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NUTRIENT ANTIOXIDANTS AND MINERAL DETERMINATIONS OF SEASONING CUBES FROM TURMERIC (*Curcuma longa)*, CALABASH NUTMEG (*Monodora myristica*) AND CURRY LEAVES (*Murraya koenigii*)

Orji, Rachel Nnenna [1]; Chima, Judith Uchenna [2]
[1,2] Department of Food Science and Technology, Akanu Ibiam Federal Polytechnic Unwana, Afikpo, Ebonyi State, Nigeria, P.O. Box 1007.
rachelorji123.ro@gmail.com, +2348064334404.

Abstract
This study investigated the nutrient antioxidants (Vitamin A, C, E & K), and mineral composition (Ca, Mg, Fe, Zn) of seasoning cubes from curry leaves (*Murraya koenigii*), calabash nutmeg (*Monodora myristica*) and tumeric (*Curcuma longa*) while using a known commercial seasoning cubes (Onga) as control. Four blend formulations were made and labelled A, B, C and D. The antioxidant and mineral evaluations were carried out using standard procedures. The result showed that all the samples were significantly different from each other in their antioxidant contents, with sample A (20% curry, 50% turmeric, and 30% calabash Nutmeg) showing remarkable values in vitamin A, C and K (13.28, 12.72, 14.84) contents respectively. In mineral composition Sample B: 50% tumeric, 30% calabash nutmeg and 20% curry leaves was significantly ($p < 0.05$) different from all the other samples followed closely by sample C (30% tumeric, 20% calabash nutmeg and 50% curry leaves). All the samples showed higher values than the control seasoning cubes in all the parameters analysed.

Keywords: Nutrient Antioxidants, minerals, Curry leaves, Calabash nutmeg, Turmeric

Introduction

Seasoning cubes are essential flavour enhancers widely used in global cuisines to improve taste and aroma in meals. These cubes, typically composed of salt, monosodium glutamate and spices, are a staple in Nigerian households, (Okafor, 2019). However, conventional seasoning cubes often contain artificial additives which are speculated to have negative health effects and lack significant nutritional value (Airaodion *et al*.,2019), prompting interest in natural alternatives derived from local spices like curry leaves, calabash nutmeg, and turmeric to boost their nutritional, antioxidant and mineral content while maintaining affordability and cultural relevance.

Turmeric, the rhizome of *Curcumin longa*, a vibrant yellow-orange spice commonly used in Indian and middle eastern cooking, belonging to the ginger family, *Zingiberaceae* has a history in *Ayurvedic* and traditional medicine for the treatment of chronic diseases including metabolic and cardiovascular diseases (CVD) (Zhang and Kitts,2021). The roots of which are used for cooking with an amazing mineral profile (Singh & Gupta,2020). It is a potent anti-inflammatory and antioxidant spice primarily driven by its active compound *curcumin*. It helps to relief joint pains and arthritis, improve gastroenteric disorder, impact neuroprotective effect to the body and may help inhibit the growth and spread of cancer cells, (Ali, 2025)

Calabash nutmeg (*Monodora myristica*), a native of West African, is valued for its nutty aroma and bioactive compounds, including antioxidants that combats inflammation and promote cellular health.

It is a good source of minerals such as zinc, magnesium, and phosphorus, which aid in metabolic processes and bone development (Ekeanyanwu, 2013). In Ebonyi State of Nigeria, calabash nutmeg is readily available but rarely used in commercial seasoning products, representing a gap in utilizing local resources for functional food development (Ogunmoyela, 2017). Blending it with other spices in seasoning cubes could improve mineral content and provide health benefits.

Curry leaves (*Murraya koenigii*), an aromatic herb commonly grown in Nigeria, are rich in antioxidants such as flavonoids and phenolic compounds, which help neutralize free radicals and reduce oxidative stress. They also provide essential minerals like calcium, iron, potassium, magnesium which supports bone health and immune function (Singh, 2019). Despite their abundance in nature, curry leaves are underutilized in processed foods, offering an opportunity to incorporate them into seasoning cubes for enhanced nutritional profiles (Singh *et al.,* 2017). Their integration could address dietary deficiencies while leveraging their natural flavour-enhancing properties.

The development of seasoning cubes from curry leaves, calabash nutmeg, and turmeric represents an innovative approach to food product formulation. This combination utilizes local spices to create nutrient-dense cubes that address antioxidant deficiencies and mineral shortages common in Nigerian diets, such as iron deficiency anaemia (FAO, 2020). By harnessing these indigenous resources, the cubes could promote sustainable agriculture in Nigeria and other parts of the world and also offer a healthier alternative to synthetic seasonings.

Antioxidant determination is crucial for evaluating the health-protective potential of food products, measuring compounds that inhibit oxidation and prevent chronic diseases. Mineral analysis quantifies essential elements vital for physiological functions (AOAC, 2019). This study aims to determine the antioxidant and mineral content of seasoning cubes produced from curry leaves, calabash nutmeg and turmeric thereby contributing to improved food security and wellness in Nigeria and the world at large.

Material and Methods.

Study Site: The study was carried out in the Department of Food Science and Technology, Akanu Ibiam Federal Polytechnic Unwana, Afikpo in Ebonyi State. The analyses were done at the Department of Food Science and Technology, Akanu Ibiam Federal Polytechnic Unwana and Biochemistry Department of the National Root Crops Research Institute (NRCRI) Umudike in Umuahia, Abia state. The method described by Onwuka (2018) was used for the nutrient antioxidant and mineral determinations.

Raw materials and preparations.

Method of preparation of samples:

The Curry leaves, calabash and turmeric were bought from Eke market in Afikpo Local Government of Ebonyi State. The curry leaves were sorted, plucked from their stem, weighed washed, sliced, oven dried till no moisture is left and ground into powder. Calabash nutmegs were sorted washed, roasted at 120^{o}C for 30 minutes, cooled, peeled, weighed, oven dried till no moisture is left and ground into powder. Turmeric was peeled, washed, weighed, diced, oven dried till no moisture is left and ground into powder.

Production of Seasoning Cubes

Seasoning cubes were produced using a modified mixing and moulding method as described by Fatima Rodrigues *et al.* (2016):

- Blend powders of the three samples A, B and C (100g each) (from Table 1) were mixed with a pinch of salt and 10g corn starch (1:10) ratio in a mixing bowl.
- Five (5% w/w) palm oil and 5% margarine (w/w) were added as a binder and mixed thoroughly to form a uniform paste.
- The paste was kneaded with a rolling pin and pressed into cube-shaped moulds using a stainless-steel moulding tray.
- The cubes were wrapped in a waxed paper and then covered with aluminium foil.
- The moulded cubes were air-dried on a tray at room temperature and stored for 30 hours to mature and solidify.
- The cubes were removed from the tray after 30 hours and packaged in polyethylene bags for analyses.

Each of the blends were formulated in the following ratios as shown in the table below;

FORMULATION TABLE

	Turmeric (%)	Calabash nutmeg(%)	Curry(%)
A	**20**	**50**	**30**
B	**50**	**30**	**20**
C	**30**	**20**	**50**
D	**Control (100% Lipton tea)**		



Plate 1= SAMPLE A
Plate 2= SAMPLE B

Plate 3= SAMPLE C
Plate 4= SAMPLE D



Plate 1= SAMPLE A
Plate 2= SAMPLE B
Plate 3= SAMPLE C
Plate 4= SAMPLE D

KEY
Sample A: 20% Turmeric, 50% Calabash nutmeg, 30% Curry
Sample B: 50% Turmeric, 30% Calabash nutmeg, 20% Curry
Sample C: 30% Turmeric, 20% Calabash, 50% Curry
Sample D: Control (100% Commercial seasoning cube: Onga)

Table 2: Antioxidant Composition of Seasoning Cubes from Turmeric, Calabash nutmeg and Curry leaves

Sample	VitaminA (mg/100g)	VitaminC (mg/100g)	VitaminE (mg/100g)	VitaminK (mg/100g)
A	$13.28^{a} \pm 0.04$	$12.12^{a} \pm 0.02$	$3.38^{c} \pm 0.03$	$14.84^{a} \pm 0.01$
B	$7.63^{b} \pm 0.04$	$8.34^{b} \pm 0.03$	$4.57^{a} \pm 0.02$	$6.82^{b} \pm 0.04$
C	$6.86^{c} \pm 0.03$	$8.13^{c} \pm 0.03$	$3.84^{b} \pm 0.03$	$4.96^{c} \pm 0.02$
D	$2.27^{d} \pm 0.04$	$1.41^{d} \pm 0.02$	$3.16^{d} \pm 0.02$	$2.33^{d} \pm 0.40$

Values are mean ± standard deviation of duplicate determinations. Means in the same column bearing different superscripts are significantly ($p < 0.05$) different.

KEY

Sample A: 20% Turmeric, 50% Calabash nutmeg, 30% Curry
Sample B: 50% Turmeric, 30% Calabash nutmeg, 20% Curry
Sample C: 30% Turmeric, 20% Calabash, 50% Curry
Sample D: Control (100% Commercial seasoning cube, Onga)

DISCUSSION

Vitamin A(mg/100g)

The vitamin A content ranged from 2.27 to 13.28. Sample A (13.28) had the highest value and was significantly ($p < 0.05$) different from the other samples, while Sample D (2.27 µg/100g) had the least. This suggests that curry leaves and calabash nutmeg were the major contributor to vitamin A in the blend formulation of sample A, as they are naturally rich in carotenoids which are pro vitamin A. Afolabi *et al*., (2024) reported 425mg/100g for *Monodora myristica* while Devi *et al*. (2020) similarly reported that curry leaves are good sources of β-carotene, which enhances vitamin A activity. Devi *et al*. (2020) reported vitamin A values in seasoning cubes ranging from 20.30–45.30 µg/100g higher than what was observed in this study. This implies that this sample blend will be good for eye health, age related macular degeneration, anti-inflammation and white blood cell support. Vitamin A is the name of chemical substances called the *retinoids*, fat soluble compounds that are essential for human body. They cannot be produced by the human body so have to be provided as a part of the diet, (Pawel and Jarogniew, 2019)

Vitamin C(mg/100g)

Vitamin C values of the samples ranged from 1.41 to 12.12 mg/100g. Sample A (12.12) was significantly ($p< 0.05$) higher than the other samples, while Sample D (1.41) was the lowest. The result indicates that curry leaves and calabash nutmeg contributed more to vitamin C content being naturally high in vitamin C. Ndife *et al.*, (2022) documented a higher than what is reported on this research, vitamin C range (50.65-61.20) of seasoning cubes made from local spices: Suziza (*Piper guineense*), uda (*Xylopia aethiopica*), ehuru (*Monodora myristica*) and ginger (*Zingiber officianale*).Vitamin C also known as L-ascorbic acid is a micronutrient necessary for numerous biological functions such as: potent antioxidant, cofactor for enzymes, pro oxidant(potential for cancer treatment),hydroxylation of collagen and stimulation of iron absorption at the intestinal level,(Albert *et al*.,2025).

Vitamin E (mg/100g)

Vitamin E levels ranged from 3.16 to 4.57. Sample B (4.57) was significantly ($p < 0.05$) higher than the other samples, while Sample D (3.16) had the lowest. This shows that turmeric and calabash nutmeg contributed substantially to vitamin E content being naturally high in vitamin E. Anyaoku *et al*., (2023) also reported that turmeric contains considerable amounts of vitamin E (15.4mg/kg) which can enhance antioxidant activity. Okoye *et al.* (2017) documented vitamin E values of 3.50–5.20 in spice-based formulations, which is comparable to the values recorded in this study. Vitamin E, also known as *Tocopherol* is a powerful antioxidant against free radical damage, supports immune system, cardiovascular, skin, brain and eye health, (Fatima *et al*.,2025).

Vitamin K (mg/100g)

Vitamin K concentrations ranged from 2.33 to 14.84. Sample A (14.84) had the highest content and was significantly ($p < 0.05$) different from the other samples, while Sample D (2.33) was the least. This highlights the role of curry leaves, which are naturally high in phylloquinone. Devi *et al.* (2020) reported vitamin K values of 12.50–20.40 in fortified seasoning cubes, which is close to the results obtained in this work. The primary form of Vitamin K in the human diet is Vitamin K1 (phylloquinone) found in green leafy vegetable while Vitamin K2 (menaquinone 7) can be found in dairy products, some fermented or cultured vegetables and diary supplements (Marles *et al*.,2017). Vitamin K is unequivocally beneficial for blood coagulation, inflammatory regulation, avoidance of artery hardening and bone health, (Tarento *et al.*,2019)

Table 3: Mineral Composition of Seasoning Cubes from Turmeric, Calabash nutmeg and Curry leaves

Sample	Calcium (mg/100g)	Magnesium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)
A	$40.56^{c} \pm 0.04$	$60.97^{c} \pm 0.03$	$4.31^{c} \pm 0.03$	$4.12^{a} \pm 1.43$
B	$68.75^{a} \pm 0.03$	$82.24^{a} \pm 0.02$	$5.79^{b} \pm 0.01$	$4.51^{a} \pm 0.02$
C	$59.22^{b} \pm 0.02$	$74.67^{b} \pm 0.01$	$8.38^{a} \pm 0.04$	$5.12^{a} \pm 0.02$
D	$16.85^{d} \pm 0.04$	$24.93^{d} \pm 0.05$	$3.70^{d} \pm 0.04$	$1.53^{b} \pm 0.04$

Values are mean ± standard deviation of duplicate determinations. Means in the same column bearing different superscripts are significantly ($p < 0.05$) different.

KEY

Sample A: 20% Turmeric, 50% Calabash nutmeg, 30% Curry
Sample B: 50% Turmeric, 30% Calabash nutmeg, 20% Curry
Sample C: 30% Turmeric, 20% Calabash, 50% Curry
Sample D: Control (100% Commercial seasoning cubes

DISCUSSION

Calcium (mg/100g)

Calcium content ranged between 16.85 and 68.75 mg/100g. Sample B (68.75 mg/100g) recorded the highest value and was significantly ($p < 0.05$) different from the other samples, while Sample D (16.85 mg/100g) had the least. 178.3mg /100g was reported by Afolabi, *et al.*, (2024) while analysing the nutritional value of African Nutmeg also known as Calabash nutmeg (*Monodora myristica*) seed meal. This indicates that calabash nutmeg enriched the calcium composition of the cubes. Nkwocha *et al.* (2019) also reported that calabash nutmeg is a good dietary source of calcium. Okeke *et al.* (2018) documented calcium contents of 55.20–72.60 mg/100g in spice-based condiments, which is close to the values obtained in this study. Calcium is necessary for bone formation and has been reported by Amer *et al*, (2025) to have the ability to significantly reduce Diastolic Blood Pressure (DBP) when combined with magnesium.

Magnesium(mg/100g)

Magnesium concentrations ranged from 24.93 to 82.24 mg/100g. Sample B (82.24 mg/100g) had the highest value and was significantly ($p < 0.05$) different from the others, while Sample D (24.93

mg/100g) was the lowest. This shows that calabash nutmeg greatly influenced the magnesium content. Afolabi *et al.* (2024) confirmed that calabash nutmeg seeds contain essential minerals such as magnesium (60mg/100g), which contribute to enzyme activation and energy metabolism. Similarly, Eze *et al.* (2017) reported magnesium contents of 30.40–85.10 mg/100g in spice mixtures, which aligns with the present findings in this work. Magnesium is most abundant ion in the body after potassium which is responsible for energy metabolism and protein synthesis. It acts as an anticonvulsant and antagonizes bronchospasm so can be used in the management of asthma, (Abraham and Schellack, 2016)

Iron(mg/100g)

Iron levels ranged from 3.70 to 8.38 mg/100g. Sample C (8.38 mg/100g) had the highest value and was significantly ($p < 0.05$) different from the other samples, while Sample D (3.70 mg/100g) was the lowest. This demonstrates the contribution of turmeric iron content(1.2ppm) as reported by Anyaoku *et al.* (2023). They reported that turmeric rhizomes are naturally rich in iron. Furthermore, Uzochukwu *et al.* (2016) recorded iron levels of 4.20–9.15 mg/100g in herbal seasonings, which compares well with the results of this study.

Iron is an essential mineral for human being used for oxygen transport, Deoxyribo Nucleic Acid (DNA) synthesis and energy metabolism, (Luciano de Souza *et al*., 2022).

Zinc(mg/100g)

Zinc content ranged between 1.53 and 5.12 mg/100g. Sample C (5.12 mg/100g) was significantly ($p < 0.05$) higher than the other samples, while Sample D (1.53 mg/100g) was the least. This indicates that turmeric contributed significantly to zinc levels. Oboh *et al*., (2015) noted that turmeric and related spices contain appreciable levels of zinc, which is important in immune system function and protein synthesis. Likewise, Nwankwo *et al.* (2019) reported zinc values of 2.10–6.00 mg/100g in spice-based formulations, which are comparable to the values observed in this work. Zinc plays a crucial role in cellular metabolism, immune function, DeoxyriboNucleic Acid (DNA) synthesis and protein production in the body, (National Institute of Health Dietary Fact Sheet,2026)

CONCLUSION

The study examined the antioxidant and mineral value of the seasoning cubes from blends of turmeric (*Curcuma longa*), calabash nutmeg (*Monodora myristica*), and curry leaves (*Murraya koenigii*). considerably increased the while outperforming the commercial control. The nutrient antioxidant analysis showed that the formulated sample A (20% turmeric, 50% calabash nutmeg, 30% curry leaves) had considerably higher values for vitamins A, C, and K compared to the control. This suggests that curry leaves and calabash nutmeg being rich in vitamins significantly enhanced the antioxidant density of the cubes. Mineral analysis corroborated the nutritional benefits of the formulations, as calcium, magnesium, iron, and zinc levels were significantly greater in the formulated Sample B (50% turmeric, 30% calabash nutmeg, 20% curry leaves) and sample C (30% turmeric, 20% calabash nutmeg, 50% curry leaves).

All formulated samples demonstrated superior antioxidant and mineral profiles compared to the control- Sample D (commercial seasoning Onga), highlighting the synergistic effects of these indigenous spices in creating nutrient-dense products.

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