International Conference of Sciences, Engineering & Environmental Technology (ICONSEET), 6(37): 298 – 304, 2021
ISSN 0794-9650

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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 a rich source of vitamins such as beta carotene, ascorbic acid, riboflavin, folic acid, and minerals such as iron, Calcium, phosphorus, etc. They are also recognized for their flavor and therapeutic value. The majority of the commonly consumed leafy vegetables, are: amaranth, spinach, coriander, are 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 one of the edible and ornamental plants in the amaranth family, Amaranthaceae (cockscomb). The generic name is derived from "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, known as *Soko yokoto*, meaning "make husband fat and happy." It is a medicinal vegetable used to treat ailments including intestinal worms, blood diseases, chest complaints (seeds) (Kroger *et al.*, 2001). Vegetables are poor sources of fat and calories 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 exceptionally high since there is photosynthesis (Opebode and Adebooye, 2015).

1.1 Pots

Pots are containers made of earthenware and metals material, typically round in shape 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 have advantages and disadvantages. The most common cooking pots are made from stainless steel, copper, aluminum, 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 aluminum cooking pot on the mineral content of vegetables (Lagos spinach)
- Determine the impact of stainless-steel cooking pot on the mineral content of vegetables (Lagos spinach)
- Determine the effect of clay cooking pot on the mineral content of vegetables (Lagos spinach).

2.0 LITERATURE REVIEW

2.1 Vegetable

Vegetables are edible parts of plants which are usually cooked or salted before consumption with other foods. These include leaves, stems, roots, flowers, seeds, fruits, bulbs, tubers, and fungi. There are thousands of plants used as vegetables. These plants belong to different botanical classes. They may be cultivated or wild, maybe trees, herbs, shrubs, climbers, or erect plants cut across the plant kingdom. Certain fruits such as tomatoes, eggplant, and beans are used as vegetables (Enwere, 2018).

2.1.1 Composition and nutritional quality of vegetables

Vegetables contain:

- Non-volatile acids.
- Organic acids.
- Mineral salts.
- Volatile sulfur compounds.
- Tannins impart flavor to diets.

The color of vegetables depends on the pigments that they contain. Anthocyanin imparts blue, purple, and red colors to vegetables such as radish and red cabbage. Chlorophyll colors vegetable green, especially leafy ones, green peas, and cucumber, while carotenoids are responsible for the yellow color of ripe tomatoes, carrots, sweet potatoes, and maize (Uwaegbute, 2019). The carbohydrate in vegetables consists mainly of indigestible fibrous materials such as cellulose, hemicellulose, and lignin. These are in addition to small quantities of sugars such as glucose, fructose, and sucrose. However, the proportion of fiber in the vegetables depends on the stage of maturity. The turgidity or rigidity of vegetables depends on the water content.

Vegetables are low in energy, contribute relatively moderate quantities of protein, and are rich vitamins. They contribute roughage to the diet when solid matter is considered. Vegetables are low in fat. However, fat-soluble vitamins (A, E, and K) present in vegetables are soluble. The dietary fiber in vegetables increases bulk and reduces food transit time in the gastrointestinal tract and the incidence of constipation and other related diseases (Purseglove, 2017). Vegetables are important sources of minerals and vitamins, other nutrients, add color, flavor, and appeal to meals (Smith, 2019).

2.1.2 Uses of vegetables

The use to which vegetables are put in the diet depends on the purpose to be achieved. They may be used as major or minor ingredients in soups, sauces, stews, pottage, porridge, and salads too; (a) enhance the flavors of foods (b) to garnish prepared dish to enhance eye appeal (c) as fillings for sandwiches, pies, and Indian egg rolls and (d) as a critical part of the ingredients in the preparation of certain dishes such as vegetable soups, vegetable pottage, vegetable porridge, vegetable parcels and salads (Enwere, 2018).

2.1.3 Processing of vegetables

Any method selected for processing vegetables should be such that it does not adversely affect color, texture, flavor, and nutritional value, especially the vitamins and minerals. The processing of vegetables involves such unit operations as cleaning, sorting, grinding, peeling (for cassava and related vegetables), trimming, size reduction (slicing or dicing or shredding or pulping), blanching, filling into cans (where it is to be canned), sealing, sterilizing, cooling, labeling, storing and distributing. Processed vegetables may also be frozen or dried (Enwere, 2018).
Vegetables, which are eaten raw, do not go beyond the slicing stage. Sliced vegetables are added into the stew, soups, sauces, and pottage, while shredded, sliced, or diced vegetables used for vegetable salads are eaten raw. Potatoes used for salad are cooked, sliced, and diced. The processing method used for vegetables depends on the end product desired and storage facilities available (Gruess, 2018),

3.0 **MATERIALS AND METHODS**

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

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 Chemists (A.O.A.C., 18TH EDITION, 2005). All analysis was carried out in triplicate.

Determination of mineral element (A.O.A.C., 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 M.H.C.L.

Determination: The ash of each sample obtained was digested by adding 5ml of 2 M.H.C.L. to the ash in the crucible and heat to dryness on a heating mantle. 5ml of 2 M.H.C.L. has been added again, heat to boil, and filtered through a Whatman No. 1 filter paper into a 100ml volumetric flask. The filtrate was made up to mark with distilled water stoppered and made ready for reading of the 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 elements 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: M.R. x slope x dilution factor will give the concentration in part per million (ppm or mg/kg). You get attention in % when you divide by 10000.

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

Apparatus: Spectrophotometer or colorimeter, 50ml volumetric flask, filter paper, funnel, wash bottle, glass rod, heating mantle, crucibles.
Reagents: Vanadate – Molybdate yellow solution, 2 M.H.C.L.

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

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

Determination of Se, Mg, Cd, Pb, Cu, Mn, Fe, Zn, Ni using BUCK 200 AAS (A.O.A.C., 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 (A.A.S.) through the suction tube. Each of the trace mineral elements was read at their respective wavelengths with their individual hollow cathode lamps using appropriate fuel and oxidant combinations.

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

The 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) cause a 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 R.D.A. 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. (F.N.B. 2001).
Mineral element of the vegetable is present in table 2. Calcium is an essential dietary mineral for strong bones and muscle/neurological functions. Sample C had a high calcium content as compared to other samples. Magnesium is a crucial mineral required for cellular metabolites and green leafy vegetables are an excellent source of magnesium. Phosphorus was maximum in Celosia argentea. Iron is essential during the formation of the hemoglobin of blood.

From the result, Celosia cooked in a 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 a high concentration of Calcium, phosphorous, sodium, potassium, magnesium, zinc, iron, and copper, while the attention of nickel, manganese, nickel and lead are in the trace. The low concentration of lead and other heavy metals make it suitable for consumption.
Regular addition of green leafy vegetables in the diet may help in preventing the adverse effect of Zinc deficiency, such as growth retardation. Owolabi *et al.,* (2018) reported significant sodium content in Celosia argentea.

4.0 **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 a pot which are aluminum, clay, has on the mineral content of vegetables (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 most minor level retention of all minerals compared to different cooking pots.
This study has demonstrated that celosia argentea is the powerhouse of nutrients. The result of the study revealed that the leaf has a high composition of Calcium, phosphorous, sodium, potassium, iron zinc, which indicated that celosia argentea could contribute significantly to human health requirements.
Malnourished people could be advised to eat the leaves of celosia argentea, which has a relatively high amount of minerals.

5.1 Recommendation

Vegetables are a rich source of minerals, Calcium, and iron; Vegetables promote the intake of essential nutrients from other foods by making them more palatable. The seeds are used as medicinal for the treatment of dysentery, diarrhea, and muscle troubles. The flowers are used as medicine for dysentery and menstruation problems. Most vegetables are water-soluble and are destroyed by heat or oxidation. If cooking water is thrown away considerably, loss of nutrients occurs due to leaching, especially potassium, magnesium. To avoid these losses of essential nutrients, 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 is advisable to use the steaming method of cooking to cook the leafy vegetable.
- Avoid washing vegetables after cutting to avoid the considerable loss of minerals in the water.

REFERENCES

AOAC, (18th edition, 2005) Official Method of Analytical Chemistry.

Bhaskarachary K, Rao D.S.S., Deosthale YG, Reddy V. (2018) Carotene content of some common and less familiar foods of plant origin.

Enwere, N.J. (2018). Foods of plant origin. Nigeria, Afro-Orbis public. Ltd. 293.

Gruess, W.V. (2018). Commercial fruits and vegetable products. 4th edn. New York McGraw Hill book company, 244.

Grubben G.J.H. and Denton O.A. (2014). PROTA (Plant Resources of Tropical Africa / Ressources Végétales de l' Afrique Tropicale), Wageningen, Netherlands. Celosia Argentea L. [Internet] Record from Protabase.

Grubben G.J.H. and Denton O.A. (2014) Plant resources of tropical Africa Vegetables. PROTA foundation, Wageningen; Backhuys, Leiden; CTA, Wageningen.

Kröger-Ohlsen, M.V., Trúgvason, L.H. Skibstedand K.F. Michaelsen, (2012). "Release o Iron into Foods Cooked in an Iron Pot: Effect of pH, Salt, and Organic Acids" in Journal of Food Science.132,133.

Luke, K. (2013). "EVIDENCE That Human Ancestors Used Fire One Million Years Ago". University of Toronto and Hebrew University Martin, F.W., R.M. Ruberté N.D. Sylvester(1935, Retrieved 02 February, 2014).

Omueti, O. 1980. Effects of Age on Celosia cultivars. Experimental Agriculture 16(3):279-286.

Opabode, J.T, Adebooye. O.C. 2015. Application of Biotechnology for the Improvement of Nigerian Indigenous Leaf Vegetables. African Journal of Biotechnology 4(3):138-142.Lagos Spinach Page 8.

Owolabi, T.A., Taiwo, M.A. Thottappilly, G.A. Shoyinka, S.A. Proll E. and Rabenstein. F.2018. Properties of a virus causing mosaic and leaf curl disease of Celosia argentea L. in Nigeria.ActaVirologica 42

Prakash, D., N. Pashupati, and M. Pal. 2015. Composition and variation in vitamin C carotenoids, protein, nitrate and oxalate contents in Celosia leaves. Plant Foods for Human Nutrition 47:221-226.Retrieved 2000.

Purseglove, J.W. (2017). Tropical crops. Dicotyledons. Longman Scientific and Technical, U.S.A. John Wiley and Sons. 199.