

Determination of Trace Mineral Elements in some Tropical Fruits

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Abstract: Trace mineral elements play a vital role in the metabolic pathways in humans, when available in adequate concentrations. These elements may be present in varying amount in fruits. This study was carried out to determine the concentration of some the trace mineral element in some tropical fruits commonly consumed in Port Harcourt metropolis in Nigeria. The mineral elements measured included: Co, Fe, Mn, Ni & Zn. The levels of these elements were analyzed in banana, cucumber, guava, mango, orange and tomato, using AAS after acid digestion. The results obtained were as follow Co between 0.0108-0.0156mg/kg, Fe between 0.066-0.119mg/kg, Mn between 0.0051-0.0117mg/kg, Ni between 0.002-0.012mg/kg and Zn between 0.0276-0.0624. These trace mineral elements were found in comparatively low concentration in the six tropical fruits used for this research

Keywords: tropical fruits, human nutrients, trace mineral elements, Co, Fe, Mn, Ni, Zn,

1. Introduction

Fruits are the ripen ovary of flowering plant. Tropical fruits require tropical climate and originate from the tropics, they includes: Banana, Cucumber, Guava, Mango, Orange and Tomato.

Fruits are a good source of essential mineral elements that are necessary for multiple physiological and metabolic reactions involved in maintaining good health [1]. They are comparatively in low amount in fruits but play an important role in human. Trace elements do not provide any calorie but they play an important role in the metabolic regulation of the human body. Increased fruit consumption can improve mineral regulation and reduce cardiovascular diseases and certain cancer risks [2].

Trace mineral consistency of fruits depends on different factors e.g. genetic, weather, soil, the harvesting stage of maturity and their supply to the market. Mineral content reduced in plants by the climatic conditions due to rain, mist, fog, light and temperature and then further loss takes place due to less suitable storage conditions. If the cultivated soil is deficient in certain trace mineral element then the cultivated crop would ultimately be deficient for those mineral. Trace minerals help the body maintain body pH, osmotic regularity and acts as coenzyme which regulates metabolic reactions.

Cobalt (Co): Co is an indispensable element; it is an integral component of cyanocobalamin (vitamin B₁₂). It is essential for the formation of red blood cell and maintenance of nerve tissue. Co deficiency plays a role in producing anoxia and injuring the heart muscle [3]. The daily recommended range of Co in human diet is 0.005mg/day [4]. Co intake greater than 30mg/day can cause digestive and skin disorders in human.

Iron (Fe): Fe is a core component of the red blood cells. Its deficiency can cause anemia. Fe is needed in the formation of hemoglobin and myoglobin. The daily intake limit is 8-

11mg/day [5].

Manganese (Mn): Mn is one of the important essential elements required for carbohydrates metabolism as well as an antioxidant in superoxide dismutases enzymes. It is required in very little quantity and its deficiency rarely occur. The daily intake is 1.8-2.3mg/day [5].

Nickel (Ni): Ni plays its role as a coenzyme in different enzymes. Lower content of Ni in fruits and vegetables source can lead to increase blood sugar level, hypertension and deficient growth in human but on the other hand the increased uptake of Ni in fruits and vegetable can reduced the blood glucose level, difficulty in breathing, nausea etc. the daily intake is 3-7mg/day [6].

Zinc (Zn): Zn is reported as coenzyme for over 200 enzymes involved in immunity, new cell growth, acid-base regulation, etc. On the other hand, lack of sufficient amount of Zn results in reduced activity of related enzymes. According to study, the daily intake limit is up to 15mg/day [7]. While higher uptake of Zn may lead to muscle cramps, kidney damage and digestive problems. The reported limit of Zn for human uptake is up to 150ppm.

Evaluation of micronutrients and essential trace elements levels of fruits and vegetables is a growing trend in nutritional studies throughout the world but limited information is available on this in this part of the world. This is what necessitated this research work.

My aim was to determine the trace element content of these tropical fruits.

2. Materials and Methods

Minerals Determination:

Fresh samples of fruits were air dried for seven days and then oven dried at 45°C to constant weight. They were grounded with porcelain mortar and pestle to fine particle size and

stored in plastic containers for Atomic Absorption Spectrophotometer analysis. In mineral determination, these Co, Fe, Mn, Ni and Zn were determined by atomic absorption spectrophotometer by wet digestion.

Wet Digestion:

1g of dried sample was added to 5ml conc. HNO_3 and placed on hot plate for 1 hr and on getting semi dried, another 5ml of HNO_3 and 2ml of H_2O_2 was added and kept on hot plate for another 1 hr and after getting semi dried, it was cooled and filtered with the help of watt man filter paper and the volume of the residue was made up to 10ml with 2N HNO_3 and taken for AAS analysis. This above mentioned mineral analysis was developed following AOAC standard [8].

3. Results

Table 1: Trace mineral element composition of some tropical fruits.

	Co	Fe	Mn	Ni	Zn
mg/kg.....				
Banana	0.0108	0.119	0.0111	0.006	0.0504
Cucumber	0.0121	0.087	0.0117	0.012	0.0624
Guava	0.0118	0.096	0.0109	0.004	0.0384
Mango	0.0156	0.101	0.0051	0.006	0.0384
Orange	0.0105	0.087	0.0072	0.002	0.0276
Tomato	0.0135	0.066	0.0095	0.004	0.0392

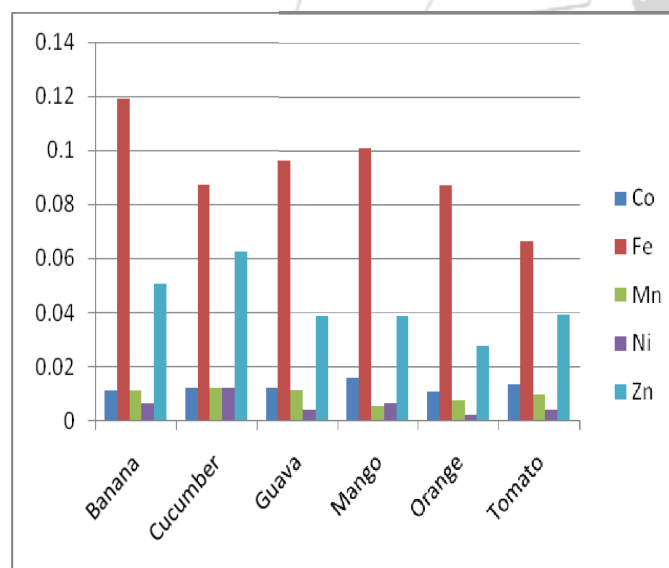


Figure 1: Trace mineral element composition of some tropical fruits.

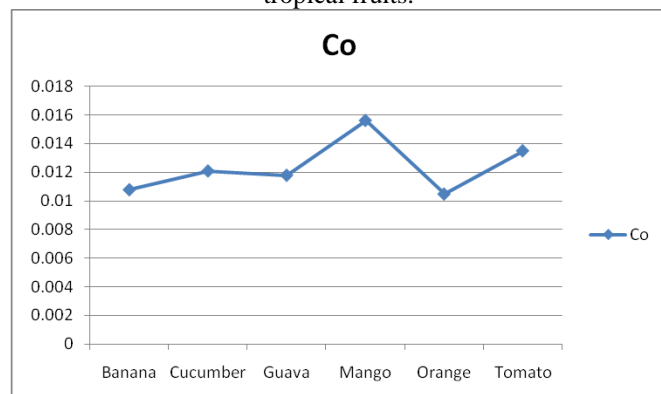


Figure 2: Cobalt (Co) composition of some tropical fruits.

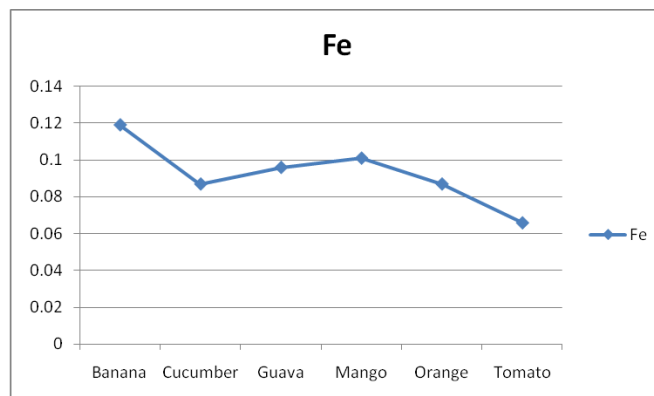


Figure 3: Iron (Fe) composition of some tropical fruits.

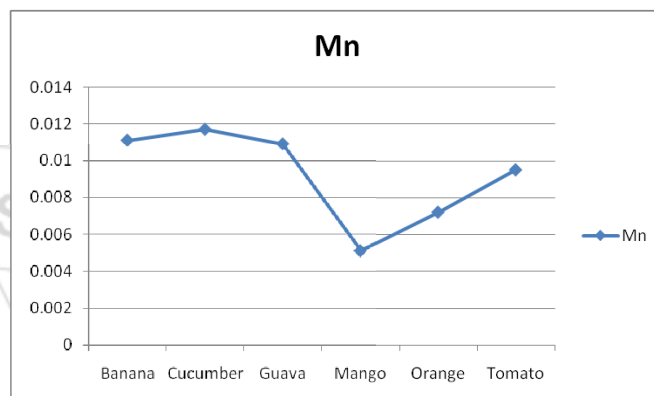


Figure 4: Manganese (Mn) composition of some tropical fruits.

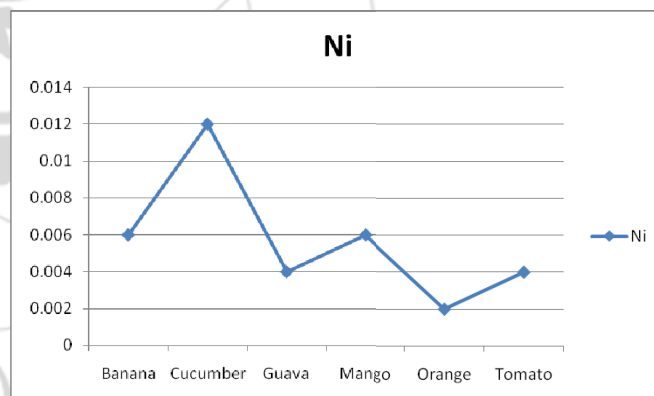


Figure 5: Nickel (Ni) composition of some tropical fruits.

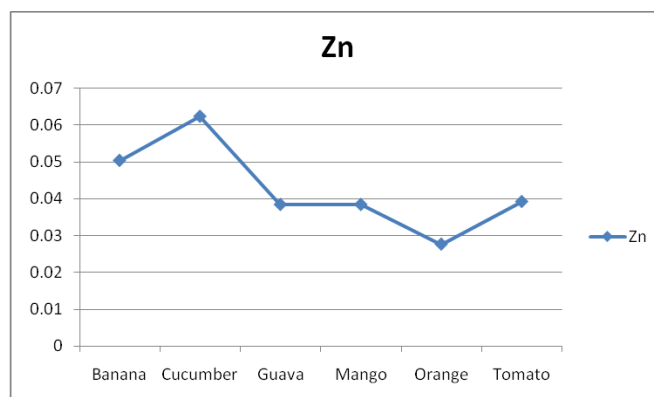


Figure 6: Zinc (Zn) composition of some tropical fruits.

4. Discussions

Trace elements uptakes in fruits result from absorption from the soil of the cultivated area, the atmospheric condition and partly from the irrigated water.

From the results obtained, Co was found higher in mango than other fruits. Orange contains the least concentration of Co (table 1 and figure 2). Cobalt determination in fruits was shown slightly high in all fruit. According to a study carried out on Co in different food, Co variation in fruits and vegetables is 0.006-0.009mg/kg [9].

Fe was found to be higher in banana and lesser in tomato than in other fruits (table 1 & figure3). Fe is one of the essential metals needed in various enzymatic reactions and its daily requirement is between 1.5-2.2mg/day [5].

Mango contains the least concentration while cucumber contains the highest concentration of Mn than other fruits (figure 4). Manganese safe limit for daily intake is 2.0-5.0mg/day for an adult [10] and its recommended range in fruits and vegetables are 0.42-6.64mg/kg [11]

Ni was found higher in cucumber and lesser in orange (figure 5). Nickel is one of the toxic metal required for metabolic reactions in the body. The reported safety range is between 3-7mg/kg [12].

Zn uptake was 0.0624mg/kg and 0.0276mg/kg as highest uptake in cucumber and lowest in orange (table 1 & figure 6). Dietary intake of Zn is between 14-20mg/day [13].

According to this study, trace mineral elements were found in comparatively in low concentration in the six tropical fruits used for this research. This imply that there is need for consumption of large quantity of these fruits to be able to meet the daily dietary intake level.

5. Conclusion

Many international and national health agencies are working throughout the world to develop new standards, but in developing country like Nigeria, it is still lacking in maintaining a standard composition. According to this study, trace mineral elements were found in comparatively low concentration in the six tropical fruits used for this research.

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