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Nutritional Composition of "Ose Oku": A Traditional Food of Abatete in Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors ECU and ABA designed the study. Author ECU and NB performed and monitored the experimental work. Author ECU wrote the first draft of the manuscript and performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study assessed the nutritional composition of "Ose-Oku", a traditional food of Abatete in Anambra State, Nigeria.
Study Design: The research involved the preparation of "Ose-Oku" as traditionally done, followed by comprehensive laboratory analyses to determine its nutritional composition. Proximate, mineral, vitamin, antinutrient, fatty acid, and amino acid analyses were conducted using established scientific methods.
Place and Duration of Study: The study was carried out in a laboratory setting with samples collected from Abatete in Anambra State. The duration of the study spanned several months, allowing for thorough analysis and validation of results.
Methodology: The food was prepared as it is done in the traditional setting. The methods of AOAC (1984) were used in the proximate analysis of the dried food sample. Mineral and vitamin

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analyses were carried out using Atomic Absorption Spectrophotometer. Antinutrient and fatty acid analyses were done using Gas chromatography. HPLC apparatus was used to determine the amino acid composition.

Results: Among the nutrients found in the studied food sample were carbohydrates (82.56 ± 0.009%), crude protein (7.67 ± 0.042%), crude fat (1.49 ± 0.004%), crude fibre (0.44 ± 0.011%), moisture (6.05 ± 0.005%), ash (1.78 ± 0.002%), and total amino acids (72.64%). Also total SFA (26.62%), total UFA (85.09%), and total PUFA (70.60%) were found. Vitamins A (0.71mg/100g), C (72.67mg/100g), D (0.73mg/100g), E (3.92mg/100g), K (7.83mg/100g), B1 (0.04mg/100g), B3 (0.58mg/100g), B6 (0.20mg/100g), B9 (3.48mg/100g), and B12 (0.25mg/100g) were also found. Minerals such as iron (0.02mg/100g), manganese (0.02mg/100g), zinc (0.16mg/100g), sodium (0.20mg/100g), potassium (3.00mg/100g), magnesium (2.08mg/100g), calcium (3.61mg/100g), and copper (0.47mg/100g) were present. Antinutrients such as Kaempferol, CyanogenicGlycosides, Narigenin, Ammodendrine, Tannins, Flavonones, Flavone, Proanthocyanidin, and Spartein were present in the food.

Conclusion: This study has shown that the proportionate combination of the food materials enhanced the nutrient quality of this traditional food sample. Besides the low content of moisture and fats with high carbohydrate, appreciable amount of protein, fibre and vitamins qualify its complimentary use to tackle food insecurity and malnutrition.

Keywords: Ose-oku; proximate; mineral; vitamin; antinutrient; fatty acid; amino acid analyses.

1. INTRODUCTION

Traditional foods are the origin of diet in various cultures and societies. Since the onset of food industrialization, that is, the mass manufacture that began in the mid-twentieth century, a clear difference in quality was observed, especially by consumers, which divided food into two large groups: those manufactured in mass, homogeneous and from which the source of the raw material with which they are manufactured is not known, neither the method of explanation; and those that are manufactured in small scale, to a certain point heterogeneous and we could say that artisan, and of which the link producer–consumer is closer, since the method of explanation is not absolutely known, the source of the raw material can be indirect, therefore resulting in a better assurance for the consumers. Consequently, it can be said that, ironically, globalization inhibited and encouraged the consumption and manufacture of these foods. Consequently, interest in these foods has increased since the 1990s, especially focused on enhancing their significance and protecting them [1,2,3].

"Ose Oku", a traditional food of the Abatete people, is among the foods of plant origin that contains nutrients and phytochemicals. Though, this very traditional food, Ose Oku, has been extincted, since after the Biafra-Nigeria civil war, when it was predominantly consumed. Abatete is a community in Idemili North L.G.A. of Anambra State, South-eastern Nigeria. The people of Abatete are of Igbo ethnicity, and speak Igbo as their dialect. Ose Oku was predominantly consumed during the Biafra-Nigeria civil war due to the fact that it was very easy and quick to prepare ipso-facto as an emergency traditional food. Amadi et al., 2017 worked on nutritional, phytochemical and sensory evaluation of "Mberiagworagwo", a traditional food of Uruagu-Nnewi people in Anambra State, Nigeria [4]. Also, Okwu & Okwu, 2004 researched on phytochemicals and vitamin content of indigenous spices of South-eastern Nigeria [5]. Another research was carried out by Duru et al., 2012, on nutrient composition of "Nduduagworagwo", a traditional food of Akokwa people in Ideato L.G.A. of Imo State, Nigeria [6]. Then Majesty et al., 2013 worked on fatty acid composition and sensory evaluation of "Nduduagworagwo", a local food of Akokwa people in Imo State, Nigeria [7,8]. Yet some traditional diets in the South-eastern part of Nigeria, such as Ose Oku, are going into extinction, thereby reducing the availability and variety of foods needed to cushion the effect of the food insecurity in Nigeria. Consequently, it is imperative to assess the nutritional composition of Ose Oku, a traditional food of the Abatete people in Anambra State, in the South-eastern part of Nigeria. A survey of available literature shows that nutritional composition of Ose Oku has not been studied.

The present study is geared towards the investigation of the nutritional composition of "Ose Oku", a traditional food. This will help to

expose the possible health benefits on consuming the food, and its possible acceptability.

2. MATERIALS AND METHODS

2.1 Sample Collection

The major raw materials and ingredients such as yam, dried fish, biscuit bone of beef, etc, used in the preparation of the traditional diet used in this study, were purchased from "Eke Agu" market in Abatete, Idemili North Local Government Area of Anambra State, South-eastern Nigeria.

2.2 Preparation of "Ose Oku"

Recipe: About200g of peeled yam (a thickner), 12.31g of fresh pepper, 1g of salt, 850g of dried fish, 2.5g of fermented sesame seed (ogiri), 200ml of water.

Procedure: About 200ml of water, together with 850g of dried fish, was put in 2000mL pot and boiled for 2 minutes, using gas burner. Then 12.31g of fresh pepper, 1g of salt, 2.5g of fermented sesame seed (ogiri) were added. Also, 200g of sliced peeled yam was washed, boiled and pounded, to produce a paste. The yam paste was added to the boiling soup. It was allowed to boil for about 15 minutes, and then put down from fire.

2.3 Processing of Traditional Food Sample for Analysis

The prepared sample of "Ose Oku" was dried in an oven at 70^0C for 48 hours. The dried food sample was ground, with a hand mill, into powdered form and stored in air-tight sample containers at 4^0C, until required for analysis.

2.4 Proximate Analysis of Traditional Food Sample

The methods of AOAC (1984) were used in the proximate analysis of the food sample [9].

2.5 Determination of Amino Acid Composition of the Sample

A 0.1g lyophilized sample was weighed into a 16 × 125mm screw-cap Pyrex (Barcelona, Spain) tube, 15 ml of 6N hydrochloric acid was added, and the tube was thoroughly flushed with N_2, quickly capped, and placed in an oven at 110°C for 24 h (17). After hydrolysis, the tube contents were vacuum filtered (Whatmann #541, Maidstone, England) to remove solids, the filtrate was made up to 25 ml with water, and an aliquot of this solution was further filtered through a 0.50-µm pore-size membrane (Millipore, Madrid, Spain). A standard solution containing 1.25 µmol/ml of each amino acid in 0.1N hydrochloric acid was created.

2.6 Determination of Fatty Acid Profile Analysis of the Sample

One mililitre (1ml) of filtered residue was dissolved in 50ml of chloroform and transferred to a 100ml volumetric flask and was then diluted to the mark. Most of the chloroform was evaporated at room temperature. 1 ml of the reagent (20% vol. benzene and 55% vol. methanol) was added into the volumetric flask, sealed, and heated at 40^0C in a water bath for 30 minutes. After heating, the organic sample, with hexane and water, was extracted, so that the final mixture of the reagent, hexane and water, was in proportion of 1:1:1 (i.e. 1ml each of hexane and water to the reaction mixture). The mixture was shaken vigorously by hand for 2min. Due to a stable emulsion that was formed, it was broken by centrifugation. About half of the top hexane phase was transferred to a small test tube for injection. Only the organic layer was carefully removed. Injection was not done directly from the reaction vial because of the risk of injecting water, as it can ruin the GC column.

2.7 Determination of Vitamins

Vitamin A was estimated by the method of Bayfield and Cole, 1980 [10]. Vitamin E was estimated in the samples by the Emmerie-Engel reaction as reported by Emmerie & Engel, 2010 [11]. Vitamin C was analyzed by the spectrophotometric method described by Roe and Kuether, 1943 [12]. Vitamin D was assayed according to the method reported by Holick, 2009 [13].

2.8 Determination of Heavy Metals

Heavy metal analysis was conducted using Varian AA240 Atomic Absorption Spectrophotometer according to the method of APHA, 1995 (American Public Health Association) [14].

2.9 Determination of the Phytochemical and Anti-nutrient Contents of the Traditional Food Sample

One gram (1g) of the ground food sample was weighed and transferred into a test tube and

15ml ethanol and 10ml of 50% potassium hydroxide was added. The test tube was allowed to stay in a water bath at 60^0C for 60mins. After the reaction time, the reaction product contained in the test tube was transferred to a separatory funnel. The tube was washed successfully with 20ml of ethanol, 10ml of cold water, 10ml of hot water and 3ml of hexane, which were all transferred to the separatory funnel. These extracts were combined and washed three times with 10ml of 10%v/v ethanol aqueous solution. The solution was dried with anhydrous sodium sulfate and the solvent was evaporated. The sample was solubilized in 1000µl of pyridine of which 200µl was transferred to a vial for analysis. The analysis of anti-nutrient was performed on a BUCK M910 Gas chromatography equipped with a flame ionization detector. A RESTEK 15 meter MXT-1 column (15m x 250µm x 0.15µm) was used. The injector temperature was 280^oC with split-less injection of 2µl of sample and a linear velocity of $30cms^{-1}$, Helium 5.0pa.s was the carrier gas with a flow rate of 40 $mlmin^{-1}$. The oven operated initially at 200^0C, it was heated to 330^0C at a rate of 3^0C min^{-1} and was kept at this temperature for 5min. the detector operated at a temperature of 320^0C. Anti-nutrients were determined by the ratio between the area and mass of internal standard and the area of the identified anti-nutrients. The concentration of the different anti-nutrients was expressed in µg/g.

2.10 Statistical Analyses

All values were reported as mean ± standard deviation. Data obtained from the various parameters were analyzed statistically by analysis of variance (ANOVA) using the IBM Statistical Package for Social Sciences (SPSS) 24.0 software programme. Significance testing was done at 95% confidence interval.

3. RESULTS AND DISCUSSION

The results of the proximate composition of “Ose Oku” are presented in Table 1. This showed the carbohydrate (82.56 ± 0.009%), crude protein (7.67 ± 0.042%), crude fat (1.49 ± 0.004%), crude fibre (0.44 ± 0.011%), and moisture (6.05 ± 0.005%). The moisture content obtained in this study was very much lower, when compared to values obtained by Amadi (2011) (22.73%) [15], and Ejiogu (2019) (11.50%) [16]. The low moisture content found in “Ose Oku” traditional food could be due to the method of drying undertaken on the traditional food sample, to prevent microbial growth, and aid for longer storage. High moisture content in foods has been shown to encourage microbial growth [17]. Ash represents the mineral matter left after feeds are burnt in oxygen [18]. It is used as a measure of the mineral content in any sample [19]. The ash obtained was 1.78 ± 0.002%. The energy value was 57.98 Kcal/100g. The energy value of “Ose Oku” traditional food sample in this study was very much lower, when compared to the values reported by Amadi (2011) (348 - 499 Kcal/100g), and the values obtained in Beniseed soup (572.97 - 666.05 Kcal/100g), a local delicacy cherished in the Northern Cross Rivers State of Nigeria, by Agiang et al. (2010) [15,20].

The amino acid composition of “Ose Oku” traditional food showed that the food sample contains some quantity of essential and non-essential amino acids, as presented in Table 2. Arginine, lysine, aspartate and glutamate were very much high in “Ose Oku”. According to studies, arginine boosts immune function, hastens healing process, promotes cell division, and triggers the release of hormone [21,22,23]. Lysine aids in cardiac arrest [24] and its deficiency results to immunodeficiency [25]. Onyeike *etal*. (2005) reported that arginine and histidine are required for the growth of infants [26]. The total saturated fatty acid (SFA) content of “Ose Oku” (26.62%), as revealed in Table 4, is comparably higher than those of some Middle Eastern traditional dishes in Lebanon that ranged from 2.8% to 24.8%, as reported by Hoteit *etal*. (2021) [27]. Linoleic acid was the most abundant fatty acid in “Ose Oku” traditional diet. The total unsaturated fatty acids (UFA) content of “Ose Oku” was 85.09%; linoleic acid and oleic acid were the major UFA and PUFA in the traditional food sample, but linoleic acid was most abundant (41.75%). MUFA and PUFA have beneficial health and dietary values. They contribute to a decrease in the occurrence of vascular syndrome, carcinoma of the uterine cervix and immunological diseases [28]. Knowledge of the ratio of PUFA to SFA is essential in most nutritional studies. The British Department of Health and Social Security considers PUFA/SFA values lower than 0.45 as inappropriate for human health due to their association with cardiac diseases [29]. The PUFA/SFA ratio of Ose Oku is 2.65, ipso-facto can be said to be very much appropriate for human health with respect to cardiac disease.

Table 1. Proximate composition (%) of "Ose Oku"

Proximate (%)	Ose Oku
Carbohydrate	82.56 ± 0.009
Crude Protein	7.67 ± 0.042
Crude Fat	1.49 ± 0.004
Crude Fiber	0.44 ± 0.011
Moisture	6.05 ± 0.005
Ash	1.78 ± 0.002
Energy value (Kcal/100g)	57.98 ± 0.165

Values are means ± standard deviations of triplicate determinations

Table 2. Amino acid content of "Ose Oku" traditional diet

Aminoacids (mg/g)	Ose Oku
Essential	
Arginine	5.69
Histidine	2.68
Isoleucine	4.20
Leucine	2.27
Lysine	6.66
Methionine	1.37
Phenylalanine	3.95
Threonine	3.70
Tryptophan	1.68
Valine	2.46
Non-Essential	
Alanine	1.75
Aspartate	10.35
Cysteine	2.47
Glutamate	14.34
Glycine	2.60
Proline	1.50
Serine	2.40
Tyrosine	2.57
Total	72.64

Table 3. Fatty acid content of "Ose Oku" traditional diet

Fatty acid components (%)	Ose Oku
StearicAcid ($C_{18:0}$)	5.69
LauricAcid ($C_{12:0}$)	10.25
PalmiticAcid ($C_{16:0}$)	10.68
OleicAcid ($C_{18:1}$)	14.49
LinoleicAcid ($C_{18:2}$)	41.75
LinolenicAcid ($C_{18:3}$)	5.04
DocosahexaenoicAcid ($C_{22:6}$)	2.56
AdrenicAcid ($C_{22:4}$)	21.25
Total Sfa	**26.62**
Total Ufa	**85.09**
Total Pufa	**70.60**
Ufa/Sfa	**3.20**
Pufa/Sfa	**2.65**

SFA = Saturated Fatty Acids;
UFA = Unsaturated Fatty Acids;
PUFA = Polyunsaturated Fatty Acids;
PUFA/SFA value below 0.45 is inappropriate for the body system

Table 4. Phytochemical and antinutrient content of "Ose Oku" traditional diet

Antinutrients (µg/g)	Ose Oku
Kaempferol	5.59
CardiacGlycosides	3.32
Steroid	4.14
Catechin	3.80
Anthocyanin	2.29
Dihydrocystidine	3.68
CyanogenicGlycosides	9.46
Aphyllidine	3.66
Narigenin	8.45
Ammodendrine	5.99
Tannins	18.88
Flavonones	9.37
Flavone	6.77
Proanthocyanidin	8.75
Phytates	4.15
Spartein	7.63
Oxalates	2.53
Ephedrine	3.48
Sapogenins	0.02

The concentrations of some of the phytochemicals and antinutrients present in "Ose Oku" traditional food are presented in Table 4. Antinutrients are natural or artificial compounds that meddle with the assimilation of nutrients [30]. The "Ose Oku" traditional food sample was analyzed qualitatively and quantitatively for the presence of saponins, tannins, phytates, flavonoids, oxalates, cyanogenic glycosides, cardiac glycosides, kaempferol, catechin, proanthocyanidin and sapogenin. Tannins are protective substances produced majorly by plants used for treatment of wound, inflamed mucous membrane and astringent in nature [31]. Tannins also have some pharmacological activity like soothing relief, anti-inflammatory, diuretics, frostbite, burn and regeneration of skin hemorrhoids [5,32]. Butler, 1989 reported that tannins have possible anticarcinogenic effect. Dietary phytate could be associated to the prevention of dental decay, kidney stones, and calcification of blood vessels [30]. Oxalates and phytates bind calcium, magnesium and iron in the body; acts as pathogenic factor, thereby enhancing the acquisition of nutrients [33]. There is concern about oxalates because diets with high level of oxalates can be a risk for renal calcium absorption [34]. The toxic level of soluble oxalate is, however, reported to range from 2.0g to 5.0g [35].

4. CONCLUSION

The proximate and nutritional composition of "Ose Oku" traditional food from Abatete in Anambra State cannot be overemphasized. This indicates their abundance in nutrients, and encourages their usage as complementary diets for children, adults, and people suffering from malnutrition, especially when taken at 100%.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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