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THE EFFECT OF COOKING POTS ON THE MINERAL CONTENT OF LAGOS SPINACH (CELOSIA ARGENTEA)

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Abstract: Leafy vegetables are highly perishable food items and required special processing treatment to post-harvest losses. Green vegetables usually undergo cooking before consumption. Apart from the effect of heat applied on the vegetable, there is also an effect of cooking utensils (cooking pots) on the nutritional composition of this leafy vegetable, such as loss of some nutrients or imbibing heavy metals from the cooking utensils. This study examines the effect of cooking pots on Lagos spinach (celosia argentea). Three different types of pots were used clay pot and aluminum pots, and raw leaf as control. Analyses were carried out on the cooked vegetable. The mineral elements are determined. Boiling and cooking vegetables caused a significant reduction in certain mineral elements such as K, Ca, Mg, Zn, Fe, P, Cu, Mn, and Na content. The result shows that celosia cooked in clay pot has the highest retention value of iron (Fe), accounting for 243.73±0.1, while celosia cooked in the Aluminum pot followed with retention value of zinc (Zn) accounting for 131.33 ±173.08. Also, celosia cooked in a clay pot has the highest retention value of Fe, Na, K, Ca, Mg, Cu Mn, P, and Se because clay is inert or non-reactive and does not leach into food, celosia cooked in an Aluminum pot. In contrast, Raw leaf has the highest retaining value of this micronutrient (Minerals). The clay pot is mostly advised in cooking such vegetables. The leaves of celosia argentea are high in protein, vitamin A and C, and are good sources of calcium and iron. Cooking in high minerals retention pots should be encouraged.
Keywords: Celosia argentea, Pots, Mineral composition, Cooking.

1.0 INTRODUCTION

Green leafy vegetables are rich source of vitamins such as beta carotene, ascorbic acid, riboflavin, folic acid as well as minerals like iron, calcium, phosphorus etc. They are also recognized for their colour flavor and therapeutic value. Some of the commonly consumed leafy vegetables viz. amaranth, spinach, coriander is analyzed for their nutritive value (Bhaskarachary *et al.,* 2013) have reported some less familiar, green leafy vegetables which are rich sources of beta carotene.

Celosia is a small genus of edible and ornamental plants in the amaranth family, Amaranthaceae (cocks comb). The generic name is derived from the word "kelos" meaning "burned" and refers to the flame like flower heads. The leaves and flowers are edible and one of the main boiled greens in West Africa where it is known as *Soko yokoto* meaning "make husband fat and happy". It is a medicinal vegetable used for the treatment of ailments including intestinal worms, blood diseases, chest complaints (seeds) (Kroger *et al.,* 2001). Leafy vegetables are typically low in calories and fat, and high in protein per calorie, dietary fiber, vitamin C, pro-vitamin A carotenoids, folate, manganese and vitamin K. The vitamin K content of leaf vegetables is particularly high, since there is photosynthesis (Opebode and Adebooye, 2015).

1.1 Pots

Pots are containers made of earthenware and metals material, usually round and deep often having a handle and lid, used for cooking and other domestic purposes (Schippers, 2019). There are several types of cooking pots: stainless steel pots, copper cooking pots, aluminum pots and clay pots, each of which has advantages and disadvantages. The most common type of cooking pots is made from stainless steel, copper, aluminums, cast iron, and ceramic (Sato, 2003)

1.2 Aim and Objectives of the study

To determine the effect of cooking pots on the mineral content of lagos spinach (celosia argentea)

Specific Objectives:

- Determine the effect of aluminium cooking pot on the mineral content of vegetable (lagos spinach)
- Determine the effect of stainless, steel cooking pot on the mineral content of vegetable (lagos spinach)
- Determine the effect of clay cooking pot on the mineral content of vegetable (Lagos spinach).

3.0 MATERIALS AND METHODS

Fresh sample of Celosia argentea (Lagos spinach), was purchase in a local market in Ede, Osun State, Nigeria (Oja - Oje market). Clay pot, Stainless steel pot and aluminum pot, weighing scale: HANA weighing scale (made in China) collected from the department was used. The edible parts of the vegetable (Lagos Spinach) as would normally be eaten were picked, washed, chopped, weighed and subjected to boiling method using different cooking pots such as Aluminum pot, clay pot and stainless-steel pot.

3.1 **Methods of analysis with reference number**

Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (A.O.A.C., 18TH EDITION, 2005). All analysis was carried out in triplicate.

Determination of mineral element (AOAC, 975.11)
Calcium, Potassium and Sodium

Apparatus: Heating mantle, Crucible, Glass rod, Flame photometer, 100ml Volumetric flask, Whatman No. 1 Filter paper, Wash bottle, 10ml pipette, funnel.

Reagents: 2 MHCL.

Determination: The ash of each sample obtained was digested by adding 5ml of 2 MHCL to the ash in the crucible and heat to dryness on a heating mantle. 5ml of 2 MHCL was added again, heat to boil, and filtered through a Whatman No. 1 filter paper into a 100ml volumetric flask. The filterate was made up to mark with distilled water stoppered and made ready for reading of concentration of Calcium, Potassium and Sodium on the Jenway Digital Flame Photometer (PFP7 Model) using the filter corresponding to each mineral element.
The concentration of each of the element was calculated using the formula:

$$\%Ca \text{ or } \%K \text{ or } \%Na = \frac{\text{Meter Reading (MR)} \times \text{Slope} \times \text{Dilution factor}}{1000}$$

NB: MR x slope x dilution factor will give you the concentration in part per million (ppm or mg/kg). You get concentration in % when you divide by 10000.

Phosphorus determination (Spectrophotometric method) (AOAC, 975.16)
Phosphorus was determined routinely by the vanado-molybdate colorimetric or spectrophotometric method.

Apparatus: Spectrophotometer or colorimeter, 50ml volumetric flask, 10ml pipette, filter paper, funnel, wash bottle, glass rod, heating mantle, crucibles.

Reagents: Vanadate – Molybdate yellow solution, 2 MHCL.

Determination: The ash of each sample obtained was treated 2 MHCL solution as described for calcium determination above. 10ml of the filtrate solution was pipetted into 50ml standard flask and 10ml of vanadate yellow solution was added and the flask was made up to mark with distilled water, stoppered and left for 10 minutes for full yellow development. The concentration of phosphorus was obtained by taking the optical density (OD) or absorbance of the solution on a Spintronic 20 spectrophotometer or colorimeter at a wavelength of 470nm.
The percentage phosphorus was calculated from using the formula:

$$\%\text{Phosphorus} = \frac{\text{Absorbance} \times \text{Slope} \times \text{Dilution factor}}{10000}$$

Determination of Se, Mg, Pb, Cd, Cu, Mn, Fe, Ni, Zn using BUCK 200 AAS (AOAC, 975.23)

The digest of the ash of each sample above as obtained in calcium and potassium determination was washed into 100ml volumetric flask with deionized or distilled water and made up to mark. This diluent was aspirated into the Buck 200 Atomic Absorption Spectrophotometer(AAS) through the suction tube. Each of the trace mineral elements was read at their respective wavelengths with their respective hollow cathode lamps using appropriate fuel and oxidant combination

4.0 Result

Table 1 The results of the mineral determination done on the samples.

Sample	Na	K	Ca	Mg	P	Fe	Zn	Cu	Mn	Se
A	0.13±0.0b	0.83±0.1b	0.26±0.0b	0.36±0.0b	0.27+0.0b	218.86±0.3b	131.3±173.08a	6.50±0.2b	10.0±0.2b	0.08±0.0b
S	0.14±0.0a	0.91±0.0a	0.29±0.0a	0.38±0.0a	0.28±0.0a	243.73±0.1a	48.96±0.3	9.40±0.1a	12.4±0.3a	0.10±0.0a
C	0.12±0.0c	0.79±0.0c	0.25±0.0c	0.34±0.0c	0.25±0.0c	212.63±0.1c	27.13±0.3 c	5.06±0.2c	8.46±0.1c	0.07±0.0c

Note: Sample A (Lagos Spinach cooked in Aluminum Pot), Sample S (Lagos Spinach cooked in Clay pot) and Sample C (Lagos Spinach raw leaf for Control). Mean=3, mean with the same superscripts are not significantly difference

4.1 Mineral element

Processing method (boiling) significantly reduced the level of all the minerals element analyzed. The observed significant lower Fe, Cu, Mg, K, Ca, Mn, P and Zn levels is in accordance with the submission of Grubben and Denton (2014); Luke (2013), that various conventional food processing techniques (boiling) causes significant decrease in the mineral element of vegetables.

Vegetables are generally poor sources of iron. However, Fe content of Lagos spinach(celosia) can be considered adequate when viewed against an RDA of 8mg/day for men (19 years and older) and for women over 50 years, 18mg/day for girls and women 11 to 50 years old when judiciously consumed (Sato *et al.*, 2012). However, neither the total iron content nor the nutrient density of the individual food contributes an accurate guide for choosing dietary sources of iron. Rather the bioavailability of iron present in a meal, which depends on its form and the presence or absence of factors that influence absorption and the body's need for iron ultimately determine how much iron that is actually delivered to the body. (FNB. 2001).

Mineral element of the vegetable is present in table 2. Calcium is an important dietary mineral for strong bones and muscle/neurological functions. Sample C had a high calcium content as compared to other samples. Magnesium is important mineral required for cellular metabolites and green leafy vegetables are very good source of magnesium. Phosphorus was maximum in Celosia argentea. Iron is important in the formation of haemoglobin of blood.
From the result, Celosia cooked in clay pot had the highest concentration of iron (243.73±0.1) while the lowest content was found in Stainless pot (212.63±0.1). in this study, the nutrient retention was a bite higher in celosia cooked in clay pot than other pots.
Celosia argentea showed high concentration of Calcium, phosphorous, sodium, potassium, magnesium, iron zinc and copper while the concentrations of chromium, manganese, nickel and lead are in trace. The low concentration of lead and other heavy metals make it suitable for consumption.
Regular addition of green leafy vegetable in the diet may help in preventing the adverse effect of Zinc deficiency such as growth retardation. Owolabi *et al.*, (2018) reported large sodium content in Celosia argentea.

5.0 Conclusion

The vegetable analyzed in the present study occur naturally and widely and possess an ample amount of minerals. This experiment is centered on the effect of using different types of pot which are aluminum, clay, has on the mineral content of vegetable (Lagos Spinach). Celosia cooked in raw leaf had the highest-level retention of iron compared to other cooking pots while, celosia cooked in Aluminum pot had the highest-level retention of zinc compared to other cooking pots and celosia cooked in had the least level retention of all minerals compared to other cooking pots.
This study has demonstrated that celosia argentea is power house of nutrients. The result of the study revealed that the leaf has high composition of Calcium, phosphorous, sodium, potassium, iron zinc, which indicated that celosia argentea could contribute significantly to human health requirement.
Malnourished people could be advised to eat the leaves of celosia argentea which has relatively high amount of minerals.

5.1 Recommendation

Vegetable are rich source of minerals, calcium and iron, Vegetables promote intake of essential nutrient from other foods by making them more palatable. The seeds are used has medicine for the treatment of diarrhea, dysentery and muscle troubles. The flowers are used as medicine or dysentery and menstruation problems. Most vegetable are water soluble and are destroyed by heat or oxidation. If cooking water is thrown away considerably loss of nutrient occur due to leaching, especially, potassium, magnesium. To avoid these losses of essential nutrient, the following steps should be observed:

- The cooking time and temperature should be minimized when cooking leafy vegetables.
- Use minimum amount of water or the excess water after cooking can be for other preparations.
- Cut the vegetables as big as possible.
- Avoid the use of sodium bicarbonate to avoid the destruction of some minerals especially Thiamine.
- It advisable to use the steaming method of cooking to cook leafy vegetable.
- Avoid washing vegetable after cutting to avoid the considerable loss of mineral in the water.

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