COMPARISON OF PHYSIOCHEMICAL PARAMETERS AND METAL CONTENTS IN DIFFERENT SAMPLES OF *CORIANDRUM SATIVUM L.* SEEDS

FARAH KISHWAR*, FAIZA MUSTAFA, RUBINA PERWEEN, RABIA FARHEEN AND ANILA ANWAR

Department of Chemistry, Federal Urdu University of Science and Technology,
Gulshan-e-Iqbal Campus, Karachi, Pakistan
**Corresponding author e-mail:farahkishwar@yahoo.com*

خلاصہ

Coriandrum sativum L. (دھنیہ) پاکستانی کھانوں میں استعمال ہونے والا ایک اہم جزہے۔ یہ بوٹی دنیا بھر میں نہ صرف اپنے صحت مند اثرات کی وجہ سے مشہور ہے بلکہ دوا کے طور پر بھی استعمال کی جاتی ہے۔ حالیہ مطالعے کا مقصد بازار میں مہیا مختلف دھنیے کے بیجوں کے پاؤڈر کے نمونوں کی طبعی خصوصیات معلوم کرنے کے ساتھ ساتھ ان میں پائی جانے والی کچھ ضروری اور غیر ضروری دھاتوں کی مقدار کا موازنہ کرنا تھا۔ اس مقصد کے لئے دھنیہ پاؤڈر کے مختلف پیکنگ والے نمونے کراچی کی مارکیٹ سے حاصل کئے گئے۔ حاصل کردہ نمونوں کی کئی طبعی خصوصیات جیسا کہ pH :، conductivity ،refractive index ،total dissolved solid ،undissolved solid, percentage of ash اور moisture معلوم کی گئیں جو بالترتیب 5.401-6.003، 523-582µS، 1.331-1.332، 3.089-3.508٪، 94.024- 94.889٪، 6.98-7.59٪اور 5.41-6.21٪ حاصل ہوئیں۔ اسکے علاوہ دھنیہ پاؤڈر میں پائے جانے والی کچھ دھاتوں مثلاً Ca, Mg، Fe اور Al کا ارتکاز بھی معلوم کیا گیا جو بالترتیب 680-720mg/100g، 300-360mg/100g، 16.01-17.57mg/100g اور 38.93-64.88 mg/100g حاصل ہوا۔ حالیہ تحقیق کے نتیجے میں حاصل شدہ تمام نتائج پہلے سے رپورٹ شدہ نتائج سے بہت اچھی مطابقت رکھتے ہیں سوائے Al کے۔ جو تحقیق شدہ نمونوں میں بہت زیادہ مقدار میں پایا گیا۔ لہٰذا مطالعہ کئے گئے دھنیہ پاؤڈر کے روزانہ استعمال کے نتیجے میں ایلومینیم دھات کی مقدار خون میں بڑھ سکتی ہے اور زہریلا پن پیدا کر سکتی ہے

Abstract

Coriandrum sativum L. (Coriander) is one of the most common ingredients of Pakistani cuisine. This herb is famous all over the world for its health benefits and medicinal uses. Present research is carried out to compare different physicochemical parameters and metal contents in different samples of Coriander seed. For this purpose, samples of coriander seeds available in three different types of packaging were collected from the local market in Karachi, Pakistan. Various physiochemical parameters, i.e. pH, conductivity, refractive index, total dissolved solid, undissolved solid, percentage of ash and moisture, were determined and found to be in the range of 5.401-6.003, 523-582µS, 1.331-1.332, 3.089-3.508%, 94.024-94.889%, 6.98-7.59%, 5.41-6.21% respectively. The concentrations of different macro and micro metals i.e. Ca, Mg, Fe and Al were determined in the range 680-720mg/100g, 300-360mg/100g, 16.01-17.57mg/100g, 38.93-64.88mg/100g respectively. The results of all parameters and metal content showed good agreement with the reported values except Al; hence excessive use of these samples may cause aluminium toxicity.

Introduction

Coriander (*Coriandrum sativum L.*) is an annual herb and is most commonly used for seasoning purpose. It has a light and fresh flavor (Bhat *et al.*, 2014). The use of coriander can be traced back to 5,000 BC, making it one of the world's oldest spices. The fruits of coriander have been used to treat cough, bronchitis, vomiting, dysentery, diarrhea, gout, rheumatism, intermittent fevers and giddiness among others. The essential oil from coriander plant has also been traditionally used to stimulate gastric juices and to treat ulcers and mouth infections in the Asian region (Peter, 2001). Coriander seeds are a good household remedy for many disorders, particularly those of neurological (Kannappan *et al.*, 2011), digestive (Kubo *et al.*, 2004) or urinary tracts (Frawley and Lad, 1986). They also have ability to lower blood sugar (Chithra and Leelamma, 1997), blood pressure (Jabeen *et al.*, 2009) and LDL level whereas to increase level of HDL (Dhanapakiam *et al.*, 2008). In addition antioxidant (Mandal and Mandal, 2015), relaxant (Renata, 2013) and antimicrobial activities (Sabahat and Perween *et al.*, 2007) of Coriander seed have been reported also.

Mineral nutrients have important biological and nutritional functions and are involved in the most of the fundamental processes of life (Hui, 1992). They play critical roles in virtually all aspects of human health and function, for example calcium and magnesium play structural role and are crucial for healthy bones and teeth. In addition these minerals are also involved in conduction of nerve impulses, muscle contraction and normal heart rhythm (Rude *et al.,* 2006, Whitney and Rolfes, 2008). Iron is also vital for human beings and is involved in several body processes (Whitney and Rolfes, 2008). But in order to perform their functions the minerals should be in proper balance with respect to one another (Smolin and Grosvenor, 2007). They become toxic if they exceed the required concentration. For example high level of Al may be harmful to nervous, hematopoietic systems and to skeleton (Ochmański and Barabasz, 2000).

Coriander seeds contain an unusual array of phyto-nutrients and are a good source of copper, manganese, iron, magnesium and calcium (Ballal *et al.,* 1997). But the day by day increase in environmental pollution has affected the quality of raw and processed food badly. The widespread of contamination with metals in the last decades has raised consumers and scientific awareness due to their hazardous effects on human health. Due to this fact current research was carried out in order to compare the reported and the experimental data regarding the physiochemical parameters and the metal content of the coriander seed.

Materials and Methods

Sample Collection

Three types of commercially available coriander samples were purchased from local market during summer:

- Branded coriander seed powder (100g), packed in aluminum laminated polythene bag which was enclosed in card board box.
- Unbranded coriander seed powder (100g), packed in polythene pouch.
- Whole coriander seed (100g), which was ground in grind mill to fine powder and stored in cleaned air tight glass bottle.

All samples were coded and kept in refrigerator at 5 ^{o}C. Before every experimental analysis the samples were brought to room temperature.

Reagent and Glassware

All experimental work was done using analytical grade reagents and purchased from BDH, Merck and Sigma. During whole experimental work, distilled de-ionized water was used for preparation of standard solution and dilution of stock solution.

Analysis

Determination of physiochemical properties

Some physiochemical parameters such as pH, conductivity, refractive index, total dissolved solids (TDS), percentage of ash and moisture of all the samples were noted. For determination of pH and conductance, 1.00g of finely powdered sample was dissolved in 100ml distilled deionized water to obtain a heterogeneous mixture. The pH meter was calibrated, using buffer solution of pH 4 and 7, every time before taking observations. Refractive index of sample was determined by taking one drop of sample in sample holder. TDS was determined by dissolving 1g of the sample in 100ml of distilled water. The mixture was filtered and dried in oven at 100^{o}C and weighed. The moisture content was determined at 100±5^{o}C. The percentage of ash in samples was determined by muffle furnace method (AOAC, 2000) at 550^{o}C.

Determination of Metal Content

For this purpose sample solution was prepared by dissolving a known amount of ash in 0.2M solution of HNO_3 and made the volume up to the mark with distilled water.

Calcium: The prepared solution was titrated against standard di sodium salt of EDTA solution after addition of 1g KOH, and one pinch of calcon indicator, till end point.

Magnesium: In this case also, the sample solution was titrated against standard EDTA solution. Before titration 0.25gm of hydroxyl ammonium chloride, buffer solution of pH= 10 and one drop of Eriochrome Black T indicator (Jeffery *et al*., 1989).

Aluminium: For determination of aluminium, approximately 2g of NH_4Cl was added to a known volume of sample solution. The solution was boiled and then concentrated NH_4OH was added till complete precipitation. Aluminium was estimated through the weight of the precipitate after complete drying (Mehmood *et al*., 2009).
Iron: Concentration of iron was determined by spectrophotometer using calibration curve method (Fig. 1). For which a series of solutions were prepared using sample solution and KCN. Absorbance of all solutions was noted at 480nm (Jeffery *et al.,* 1989).

Results and Discussion

Botanical classification of coriander is mentioned in Table 1 whereas physiochemical parameters and metal contents (previously reported and experimental) are described in Table 2 and 3 respectively.

The pH content of the sample depends on the maturity of the plant, soil type, harvesting conditions and freshness of the sample (Shankuntala and Shadaksharawamy, 1995). In present study the observed range of pH was 5.401 to 6.003 (Table 2), indicating that the samples were not highly acidic. Srinivasan (2003) reported the value of pH as 5.25 in coriander seed powder. Our results for pH are slightly higher than reported value which might be due to difference in soil type or harvesting conditions.

The electrical conductivity is one of the soil properties, which is associated with the nature of soil composition (i.e. particle size distribution and mineralogy), structure (i.e. porosity, pore size distribution and connectivity), water content, and temperature (Archie, 1942).The observed range of conductivity in various samples of coriander seed powder was observed to be 523 µS to 582µS. Sample C showed highest value indicating higher level of electrolytes in it (Table 2).

In present studies the refractive index of the samples was found to be in the range of 1.331 to 1.332 (Table 2). Refractive index indicates the purity and quality of the food (Hui, 1992).

Total dissolved solid (TDS) is a measure of electrolytes and salts of metal contained in any sample. It was also estimated in all the samples of coriander seed powder and was found to be in the range of 3.089 to 3.195%, whereas for moisture content the observed range was 5.415 to 6.210% (Table 2). Different researchers have reported different values for the moisture content in coriander seed powder (Ehssan, *et al.,* 2018, Shahwar *et al.,* 2012, Raya *et al.,* 2013, Sharanagat, 2013 and Bhat *et al*., 2014). These differences may be due to differences in humidity of environment. The range of moisture which is less favorable for any kind of microbial growth in food is 1-8% (Jay, 2000). Hence observed values of all the samples of current study lie in this reported range.

In present study the observed percentage of ash content in various samples of coriander seed powder was found to be 6.98-7.59% as shown in Table 2. Here also different values have been reported by Shahwar *et al*., (2012), Raya *et al*., (2013) and Asif *et al.,* (2013). These variations may be due to environmental and geographical factors. Our results were found within the reported range.

In current study the mean concentrations of all the observed electrolytes were examined with standard deviation at confidence level $p<0.01$ (95%). In case of calcium it was found to be 680mg to 720mg/100g (Table 3). The concentration of magnesium was observed to be 300 to 360 mg/100g. The concentration of iron in the samples was found in the range of 16.015 to 17.578mg/100g (Table 3). For all the three cases of electrolytes, the observed results are in good agreement with the reported values of Raya *et al.,* (2013) and Bhat *et al.,* (2014) and it is suggested that all samples are suitable for daily intake. On the other hand obtained results for Al showed high concentration of Al in all the samples, hence they may cause toxicity. The concentration of Al was found in the range of 38.93 to 64.88mg/100g (Table 3). Here it is important to note that the sample A, which was packed in aluminum laminated polythene bag, showed the highest concentration of Al, which may be due to its packing. Other factors which may be the cause of variation in results are environmental, geological, anthropogenic pathways and processing of samples.

In short the results of the examined physiochemical parameters (pH, conductivity, TDS, refractive index and moisture) showed that the locally available coriander seed powder samples are pure and have good shelf life. The current study concluded that coriander seed powder enhances the nutritive value of food as it contains appropriate level of Ca, Mg and Fe, which are essential nutrients and play very important biological roles in the human body. There was no significant difference between the concentrations of these minerals in different samples. However, Al was detected in considerable high levels especially in branded samples, packed in aluminum foil packaging. Excessive use of these samples could therefore pose health hazards to consumers (Caramelo *et al.,* 1995 and Molitoris *et al*., 1989).

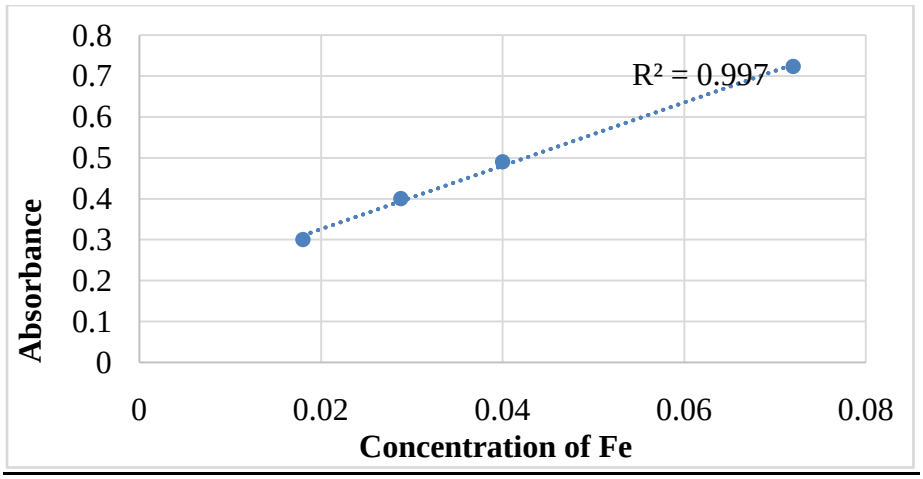

Fig.1. Determination of concentration of Iron by Calibration curve method

Table 1.Botanical description of *Coriandrum sativum L.*

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Rosidae
Order	Apiales
Family	Apiaceae
Genus	*CoriandrumL.*
Species	*Coriandrumsativum L*

Table 2. Reported and Eperimentally found physiochemical properties of *Coriandrum sativum L* seed

Physiochemical parameters	Reported values (per 100g)	References	Experimentally found values (per 100g)		
			A	B	C
Moisture	8.86	Bhat *et al*., 2014	5.415±0.2899	5.825±0.120	6.210±0.028
Ash	5 to 7	Rao*et al*., 2012	7.590±0.1131	7.421±0.028	6.981±0.014
pH	5.25	Srinivasan, 2003	6.003	5.401	5.905
Conductance	Not reported	-	523	526	582
Refractive Index	Not reported	-	1.331	1.331	1.332
Dissolved solids (TDS)	Not reported	-	3.195±0.1402	3.508±0.152	3. 089±0.104
Undissolved solids (UDS)	Not reported	-	94.024±0.4144	94.11±0.399	94.89±0.473
Total solids	Not reported	-	97.219	97.62	97.988

Table 3. Reported and Eperimentally found metal content of *Coriandrum sativum L* seed

Metal Content	Reported values (mg / 100g)	References	Experimentally found values (mg / 100g)		
			A	B	C
Ca	709	Bhat *et al*., 2014	680.00±56.57	685.00±49.50	720.00±56.57
Mg	330	Bhat *et al.*, 2014	300.0 ±254.6	300.0±84.9	360.0±169.7
Fe	16.32	Bhat *et al.*, 2014	16.010±1.655	16.790±1.655	17.575±1.662
Al	Not reported	-	64.88±18.35	51.90±12.23	38.93±42.82

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