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Studies on nutritional composition of coriander leaves by using sun and cabinet drying methods

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Abstract
The preservation of green leafy spices is very important. Coriander as a whole plant has various benefits in human life. Coriander leaves are used in various foods and also for various medicinal purposes. In the present investigation, coriander powder was prepared by using different drying techniques viz sun drying and cabinet drying of coriander leaves which were blanched with different treatments. The results obtained from cabinet drying under blanched treatment were better than the other treatment combinations.

Keywords: Blanching, coriander, cabinet, preservation

Introduction
Coriander (*Coriandrum sativum* L.) belongs to family Umbelliferae and genus Coriandrum (*Coriandrum sativum*). The "Coriander", is consequential from Greek word for "bed-bug", as smell of spanking new foliage is said to resemble that of bug plague-ridden bed line. Coriander is referred to as "kusthumbari" or "dhanayaka" in the Sanskrit literature (Prakash, 1990) [6]. Coriander was used in time-honored Greek medicines by Hippocrates (460-377 BC). The Egyptians called this herb as "Spice of Happiness". The Romans and Greeks used coriander to flavour wine and also as a medication. Afterward, it was introduced into Great Britain by the Romans (Livarda and van der Veen, 2008) [4].
Fresh coriander leaves are perishable in nature and a considerable amount of produce is wasted due to lack of post-harvest processing facilities. This leads to market scarcity in availability and sharp rise in price in the lean period (Ahmed *et al.*, 2001) [1]. The fresh coriander leaves if properly dried, packaged and stored may help in increasing its availability during lean periods at low price. In the present study the Physico-chemical composition of fresh as well as dried leaves by applying various procedures were determined. These features allow it to be identified for medicinal use and classified among other dried spices available in the international market.

Materials and Methods
The investigation was carried out in the laboratory of biochemistry at the division of Post-Harvest Technology, Sher-e-Kashmir University of Agricultural Science & Technology.
The investigation was carried out on two types of varieties of coriander viz local variety & hybrid variety (SH-DH-1). Local variety was procured from the markets of Shalimar, Kashmir & the hybrid variety was procured from the fields of SKUAST-K SHALIMAR.

Methods
Preparation of Coriander leaves for drying:
a) **Sorting**: The fresh leaves were collected from the local markets of Shalimar, Kashmir (V_1) and from the horticulture department of SKUAST-K, Shalimar (V_2). The stems and other unwanted parts were removed from Coriander leaves.
b) **Washing**: The leaves were washed with cold water to remove the dirt particles. The excess water was drained out from leaves. After complete removal of water particles the leaves were kept in thin layer in tray for actual drying process.

Pretreatments
a) Blanching: Before drying, prepared samples were subjected to blanching in boiling water (100 °C) for 30s.

b) Control: Samples were washed in cold water and subjected to drying.

Methods of drying

a) Sun drying: Weighed accurately 200g of coriander leaves for sun drying process. In this method the fresh coriander leaves, (blanched as well as control) were air dried for few minutes then kept single layered in the tray of suitable dimensions. Then the trays were placed at a place where adequate amount of sunlight was available.

b) Cabinet drying: In cabinet drying method, the fresh coriander leaves, (blanched as well as control) air dried for few minutes were spread single layered on the trays of suitable dimension and placed into cabinet tray drier at 45 °C for 5-6 hours.

Determination of proximate analysis

The proximate analysis of coriander leaves (fresh as well as dried) was carried out by standard methods (AOAC, 1995) [2].

1. Determination of moisture content: Moisture content of fresh and dried coriander leaves was determined by using a laboratory oven method (AOAC, 1995) [2].

$$\text{Moisture content (\%)} = \frac{\text{Initial weight (g)} - \text{final weight (g)} \times 100}{\text{initial weight (g)}}$$

2. Determination of carbohydrate content: Carbohydrates were estimated by the anthrone method, given by Thimmaiah (1999) [8].

$$\text{Amount of carbohydrate present} = \frac{\text{Sugar value from graph}}{\text{Aliquot sample used (0.5 or 1 ml)}} \times \frac{\text{Total vol. of Extract (ml)} \times 100}{\text{Weight of sample (mg)}}$$

3. Determination of total solids: Total solid content in fresh and dried coriander leaves were determined by the method as discussed by Ranganna (1986) [7] and using following formula:

Total solids (%) = 100 – moisture content (%)

4. Determination of crude protein content: Proteins were determined by the kjeldals methods as described in Thimmaiah (1999) [8].

$$\text{N (\%)} = \frac{\text{Quantity of sample-Blank(ml)} \times \text{N of HCl} \times 14}{1000 \times \text{weight of sample (g)}} \times 100$$

Then per cent protein was calculated by multiplying nitrogen content (N%) by 6.25. Protein (%) = N% × 6.25

5. Determination of crude fiber content: Crude fiber was determined by Weende method (1985) given by AOAC (1995) [2].

$$\text{Crude fibre (\%)} = \frac{W_1 - W_2}{W} \times 100$$

Where,
W gm = weight of sample
W_1 gm = Residue (crude fibre + minerals)
W_2gm= ash remained

6. Determination of Ash content: Ash content was determined according to AOAC (1995) [2] procedures.

$$\text{Ash content (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

7. Determination of Minerals

a) Calcium & Iron: Determined by Versenate method as described by Jackson (1973) [3].

b) Potassium, Magnesium & Sodium: Determined by flame photometric method given by Piper (1966) [5].

Results and Discussion

The moisture content in 8 of the samples of dehydrated leaves was in range of 13-14 %. Maximum moisture content was highest in sun dried unblanched sample (13.40%) in variety V_2 and minimum in cabinet dried blanched sample (13.10%) in variety V_1. This result was consistent with the findings of Ahmed *et al* (2001) [1].

Carbohydrate content of dried coriander leaves in various samples ranged from 11-13%. The carbohydrate content in dehydrated powder of cabinet tray dried sample was highest in variety V_1 (12.93%). Crude Protein content in all the various samples ranged from 10-12%. Maximum crude protein content was showed by cabinet dried blanched samples in variety V_2. Total solid content in all the samples ranged between 85-87%. Maximum total solid content was showed by cabinet dried blanched sample. Crude fiber content in various samples ranged from 5-6%. Maximum crude fiber content was measured in cabinet dried blanched samples.

Proximate analysis

Table 1: Physico-chemical properties of fresh coriander leaves (V1) & (V2)

S. No.	Parameter	Local Variety (V1)	Hybrid Variety (V2)
1.	Moisture (%)	85.09	85.33
2.	Carbohydrate (%)	4.29	4.01
3.	Total Solids (%)	14.91	14.67
4.	Crude Protein (%)	3.06	3.02
5.	Crude Fiber (%)	2.01	1.92
6.	Ash (%)	4.50	4.45
7.	MINERALS %)		
	a) Calcium	0.66	0.68
	b) Potassium	1.62	1.58
	c) Iron	0.03	0.03
	d) Magnesium	0.52	0.47
	e) Sodium	0.20	0.18

Table 2: Physico chemical properties of dried coriander leaves of local variety (V1).

S.no	Parameters		Blanched		Unblanched	
			Sun dried	Cabinet dried	Sun dried	Cabinet dried
1	Moisture (%)		13.22	13.10	13.37	13.15
2	Carbohydrates (%)		11.25	11.30	11.95	12.93
3	Crude protein (%)		10.31	10.61	11.12	10.62
4	Crude fiber (%)		5.58	5.97	5.58	5.97
5	Total solids (%)		86.77	86.90	86.63	86.85
6	Ash (%)		12.06	12.35	12.06	12.35
7	Minerals (%)					
	a)	Calcium	2.01	2.11	2.01	2.11
	b)	Potassium	4.25	4.29	4.25	4.29
	c)	Iron	0.088	0.091	0.088	0.091
	d)	Magnesium	1.21	1.29	1.21	1.29
	e)	Sodium	0.68	0.72	0.68	0.72

Table 3: physico chemical properties of dried coriander leaves of hybrid variety (v2).

S.no	Parameters		Blanched		Unblanched	
			Sun dried	Cabinet dried	Sun dried	Cabinet dried
1	Moisture (%)		13.29	13.13	13.40	13.22
2	Carbohydrates (%)		10.74	11.46	12.25	12.82
3	Crude protein (%)		10.19	10.31	11.06	11.46
4	Crude fiber (%)		5.43	5.83	5.43	5.83
5	Total solids (%)		86.65	86.87	86.60	86.67
6	Ash (%)		12.15	12.83	12.15	12.83
7	Minerals (%)					
	a)	Calcium	2.48	2.58	2.48	2.58
	b)	Potassium	4.15	4.16	4.15	4.16
	c)	Iron	0.079	0.082	0.079	0.082
	d)	Magnesium	1.26	1.29	1.26	1.29
	e)	Sodium	0.63	0.70	0.63	0.70

Conclusion

It can be concluded that blanched coriander leaves under cabinet drying was best treatment and method of dehydration of coriander leaves. There was better retention of nutrients like crude proteins, carbohydrates, crude fiber, minerals and dehydrated characteristics as compared to sun drying method. The preparation of coriander leaves powder for addition in various processed food products and to ascertain acceptability also needs investigation.

Dehydration technique resulted in concentration of nutrients. Dehydration is one of the best possible method for preservation of seasonal and perishable green leafy vegetables. If we can make the availability of dried leaves of coriander in abundance, it can be helpful in overcoming the micronutrient deficiencies in the various developing countries.

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