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Nisha Mehra
Department of Chemistry, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Garima Tamta
Department of Chemistry, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Viveka Nand
Department of Chemistry, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Shiva Biswas
Department of Chemistry, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Corresponding Author:
Nisha Mehra
Department of Chemistry, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Compositional analysis of *Foeniculum vulgare* seeds genotypes collected from Tarai region of Uttarakhand

Nisha Mehra, Garima Tamta, Viveka Nand and Shiva Biswas

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Abstract
Foeniculum vulgare is a known herbal spice, and is commonly used in traditional medicine. Our aim was to perform the compositional analysis of ten varieties of fennel genotypes collected from a Tarai region of Uttarakhand. Mineral content was performed by using AAS to find out elements present in fennel seeds. Present study demonstrated significant mineral contents, moisture content and ash content in fennel and is used as food additives. The fennel seed genotype contains Ca, K, Mg, Fe, Na, Cu, Ni, Mn, Cr and Co elements present in it. 60.42 to 48.14 mg/100g K, 32.04 to 25.42 mg/100g Ca, 20.43 to 14.42 mg/100g Mg, 3.43 to 1.05 mg/100g Fe, 3.12 to 0.21 mg/100g Na, 0.78 to 0.10 mg/100g Cu, 0.79 to 0.31 mg/100g Ni, 0.62 to 0.07 mg/100g Mn, 0.23 to 0.07 mg/100g Cr and 0.07 to 0.03 mg/100g Co are present in substantial amount. 8.45 to 5.85 % moisture content and 12.8 to 9.5 % ash content are present in fennel genotypes. The above result inferred that *Foeniculum vulgare* may be a good source of minerals that need to develop and proper functioning of body.

Keywords: *Foeniculum vulgare*, AAS, mineral content, moisture content, ash content

Introduction
Plants play a major role in human welfare due to existence of numerous advances in the field of healthcare and nutrition. Awareness of the benefits of plants in food as rich additives contributes researchers to explore how well these ingredients affect the human health [1, 2].
Botanically, spices are a genus of aromatic plants and they are present primarily in semiarid regions [3]. Spices and herbs have been used not only as a flavoring agents in Indian foods moreover as traditional medicines supplements and food preservatives [4].
Due to their many beneficial uses, medicinal plants or spices are in high demand and are strongly favored in the nutritional food and pharmaceutical industries due to consumer choices [5]. Nutritionally, spices and herbs are important in reducing lipid peroxidation, which is the alteration (off-flavor) in the nature and chemical properties of lipids during processing and preservation of food [6].
Foeniculum vulgare is a culinary herbal spice belongs to Apiaceae genus. It is well known aromatic plant used as flavoring agent in food additives. Fennel is extensively cultivated in the world's tropical and temperate region [7]. A number of chemical components and specific therapeutic impacts of this herb have been reported in studies [8]. *F. Vulgare* contains essential oil, fatty acids and phenolic compounds etc. as major constituents present in it [9].
Present study was undertaken to evaluate the amount of minerals present in *Foeniculum vulgare* seeds genotypes that provide proper minerals in our body for better growth. Moisture content and ash content were also evaluated in fennel seed genotypes.

Plant profile
Synonyms
F. officinale; fenkel; Anethum foeniculum; capillaceum**;** sweet fennel; common fennel [10].

Common names
French: fenouli; Spanish: hinojo; Italian: finnochio; Russian: fynkhel; Hindi: saunf; German: fenchel; Arabic: shamar [10].

Taxonomic classification [11]:
Kingdom: Plantae
Subkingdom: Viridеplantae
Superdivision: Embryophyta

Division: Tracheophyta
Subdivision: Spermatophytina
Class: Magnoliopsida
Order: Apiales
Family: Apiaceae
Genus: Foeniculum Mill.
Species: *Foeniculum vulgare* Mill.

Materials and Methods

Source of plant material

Seeds of ten genotype varieties of *F. vulgare* were collected from Vegetable Research Centre (VRC) of GBPUA&T Pantnagar for experimental analysis. These varieties were developed in Pantnagar Tarai region *viz*. FNL-116, FNL-117, FNL-118, FNL-119, FNL-120, FNL-121, FNL-123, FNL-124, FNL-125, FNL-126 of Uttarakhand state.

Site of experimental study

The present study was carried out in Department of Chemistry, College of Basic Science and Humanities, Department of Veterinary Medicine, College of Veterinary and Animal Science, College of Home Science and Vegetable Research Centre (V.R.C), G.B. Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar (Uttarakhand).

Chemicals

The chemicals and solvent used were of gravimetric, analytical and laboratory grade and procured from standard manufactures like Himedia, Sigma, Molychem, SRL Pvt. Ltd.

Glasswares

The glassware used during investigation was of Borosil, Corning, J-Sil and Schott Duran.

Sample preparation

Fennel seed genotypes were shade dried and grounded to fine powder form. Fine powdered sample were kept in air tight container and study for further analysis.

Moisture content in samples

Weigh 2g of each powdered sample and put it in drying oven at 130 ˚C temperature for one hour. After one hour, bring the sample outside carefully and kept in muffle furnaces for cooling. Now weight again each sample for moisture content present in it.

Ash content in samples

Take 5 g of fennel seed sample on crucible and put on hot plate for complete charring. After charring, keep it on muffle furnaces up to 550 ˚C to 600 ˚C till greyish white residue appears. Now weigh each sample to estimate the ash content.

Mineral content in samples

Mineral content in powdered sample of fennel seeds were evaluated by the procedure of Elwell and Gidley [12]. 0.5 g of powdered sample were weighed and transferred to beakers for digestion. 13 ml mixture of nitric acid, sulphuric acid and perchloric acid (10:2:1, v/v/v) added in each sample and enable for overnight standing. These samples were now placed for full digestion in a hot plate until the transparent and colourless solution was formed. The digested samples were subsequently cooled and the volume was increased up to 100 ml of distilled water. Whattman filter paper (grade 1) was used to filter the digested sample and store it for further analysis. All the digested samples were analysed using double beam atomic absorption spectrophotometers (AAS) for sodium, potassium, calcium, magnesium, chromium, manganese, iron, cobalt, nickel and copper elements present in the *Foeniculum vulgare* seeds genotypes.

Results and Discussion

Elemental analysis is the analytical study of the amount of percentage of components present in the sample. The screening of chemical constituents plays an important role in these studies. Mineral profiling of fennel genotypes represented in Table 1 and Fig 1 and moisture content, ash content are represented in Table 2 and Fig 2 respectively. Fennel genotypes contained significant amount of K, Ca and Mg whereas Fe, Na, Cu, Ni, Mn, Cr and Co present in small amount. FNL-116 contained larger amount of K, Ca, Mg and Fe present in *F. vulgare* seeds. FNL-116, FNL-120 and FNL-126 genotypes have comparatively larger amount of K, Mg and Ca minerals. FNL-119 genotype having higher amount of Fe is present in it. FNL-117 contained higher amount of moisture content. FNL-123 have large amount of ash content present in it. *F. vulgare* contained significant amount of minerals calcium 580.6±24.39 mg/100 g, potassium 852.45±33.25 mg/100 g manganese 211.35±7.40 mg/100 g, sodium 16.21±0.65 mg/100 g and iron 9.72±0.38 mg/100 g. *F. vulgare* contains 6.24±0.24 moisture content and 12.97±0.51 ash content [13]. *F. vulgare* contains minerals are Na 77 to 512 mg/kg, K 4241 to 5851 mg/kg, Ca 56 to 363 mg/kg, and Mg 82 to 389 mg/kg [14].

Table 1: Mineral content of *Fennel genotypes* (mg/100g)

Fennel genotypes	K	Ca	Mg	Fe	Na	Cu	Ni	Mn	Cr	Co
FNL-116	60.42	32.04	20.43	3.15	0.42	0.78	0.58	0.10	0.12	0.05
FNL-117	54.04	29.54	19.10	1.27	0.36	0.28	0.30	0.16	0.07	0.06
FNL-118	48.14	26.02	17.62	1.74	0.30	0.16	0.31	0.62	0.06	0.07
FNL-119	52.42	28.12	18.04	3.43	0.21	0.08	0.42	0.21	0.03	0.05
FNL-120	60.14	29.04	20.41	1.45	0.32	0.42	0.62	0.07	0.13	0.04
FNL-121	55.09	30.14	18.82	1.46	0.43	0.44	0.63	0.15	0.07	0.05
FNL-123	50.49	25.42	14.42	1.05	1.30	0.17	0.71	0.18	0.10	0.03
FNL-124	58.42	31.09	19.42	1.18	3.12	0.18	0.77	0.21	0.12	0.04
FNL-125	54.63	29.01	19.02	1.31	0.46	0.21	0.58	0.19	0.23	0.05
FNL-126	59.92	29.62	19.86	1.34	0.47	0.10	0.79	0.24	0.09	0.03

Table 2: Moisture content and ash content in fennel genotypes (%)

Fennel genotypes	Moisture content	Ash content
FNL-116	8.40%	11.10%
FNL-117	8.45%	10.70%
FNL-118	6.45%	10.10%

FNL-119	5.85%	9.50%
FNL-120	6.85%	11.50%
FNL-121	7.90%	11.20%
FNL-123	7.45%	12.80%
FNL-124	6.50%	10.70%
FNL-125	6.30%	10.30%
FNL-126	6.60%	10.71%

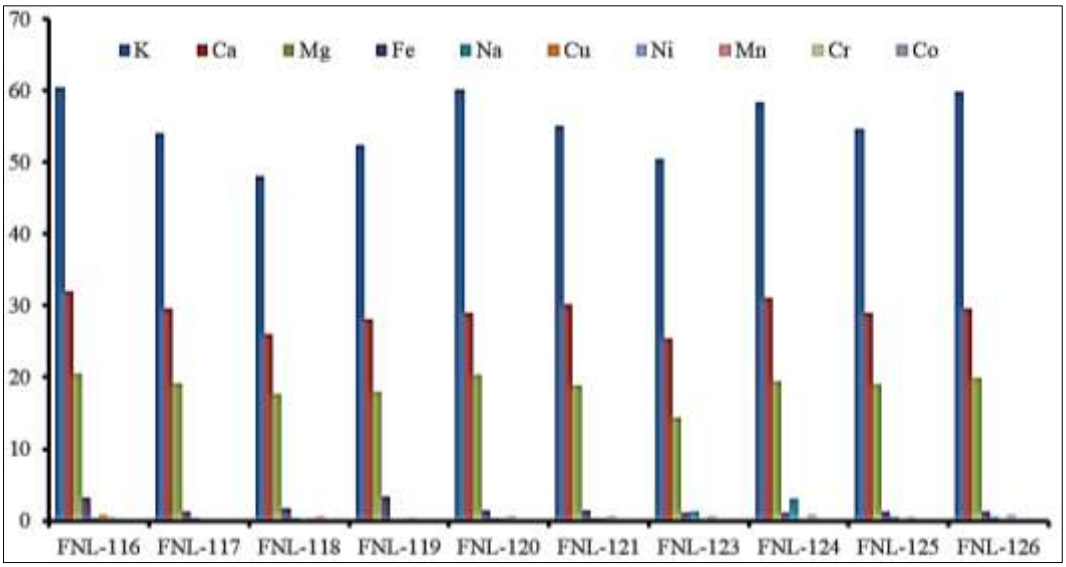

Fig 1: Graphical representation of mineral content in *Fennel genotypes*

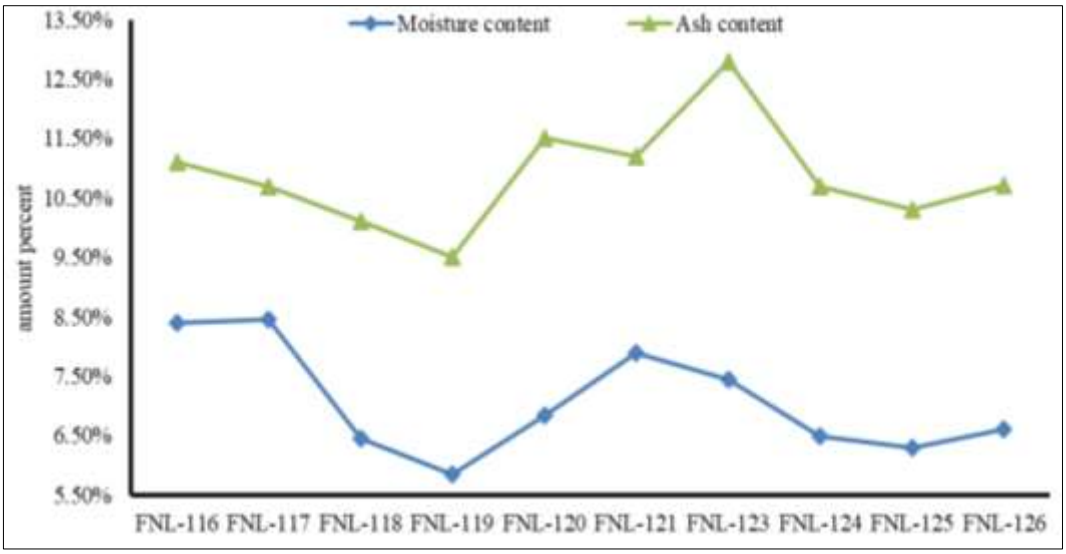

Fig 2: Graphical representation of moisture content and ash content in fennel genotypes

Conclusion

Plants are rich source of nutrients. *Foeniculum vulgare* seeds contained appreciable amount of nutrients to provide proper nutrition to our body. *F. vulgare* seeds are additive in nature and used in food processing. Present study demonstrated the different varieties of fennel seeds which contains considerable amount of minerals present in it. These fennel genotypes contained appreciable amount of K, Ca and Mg element present in it. FNL-116, FNL-120 and FNL-126 have significantly higher amount of K, Ca and Mg mineral present in it**.** FNL-117 exhibits large amount of moisture content whereas FNL-123 contained high ash content present in it. These varieties of *F. vulgare* can be used for future implementation in food processing.

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