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**Original Articles: Quantitative Research**

**ANTINUTRIENTS IN HERBAL PRODUCTS: AN ASSESSMENT OF NITRATE,  
PHYTATE, OXALATE, AND CYANIDE IN COMMONLY CONSUMED HERBAL  
SNUFFS IN SOKOTO, NIGERIA**

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**Abstract**

**Background:** Herbs are major players in present day therapy, especially by the locals. However, there are some secondary metabolites present in them that can act as antinutrients when consumed by humans. Thus, it is important to monitor the levels of antinutrients in herbal snuff to save the public, especially in Sokoto (a state battling with challenges of nutrients deficiency and malnutrition).

**Objective:** The objective of this work was to measure levels of cyanide, nitrate, phytate, and oxalate, in herbal snuff in Sokoto, Nigeria.

**Methods:** Snuffs were brought from Sokoto market and subjected to antinutritional analysis according to standard methods and using reagents/materials of analytical grade.

**Result:** The amount of nitrate present in three herbal snuff brands sold in Sokoto, Nigeria show that, nitrate ranges from  $18.81 \pm 0.9$  mg/100g (found in Hajiya Safiya snuff brand) to  $21.82 \pm 0.08$  mg/100g (found in Hajiya Aisha snuff brand). The concentrations of phytate in 3 brands of herbal snuffs revealed, the highest value ( $91.164 \pm 0.001$  mg/100g) was recorded in Hajiya Aisha, and the lowest ( $4.05 \pm 0.04$  mg/100g) was observed in Dr Lambo herbal brand. The concentrations of oxalate show that, the highest level ( $0.0787 \pm 0.059$  mg/100g) was found in Dr lambo, and lowest ( $0.0055 \pm 0.0001$  mg/100g) observed in Hajiya Aisha snuff. Then, levels of cyanide in herbal snuff show, the highest value ( $25.68 \pm 1.45$  mg/100g) was recorded in Dr Lambo snuff brand, and the lowest level of cyanide was recorded in Hajiya Safiya ( $19.32 \pm 1.04$  mg/100g).

**Conclusion:** The snuffs contain the assessed antinutrients at levels that are not likely to pose risk.

**INTRODUCTION**

Plants are of many types and many of them have medicinal properties and potentials. They are a rich source of resources that are ingredients beneficial in synthesis and development of drugs. For

instance, laxatives, antibiotics, blood thinners, malaria drugs, Taxol, morphine etc. are all from plants (Hassan, 2013; Chukwuebuka & Chinenye, 2015; Khare et al., 2021; Ngumah et al., 2022). Indeed, about 13 000 species of plants are into traditional or alternative medical therapy around the world in the last century. Nowadays, about 20000 plants or more are useful in medicine (Yudhara et al., 2016; Umar et al., 2022). Many plant materials, for example herbs are made into pills, capsules, tablets, and snuffs with a view to exert a number of actions and benefits on the human body. They are utilized to reduce pain, increase food flavor, treat headache, and prevent any diseases or ailments (Mohammed et al., 2019; Quds et al., 2021). Mostly, medicinal herbs support the activities of other compounds in the body or support official medicines or act as preventive medicinal agents (Mohammed et al., 2019). By and large, these properties are due to phytochemicals embedded naturally in the plants (Hassan, 2013; Kumar, 2015; Afuape et al., 2022).

Moreover, apart from medicinal value of herbs/ plants, a good array of nutrients such as micronutrients, macronutrients, and vitamins are present. Nevertheless, the useful properties of plants/ herbs regarding medicinal potential are ascribed to certain chemicals synthesized by the plants/ herbs for self-protection and biochemical functions. These chemicals are known with their ability to have medicinal or preventive potentials in many cases (Hassan, 2011; Yudharaj et al., 2016; Afuape et al., 2022; Tukur et al., 2023). These chemicals are called phytochemicals and some of them act as antinutrients more often.

Antinutrients (oxalate, phytate, etc.) consumption is a major risk that elicits malnutrition or deficiencies leading to effects such as scurvy, rickets, osteoporosis, goiter, xerophthalmia, etc. (Sree & Vijayalakshmi, 2018). However, the phytochemicals of great medicinal values in herbs when consumed by humans at excess amounts are likely to cause effects (Sree & Vijayalakshmi, 2018; Umar et al., 2023ab). Herbal snuffs are popular among Hausa people and are taken for medicinal or psychoactive purposes by many across the ages. Certainly, the effects (positive) exerted on humans by herbal snuffs are due to phytochemicals or other quasi constituents (Muhammad & Umar, 2015; Halden & Khaled, 2021; Arsene et al., 2022). Some of these constituents, when taken in excess elicit effects and act as antinutrients. Therewith, they inhibit proper uptake of nutrients by the body (Mohammed, 2019; Tukur et al., 2023). Thus, their levels in snuff needs to be monitored to safeguard public health. This study will help in providing a baseline information, as there is scarce information regarding constituents of herbal snuff in the state. The objective of this work was to measure levels of cyanide, nitrate, phytate, and oxalate, in herbal snuff in Sokoto, Nigeria.

## **METHODS**

### ***Study Design***

The design of this research was a quantitative analysis of oxalate, cyanide, phytate, and nitrate compounds contained in several snuff herbs in Sokoto, Nigeria.

**Settings**

This research was conducted at Sokoto Market, Sokoto City, Sokoto State, Nigeria.

**Research subject**

The three different herbal snuffs namely, Hajiya Aisha, Hajiya safiya, and Dr Lambo were purchased from Sokoto Market, Sokoto City, Sokoto State, Nigeria.

**Instruments**

Herbal snuffs are famous in Sokoto state, especially in the Sokoto city. Snuffs are made in powder and packaged in small plastic containers to be bought by consumers for solving health needs and elicitation of psychological feelings. They are used for various therapeutic means equally. Each herbal snuff pack is named after the manufacturer or uses or relations and the name is denoted in the container. Since the snuffs are from different companies/ manufacturers they may differ in effect and compositions, likewise their price and consumer preferences.

**Data collection**

After all the data were collected using checklists and paper, they were grouped according to the variables under investigation using a spreadsheet and the SPSS application, and both univariate and bivariate analyses were conducted.

**Data Analysis**

The determination of phytochemicals (particularly, the antinutrients including cyanide, oxalate, phytate, and nitrate) compositions in herbal snuffs was performed by the methods of Association of Analytical Chemists (AOAC) described in Hassan et al., (2011) and Umar & Sarkingobir et al., (2023).

**Ethical Consideration**

This research has received permission for implementation from the Shehu Shagari University of Education, Sokoto, Nigeria.

**RESULTS AND DISCUSSION**

The results for determination of antinutrients concentrations in snuff brands in Sokoto, Nigeria were shown in Tables 1-4.

**Table 1.** The Level of Nitrate Antinutrient Determined in Snuff Brands Collected from Sokoto, Nigeria.

Type of snuff	Mg/100g
Dr Lambo	19.21 ± 0.08
Hajiya Safiya	18.81 ± 0.9
Haajiya Aisha	21.82 ± 0.08

Values are expressed as mean ± standard deviation.

Excess nitrate is linked to birth defects and colorectal cancer (Wang et al., 2017). Table 1 shows the compositional amount of nitrate in 3 herbal snuff brands sold in Sokoto, Nigeria. The range of the nitrate concentration was 18.81 ± 0.9 mg/100g (found in Hajiya Safiya snuff brand) to 21.82 ± 0.08 mg/100g (found in Hajiya Aisha snuff brand). The values are above the level found in Garden cress

plant in Sokoto by Hassan et al., (2011). But the values are lower than the tolerance level of 220 mg/day for a 60kg person (Hassan et al., 2011).

**Table 2.** The Level of Phytate Antinutrient Determined in Snuff Brands Collected from Sokoto, Nigeria.

Type of snuff	Mg/100g
Dr Lambo	4.05 ± 0.04
Hajiya Safiya	5.94 ± 0.01
Haajiya Aisha	9.164 ± 0.001

Values are expressed as mean ± standard deviation.

Phytochemicals are important to plants, as well as to humans (in health and disease prevention). Thus, moderate intake of phytochemicals is key (Chukwuebuka & Chinenye, 2015). Knowledge of nutrients and antinutrients composition of herbal stuffs enhances their better usage; because the plants utilized in their production contain antinutrients (Halder & Khalid, 2021). Antinutrients reduce the bioavailability of food nutrients in the body (Halder & Khalid, 2021). Phytates are typical antinutrients produced in plants. However, human digestive system is unable to metabolize phytate and form complex with useful compounds such as Fe, Zn, Mg, and Ca in food materials and in turn render them unavailable (Halder & Khalid, 2021). On the other hand, phytate has an anticancer property, antioxidant purposes, reduces blood glucose, and helps in prevention of kidney stones (Chukwuebuka & Chinenye, 2015). The concentrations of phytate in three brands of herbal snuff in Sokoto, Nigeria were revealed in Table 2. The highest value (91.164 0.001 mg/ 100g) was recorded in Hajiya Aisha, and the lowest (4.05 0.04 mg/100g) was observed in Dr Lambo herbal brand. The values recorded (Table 2) are lower than the ones obtained in Garden cress, and also higher than the phytate recorded in *A. sessilis* from India (Sree & Vijayalakshmi, 2018) ; albeit higher values (than those in Table 2) were recorded in *Carica papaya*, *Curcubita maxima*, and *Allium cepa* from India (Halder & Khaled, 2021).

**Table 3.** The Concentration of Oxalate Antinutrient Assessed in Snuff Brands Collected from Sokoto, Nigeria.

Type of snuff	Mg/100g
Dr Lambo	0.0787 ± 0.059
Hajiya Safiya	0.0068 ± 0.0001
Haajiya Aisha	0.0055 ± 0.0001

Values are expressed as mean ± standard deviation.

Oxalate, a form of antinutrients found in some plant materials, when consumed by humans, it is able to make insoluble or soluble salts or esters (like calcium oxalate) that are harmful. For instance, when to the salts accumulate in the kidney, kidney stones are formed that in turn affect kidney functions (Halder & Khalid,2021). Moreover, the oxalate compound can serve as chelating agent against harmful

metals such as lead and mercury (Chukwuebuka & Chinenye, 2015). The concentrations of oxalate observed in herbal snuffs were shown in Table 3. The highest level ( $0.0787 \pm 0.059$  mg/100g) was found in Dr lambo, and lowest ( $0.0055 \pm 0.0001$  mg/100g) observed in Hajiya Aisha snuff. The concentrations are much lower than  $337.50 \pm 56.25$  found in Garden cress in Sokoto; and lower than 2-5g toxic levels for humans (Hassan et al., 2011). Similarly, the concentrations are lower than the levels found in *A. sessilis* in India (Sree & Vijayalakshmi, 2018).

**Table 4.** The Level of Cyanide Antinutrient Determined in Snuff Brands Collected from Sokoto, Nigeria.

Type of snuff	Mg/100g
Dr Lambo	$25.68 \pm 1.45$
Hajiya Safiya	$19.32 \pm 1.04$
Haajiya Aisha	$23.86 \pm 3.03$

Values are expressed as mean  $\pm$  standard deviation.

Cyanide acts in the body to prevent the bioavailability of the important micronutrient, the iodine. People consuming materials rich in cyanide are predisposed to iodine deficiency even when they consumed enough iodine. Low iodine affects growth and development especially in youngsters (Umar & Sarkingobir, 2023). Cyanide causes respiratory effect, itching, dermatitis, hindered oxygen transport chain and injured thyroid gland among others (Umar et al., 2023ab). The Table 4 shows the levels of cyanide in herbal snuff in Sokoto, the highest value ( $25.68 \pm 1.45$  mg/ 100g) was recorded in Dr Lambo snuff brand, and the lowest level of cyanide was recorded in Hajiya Safiya ( $19.32 \pm 1.04$  mg/ 100g). The values are lower than that of Garden cress from Sokoto and lower than 200mg/ 100mg fresh weight cyanide regarded as dangerous levels (Hassan et al., 2011). These values are lower than the concentrations observed in cannabis consumed in Sokoto, Nigeria (Umar & Sarkingobir, 2023); and lower than the values recorded in soil and tobacco from Sokoto (Sarkingobir et al., 2022; Umar et al., 2023ab).

## LIMITATION

This study is limited to some antinutrients, other antinutrients and phytochemicals that affect biological systems were not part of the work.

## CONCLUSION

Herbal stuffs are popularly used in Sokoto for therapeutic and other purposes by the citizens. Therefore, it is important to monitor the levels of metabolites embedded in plants that were used for the making of snuffs, because some of them like oxalate, cyanide, phytate, and nitrate when taken in excess amount can pose risk and act as antinutrients. The aim of this work was to discover the levels of oxalate, cyanide, phytate, and nitrate in herbal snuff in Sokoto, Nigeria. However, based on the findings revealed

by this work; it was denoted that, the oxalate, cyanide, phytate, and nitrate are lower than the levels that could probably elicit risk to human consumers. More studies of toxicity possibility are required to recommend or discredit the consumption of snuff to the public for better public health.

#### **AUTHOR CONTRIBUTION**

**Aminu Umar Imam:** Ensured the formulation of concept and design of the work and proofread the document severally.

**Yusuf Sarkingobir:** Collected the data through analysis in the laboratory.

**Malami Dikko:** Ensured the writing of the manuscript and additional proofreading.

**Kasimu Abubakar Shagari:** Help in data collection.

**Bello Sulaiman:** Help in collection of data and data analysis.

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#### **CONFLICT OF INTEREST**

There is no conflict of interest in this work.

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