



## Chemical composition and mineral contents of *Zingiber officinale* and *Alpinia allughas* (Zingiberaceae) rhizomes

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### Abstract

*Zingiber officinale* and *Alpinia allughas* are used in Chinese, Ayurvedic and Tibb-Unani herbal medicines all over the world for a wide array of ailments. Present study was carried out to determine chemical composition and minerals contents of *Zingiber officinale* and *Alpinia allughas* rhizomes. Samples were collected from local retail market of Faisalabad, Pakistan. Moisture, ash, crude fiber, crude protein and crude fat percent contents of *Zingiber officinale* and *Alpinia allughas* rhizomes were  $8.60 \pm 0.23$  and  $9.87 \pm 0.51$ ,  $1.74 \pm 0.04$  and  $1.86 \pm 0.05$ ,  $76.4 \pm 1.30$  and  $76.53 \pm 1.06$ ,  $7.88 \pm 0.01$  and  $5.64 \pm 0.06$  and  $5.03 \pm 0.43$  and  $6.1 \pm 0.23$  respectively. While, ascorbic acid levels were  $3.75 \pm 0.58$  and  $1.25 \pm 0.03$  mg/100g in *Zingiber officinale* and *Alpinia allughas* respectively. Minerals contents (mg/100 g  $\pm$  SD) were  $12.50 \pm 0.29$  and  $7.50 \pm 0.87$  Cu,  $12.23 \pm 0.16$  and  $12.00 \pm 0.28$  Zn,  $80.00 \pm 2.89$  and  $32.75 \pm 0.43$  Fe,  $7.33 \pm 0.22$  and  $6.25 \pm 0.14$  Mn,  $0.49 \pm 1.9$  and  $0.37 \pm 1.3$  Ca,  $1.2 \pm 1.43$  and  $1.2 \pm 1.55$  Mg in *Zingiber officinale* and *Alpinia allughas* species respectively.

**Key words:** *Zingiber officinale*, *Alpinia allughas*, minerals, rhizomes

**Full length article** Received: 19-07-2012 Revised: 30-07-2012  
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Accepted: 31-07-2012

Available online: 31-07-2012

### 1. Introduction

For centuries, plants are the basic therapeutic option available to mankind and herbal formulations make up to 40% of total prescriptions. A significant rise in the practice of phytotherapeutic agents is observed over the past few years due to minimal side effects. Due to their properties, medicinal plants are used as primary health care aid among 80% of the world's population in the form of plant extracts or their active components [1]. About 25 species of Zingiberaceae are used to cure multiple disorders in human and animals [2]. *Zingiber officinale* (ginger) has been used in diarrhea, nausea, asthma and respiratory disorders [3]. In addition to their medicinal activities, Zingiberaceae plants extracts may also serve as a natural larvicidal agent [4]. The extract of *Zingiber officinale* can increase the rate of salivation significantly in animal model [5]. Ginger extracts have anti-inflammatory, anti-oxidant and anti-cancer effects. Shogaol can significantly attenuate a variety of neuroinflammatory responses in cortical astrocytes [6-8]. Ginger supplementations significantly reduce severity of acute chemotherapy-induced nausea in adult cancer patients [9]. Another member of Zingiberaceae is *Alpinia allughas* Roscoe (Lachii). *Alpinia allughas* rhizomes are used in gout and colic disease. It is considered as a plant related to magico-religious beliefs (Dobur Uie) in some part of the world [10].

Although no energy is provided by minerals, these play a vital role in regulation of cellular and physiological metabolism. Trace metals in the body maintain the pH, osmotic regularity and used as coenzyme which regularize the metabolic reactions [11]. Plant-derived foods have the potential to serve as dietary sources for all human-essential mineral [12]. Generally, too low or too high concentration of trace elements in human diet can affect the quality of human life [13-15].

The objective of the study was to analyze and document the chemical composition and mineral contents in the rhizomes of *Zingiber officinale* and *Alpinia allughas*.

### 2. Materials and methods

#### 2.1. Collection and Preparation of Samples

*Zingiber officinale* and *Alpinia allughas* roots (rhizomes) were collected randomly from local retail markets of Faisalabad, Pakistan. All materials were procured in their fresh unprocessed state. The rhizomes were thoroughly washed with tap water. The light outer skin was scrapped off using a blunt knife and later cut into tiny pieces. All samples so prepared were then dried in an air-circulating oven in the laboratory and ground manually into a fine power, using a grinder. The powder of each sample was stored in an air-tight cellophane bag as stock sample in

a refrigerator until required for analysis. All the analytical work was performed at General Biochemistry laboratory, Department of Chemistry and Biochemistry and Hi-Tech laboratories, University of Agriculture, Faisalabad, Pakistan.

## 2.2. Chemical Analysis

The methods described in AOAC [16] were used to evaluate the proximate composition (moisture, ash, crude protein and crude fat) of the *Zingiber officinale* and *Alpinia allughas*. While carbohydrate contents were calculated by subtracting the sum of the values of the other nutrients from 100. Estimation of ascorbic acid was carried out by HPLC (HPLC system =Lc-10, Shimadzu, Japan) with UV detection at 254 nm [17].

## 2.3. Mineral Contents

The mineral analysis was performed by using Atomic absorption spectrophotometer (Hitachi Polarized Zeeman; Model no Z-8200) following the conditions described in AOAC [16]. The minerals determined were copper (Cu), zinc (Zn), iron (Fe), manganese (Mn), calcium (Ca), nickel (Ni) and magnesium (Mg).

## 2.4 Statistical Analysis

All data were expressed as mean  $\pm$  S.D. Comparisons between the two plant species was done with ANOVA, using the Statistical Package for the Social Sciences (SPSS Inc. Chicago, IL, USA) software, (version 15.0). A *p*-value of less than 0.05 is considered statistically significant.

**Table 1.** Proximate Composition (%) of *Zingiber officinale* and *Alpinia allughas* Rhizomes

Constituents	<i>Z. officinale</i>	<i>A.allughas</i>
Moisture	8.60 $\pm$ 0.23	9.87 $\pm$ 0.51*
Ash	1.74 $\pm$ 0.04	1.86 $\pm$ 0.05 <sup>NS</sup>
Crude fiber	76.4 $\pm$ 1.30	76.53 $\pm$ 1.06 <sup>NS</sup>
Crude protein	7.88 $\pm$ 0.01	5.64 $\pm$ 0.06*
Crude fat	5.03 $\pm$ 0.43	6.1 $\pm$ 0.23*
Ascorbic acid	3.75 $\pm$ 0.58	1.25 $\pm$ 0.03*

Data are mean  $\pm$  standard deviations of triplicate determinations, NS = Non-significant, \*Significant at *p*<0.05

**Table 2.** Mineral contents (mg / 100 g) contents of *Zingiber officinale* and *Alpinia allughas* Rhizomes

Constituents	<i>Zingiber officinale</i>	<i>Alpinia allughas</i>
Copper	12.50 $\pm$ 0.29	7.50 $\pm$ 0.87*
Zinc	12.23 $\pm$ 0.16	12.00 $\pm$ 0.28 <sup>NS</sup>
Iron	80.00 $\pm$ 2.89	32.75 $\pm$ 0.43*
Manganese	7.33 $\pm$ 0.22	6.25 $\pm$ 0.14*
Calcium	0.49 $\pm$ 1.9	0.37 $\pm$ 1.3*
Nickel	BDL	0.17 $\pm$ 0.07
Magnesium	1.2 $\pm$ 1.43	1.2 $\pm$ 1.55 <sup>NS</sup>

Data are mean  $\pm$  standard deviations of triplicate determinations, NS = Non-significant, \*Significant at *p*<0.05, BDL = below detectable limits

## 3. Results and Discussion

### 3.1. Chemical Analysis

The results of proximate composition are presented in table 1. The moisture contents of the *A. allughas* samples were significantly higher (*p* < 0.05) than those of *Z. officinale*. Although the difference in crude fibre contents was nonsignificant, their values were the highest among all the parameters determined. The results indicated that both *Zingiber officinale* and *Alpinia allughas* were carbohydrate rich spices. Similarly, lower ash contents were analogous in both the species, an indication that *Z.officinale* and *A. allughas* are poor source of minerals. Crude fat contents were significantly higher (*p* < 0.05) in *A. allughas* when compared with *Zingiber officinale*. Vitamin C contents were found to be 3.75  $\pm$  0.58 and 1.25  $\pm$  0.03 mg/100 g dry weight in *Zingiber officinale* and *Alpinia allughas*,

respectively. Whereas, *Zingiber officinale* had significantly higher (*p* < 0.05) crude protein and ascorbic acid contents when compared with *A. allughas*. The protein contents in both the spices were below 10%.

### 3.2. Mineral Contents

The data representing minerals namely; copper, zinc, iron, manganese, calcium, nickel and magnesium is presented in table 2. Both the species were rich source of iron as its values were the highest among all the minerals determined. The level of Fe, Cu, Mn and Ca in *Zingiber officinale* was markedly (*p* < 0.05) higher than that of *Alpinia allughas*. However, differences in Zn, Ni and Mg concentrations were insignificant among both spices. The mineral analysis indicated that *Zingiber officinale* and *Alpinia allughas* were abundant in copper, zinc, iron and manganese.

#### 4. Discussion

Moisture contents of *Zingiber officinale* and *Alpinia allughas* roots were partly in accordance with the 6.67% moisture in ginger observed in another study [18]. A study on chemical composition of ginger in India described  $15.02 \pm 0.04$  % moisture contents [19]. Contrary to that, 70.90-76.86% moisture contents were also measured [20, 21].

Ash contents of *Zingiber officinale* and *Alpinia allughas* rhizomes in our study were much lower than those ( $3.85 \pm 0.61 - 6.40 \pm 0.15\%$ ) determined by Nwinuka *et al.* [18]. Both the species were rich in carbohydrate contents (crude fibres) and the results obtained were in accordance with previously data [18, 22]. Crude protein contents of *Zingiber officinale* and *Alpinia allughas* rhizomes were in accordance with the previous documented crude proteins contents in *Zingiber officinale* [18, 19]. Crude fat levels of *Zingiber officinale* and *Alpinia allughas* were lower than those ( $7.30 \pm 0.07$ ) determined by Hashmi *et al.* [23]. Both the species had ascorbic acid contents less than those ( $9.33 \pm 0.08$  mg) reported earlier [19].

Levels of Cu in present study were not in compliance with the Cu contents measured in retail markets of Hyderabad, Pakistan [11]. Similarly, two studies from Pakistan detected  $0.17 \pm 0.01$  and  $4.94$  mg/100 g Cu in ginger [23, 24]. Higher levels of zinc in family Zingiberaceae species namely; *Zingiber officinale* and *Alpinia allughas* were observed. Our analyses are not comparable to those mentioned by local studies [11, 23, 24]. *Zingiber officinale* and *Alpinia allughas* rhizomes had highest iron concentrations. This finding was not in compliance with earlier reports [11, 23, 24]. Earlier, Masud & Jaffar [25] measured  $0.1885$  mg/100 g Fe in ginger in NWFP province, Pakistan. Present study did not confirm previously reported  $0.16$  mg/100 g,  $0.1207$  mg/100g and  $101.4$  mg/100 g Mn contents in ginger [11, 23, 24].

Mg contents of *Zingiber officinale* and *Alpinia allughas* rhizomes were lower than those identified ( $2.24$  mg/100 g) recently [11]. But Ca contents in our analysis are parallel to formerly stated  $0.30$  mg/100 g Ca [11]. Our results are different from the findings of Wagesho [14] who observed much higher Ca ( $2001-2543$  g/g). Nickle levels in *Zingiber officinale* were below detectable limits, however *A. allughas* rhizomes had  $0.17 \pm 0.07$  mg/100 g Ni. These results were quite similar with the  $0.1405$  mg/ 100 g Ni noticed in local ginger [25].

#### 5. Conclusion

The present study has delivered some basic information on the proximate and mineral contents of the two locally consumed spices; *Zingiber officinale* and *Alpinia allughas* rhizomes. Their proximate compositions and mineral analysis depict them as rich source of carbohydrates and iron hence they are used mainly as food and medicinal adjuncts.

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