

**Comparison of Minerals Content from *Foeniculum vulgare* Mill. (Fennel)
Seeds and *Zingiber officinale* Roscoe (Ginger)**

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Medicinal plants are indigenous source of new compounds possessing therapeutic value and also used in drug development. World Health Organization estimated that 80% of population in developing countries consume indigenous medicinal plants in direct and indirect ways to treat their diseases. Different parts of plants accumulated minerals, which are essential to human nutrition. Micronutrient malnutrition is a major global health concern because its deficiency in the body is linked with ill health and diseases. The purpose of current study was to compare minerals content (macrominerals; Ca, Mg, Na, K and microminerals; Cu, Fe, Mn, Zn) from *Foeniculum vulgare* (fennel) seeds and *Zingiber officinale* Roscoe by using Atomic Absorption Spectrophotometer (AAS). Macrominerals content of fennel seeds and ginger were comparable with other studies and content of microminerals were within permissible limit of vegetables set by FAO/WHO, 2001. These findings indicated that, fennel seeds and ginger are a good source of essential nutrients required for the wellbeing of human body. The results obtained from this study will provide scientific validity validates for use of these spices in traditional medicine.

Keywords: *Foeniculum vulgare* Mill., *Zingiber officinale* Roscoe, Macrominerals, Microminerals, Atomic Absorption Spectrophotometer (AAS)

INTRODUCTION

Medicinal plants are indigenous source of new compounds possessing therapeutic value and also used in drug development. Medicinal plants are widely consumed as home remedies and also play an important and vital role in traditional medicine.¹ World Health Organization estimated that more than 80% of population in developing countries consumes indigenous medicinal plants in direct and indirect ways to treat their diseases.² In the past decade, the majority of population has significantly increased in the use of herbal medicine due to their minimal side effects, availability and acceptability.³ Nowadays, scientific interest is increased and the consumers are using herbal

products as dietary supplements.⁴ Spices and medicinal plants gained significant role in agronomy production, pharmacy and exportation because of their increased use as raw materials for the pharmaceutical industry and in the everyday life.⁵

Different parts of plants accumulate minerals, which are essential to human nutrition.³ Plants may absorb minerals from soil, water or air.⁶ Micronutrient deficiency is a major global health concern due to its deficiency in the body and is linked with ill health and diseases. More than half of total population in

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developing countries are reported to be affected by micronutrient deficiency.⁷ Their excess or deficiency may disturb normal biochemical functions of the body.⁸

Foeniculum vulgare (fennel) seeds are used as important ingredient in various folklore medicines and also as a spice throughout the world.⁹ Fennel is used as anti-inflammatory, antioxidant, antimicrobial, analgesic, carminative, diuretic and antispasmodic agents.¹⁰ *Zingiber officinale*, ginger is a member of the family Zingiberaceae; a small family with more than 45 genera, and 800 species.¹¹ This plant is widely distributed in South-Eastern Asia.¹² Ginger is one of the most commonly consumed dietary condiments in the world.¹³ Ginger possesses antioxidant, antibacterial, antifungal, anticancer and anti-inflammatory effects.¹ The purpose of current study was comparison of minerals content from fennel seeds and ginger.

MATERIALS AND METHODS

Reagents and instruments

Analytical grade standard of calcium (Ca), copper (Cu), iron (Fe), magnesium (Mg), manganese (Mn), potassium (K), sodium (Na) and zinc (Zn), 70% nitric acid (HNO₃) and 69% hydrochloric acid (HCl), double deionized water (DDW) were used. Atomic Absorption Spectrophotometer (AAS), AA 6650 and muffle furnace (LEF 1035) were used for this study.

Plant authenticity

Fennel seeds and ginger were identified and confirmed for its specific botanical name by competent taxonomist according to The Flora of Ceylon.¹⁴

Sample collection

Fennel seeds were collected from the farms of Myin Gyan (MGN) and Pyin Oo Lwin (POL) townships. Rhizomes of ginger was collected from Mandalay (Mdy) and POL townships, respectively.

Phytochemical test

Types of compounds present in these samples were tested according to the methods of Harborne, 1998.¹⁵

Sample preparation for AAS

Cleaned dried each sample was crushed, powdered and homogenized, using mortar and pestle, and then kept in sampling bags for further analysis.

Digestion of samples

Specified weight (2.5 g) of each powder sample was placed into crucible for heating in an oven at 110°C for 2 hours to remove moisture. These dried samples were placed in muffle furnace at 550°C for 4 hours until the sample became totally ashes. After that, 5 ml of 6 M HNO₃ were added to each ash sample to dissolve and digest the contents. Then, each solution was filtered and diluted with DDW up to 50 ml in volumetric flask.¹⁶ Standard solutions of each metal were separately prepared from their respective concentration of 1000 mg/ml stock solutions, for the standard calibration curve. Reagent blank determination was used to correct the instrument readings.⁷

Statistical analysis

Data were analyzed by using Microsoft Office Excel v. 2007. Results were presented as mean±SE.

RESULTS

Identification of plant

Morphology and anatomy of *Foeniculum vulgare* Mill. and *Zingiber officinale* Roscoe were studied. (Fig. 1)

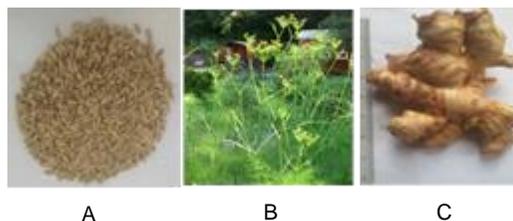


Fig. 1. *Foeniculum vulgare* Mill. (A, B) and *Zingiber officinale* Roscoe (C).

Foeniculum vulgare Mill., Apiaceae family, is perennial, glabrous, aromatic herb, up to 2 m tall. Stem is erect, striate and much branched bearing leaves. Leaves are alternate, 3-4 pinnate, leaf base sheathing. Inflorescence is a terminal, flat, umbel, rays 5-30 and bloom in July to August. Fruit is oblong to ovoid, 3-5 mm long and glabrous. *Zingiber officinale* Roscoe, Zingiberaceae family, is a perennial, erect, rhizomatus plant up to 3-4 feet. The rhizome is irregular in shape, brown, pale yellow within. The leaves are simple, lanceolate, alternates, distichous. Inflorescence is terminal dense spikes. Flowers are greenish pale yellow.

Phytochemical test

Phytochemical constituents of fennel seeds and ginger are shown in Table 1.

Table 1. Phytochemical constituents of fennel seeds and gingers from two places

Phytochemicals	Fennel		Ginger	
	MGN	POL	Mdy	POL
Alkaloids	+	+	+	+
α amino acid	+	+	+	+
Carbohydrate	+	+	+	+
Flavonoids	-	-	+	+
Glycosides	+	+	+	+
Phenols	+	+	+	+
Protein	-	-	-	-
Reducing sugar	++	++	++	++
Saponins	++	++	++	++
Starch	-	-	-	-
Steroids	-	-	-	-
Tannins	-	-	+	+
Tri-terpene	-	-	+	+

MGN=Myin Gyan Township, POL=Pyin Oo Lwin Township, (+)=detected, (-)=not detected

The minerals contents of fennel seeds are shown in Table 2.

Table 2. Comparison of mineral contents (ppm) in fennel seeds and ginger with those of other countries

Present/ Other study	Macrominerals (ppm)				Microminerals (ppm)				Refer- ence
	Ca	Mg	K	Na	Cu	Fe	Mn	Zn	
MGN (fennel)	1928.13 ±8.25	42.27 ±0.03	727.92 ±15.68	87.82 ±0.59	10.18±0.32	78.75±1.16	51.21±0.79	22.17±0.38	
POL (fennel)	2007.99 ±5.87	42.27 ±0.12	738.36 ±5.10	87.96 ±1.05	7.23±0.3	104.32±1.3	44.19±0.79	19.44±0.36	
Saudi Arabia (fennel)	13654 ±0	3037 ±0	14164 ±0	2664 ±0	13.9±0	104.7±0	69.69±0	29.56±0	17
Pakistan (fennel)	-	-	9038 ±571	69.61 ±0.532	37.13±1.22	136.5±7.927	41.2±1.264	53.69±1.465	6
Turkey, (fennel)	-	-	-	-	16.2±0.4	224.8±9.2	27.8±0.4	37.0±2.4	18
Pakistan (fennel)					117±22	1034±293	877±85	37.5±3.0	19
Mdy (ginger)	605.85 ±13.85	40.852 ±0.03	730.577 ±10.20	85.955 ±0.79	3.25±0.14	168.65±2.08	145.01±2.14	13.65±0.28	
POL (ginger)	291.05 ±8.02	40.605 ±0.02	739.14 ±7.86	83.588 ±0.90	2.38±0.14	209.57±2.49	168.09±2.09	11.66±0.27	
Pakistan (ginger)					49.4±2.7	2457±1110	1014±52	19.7±1.9	19
Ethiopia (ginger)	2000 -2540	2700 -4090			1.10-4.78	41.8-89.0	184-401	38.5-55.2	20
WHO/FAO 2001	-	-	-	-	73	425	500	100	21
WHO 1996	3600	-	10-100	400-500	-	-	-	-	22
Ajasa, 2004	44 -614	2000	6380 -36600	2610 -51340	-	-	-	-	23

ppm=Parts per million, MGN = Myin Gyan, POL = Pyin Oo Lwin, Mdy = Mandalay, Ca = calcium, Mg = magnesium, K = potassium, Na = sodium, Cu = copper, Fe = iron, Mn = manganese, Zn = zinc

DISCUSSION

According to phytochemical test, alkaloids, α amino acid, carbohydrate, glycosides, phenols, reducing sugar and saponins were contained in both fennel seeds and ginger. Alkaloids possess analgesic, antispasmodic, antibacterial, anti-inflammatory, anticancer and antioxidant activities.^{24, 25} Glycosides play an important role in living organisms. Glycosides are used as medications for diabetic, purgative, treatment of congestive heart failure, cardiac arrhythmia and skin diseases. Plants containing phenolic compounds show antioxidant activity. Saponins shows antifungal, antibacterial, antiprotozoal, anti-cancer, hypolipidemic, hypocholesterolemic activities and responsible for central nervous system.^{22, 26, 27, 28}

The results of macrominerals content in fennel seeds and ginger were comparable with other studies.

Calcium contents of MGN and POL fennel seeds were 1928 ppm and 2007 ppm. Calcium contents of Mdy and POL ginger were 605 ppm and 291 ppm. Ca plays function in clotting process, nerve transmission, hormone function and metabolism of vitamin D. High concentration of Ca is considered important in medicinal plants may be due to its role in bones, teeth, muscles system and heart functions.^{29, 30}

Magnesium contents of MGN and POL fennel seeds were 42 ppm. Mg plays an important role in maintaining electrical potential in nerves and membranes. It improves insulin sensitivity, protect against diabetes and its complications and also reduce blood pressure.²²

Sodium contents of MGN and POL fennel seeds were 87 ppm. Sodium contents of Mdy and POL ginger were 85 and 83 ppm. Na maintains acid alkali (pH) balance in the body. Deficiency of sodium may cause diarrhea, vomiting and excessive sweating, nausea, dizziness, poor concentration, cramps, confusion, dehydration, depression and muscle weakness. It involves in

production of energy, transport of amino-acids and glucose into the body cells.^{22, 29}

Potassium contents of MGN and POL fennel seeds were 727 ppm and 738 ppm, respectively. Potassium contents of Mdy and POL ginger were 730 and 739 ppm, respectively. K is the principal intracellular cation and helps to regulate osmotic pressure and pH equilibrium. Its deficiency causes muscles weakness, decrease reflex responses and respiratory paralysis.²²

The content of microminerals was within permissible limit of vegetables set by FAO/WHO, 2001.

Copper is one of essential micronutrients. The decoloration of hair and skin, dermatitis, irritation of the upper respiratory tract, metallic taste in mouth and nausea may occur due to high level of copper. Copper deficiency may cause anemia and congenital inability to excrete copper resulting in Wilson's disease.⁴

Iron is the most abundant essential trace element of human body tissues. Iron plays important role in oxygen and electron transport in human body and also necessary for formation of haemoglobin. High content of iron in human body can cause tissue damage due to formation of free radicals. Low iron level results gastrointestinal infection, nose bleeding and myocardial infarction.^{30, 31, 32}

Manganese is an essential trace element. Manganese plays essential role in normal growth, skeleton formation and normal reproductive function. Manganese deficiency occurs skeletal abnormalities, retarded bone growth, change in hair color to growth, abnormalities in pancreas and disturbances in lipid and carbohydrate metabolism.^{29, 31}

Zinc is also essential nutrient. Zinc deficiency in human causes diarrhea, dermatitis, hair loss, bleeding tendency, hypotension, seizure, hypothermia, impaired parturition, neuropathy, decreased cyclic food intake and growth failure and mostly occurs in pregnancy.^{29, 31}

Conclusion

Fennel seeds and ginger have lots of phytochemicals and minerals which may be responsible for many pharmacological activities and in accordance with medicinal usage of literature review. These findings indicated that, fennel seeds and ginger are good source of essential nutrients required for the wellbeing of human body. The results obtained from this study will provide scientifically validates for use of these spices in traditional medicine. Further investigation in other scientific area will show more of its potentials.

Competing interests

The authors declare that they have no competing interests.

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