of dried chillies was found to be significant. The maximum ascorbic acid content of (60.67mg/100g) was obtained in V2D4 while it was minimum of (48mg/100g) in V1D1. The maximum ascorbic acid content of (60.50mg/100g) was obtained in T2D4 while it was minimum of (47.00mg/100g) in T1D1.

Table 2: Combined effect of pretreatments and methods of drying on carotenoid content of red chilli cultivars

Treatment	V1			V2			Mean VXD		Mean TXD		
	T1	T2	T3	T1	T2	T3	V1	V2	T1	T2	T3
D1	337	347	342	340	352	346	342.00	346	338.50	349.50	344.00
D2	342	351	346	351	365	357	346.33	357.67	346.50	358.00	351.50
D3	341	352	347	346	357	351	346.67	351.33	343.50	354.50	349.00
D4	339	349	345	355	375	364	344.33	364.67	347.00	362.00	354.50
Mean VXT	339.75	349.75	345.00	348.00	362.25	354.50	**Control**	225			

Treatments	**S. Em±**	**CD at 5 %**
VXT	0.577	1.639
VXD	0.666	1.893
TXD	0.816	NS
VXTXD	1.154	NS

The maximum ascorbic acid content of (64.00mg/100g) was obtained in V2T2D4 while it was minimum of (47.00mg/100g) in V1T1D1. It is clear from the data that combined application of pretreatments, drying methods and varieties showed non-significant effect on ascorbic acid content of dried chillies (Table 3). However, untreated control recorded lower ascorbic acid content (45mg/100g). Maximum ascorbic acid content found in the sample when blanched and soaked in gum acacia, and in drying methods mechanical dried chillies had maximum ascorbic acid content. Among the varieties, V2 had maximum ascorbic acid content. The present findings are supported by Pruthi *et al*. [7]. They observed that Indian dried red chillies have 50 mg/100g. of ascorbic acid. Further Perez-Galvez *et al.* (2004), reported that ascorbic acid is very sensitive to the drying process, with a decrease of about 76% during the first 24 hr and remaining only a trace levels during the rest of the process. Therefore, no antioxidant

role should be expected from ascorbic acid during the whole process and in the corresponding final product, despite that red chilli fruit is well known to be rich in this compound.

Table 3: Combined effect of pretreatments and method of drying on ascorbic acid content of red chilli cultivars

Treatment	V1			V2			Mean VXD		Mean TXD		
	T1	T2	T3	T1	T2	T3	V1	V2	T1	T2	T3
D1	47	49	48	47	51	49	48.00	49.00	47.00	50.00	48.50
D2	48	48	51	52	57	54	49.00	54.33	50.00	52.50	52.50
D3	51	53	55	54	56	55	53.00	55.00	52.50	54.50	55.00
D4	51	57	55	58	64	60	54.33	60.67	54.50	60.50	57.50
Mean VXT	**49.25**	**51.75**	**52.25**	**52.75**	**57.00**	**54.50**	**Control**	45.00			

Treatments	**S. Em±**	**CD at 5 %**
VXT	0.577	1.639
VXD	0.666	1.893
TXD	0.816	NS
VXTXD	1.154	N

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