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# Determination of some antioxidant vitamins and trace elements in selected grains, fruits and vegetables commercially sold in Eke Awka market, Awka, Anambra State, Nigeria

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## ABSTRACT

Six samples from cucumber (*Cucumis sativus)*, apple (*Malus domestica*), cabbage (*Brassica oleracea*), Tiger nuts (*Cyperus esculentus*), Beans (*Phaseolus vulgaris*), Green peas (*Pisum sativum*) were purchased from Eke Awka market, Awka in Anambra state, and evaluated for some antioxidant vitamins using standard method. The concentration of the Trace metals namely Fe,Zn, Cu, Mn, Se, Pb, Cd and Ni were assessed using Atomic Absorption Spectrophotometer. The concentration of each trace metal in the sample was determined and compared with the permissible levels set by the Food and Agricultural Organization/World Health Organization. Antioxidant vitamins results showed that cabbage has the highest Vitamin A level, green peas the highest Vitamin C level while tigernuts has the highest Vitamin E level. The result of trace metal analysis showed that the concentration of Fe, Zn, Cu, Mn, Se, Pb, Cd and Ni in the six selected samples were lower or within the recommended permissible limit. This indicates that the samples are nontoxic and also safe for human consumption because they are within the acceptable limit that is not dangerous to health as recommended by World Health Organization /Food and Agriculture Organization.

**Keywords:** Trace element, Antioxidant vitamins, Atomic Absorption Spectrophotometer, Grains, Fruits, Vegetables

## INTRODUCTION

In recent years, there has been growing recognition of the importance of antioxidants and essential trace elements in human nutrition, due to their vital role in maintaining health and preventing chronic diseases [1,2,3]. Antioxidant vitamins, such as vitamins A, C, and E, are crucial for neutralizing free radicals, which can cause oxidative stress and damage to cells [4,5]. Trace elements like zinc, copper, manganese, and selenium are equally important as they act as cofactors for various enzymatic reactions, support the immune system, and contribute to the proper functioning of antioxidant defense mechanisms [6,7]. Grains, fruits, and vegetables are primary dietary sources of these nutrients. They provide a range of bioactive compounds, including antioxidants and trace elements, which are essential for maintaining good health [3]. The composition and concentration of these nutrients, however, can vary significantly depending on factors such as the type of food, environmental conditions, agricultural practices, and post-harvest handling [8]. Hence, the determination of antioxidant vitamins and trace elements in these foods is important for understanding their nutritional value, promoting dietary diversity, and informing public health strategies. Eke Awka Market, located in Awka, Anambra State, Nigeria, is a major marketplace where various grains, fruits, and vegetables are sold. This market is frequented by a diverse population, and the foods available here play a crucial role in the diet of the local community. However, there is limited information on the nutritional composition of these foods, particularly with respect to their antioxidant vitamin and trace element content [9]. This research study aimed to determine the levels of some antioxidant vitamins

(such as vitamins A, C, and E) and trace elements (such as zinc, copper, manganese, and selenium) in selected grains, fruits, and vegetables available at Eke Awka Market. The study provides valuable data on the nutritional quality of these foods, which could help in making informed dietary choices and contribute to the overall health and well-being of the population. Additionally, the findings could serve as a reference for future studies and will inform local agricultural and food policies to enhance the nutritional status of the community. By assessing the antioxidant vitamin and trace element content in these commonly consumed foods, this study also aimed to contribute to the broader field of nutritional science, particularly in the context of developing countries where access to diverse and nutrient-rich foods may be limited. The results of this study could potentially guide nutritional interventions, dietary recommendations, and strategies for combating micronutrient deficiencies.

## METHODOLOGY

### Sample collection

The samples for this investigation were purchased at the Eke Awka Market in Awka, Anambra State. To avoid spoiling, the fruits and vegetables were collected in an air-ventilated environment, washed and spread out to dry.

### Determination of trace metals and micronutrients

Vitamins A C and E were carried out using established methods as described by AOAC [10], Pearson [11].

### Trace metal Analysis in Fruits and Vegetables

The heavy metal analysis was carried out utilising an FS240AA Atomic Absorption Spectrophotometer using the APHA technique (American Public Health Association) [12].

Half a gramme (0.5 g) of the sample was placed in 250 ml conical flasks, followed by 6 ml nitric acid ($HNO_3$) and 3 ml perchloric acid ($HClO_3$), stirred, and heated at 120$^0$C for 10 minutes. To decrease the bubbling effects of the boiling solution, boiling chips were utilised as an anti-bubble agent. Brown nitric acid ($HNO_3$) vapours show first when heated, followed by white frost, indicating that digestion is complete. After allowing the solution to cool to room temperature, Whatman filter paper was used to filter it. The filter was placed into a calibrated plastic container that was suitably labeled, and distilled water was added to get it up to the mark (50 ml). The container was corked and placed in a storage area for further investigation. Using an Atomic Absorption Spectrophotometer, the digested samples were further examined (GBC Avanta Ver 2.20 equipped with lamp).

### Statistical Analysis

The results were reported as the mean of three replicates plus standard deviation (SD). The Statistical Package for Social Sciences was used to conduct the statistical analysis (SPSS). For comparison, one-way analyses of variance were used, and the findings were submitted to a post hoc test using the least square deviation (LSD). The significance level for all of the findings was set at 0.05.

## RESULTS

### Antioxidant vitamin content

Antioxidant vitamin content of selected grains, fruit and vegetable from Eke Awka market were shown in Fig.4.3. The result of the study showed that cabbage (324.00±8.00%) has the highest vitamin A when compared to other analyzed samples, followed by beans (302.26±2.16%), least in tiger nuts (2.36±6.18%).

Cabbage (415±3.12%) has highest vitamin C when compared to other analyzed samples, followed by cucumber (25.07±0.52%) and the least was tiger nuts (2.90±0.03%). Vitamin E content of tiger nuts (30.94±1.05%) was highest when compared to other analyzed samples, followed by cabbage (30.20±1.25%) and least was beans (1.20±0.03%). The difference in the mean value were significant at $p<0.05$.

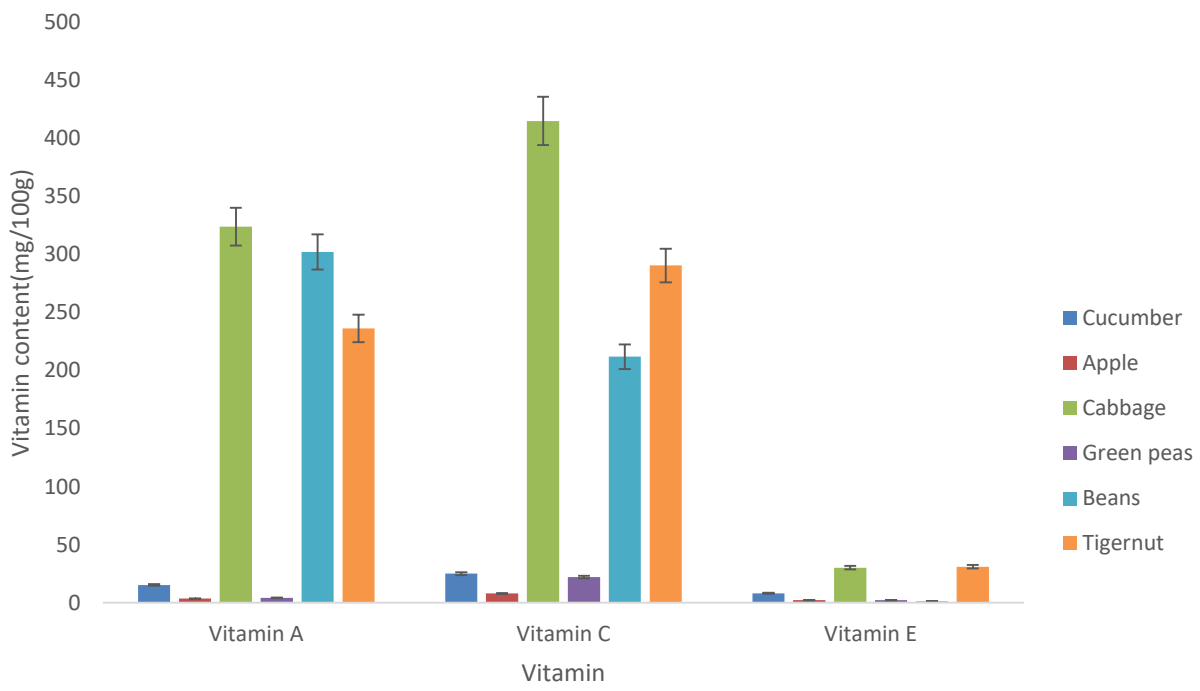


Fig 1: Antioxidant Vitamin Content of Fruits and vegetables From Eke Awka Market

**Trace metal levels**

The trace metal contents of grains, Fruits and vegetables are shown in Fig.4.5. The results of the study showed that, the trace metal concentrations in beans (18.12 ± 0.02mg/kg) was significantly high level in Iron while less in cucumber (0.04±0.01mg/kg) when compared to all the samples studied.

The trace metal zinc concentration in beans (4.16±0.03mg/kg) was significantly high when compared to other samples studied while less in apple(0.03±0.00mg/kg).

The trace metal copper concentrations in beans and tiger nuts (0.12±0.02mg/kg and 0.11±0.01mg/kg respectively) were significantly high when compared to all samples studied, while less in cabbage (0.01±0.00) and apple was Below Detectable level (BDL).

The trace metal manganese concentration in beans (0.38±0.02mg/kg) was significantly high when compared to all samples studied, while less in apple and green peas (0.04±0.01mg/kg) and (0.04±0.02mg/kg) respectively.

The trace metal selenium concentrations in tiger nuts (2.94±0.02mg/kg) was significantly high when compared to all samples studied, while less in cabbage (0.07±0.01mg/kg).

The trace metal lead concentration in cucumber was significantly high(0.02±0.01mg/kg) when compared to all samples studied and less in tigernuts(0.01±0.01mg/kg) and also below detectable level (BDL)in apple, cabbage, green peas and beans.

The trace metal cadmium concentrations in cucumber (0.06±0.03mg/kg) was high when compared to all samples studied and less in cabbage (0.01±0.00mg/kg), and also below detectable level (BDL) in beans.

The trace metal nickel concentrations in tiger nuts were high (0.02±0.01mg/kg). when compared to all samples studied less in apple, cabbage and green peas (0.01±0.00mg/kg) and also below detectable level (BDL) in beans.

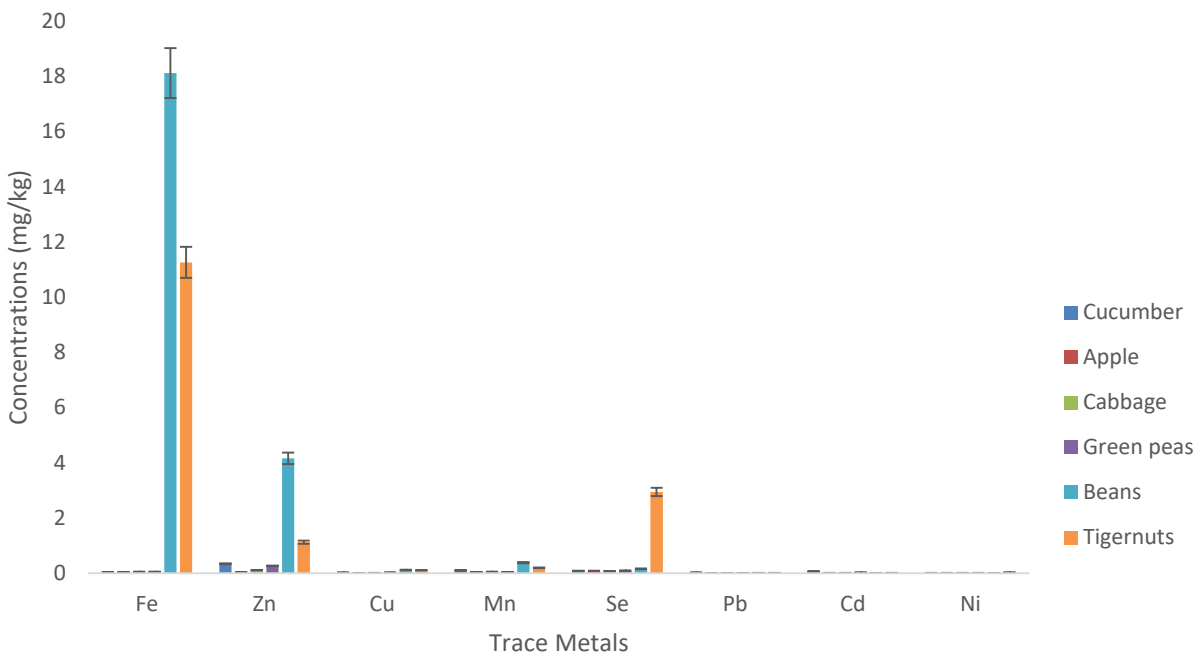


Fig 2: Trace metal levels of Selected Fruits and Vegetables From Eke Awka Market

## DISCUSSION

The result of Antioxidant Vitamin Content revealed that cabbage has the greatest Vit. A content, followed by beans. Green peas have the greatest vitamin C content, followed by apples. The greatest source of vitamin E is tiger nut, followed by cabbage. Some vitamins have antioxidant characteristics, whereas others have biological functions [13]. Vitamin A has been shown to support immune function, cell growth, reproduction, fetal development, it helps with eyesight and eye health. It has an effect on immunological health by triggering reactions that protect the body from disease and infection while also reducing oxidative stress [14] Cabbage has the greatest vitamin A concentration, according to the data. The findings contradict Jillian's [14] claim that cabbage contains just trace levels of minerals, notably vitamin A. Vitamin C are antioxidants and encourage the absorption of iron, help maintain vitamin E levels, indispensable for the immunological system and for preserving the tissues [15] From the result, green peas have highest Vit. C, therefore it is rich in antioxidant nutrients. High antioxidant levels in diet can reduce the risk of cancer. Vitamin E plays a role in the formation and functioning of the red blood cells, muscles and other tissues. It is believed to have a protective effect against cardiovascular disease and cancer. As a consequence, tiger nuts have the greatest vitamin E content. These findings corroborate the idea of [15], that tiger nuts contain protective nutrients by providing enough zinc, copper, iron, and vitamin E.

The greatest concentrations of selenium and nickel were found in tiger nuts, whereas the highest concentrations of lead and cadmium were found in cucumber. Beans had the greatest iron content (18.120.02.mg/kg), followed by tiger nuts (11.260.04mg/kg). The iron buildup in the examined samples was less than the FAO/WHO allowed limit of 425.5 [16]. According to Abdu et al., [17], zinc is the least harmful and necessary element in the human diet because it keeps the immune system working. Zinc concentrations were found to be high in beans and tiger nuts (4.160.05mg/kg and 1.128.03mg/kg, respectively), but zinc concentrations were low in apples. The concentration of zinc in the examined samples was below the FAO/WHO permitted limit (99.4 mg/kg) [16]. Beans (0.120.02mg/kg) had the highest copper concentration in the study, followed by tiger nuts (0.190.01mg/kg). Copper did not exceed the FAO/WHO permitted limit. Manganese levels are highest in beans (0.0380.02), followed by tiger nuts (0.190.01mg/kg). This result is within the

FAO/WHO acceptable guideline for Mn intake in food (0.20mg/kg) [18]. Tiger nuts have a high selenium content (0.940.021mg/kg), when compared to the allowed suggested level of selenium, which is 2.0 in grains and 0.5 in fruits and vegetables, the concentration of selenium is very low. Cucumber has a high lead content of 0.020.01%mg/kg. This is low when compared to the FAO/WHO permitted limit of 0.2 mg/kg for cereals and 0.1 mg/kg for vegetables [19].

Cadmium levels were minimal in all of the foods studied, with the exception of beans, which had BDL. The samples evaluated had low trace metal levels, which were under the FAO/WHO acceptable limits for Cd intake in food, which is 0.2 mg/kg [34], grains 0.1 mg/kg, and fruits and vegetables 0.05 mg/kg [18,19]. Except for tiger nut, which had a nickel content of 0.020.01, which was below WHO/permissible FAO's limit of Ni (0.1mg/day) [18].

## CONCLUSION

Trace metals concentration levels were low, the mineral contents were below or within the safe limit recommended by WHO/FAO. which may be harmless to consumers and also can pose no potential risk to human.

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