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Anti-Nutrient Composition of Anyan Ekpang and Otong Soup as traditional dishes in Efiks Cross River State and Oron, Akwa Ibom State, Nigeria

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Abstract
This study investigates the anti-nutrient composition of Anyan Ekpang and Otong Soup, two traditional dishes commonly consumed by the Efik and Oron ethnic groups in Nigeria. The objective is to evaluate the presence and concentration of saponins, phytates, oxalates, flavonoids, tannins, phenols, and hydrogen cyanide (HCN) in these meals, assessing their potential health implications. The soups were prepared following traditional recipes used by the Efik and Oron people. Anti-nutrient levels were analyzed using spectrophotometric and titrimetric techniques to ensure accurate quantification. Standardized laboratory procedures were applied to maintain data reliability and minimize analytical errors. Findings revealed notable concentrations of anti-nutrients in both dishes. In Otong Soup, saponin content ranged from 0.73–0.80 mg/100g, phytates from 0.70–0.73 mg/100g, and oxalates from 0.80–0.82 mg/100g for both ethnic groups. Anyan Ekpang exhibited saponin levels of 0.60–0.54 mg/100g, phytates between 0.69–0.48 mg/100g, and oxalates ranging from 0.76–0.52 mg/100g for Oron and Efik, respectively. Hydrogen cyanide (HCN) in Anyan Ekpang prepared with cassava was significantly higher (1.86–1.92 mg/100g) than the WHO safe consumption threshold of 1.52 mg/100g, indicating potential toxicity risks. Moderate levels of tannins, phenols, and flavonoids were detected, which may contribute to reduced mineral bioavailability, particularly calcium and iron, essential for bone health and anemia prevention. While Otong Soup and Anyan Ekpang are nutritionally valuable and culturally significant, their high anti-nutrient content, particularly elevated HCN levels in Anyan Ekpang, presents potential health concerns. Proper processing techniques or dietary modifications may be necessary to reduce toxicity risks while preserving their nutritional benefits. Further research into alternative preparation methods and fortification strategies could enhance their safety and dietary suitability.

Keywords: Anti-nutrient, Ayan Ekpang, Otong Soup, Cocoyam

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Introduction

Under-nutrition remains a major public health issue in many developing countries, including Nigeria. Alongside this, the prevalence of non-communicable chronic diseases is also high. One sustainable method to tackle malnutrition is the continuous consumption of nutritionally adequate diets (High-Level Panel of Experts, 2017). In Nigeria, various regional soups play a significant role in daily nutrition. According to Oboh and Olumesi (2017), typical Nigerian soups include ingredients of both plant and animal origins and are often

consumed with carbohydrate-based meals such as cassava flour, rice, cocoyam, potatoes, yam, or plantain. Common ingredients include meat, fish, palm oil, vegetables, crayfish, seasonings, and water (Ani et al., 2016). These ingredients are rich in protein, fat, and micronutrients and contribute significantly to the nutrient intake of the Nigerian population.

Soup is a liquid food, usually savory, made by stewing ingredients such as meat, fish, or game, often in stock with seasonings (Bassey *et al*., 2020). It is an important delicacy enjoyed globally by both rich and poor. The nutritional value of a particular soup depends on its ingredients, which are influenced by the financial capacity of the individual. Various soups are unique to different tribes and are prepared with indigenous tropical seeds highly cherished for their nutritive and calorific values (USDA, 2017). These soups are typically consumed with swallows such as pounded yam, 'foofoo', garri, and other flours made into stiff porridge. Despite the diversity of traditional soups in Nigeria, malnutrition persists, especially among the rural populace, pregnant women, and children (Reeds *et al*., 2016). Variations in ingredients and cooking methods raise questions about their nutritional adequacy, and there is a need for accurate data on the nutrient composition of indigenous soups.

The ingredients used in Nigerian soups may offer significant health benefits. Studies have shown that palm oil contains high levels of saturated fatty acids, particularly palmitic acid, linoleic acid, squalene, ubiquinone, and co-enzyme Q10, which are essential for good health (Obanla *et al*., 2016; Onabanjo *et al*., 2014). However, the shift from traditional to Western diets due to nutritional transitions has altered the nutrient profiles of these foods (Onabanjo *et al*., 2014). The use of synthetic chemicals and intensive animal farming has also impacted the nutritional quality of food products, potentially increasing the risk of diet-related non-communicable diseases and undernutrition in Nigeria.

Otong Soup, a traditional okra soup, is widely consumed by the Efik people of Cross River State and the Oron people of Akwa Ibom State, Nigeria. It is characterized by key vegetables such as Ikong Ubong (pumpkin leaves) and Uziza leaves (piper guineese), which differentiate it from other okra soups. Despite the nutritional benefits, the presence of poorly digestible proteins, high levels of insoluble fiber, and anti-nutritional factors in traditional diets has raised concerns about nutrient availability. Anti-nutrients such as hydrogen cyanide (HCN) in cassava, oxalates, phytates, and tannins can inhibit nutrient absorption and pose health risks (Giacometti and Leon, 2017). Therefore, evaluating the anti-nutrient composition of traditional foods like Otong Soup and Anyan Ekpang is essential.

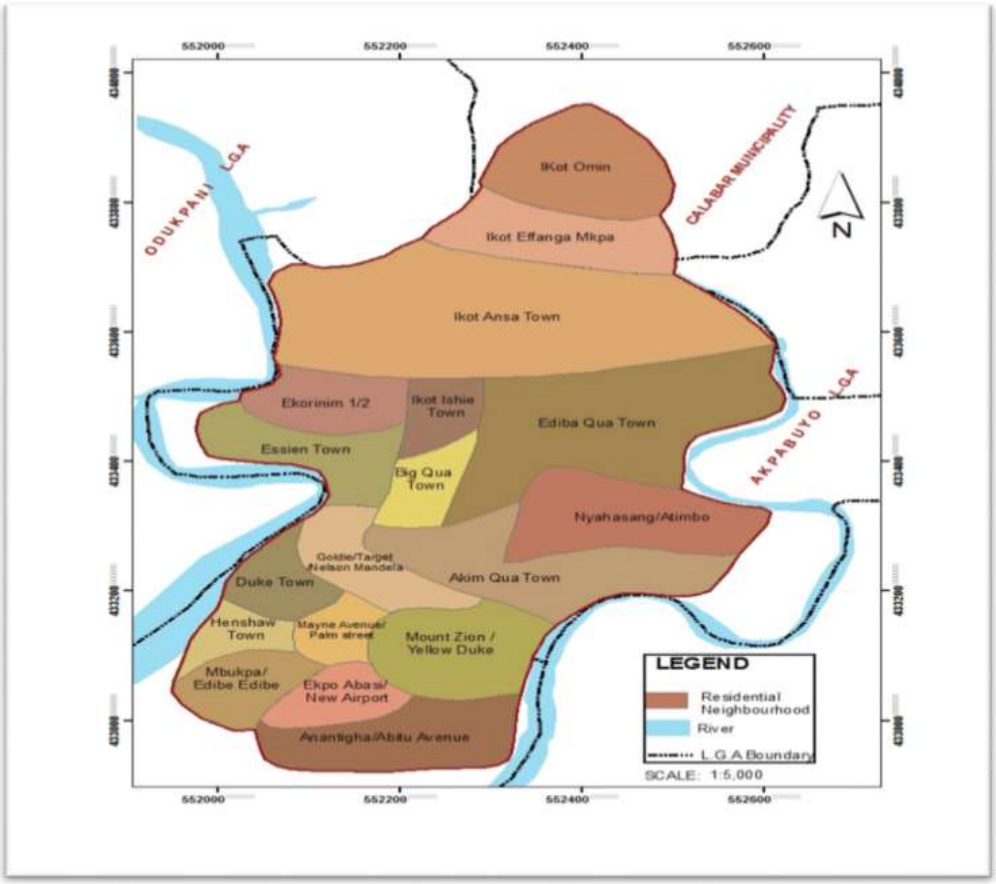
Despite the nutritional qualities of traditional dishes, some anti-nutritional factors present in foods can reduce nutrient utilization, digestibility, and mineral bioavailability, leading to potential health risks. The data on the anti-nutrient composition of indigenous soups commonly consumed in southwestern Nigeria are limited. This study aims to fill this gap by assessing the anti-nutrient composition of Otong Soup and Anyan Ekpang, generating data for food composition tables, and contributing to existing literature on anti-nutrients. The findings will provide a valuable resource for future research and public health initiatives focused on improving nutritional outcomes and food security in Nigeria.

Materials and Methods

Study area

The research geographical area focuses on two specific regions in Nigeria: Oron Local Government Area in Akwa Ibom State, and the Efiks in Calabar Municipality and Calabar South Local Government Area in Cross River State. Oron is a local government area located in the southern part of Akwa Ibom State, Nigeria. It is situated along the coastline of the Atlantic Ocean and is known for its rich cultural heritage and traditional cuisine. Calabar Municipality and Calabar South Local Government Areas of Cross River State, were selected to make up the Efik ethnic group. By specifically investigating these three regions, the study aims to provide insights into the antinutrient content of Otong soup and Ayan Ekpang in the local context of Oron, Akwa Ibom State,

and Efiks in Calabar South/Calabar Municipality.



Map showing the geographical area of Oron, Calabar Municipality and Calabar South.
Source*:* People Group (Retrieved: https//www.101lasttribes.com/tribes/oron.htm/Accessed 21, February, 2024).

Study design

This research is to evaluate the antinutrien. composition of otong soup and ayan ekpang iwa as consumed in Oron, Akwa Ibom State and otong soup and ayan ekpang as consumed by the Efiks, in Cross River State. The evaluative study employs the laboratory analysis of the four samples of otong soup and ayan ekpang which were prepared using traditional recipes. This study approach provides direct scientific data on the antinutrient composition of the meals. This involves evaluating the antinutrient composition of otong soup and ayan ekpang and comparing their antinutrient compound in relation to each other.

Equipment

The following materials and equipment were used for the study; weighting balance (analytical grade), spatula, burette, funnel, beakers, volumetric flask, centrifuge (mst-model), centrifuge tubes, water bath, test tubes, glass stoppered bottles, colorimeter, washed bottle, oven, desiccator, metal dish with 50mm diameter, platinum, porcelain or dilica crucible or dish muffle of range 0 to 1000°C, UV-vis spectrophotometer, pot, knife, bowl, spoon, cutting stick, gas cooker/cylinder, sensitive balance capable of measuring 0.1mg and pipettes.

Reagents

During the analysis, the following reagents were used; hydrochloric acid (HCl), nitric acid (NH_3), methyl indicator, calcium chloride, anti-bumping agent, potassium sulphate, potassium permanganate solution, sulphuric acid, sodium hydroxide, distilled water, ferric chloride, phosphate solution, molybdate, hydroquene solution, petroleum ether and sodium sulphate, acetic acid, ethanol, dilute ammonium hydroxide and concentrated ammonia.

Collection and identification of plant sam ples

Melon seeds and groundnut seeds and other food ingredients like dried fish, stockfish, fresh beef, crayfish, palm oil, onion, salt, pepper, bouillon cube, locust beans and fresh vegetables (water leaf, bitter leaf, hot leaf and pumpkin leaf) were obtained from Watt market in Calabar South LGA, Cross River State, Nigeria.

Ingredient purchase, sample preparation and treatment

Beef, stockfish, ogbono, palm oil, crayfish, kpomo, ukana, de-shelled periwinkle, unshelled fresh water snails (nkonko), hot leaf (uziza), stockfish, dried fish, seasoning cubes, and dried prawn, palm oil, were purchased from Watt market Calabar, Cross River State, Nigeria. The soup and ayan ekpang were prepared at the Food Preparation Laboratory of the Department of Human Nutrition and Dietetics, University of Calabr, Calabar, Nigeria.

Focus Group Discussion (FGD)

Focus Group Discussion (FGD) is a qualitative research method involving a small group of individuals participating in a guided conversation about a specific topic (Krueger and Casey, 2015). FGDs enable the exploration of diverse viewpoints within a group setting. Participants from different backgrounds or with varying experiences offer contrasting insights, enriching the data collected. This approach allows researchers to identify commonalities, differences, and nuances in perspectives (Stewart and Shamdasani, 2014).

The FGD in this study comprised 15 participants, including a professor, two lecturers, two women from Oron, two women from Efik, and eight students. The recipe and methods of preparation for Otong Soup and Anyan Ekpang were derived from this discussion. Two respective indigenes from Oron and Efik, familiar with Otong Soup and Anyan Ekpang Iwa, were carefully selected to provide detailed information on the quantity of ingredients and the different methods of preparation. The discussions lasted for more than four hours.

Standardized Methods used for this study:

Amount of Ingredients for Oron

Standardized Amount of ingredients used for preparation of Otong Soup as consumed in Oron, Akwa Ibom State

Uziza leaf - 35g

Pumpkin leaf	- 72g
Seasoning cubes (knorr)	- 7g
Dry fish	-157g
Salt	- 20g
Pepper	- 19g
Crayfish	- 21g
Blended ogbono	- 15g
Dried prawns	- 22g
Okra	- 450g
Kpomo (cow skin)	- 358g
Beef	- 650g
Stockfish	- 72g
Unshelled fresh water snail	- 74g
Unshelled periwinkle	- 50g
Organic potash liquid	- 70mls
Red cowpeas	- 126g
African oil beans (ukana)	-36g
Palm oil	- 4 tablespoons

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Standardized amount of ingredients used for preparation of Ayan Ekpang as consumed in Oron, Akwa Ibom State

Grated cassava	- 3.9kg
Plantain leaves	-566g

Method of Preparation for Oron

Standardized Method of Preparation of Ayan Ekpang as Consumed in Oron, Akwa Ibom State

- The cassava tubers were peeled and washed properly under running water.
- The washed cassava tubers were grated longitudinally using a box grater to avoid the vein from the cassava to be incorporated into the cassava paste
- Matured plantain leaves were prepared by fraying them over a heat source (an open fire) and cutting them into rectangular shapes using kitchen knife.
- The leaves were washed carefully to prevent contamination with microorganisms.
- The cassava paste was mixed with water to get a soft and flowing desired consistency.
- A small quantity of the cassava paste was placed longitudinally in each cassava leaves and securely wrapped to avoid spillage.
- Plantain leaf stalks were cut into sizes (12cm) each and were carefully placed longitudinally at the base of a big pot to prevent the wrapped paste from sticking to the base of the pot
- The wrapped cassava pastes were arranged carefully on top of the stalks.
- The pot was placed on fire and was cooked with 750mls of water for 41 minutes after which 600mls of water was added again and it was cooked for 27 minutes.
- At the end of 27 minutes, the pot was taken off the heat source (gas cooker) and allowed to cool.
- The ayan ekpang was prepared under 1hour and 8 minutes

Standardized Method of Preparation of Otong Soup as Consumed in Oron, Akwa Ibom State

- The kpomo (cow skin) was washed and placed in a pot with 150ml of water, seasoned with 2g of salt and boiled for 15 minutes and the water was drained out from the pot
- The meat (beef), dry fish, stock fish and unshelled fresh water snail (nkonko) were washed properly under running water and were added to the pot containing the pre-cooked kpomo and seasoned with 3 seasoning cubes, 3g of salt, 5g of pepper and boiled with 400ml of water for 25 minutes.
- The red cowpeas were selected carefully to remove the shaft, it was washed and boiled with 200ml of water for 1 hour.
- Okra was chopped into small pieces and pounded using mortar to reduce their sizes and increase their draw-ability.
- The pepper, ogbono, crayfish and dried prawn were blended using an electric blender.
- The pre-cooked meats (beef), dry fish, stock fish and unshelled fresh water snail and kpomo were transferred into the pot. 14g of dry pepper, 22g of blended dried prawns, 21g of blended crayfish and red cowpeas were added to the pot.
- 4 seasoning cubes, African oil beans of 5g and 120mls of water were also

added to the pot and allowed to simmer for 10 minutes.

- The blended ogbono was mixed with palm oil and were added to the pot
- The pounded okra and the unshelled periwinkle were added to the pot and stirred until they were evenly distributed.
- 55ml of organic potash liquid was mixed with 4 tablespoons of palm oil and added to the pot while the mixture was simmering.
- The sliced leafy vegetables (pumpkin and hot leaves) were added to the pot, and were allowed to simmer for 3 minutes.
- The soup was removed from heat source (gas cooker) and allowed to cool.
- No salt was added for adjustment as the salt from the pre-cooked meat mixture was enough
- The otong soup was prepared under 1hour

Table 1: Standardized amount of ingredients for otong soup as consumed by the Efiks, Cross River State

Ingredients	Weight as bought	Edible weight/Used weight
Dry fish	190g	181g
Beef	550g	550g
Crayfish	51g	43g
Stockfish	91g	91g
Dry pepper	29g	22g
Cow skin (kpomo)	300g	300g
Unshelled periwinkle	54g	54g
Uziza (hot leaves)	56g	48g
Salt	50g	5g
Bouillon cubes	24g	20g
Okra	506g	473g
Pumpkin leaves	123g	94g
Unshelled water snail.	35g	32g
Ogbono	163g	161g
Palm oil	250mls	250mls
Water	-	1000mls

Table 2: Standardized amount of ingredients for Anyan Ekpang as consumed by the Efiks, Cross River State

Ingredients	Weight as bought	Edible weight/Used weight
Cocoyam	1270g	1100g
Water yam	1400g	1250g
Plantain leaves	-	-
Water	-	1850mls
Salt	50g	2g

Standardized method of preparation of otong soup as consumed by the Efiks, Cross River

Preparation of Stock

- The beef and cow skin (kpomo) were washed and cut into pieces
- All the meats were placed inside a pot, it was seasoned with 3g of pepper, 8g of bouillon cube and 2g of salt
- All the meats were boiled for 15minute using 500mls of water at 100^0C until they were soft

○ **Preparation of Soup**

- Fresh okra fruits was washed and sliced into pieces and pounded together with the ogbono using mortar.

- Pumpkin leaves and uziza leaves were plucked from the stalk, washed, and cut into tiny pieces, separately.
- Dry fish was deboned and washed using clean water
- Unshelled periwinkle and fresh water snails were washed and properly steamed for 3 minutes using 180mls of water
- The crayfish was blended using electric blender
- 250mls of water was added to the pot containing already prepared stock
- Stockfish was washed and steamed for 3 minutes using 180mls of water
- Deboned dry fish, crayfish, pepper of 19g, salt of 3g, palm oil of 250mls, bouillon cubes of 12g, steamed stockfish, periwinkle and fresh water snails were added to the stock and allowed to steam for 5 minutes
- 50mls of water was added bit by bit to get a good consistency
- Mixture of pounded okra and ogbono was added, 300mls of water was added to get a good consistency and it was allowed to cook for 3 minutes
- Vegetables (pumpkin leaf and hot leaf) were added and stirred thoroughly then allowed to steam for 30 seconds
- At the end of 30 seconds, the otong soup was ready, it was taken off from fire and was served warm

Standardized method of preparation of anyan ekpang as consumed by the Efiks, Cross River State

- The plantain leaves were cut and frayed over a flame of fire for 5 seconds to prevent it from breaking
- The plantain leaves were cut into rectangular sizes
- The cocoyam and water yam were peeled and washed using clean water
- The cocoyam and water yam were grated differently, using the box grater then mixed properly, 3g salt was added and 450mls of water was added to get a softer consistency
- The plantain leaves were washed and greased with 3 tablespoons of vegetable oil for lubrication.
- The plantain leaf stalks were cut into sizes (12cm) and were carefully placed and nicely arranged at the base of the big pot
- The washed plantain leaves were used in wrapping the mixture of grated cocoyam and water yam in cylindrical shape. The leaves were bended at both ends and they were placed inside the big pot, on top of the plantain leaf stacks to prevent the wrapped grated cocoyam and water yam mixture paste from sticking to the base of the pot during steaming.
- 1400mls of water was used in steaming it for 45 minutes at 100^{o}C
- At the end of the 45 minutes, anyan ekpang was ready and it was served cold

Determination of Saponins

To determine the saponin content, fifty grams (50g) of the food sample were placed in a 500ml flask containing 300ml of 50% alcohol. The mixture was boiled under reflux for 30 minutes and immediately filtered while hot through a coarse filter paper. Two grams (2g) of charcoal were added to the filtrate, and the content was boiled and filtered while hot. The food sample was then cooled, allowing some saponins to separate, and an equal volume of acetone was added to complete the precipitation of saponins.

The precipitated saponins were collected by decantation and dissolved in the least amount of boiling 95% alcohol, then filtered while hot to remove any insoluble matter (Evans and Trease, 1999). The filtrate was allowed to cool to room temperature, resulting in the precipitation of saponins. The precipitated saponins were collected by decantation, suspended in about 20ml of alcohol, and filtered. The filter paper was immediately transferred to a desiccator containing anhydrous calcium chloride, and the saponins were left to dry. They were then weighed with reference to the weight of the extract used to determine the weight of the saponin residue.

The percentage of saponins was calculated using the formula:

% saponins=weight of saponin residue weight of extract used×100\text{\% saponins} = \frac{\text{weight of saponin residue}}{\text{weight of extract used}} \times 100

Determination of tannins

The food samples (0.1g) were put into a 100ml conical flask and 50ml of distilled water was added. The flask was gently heated to boiling for 1 hour, and the filtrate was collected in a 50ml volumetric flask. The residue was washed several times and the combined solution made to the volume with distilled water. To 10ml of sample solution in a 50ml volumetric flask, 2.5ml of Folin - Denis reagent and 10ml of $NaCO_3$ solution were added and made to volume with distilled water. The same treatment was made to the all the samples and the flasks were allowed to stand for 20 minutes after which optical density was measured at 760 nm using spectrophotometer (Evans and Trease, 1999).

Tannic acid (mg/ml) = Absorbance of test/Absorbance of standard× Conc. of standard

Phytate determination

About 4g of the samples was taken and soaked in 100ml of 2% HCl for 3 hours; it was then filtered through Whatman filter paper. 25ml of the filtrate was place in 250ml conical flask followed by the addition of 5ml of 0.3% Ammonium thiocyanate solution as indicator. 53.5ml of the distilled water was added to give the desired acidity. This was then titrated with standard iron (III) chloride solution which contains about 0.00195g of iron per ml until a brownish yellow persists for 5 minutes.

% Phytic Acid = 8.24t x100/1000 x wt of sample (7) Where t = titre value

Flavonoids Determination

Three methods were used to determine the presence of flavonoids in the food sample (Sofowara, 1993; Harbrone, 1973). 5ml of dilute ammonia solution were added to a portion of the aqueous filtrate of each plant extract followed by addition of concentrated H_2S0_4. A yellow colouration observed in each extract indicated the presence of flavonoids. The yellow colouration disappeared on standing. Few drops of 1% aluminium solution were added to a portion of each filtrate. A yellow colouration was observed indicating the presence of flavonoids. A portion of the powdered plant sample was in each case heated with 10ml of ethyl acetate over a steam bath for 3 min. The mixture was filtered and 4ml of the filtrate was shaken with 1ml of dilute ammonia solution. A yellow colouration was observed indicating a positive test for flavonoids.

Oxalate determination

To about 1g of the sample was added 75ml of 1.5N H2SO4 and the solution was carefully stirred using a magnetic stirrer for 1 hour before being filtered using Whatman No. II filter paper. 25ml of the extract was collected and titrated when hot against 0.1N KMnO4 solution to a faint pink colour end point.

Oxalate = (titre value x 0.9004) mg/g

Determination of phenol

Phenol content of the sample was determined using the method described by Harborne (1973). A portion of 2ml was taken and prepared in 25ml of distilled water after vigorous shaking for 1h. The solution was washed with 3ml of 0.1M NaOH (pH 9) and later mixed with 2ml of chloroform and 3ml of ice cold acetic anhydride followed by adding two drops of concentrated H_2SO_4 cautiously. The absorbance of both sample and blank were measured spectrophotometrically at 420nm.

Statistical analysis

Three replicates were analyzed per sample and the data generated were analyzed using Micro soft Excel 2013 spreadsheet and expressed as mean ± SEM. Statistical analyses ANOVA was carried out using Statistical Package for Social Sciences(SPSS version 20.0) and significance was accepted at $p< 0.05$.

Results

The moisture content of Otong Soup and Anyan Ekpang as prepared and consumed by the Oron and Efik people is detailed in Table 1. Otong Soup, when consumed in Oron (OSO), has a higher moisture content (76%

and 13.47% wet and dry weight) compared to when consumed by the Efiks (OSE) (72% and 12.77% wet and dry weight). Similarly, Anyan Ekpang, as consumed in Oron (AEO), has a higher moisture content (68% and 9.76% wet and dry weight) compared to when consumed by the Efiks (AEE) (65% and 10.50% wet and dry weight). The differences in moisture content can be attributed to various factors, including ingredients used, cooking methods, environmental factors, and cultural preferences. For example, variations in ingredient proportions, the water content of ingredients, cooking time, and temperature can all contribute to differences in moisture content. Additionally, regional climate and storage conditions may affect the moisture content of the final dish.

Table 3: The moisture content of Otong soup and Anyan Ekpang as prepared and consumed by Oron and Efik people

Sample	OSO	OSE	AEO	AEE
Wet W eight **Moisture**	76%	72%	68%	65%
Dry weight **Moisture**	13.47%	12.77%	9.76%	10.50%

OSO = Otong soup as consumed in Oron, Akwa Ibom State OSE = Otong Soup as consumed by the Efiks, Cross River State AEO = Ayan ekpang iwa as consumed in Oron, Akwa Ibom State AEE = Anyan ekpang as consumed by the Efiks, Cross River State

Phytochemical Composition of Anyan Ekpang as Prepared and Consumed by Oron and Efik People on a Dry Weight Basis

The phytochemical compositions of Anyan Ekpang, as prepared and consumed by the Oron and Efik people, are presented in Table 3. The analysis detected the presence of tannins, flavonoids, phytates, oxalates, hydrogen cyanide, phenols, and saponins in varying amounts in both samples. Tannin Concentration**:** Anyan Ekpang prepared and consumed by the Oron people had a significantly higher tannin concentration (0.63±0.05) compared to that of the Efik people (0.49±0.01) ($p<0.05$). Flavonoid Concentration the flavonoid concentration was significantly higher in the Anyan Ekpang prepared and consumed by the Oron people (0.58±0.11) compared to that of the Efik people (0.43±0.06) ($p<0.05$). Phytate Concentration, Similarly, the phytate concentration was significantly higher in the Anyan Ekpang consumed by the Oron people (0.69±0.03) compared to the Efik people (0.48±0.01) ($p<0.05$). Oxalate Concentration, the oxalate concentration was also significantly higher in the Anyan Ekpang consumed by the Oron people (0.76±0.05) compared to the Efik people (0.52±0.00) ($p<0.05$). Hydrogen Cyanide (HCN) Content**:** Conversely, the hydrogen cyanide content in the Anyan Ekpang prepared by the Efik people was significantly higher (1.92±0.02) than that prepared by the Oron people (1.86±0.03) ($p<0.05$). Phenol Value: The phenol content in the Oron sample (0.38±0.01) was significantly higher than in the Efik sample (0.24±0.00) ($p<0.05$). Saponin Concentration: Finally, the saponin concentration was significantly higher inthe Oron sample (0.60±0.00) compared to the Efik sample (0.54±0.07) ($p<0.05$). These differences in phytochemical concentrations can be attributed to regional variations in ingredients, preparation methods, and environmental factors. Understanding these compositions is crucial for assessing the nutritional and health implications of consuming Anyan Ekpang as prepared by these two ethnic groups.

Table 4: Phytochemical composition of Anyan Ekpang as prepared and consumed by Oron and Efik people based on Dry Weight Basis

Sample	Tannin (mg/100g)	Flavonoid (mg/100g)	Phytate (mg/100g)	Oxalate (mg/100g)	HCN (mg/kg)	Phenol (mg/100g)	Saponin (mg/100g)
AEO	0.63±0.05	0.58± 0.11	0.69 ±0.03	0.76±0.05	1.86±0.03	0.38±0.01	0.60±0.00
AEE	0.49±0.01*	0.43 ± 0.06*	0.48±0.01*	0.52±0.00*	1.92±0.02*	0.24±0.00*	0.54±0.07*
Safe levels	6mg/kg	150-620mg/day	200-500mg/day	40-50mg/day	1.52mg/kg	3-30g/day	200mg/day

Values are expresses as mean ± SEM of 3 samples; *significantly different from AEO sample at $p < 0.05$; AEO= Anyan Ekpang as prepared and consumed by Oron people; AEE= Anyan Ekpang as prepared and consumed by Efik people

Phytochemical composition of Otong soup as prepared and consumed by Oron and Efik people based on Dry Weight Basis

The phytochemical compositions of Otong soup as prepared and consumed by Oron and Efik people are presented in Table 4. Tannin, flavonoid, phytate, oxalate, hydrogen cyanine, phenol and saponin were found to be present in varied amount in both soup samples. Tannin concentration was significant ($p<0.05$) higher (0.85±0.01) in the Otong soup as prepared and consumed by Efik people when compared with that of the Oron people (0.76±0.05). The flavonoid concentration was significant ($p<0.05$) higher (0.82 ± 0.02) in the Otong soup as consumed by the Efik people, though not significant ($p>0.05$) different from that of the Oron people (0.80 ± 0.01). Also, the phytate concentration was significant ($p<0.05$) higher (0.73±0.04) in the Otong soup as consumed by the Efik people, though not significant ($p>0.05$) different from that of the Oron people (0.70 ±0.03). Again, oxalate concentration was significant ($p<0.05$) higher (0.82±0.03) in the Otong soup as consumed by the Efik people, though not significant ($p>0.05$) different from that of the Oron people (0.80±0.00). However, the concentration of hydrogen cyanine recorded by the Efiks' Otong soup was significant ($p<0.05$) higher (2.32±0.01) compared to that of Oron people (2.20±.0.03). Again, among the two samples, Efik sample recorded a higher phenol value (0.64±0.01), and was significant ($p<0.05$) different from the Oron sample (0.52±0.03). Finally, saponin concentration was significant ($p<0.05$) higher (0.80±0.08) in the Efik sample when compared with the Oron sample (0.73±0.04) (Table 3).

Table 5: Phytochemical composition of Otong soup as prepared and consumed by Oron and Efik people based on Dry Weight Basis

Sample	Tannin (mg/100g)	Flavenoid (mg/100g)	Phytate (mg/100g)	Oxalate (mg/100g)	HCN (mg/kg)	Phenol (mg/100g)	Saponin (mg/100g)
OSO	0.76±0.05	0.80± 0.01	0.70 ±0.03	0.80±0.00	2.20±.0.03	0.52±0.03	0.73±0.04
OSE	0.85±0.01*	0.82 ± 0.02	0.73±0.04	0.82±0.03	2.32±0.01*	0.64±0.01*	0.80±0.08*
Safe levels	6mg/kg	150-620mg/day	200-500mg/day	40-50mg/day	1.52mg/kg	3-30g/day	200mg/day

Values are expresses as mean ± SEM of 3 samples; *significantly different from OSE sample at $p < 0.05$; OSO= Otong soup as prepared and consumed by Oron people; OSE= Otong soup as prepared and consumed by Efik people

Phytochemical composition of Anyan Ekpang as prepared and consumed by Oron and Efik people based on Wet Weight Basis

The phytochemical compositions of Anyan Ekpangas prepared and consumed by Oron and Efik peopleare presented in Table 5. Tannin, flavonoid, phytate, oxalate, hydrogen cyanine, phenol and saponin were found to be present in varied amount in both samples. Tannin concentration was significant ($p<0.05$) higher (0.22±0.05) in the Anyan Ekpang as prepared and consumed by Oron people when compared with that of the Efik people (0.20±0.01). The flavonoid concentration was significant ($p<0.05$) higher (0.20± 0.11) in the Anyan Ekpang as prepared and consumed by Oron people when compared with that of the Efik people (0.17 ± 0.06). Also, the phytate concentration was significant ($p<0.05$) higher (0.24 ±0.03) in the Anyan Ekpang consumed by Oron people when compared with that of the Efik people (0.18±0.01). The concentration of oxalate was significant ($p<0.05$) higher (0.27±0.05) in the Anyan Ekpang consumed by Oron people when compared with that of the Efik people (0.20±0.00). However, the amount of hydrogen cyanine recorded by the Efiks' Anyan ekpang was significant ($p<0.05$) higher (0.65±0.02) compared to that of Oron people (0.75±0.03). Again, among the two samples, Oron sample recorded a higher phenol value (0.13±0.01), and was significant ($p<0.05$) different from the Efik sample (0.10±0.00). Saponin concentration was significant ($p<0.05$) higher (0.21±0.00) in the Oron sample when compared with the Efik sample (0.21±0.07) (Table 5).

Table 6: Phytochemical composition of Anyan Ekpang as prepared and consumed by Oron and Efik people based on Wet Weight Basis

Sample	Tannin (mg/100g)	Flavonoid (mg/100g)	Phytate (mg/100g)	Oxalate (mg/100g)	HCN (mg/kg)	Phenol (mg/100g)	Saponin (mg/100g)
AEO	0.22±0.05	0.20± 0.11	0.24 ±0.03	0.27±0.05	0.65±0.03	0.13±0.01	0.21±0.00
AEE	0.20±0.01*	0.17 ± 0.06*	0.18±0.01*	0.20±0.00*	0.75±0.02*	0.10±0.00*	0.21±0.07*
Safe levels	6mg/kg	150-620mg/day	200-500mg/day	40-50mg/day	1.52mg/kg	3-30g/day	200mg/day

Values are expresses as mean ± SEM of 3 samples; *significantly different from AEO sample at $p < 0.05$; AEO= Anyan Ekpang as prepared and consumed by Oron people; AEE= Anyan Ekpang as prepared and consumed by Efik people

Phytochemical composition of Otong soup as prepared and consumed by Oron and Efik people based on Wet Weight Basis

The phytochemical compositions of Otong soup as prepared and consumed by Oron and Efik people are presented in Table 6. Tannin, flavonoid, phytate, oxalate, hydrogen cyanine, phenol and saponin were found to be present in varied amount in both soup samples. Tannin concentration was significant ($p<0.05$) higher (0.27±0.01) in the Otong soup as prepared and consumed by Efik people when compared with that of the Oron people (0.20 ±0.05). The flavonoid concentration was significant ($p<0.05$) higher (0.20 ± 0.02) in the Otong soup as consumed by the Efikpeople, though not significant ($p>0.05$) different from that of the Oron people (0.21 ± 0.01). Also, the phytate concentration was significant ($p<0.05$) higher (0.23±0.04) in the Otong soup as consumed by the Efik people, though not significant ($p>0.05$) different from that of the Oron people (0.19 ±0.03). Again, oxalate concentration was significant ($p<0.05$) higher (0.26±0.03) in the Otong soup as consumed by the Efik people, though not significant ($p>0.05$) different from that of the Oron people (0.21±0.00). However, the concentration of hydrogen cyanine recorded by the Efiks' Otong soup was significant

($p<0.05$) higher (0.74±0.01) compared to that of Oron people (0.59 ±.0.03). Again, among the two samples, Efik sample recorded a higher phenol value (0.20±0.01), and was significant ($p<0.05$) different from the Oron sample (0.14±0.03). Finally, saponin concentration was significant ($p<0.05$) higher (0.26±0.08) in the Efik sample when compared with the Oron sample (0.20±0.04) (Table 6).

Table 7: Phytochemical composition of Otong soup as prepared and consumed by Oron and Efik people based on Wet Weight Basis

Sample	Tannin (mg/100g)	Flavenoid (mg/100g)	Phytate (mg/100g)	Oxalate (mg/100g)	HCN (mg/kg)	Phenol (mg/100g)	Saponin (mg/100g)
OSO	0.20±0.05	0.21± 0.01	0.19 ±0.03	0.21±0.00	0.59±.0.03	0.14±0.03	0.20±0.04
OSE	0.27±0.01*	0.26 ± 0.02	0.23±0.04	0.26±0.03	0.74±0.01*	0.20±0.01*	0.26±0.08*
Safe levels	6mg/kg	150-620mg/day	200-500mg/day	40-50mg/day	1.52mg/kg	3-30g/day	200mg/day

Values are expresses as mean ± SEM of 3 samples; *significantly different from OSE sample at $p < 0.05$; OSO= Otong soup as prepared and consumed by Oron people; OSE= Otong soup as prepared and consumed by Efik people

Discussion

The study highlights significant variations in the phytochemical composition of Anyan Ekpang and Otong soup between the Oron and Efik communities. These variations can be attributed to differences in ingredient proportions, cooking methods, and environmental conditions, reflecting cultural preferences and regional influences. The presence of phytochemicals such as tannins, flavonoids, phytates, oxalates, hydrogen cyanide, phenols, and saponins in varied amounts underscores the importance of these factors in determining the nutritional and health impacts of these traditional foods.

The results of the phytochemical composition of Anyan Ekpang and Otong Soup as prepared and consumed by the Oron and Efik people are presented in Tables 1 to 7. Table 3 illustrates significant variations in moisture content between the dishes consumed by the Oron and Efik communities. Notably, Otong Soup and Anyan Ekpang exhibited higher moisture content when consumed in Oron compared to Efik. This discrepancy can be attributed to various factors, such as ingredient proportions, cooking methods, and environmental conditions, reflecting cultural preferences and regional influences. For instance, the higher moisture content in Oron's Otong Soup could be due to specific ingredient combinations or cooking techniques prevalent in that community.

Tables 3 and 5 show the phytochemical compositions of Anyan Ekpang and Otong Soup, respectively, based on dry weight. The study identified tannin, flavonoid, phytate, oxalate, hydrogen cyanide, phenol, and saponin in varying amounts in both samples. Anyan Ekpang samples prepared and consumed by Oron people had higher concentrations of all phytochemicals compared to those prepared and consumed by the Efiks. This difference in phytochemical concentration may be attributed to the species of cassava used, soil type, and cassava processing methods. These findings align with Isong and Joseph (2019), who reported moderate quantities of phytochemicals in Anyan Ekpang made with fresh cassava in Akwa Ibom State.

Conversely, Otong Soup samples prepared and consumed by the Efiks had higher concentrations of all phytochemicals compared to those prepared and consumed by Oron people. This difference may be due to variations in recipes and preparation methods. This study's results are consistent with Egbung *et al*. (2021), who reported moderate levels of anti-nutrients in groundnut soup.

Hydrogen cyanide (HCN) content was the highest recorded phytochemical in both samples. According to Isong and Joseph (2019), the acute toxic lethal dose of HCN is usually 50-100mg. The slight decrease in HCN content observed in Anyan Ekpang prepared and consumed by Oron people indicates that processing methods like cooking, boiling, and sun drying can reduce HCN levels in food products (Food Info.net, 2010). The HCN values reported in this study were below the permissible level, indicating the samples are safe for human consumption. High phytate content in foods is of nutritional significance as phytate phosphorus is unavailable to humans and lowers the availability of other dietary minerals such as iron and zinc. The lethal dose of phytate is reported to be 250-500mg/100g (Bushway, 1998). Phytates have been shown to reduce blood glucose response to starchy foods, plasma cholesterol, and triacylglycerols when used at low levels (Shahidi *et al*., 1992). Phytic acid's ability to bind to zinc and lower the plasma zinc to copper ratio can reduce cardiovascular disease risk. A significant difference ($p<0.05$) was observed between the samples.

Oxalates are detrimental to human health when their amount exceeds 780mg/100g. Oxalate in food products can be reduced by grating, steaming, and boiling (Ramanatha *et al*., 2010). The FAO (2013) reports that oxalates are major anti-nutritional factors present in cassava. Studies by Noonan et al. (1999) have shown that oxalates decrease calcium absorption and aid kidney stone formation. The oxalate values reported in this study were below permissible levels, indicating the samples are safe for consumption. Regular consumption of improperly processed tubers could deliver toxic levels of oxalates into the body, leading to hypocalcemia, kidney stones, electrolyte imbalance, and reduced bioavailability of minerals (Ogbadoyi *et al*., 2006; Musa *et al*., 2011; Agbaire, 2011).

Foods rich in tannins are considered of low nutritional value because tannins precipitate proteins, inhibit digestive enzymes, and affect vitamin and mineral utilization (Tinko and Uyano, 2001). Tannins can cause growth depression and toxicity when consumed in excess amounts. The lethal dose of tannins is 25-50mg/100g. The tannin values reported in this study were below the permissible level, indicating the samples are safe for consumption. Tannins also possess astringent and fungicidal properties, aiding in wound healing and plant defense against pathogens (Okwu and Okwu, 2004).

Saponins help protect against cancers and lower cholesterol levels. The observed decrease in tannin content in Anyan Ekpang prepared and consumed by the Efiks indicates that processing methods like grating, steaming, boiling, and sun-drying can reduce tannin levels in food products (Ramanatha *et al*., 2010). A significant difference ($p<0.05$) was observed between the samples. Flavonoids, with their relatively low toxicity compared to other active plant compounds like alkaloids, can be ingested in significant quantities. Flavonoids are reported to possess antioxidant, anti-inflammatory, antitumor, anti-allergic, and antiplatelet activities.

Conclusion

This study provides an in-depth analysis of the phytochemical composition of Anyan Ekpang and Otong soup, highlighting the significant variations between the dishes consumed by the Oron and Efik communities. The results reveal that both dishes exhibit higher moisture content when consumed in Oron, which can be attributed to specific ingredient combinations and cooking techniques prevalent in that community. Also, the study emphasizes the importance of cultural preferences and regional influences in determining the phytochemical composition of traditional foods. Differences in ingredient proportions, cooking methods, and environmental conditions reflect the unique culinary practices of the Oron and Efik communities. However, the findings underscore the need for proper processing methods to ensure the safety and nutritional value of traditional dishes. Therefore, continued research is necessary to explore the broader implications of these findings on dietary habits and health outcomes.

References

Ani, I.F., Atangwho, I.J., Ejemot-Nwadiaro, R. I., Itam, E. H. and Essien, E.U. (2011). Hypoglycaemic effect and proximate composition of some selected Nigerian traditional diets used in management of diabetes mellitus. *European Journal of Food Research and Review*, 1: 94-101.

Bassey, S., Aburime, L., Ako, W. F., Odey, R. and Odey, F. C. (2020).Impact of Indigenous Methods of Preparation and Cooking on the Proximate, Mineral, Vitamins, Amino and Fatty Acids Compositions of Groundnut Soups Prepared in Cross River State, Nigeria. *Food Science and Quality Management*, 102: 34-41.

Bushway, R. J., Burea, J. J. and Gann, D, F. (1998). Phytate and cyanide contents of edible mushrooms. *Journal of Food Science*, 48: 84-86.

Egbung, J. E., Agiang, M. A., Obi-Abang, M., Essien, N. and Inyang, A. (2021). Evaluation of proximate composition and anti-nutrient content of groundnut soup delicacy prepared with processed *Ficus glumosa* leaves. *Global Journal of Pure and Applied Sciences*, 28: 1-7

Giacometti, D.C., and León, J**.** (1994). *Tannia, Yautia (Xanthosoma sagittifolium)*. In J.E. Hernando Bermejo & J. León (Eds.), *Neglected Crops: 1492 from a Different Perspective* (Plant Production and Protection Series No. 26, pp. 253-258). Food and Agriculture Organization (FAO), Rome, Italy.

HLPE (2017). Nutrition and food systems. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.11-152.

Isong, N. B. and Joseph, S. D. (2019). Proximate, mineral, antinutrient compositions and sensory properties of ayan-ekpang prepared with cassava flour in Akwa Ibom state, Nigeria. *Academic Journal of Global Who is Who in Academia*, 2 (2): 1-14.

Noonan S and Savage GP (2001). Oxalate content of food and its effect on humans. *Asia Pacific Journal of Nutrition*; 52: 289-294.

Obanla, O.O., Onabanjo, O.O., Sanni, S.A., Adegunwa, O.A., Afolabi, W.A.O., Oyawoye, O.O. and Lano-Maduagu, A.T. (2016). Fatty acid profile and dietary fibre contents of some standardized soups and dishes commonly consumed in Nigeria. *Nigerian Journal of Nutritional Sciences*, 37(1): 20-18.

Oboh, H. A. and Olumese, F. E. (2017).Effects of low carbohydrate high fat Nigerian-like diet on biochemical indices in rabbits. *Pakistan Journal of Nutrition*, 9: 245-249.

Ogbadoyi, E.O., Makun, A.H., Bamigbade, O.R., Oyewale, O. A. and Oladiran, J.A. (2006). The effect of processing and preservation methods on the oxalate levels of some Nigeria leafy vegetables. *Biokemistric*, 18(2): 121 – 125.

Okwu, J. E. and Okwu, S. P. (2004)**.** Astringent properties of tannins and their role in wound healing. *Journal of Sustainable Agriculture and Environment*, 6(2): 30-34.

Onabanjo, O.O., Sanni, S.A. Afolabi, W.A.O., Oyawoye, O.O. and Obanla, O.O. (2014). Lipid composition of some commonly consumed traditional Nigerian dishes. *Journal of Human Nutrition and Dietetics*, 26: 367-376

Ramanatha, R. B., Matthews, P. J., Eyzaguirre, P. B., and Hunter, D. (2010). The global diversity of taro: Ethnobotany and conservation. Rome, Italy: Biodiversity International. FAO (2013). FAO statistical yearbook. World food and agriculture. Rome, Italy.

Reeds J., Mansuri, S., Mamakeesick, M., Harris, S. B., Zinman, B., Gittsohn, J., Wolever, T. M., Connelly, P. W. and Hanley, A. (2016). Dietary patterns and type 2 diabetes mellitus in a first nation community. *Canadian Journal of Diabetes*, 40(4): 304-310.

Shahidi, F. and Wanasundara, P.K.J. (1992) Phenolic Antioxidants. Critical Reviews in Food Science and Nutrition, 32: 67-

103http://dx.doi.org/10.1080/10408399209527581

Stewart, D. W., and Shamdasani, P. N. (2014). Focus groups: Theory and practice (3rd edition). Thousand Oaks, CA: *Sage Publications*. 41(7):165-172

Tinko N, Uyano K. (2001) Spectrophotometric Determination of the Tannin Contents of Various Turkish Black tea, Beer and Wine samples. *International Journal of Food Sciences and Nutrition*, 52: 289-294.

USDA (2017).Foreign Agricultural Service (FAS) of the Department of Agriculture US.