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Analysis of Some Mineral Elements in Selected Spices Sold in Kano, Nigeria Markets

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Abstract: *Spices play a vital role in enhancing the flavor, aroma, and nutritional value of culinary preparations. Understanding the mineral contents of spices is essential to evaluate their potential contributions to a balanced diet and overall human health. This study assesses the proximate composition and mineral contents of nine selected spices (viz: Fenugreek, Cardamom, White pepper, Anise, Rosemary, Coriander, Cumin, Fennel, and Allspice). The mineral composition analysis indicated the presence of magnesium, potassium, calcium, and sodium in the spices. The result further showed the range of Mg (24.37±3.74 - 85.72±3.16 mg/kg), K (29.14±4.03 - 571.97±8.68 mg/kg), Ca (39.12±0.23 - 579.97±12.86 mg/kg) and Na (17.54±0.07 - 97.74±1.09 mg/kg) contents of the sampled spices. However, the mineral contents fell below the recommended dietary allowance (RDA) standards. These findings highlight the rich nutritional profile of the sampled spices, offering potential as valuable dietary additives.*

Keywords: *Calcium, Magnesium, Potassium, Sodium and Spices.*

Introduction

Spices are the building blocks of flavour in food applications. Food developers who wish to use these building blocks effectively to create successful products must understand spices completely (Jacob and Cox, 2015). The word “spice” came from the Latin word “species,” meaning specific kind. The name reflects the fact that all plant parts have been cultivated for their aromatic, fragrant, pungent, or any other desirable properties including the seed (e.g., aniseed, caraway, and coriander), leaf (cilantro, kari, bay, and mint), berry (allspice, juniper, and black pepper), bark (cinnamon), kernel (nutmeg), aril (mace), stem (chives), stalk (lemongrass), rhizome (ginger, turmeric, and galangal), root (lovage and horseradish), flower (saffron), bulb (garlic and onion), fruit (star anise, cardamom, and chile pepper), and flower bud (clove) (Jafari and He, 2016).

For people throughout the world, spices stimulate the appetite, add flavor and texture to food, and create visual appeal in meals. Called *kayan masara* (Hausa), *rempah* (Malaysian/ Indonesian), *beharat* (Arabic), *besamim* (Hebrew), *epices* (French), *kruen tet* (Thai), *masala* (Hindi), *specie* (Italian), *especerias* (Spanish), *sheng liu* (Mandarin), *specerjien* (Dutch), *krooder* (Norwegian), or

kimem (Ethiopian), spices have been savoured and sought around the world from the earliest times because of their diverse functions (Chun *et al*., 2020; Biswas *et al*., 2021).

Culinary spices are foods that are a rich source of bioactive chemicals such as sulfur-containing compounds, tannins, alkaloids, phenolic diterpenes, and vitamins, especially flavonoids and polyphenols (Yashin *et al*., 2017). Spices such as clove, rosemary, sage, oregano, and cinnamon are excellent sources of antioxidants with their high content of phenolic compounds (Beya *et al*., 2021). Research over the past decade has reported that bioactive constituents of spices possess the diverse range of health benefits (Neveu *et al*., 2010). There is now ample evidence that culinary spices are sources of constituents that possess anti-oxidative, anti-inflammatory, anti-tumourigenic, anti-carcinogenic, and glucose- and cholesterol-lowering activities as well as properties that affect cognition and mood, which are actively used in preclinical, clinical, and therapeutic trials investigating new treatments of diseases. In addition, there is now a growing amount of literature on how polyphenols confer health benefits via their action on gut microbiota (Etxeberria *et al*., 2013), which, in humans, have been recently related to risks of diabetes, cardiovascular disease, liver cirrhosis, etc.

The mineral content of spices can be affected by soil type, fertilizer application, and irrigation. The processing method of spices, such as drying, grinding, and roasting, can also affect their nutritional composition and mineral content (Fahmi *et al*., 2018). Another study by Ghasemi *et al*. (2021) investigated the mineral content of eight commonly used spices (cumin, coriander, fenugreek, black pepper, cinnamon, ginger, turmeric, and saffron) using atomic absorption spectrophotometry. The study found that the spices contained varying levels of calcium, iron, zinc, and magnesium, which are important for human health (Ghasemi *et al*., 2021).

This study is aimed at analysing some of the mineral elements (calcium, magnesium, sodium, potassium) present in selected spices sold in Kano, Nigeria markets.

Materials and Methods

Sampling

Nine (9) of the most commonly used spices in Kano, Nigeria were selected for analysis. The spices include; All-spice, Cardamom, Coriander, White pepper, Cumin, Rosemary, Fenugreek, Fennel, and Anise, during the month of January 2023. The samples were obtained from Tarauni Market.

Sample Preparation

The spices samples were cleaned using water to remove the soil and other materials on them. The spices samples were then oven-dried at 80ºC for 6 hours. The dried samples were then crushed using mortar and pestle which were then sieved and the process was repeated and was passed through 2mm sieve. The powder was stored in dry air-tight containers and kept in the laboratory at room temperature (25ºC) prior to further analysis.

Mineral Analysis

Two grams (2.0g) of each of the powdered samples were weighed into separate 100cm^3 beakers and treated with 20cm^3 of concentrated HNO_3 which was heated on an electric hot plate at 70-90ºC for 60 minutes. When the digestion was completed; the content of the beaker was allowed to cool, filtered through Whatman No. 42 filter paper into a 100 cm^3 volumetric flask and made up to the mark of 100cm^3 with distilled water. The flasks were then covered and kept for analysis. The glassware used for analysis was thoroughly cleaned and all reagents used were of analytical grade by Anjorin *et al.* (2010)

Instrumentation

The spice samples were ascertained using the Atomic Absorption spectrophotometer (PerkinElmer PinAAcle 900H).

Statistical Analysis

All data were subjected to statistical analysis. The values were reported as mean ± standard deviation (SD) while One-way ANOVA was used to test for differences between the various spices using Statistical Package for Social Sciences (SPSS) version 22. Post hoc analysis was performed using Tukey HSD. The results were considered significant at *P*-values of less than 0.05 that is at 95% confidence level ($P < 0.05$).

Results and Discussion

The results of the mineral composition of the selected spices are presented in Figures 1 to 4.

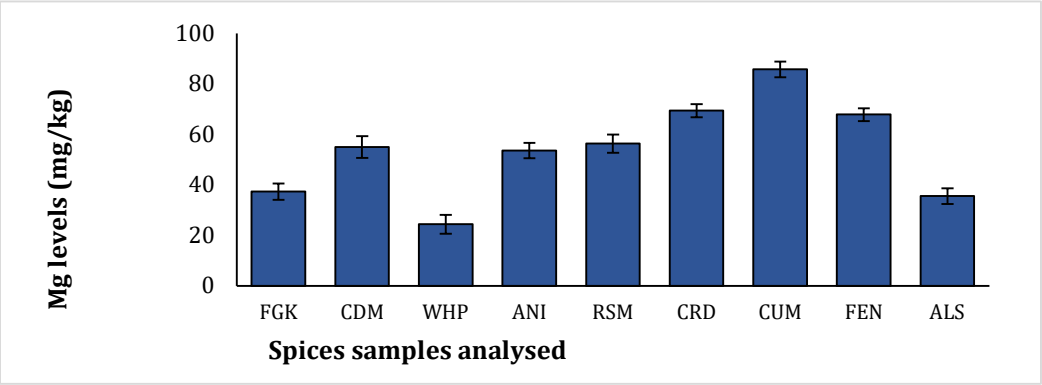

Figure 1: Magnesium contents of the spice samples analysed.

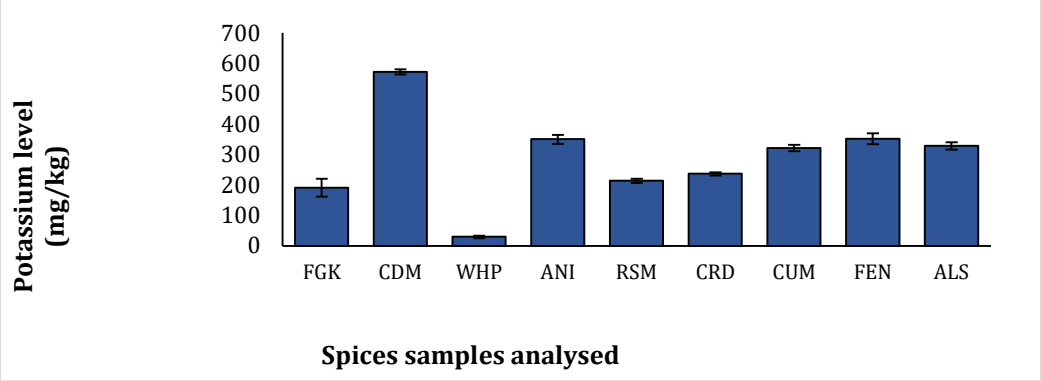

Figure 2: Potassium contents of the spice samples analysed.

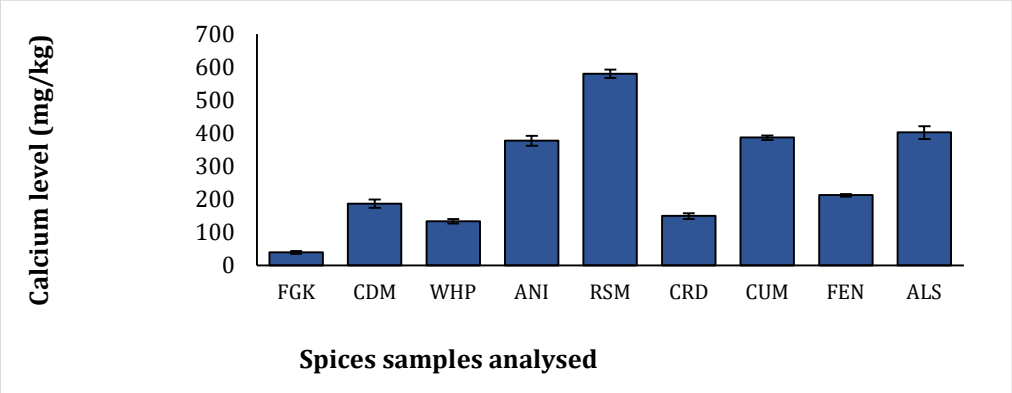

Figure 3: Calcium contents of the spice samples analysed.

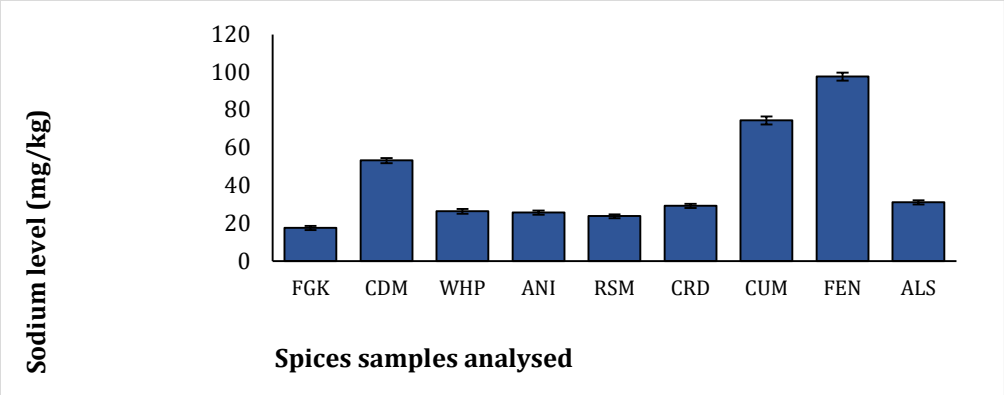

Figure 4: Sodium contents of the spice samples analysed.

Figure 1 to 4 shows the mineral constituents of the sample spices. The result of the present study revealed that all the spices have minerals such as calcium (Ca), magnesium (Mg), potassium (K) and sodium (Na) at varying concentrations. The result further showed that Cardamom has a significant ($p < 0.05$) higher level of K (571.97±8.68 mg/kg) compared to other sampled spices. The K content of the spices ranged between 29.14±4.03mg/kg-571.97±8.68 mg/kg for White pepper and Cardamom. The results show that Rosemary and Fennel have significant ($p < 0.05$) highest levels of Ca (579.97±12.86 mg/kg) and Na (97.74±1.09 mg/kg) respectively. The results show that Cumin had significant ($p < 0.05$) highest levels of Mg (85.72±3.16 mg/kg) compared to other sampled spices.

The results indicated that the calcium, magnesium, sodium and potassium contents of the sample spices are below the Recommended Dietary Allowance value (RDA) for these minerals.

The sodium content of the sampled spices was between (17.54±0.07-97.74±1.09 mg/kg). These values are comparable to 50 mg/kg for selected plant parts and lower than 450 mg/kg in *S. obtusfolia* (Khan *et al*., 2011).

Potassium content of the samples ranged between (29.14±4.03-571.97±8.68 mg/kg). The potassium level of these spices was higher compared to other green leafy vegetables as 64.2 mg/kg found in *Diospyros mespiliformis*, 1.09 mg/kg in *A. officinalis*, 0.825mg/kg in *M. dioicas* and 4.409 mg/kg in *I. astrgaalina* (Khan *et al*., 2011). The amount of magnesium present in the samples ranged between 24.37±3.74-85.72±3.16 mg/kg. This quantity was quite higher when compared to other edible wild plants like *F. bengalensis* 1.14 mg/kg (Gafar and Itodo, 2011). Consuming plants with high magnesium content can have a significant nutritional impact. Magnesium is essential for various bodily functions, including energy production, muscle and nerve function, and maintaining bone health (Volpe, 2015).

The calcium contents of the spice samples analyzed ranged between 39.12±0.23-579.97±12.86 mg/kg. This range is lower than the RDA for proper body growth and development. Calcium is crucial for maintaining strong bones and teeth, promoting proper muscle function, supporting nerve transmission, and participating in various enzymatic reactions within the body (Weaver and Plawecki, 2018).

Conclusion

The result of this study shows that the spices – (Fenugreek, Cardamom, White pepper, Anise, Rosemary, Coriander, Cumin, Fennel and All spice) contain Ca, Na, Mg and K in varying concentrations.

They contain a moderate amount of calcium which is essential for teeth and bone development, blood clotting and regulation of muscle contraction. It is low in sodium which can lead to a decrease in blood pressure within days of beginning a specific diet. The spices could bring many benefits to people (young and old) in developing countries by playing important roles in providing food security, enhancing livelihoods, and improving the nutritional status and social well-being of vulnerable groups.

Recommendations

Further studies is recommended to better understand the Clinical trials that should be conducted on the mineral bioavailability of these spices in humans. This can provide a way whereby these spices could be applied in mineral supplementation in formulating diets for vulnerable groups or diets for the management of certain non-communicable diseases.

Authors' Contributions

Dagari M.S.: Conceptualization and design of the research work
Khadija K. : Undertaking the research work, write-up and data analysis.
Mohammed, M. I.: Supervision and Editing of the write-up

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