



Nutritional, Phytochemical and Sensory Evaluation of “Mberigworagwo” Traditional Food of Uruagunnewi People in Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AB, DM and AE designed the study. Authors AP and OO performed and monitored the experimental work. Author DM 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

Nutritional, phytochemical and sensory evaluation of “Mberigworagwo” traditional food of Uruagunnewi people in Anambra State, Nigeria was investigated using standard methods. Available carbohydrates (79.60± 0.13%), crude fat (12.77±0.64%), crude protein (9.80±0.16%), total free fatty acid (12.81±0.16%) and total vitamins (22.39± 2.04%) were among the nutrients found in the studied food sample. Phytochemicals such as saponins, flavonoids, and tannins were discovered in the food. “Mberigworagwo” had improved sensory evaluation attribute in terms of aroma, taste, texture (mouth feel) and colour when compared to other traditional foods. The overall acceptability of the traditional food could be compared to those of other traditional foods. The presence of nutrients and phytochemicals in “Mberigworagwo” could be indication that the food

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maybe beneficial to the body on consumption. This study has shown the nutritional, phytochemical and sensory evaluation of “Mberigworagwo” traditional food of Uruagunnewi people in Anambra State, Nigeria.

Keywords: Nutrient; “Mberigworagwo”; phytochemicals; sensory evaluation; Uruagunnewi.

1. INTRODUCTION

Food materials are known to possess nutrients that can give energy to the body, produce growth and replace worn out cells when consumed [1-2]. Different type of foods exist, but one common characteristic of food materials is the ability to furnish nutrients when consumed [3-4]. Primary food nutrients offered to the body at different concentrations by different food materials include carbohydrates, proteins and lipids [5], and their importance cannot be over emphasized. Apart from these nutrients, studies have also shown the presence of substances that are not nutrients but work together with nutrients to increase the body immunity. These substances are known as phytochemicals [5-6]. Phytochemicals are non-nutritive chemicals that have protective or disease preventing properties [7-8]. Most foods of plant origin are known to contain phytochemicals and nutrients [9].

“Mberigworagwo”, a traditional food of Uruagunnewi people, is among the foods of plant origin that contains phytochemicals and nutrients. Uruagunnewi is found in Nnewei L.G.A of Anambra State, Eastern Nigeria. The people of Uruagunnewi speak Igbo language as dialect. Apart from being an edible food material, “Mberigworagwo” is closely related to cultural identity and heritage of Uruagunnewi people. It also performs the functions of unification and projection of the cutlery tradition of Uruagunnewi people. Harriet and Oliver [10] noted that rapid dietary changes of indigenous people worldwide is posing threats to use of traditional food and the traditional knowledge required for traditional food maintenance. “Mberigworagwo” traditional food falls into this category. Factors such as change in lifestyle, taste and migration have resulted in declined desire for the traditional food. Also, the knowledge on importance of consuming the traditional food and its method of preparation are poorly transferred. With the renewed interest on traditional foods, there is need to extend the study to accommodate those ones that have not gone into extinction.

The present study is geared towards that, and investigated the nutritional, phytochemical, and sensory evaluation of “Mberigworagwo”

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

“Mberi” (botanically known as *Colocasia esculenta*), palm oil, “Ugba” (fermented sliced *P. macrophylla* seed), crayfish, pepper, onion, maggi spice, smoked fish and vegetable used in this study were purchased from a market within Uruagunnewi, and used for preparation of “Mberigworagwo”.

2.2 Preparation of “Mberigworagwo”

The preparation started with separation of bruised ‘Mberi’ from the good ones, out of two kilogram weight purchased “Mberi”. The selected “Mberi” was peeled and sliced into shape while the damaged ones were discarded. The sliced “Mberi” was washed thoroughly with plenty of water to avoid sand. The washed “Mberi” was then put in a pot containing two liters of water and boiled for 2 hours before it was confirmed fit for consumption. Water left after proper cooking was filtered into an empty clean container. Eight grams of ground pepper, 250 ml of palm oil, 18 g of ground crayfish, 100 g of smoked fish, 8 g of maggi spice, 152.18 g of onion, and two wraps of “Ugba” were added and mixed together with the cooked “Mberi”. Fifteen grams of salt was added to taste while mixing the whole content with some quantity of the filtered off water earlier. Finally, the mixed “Mberi” was garnished with some edible vegetable leaves to form “Mberigworagwo” ready to be served.

2.3 Preparation of Sample for Analysis

The prepared “Mberigworagwo” was oven dried at 70°C for 48 hours, the dried food sample was ground using hand mill device into powder form and stored in an air tight container till needed for analysis.

2.4 Proximate Analysis

Moisture, crude protein, crude fat, ash, fibre and available carbohydrate content of the studied

sample were determined using the methods of AOAC [11]. Atwater factor method as described by Onyeike et al. [12] was used for evaluation of the energy value of the studied sample.

2.5 Determination of Percentage Free Fatty Acid

Ten grams of dried sample was weighed into a 100 ml round-bottomed flask and refluxed with 6 ml of methanolic solution of NaOH (0.5 mol/L). Ten ml of heptane was then added and heated for one more minute. The heater was switched off and saturated solution of NaCl was added and shaken in a circular fashion. The flask was allowed to cool for phase separation. One ml of the upper layer of the separated phase was pipette into gas chromatograph for analysis.

2.6 Determination of Total Vitamin

Five grams of the sample was weighed into an extraction bottle and 20 ml of the extractant (1:1) of methanol and ethanol was added. The mixture was sonicated at 30°C for 1hr. The extract was decanted and 10 ml of hexane was added to the extract. Five ml of trifluoroacetic acid was added to mixture and refluxed for 10 mins. The extract was read on UV-visible spectrophotometer at a wavelength of 280 nm. Aqueous stock solution of vitamins were prepared and used to calibrate the equipment, and the concentration of the total vitamins was calculated from the calibration graph.

2.7 Phytochemical Analysis

Alkaloids, saponins, tannins, glycosides, and flavonoids, of the studied sample were screened using the methods of Chikezie et al. [13] whereas their quantitative determinations were done using the methods of AOAC [11].

2.8 Sensory Evaluation

The sensory evaluation of the studied food sample was conducted in the Department of Chemical Sciences (Biochemistry Unit) laboratory where the food was prepared. Twenty students, seven mothers, six non-teaching members of staff and six lecturers of Rhema University were randomly selected and trained. Each of the panelists was seated in an individual compartment from distraction and was served the freshly prepared "Mberiworagwo". The judges evaluated the sample for flavour, taste, colour, texture and overall acceptability using a nine point hedonic scale, where 9 was the highest score and 1 the lowest. This was done in

line with the method described by Onwuka [9] and Amadi et al. [14].

2.9 Statistical Analysis

Results were presented as mean and standard deviation of triplicate determinations. Proximate composition, phytochemicals, and sensory evaluation values of the present study were compared to those of other traditional foods at 5% significant level using least significant difference (LSD).

3. RESULTS AND DISCUSSION

The results of proximate composition of "Mberiworagwo" traditional food are presented in Table 1. The moisture content of "Mberiworagwo" ($5.50 \pm 0.10\%$) could be compared to that of "Nduagworagwo" ($5.20 \pm 0.02\%$). Its moisture content is significantly ($p < 0.05$) lower than those of "Onunu" ($13.80 \pm 0.48\%$) and "Mgbam" ($12.20 \pm 0.27\%$) (Table 2). Since moisture content of food material is directly related to its susceptibility to microbial attack and subsequently spoilage rate [5,9]. It therefore means that the low moisture content of the studied food gives it advantage of higher shelf life over "Onunu" and "Mgbam" traditional foods of Ikwere people of Rivers State, Nigeria [15]. Ash content could be an insight that a sample contains nutritional important minerals. The ash content of "Mberiworagwo" ($4.50 \pm 0.33\%$) is significantly ($p < 0.05$) higher than that of "Onunu" ($3.80 \pm 0.26\%$), and significantly ($p < 0.05$) lower than that of "Mgbam" ($6.85 \pm 0.14\%$) and "Nduagworagwo" ($4.81 \pm 0.01\%$) traditional food of Akokwa people [16]. The crude protein recorded in the studied food sample ($9.80 \pm 0.16\%$) is the lowest compared to "Nduagworagwo" ($12.12 \pm 0.04\%$), "Onunu" ($13.12 \pm 1.42\%$) and "Mgbam" ($30.63 \pm 2.32\%$) traditional foods (Table 2). It is significantly ($p < 0.05$) lower than those of "Mgbam" and "Onunu"; But could be compared to that of "Nduagworagwo". Fiber containing foods are effective anti-constipation agents via expansion of the intracellular walls of the colon and easing the passage of waste [17]. It has also been reported to aid the reduction of cholesterol levels in blood and as well reduces the risk of cancer [18-19]. Fiber content of "Mberiworagwo" ($2.69 \pm 0.10\%$) traditional food is significantly ($p < 0.05$) lower than that of "Onunu" traditional food; and could be compared to those of "Nduagworagwo" and "Mgbam" traditional foods (Table 2). In recent times, emphasis is

being made on the need for low fiber intake in the nutrition of infants and weaning children to avoid irritation of the gut of mucosa [20]. It therefore means that the observed low fiber content of "Mberiworagwo" may qualify it as a weaning food. "Mberiworagwo" recorded crude fat (12.77±0.64%), which could be compared to that of "Onunu" but significantly ($p<0.05$) lower when compared to those of "Nduduagworagwo" and "Mgbam" traditional foods (Table 2). "Mberiworagwo" could be considered an excellent source of carbohydrate when its available carbohydrate (79.60±0.13%) is compared to those of "Nduduagworagwo" (59.00±0.01%), "Onunu" (57.71±1.03%) and "Mgbam" (10.20±0.48%) traditional foods (Table 2). The Energy value for 'Mberiworagwo' is significantly ($p<0.05$) higher than that of "Nduduagworagwo" but significantly ($p<0.05$) lower than those of "Onunu" and "Mgbam" traditional foods (Table 2).

Table 1. Proximate composition of "Mberiworagwo" traditional food.

Proximate content	"Mberiworagwo"
Moisture content (%)	5.50±0.10
Ash content (%)	4.50±0.33
Crude protein (%)	9.80±0.16
Crude fiber (%)	2.69±0.10
Crude fats (%)	12.77±0.64
Available carbohydrate (%)	79.60± 0.13
Energy value (Kcal/100g)	470.13± 0.90

Values are mean and standard deviation of triplicate determinations

The importance of having both fatty acids and vitamins in foods consumed by humans cannot be overstated. Fatty acids are for promotion and maintenance of health [21]. They are required for

brain and eye development especially in growing fetus during pregnancy [21-24]. Vitamins are known for the numerous functions they perform in the body [25]. Although they are needed in small amounts but their functions are positively overwhelming in the body [25]. "Mberiworagwo" showed the presence of fatty acids and vitamins in the form of total free fatty acid (12.81±0.16%) and total vitamin (22.39±2.04%) respectively (Table 3). Different authors have reported the presence of fatty acids and vitamins in traditional foods of Nigerian origin in a related study [26-30].

Table 4 reveals the presence of important phytochemicals such as alkaloids, flavonoids, tannins, and saponins. According to Duru et al. [31], the presence of phytochemicals in plants and their effects medically and nutritionally have been reported by different authors [32-33]. Alkaloids are known to have analgesic, antispasmodic and bactericidal properties, and are known to exhibit marked physiological activity when administered to animal [34]. Flavonoids are free radical scavengers, which prevent oxidative cell damage. They have strong anti-cancer activity and offer protection against all stages of carcinogenesis [35]. Astringency, healing of wounds and inflamed mucous membrane properties of tannins have been reported [36]. Saponins are known to inhibit sodium ion efflux by blocking its entrance out of the cell. This results in higher sodium ion concentration in the cell, which invariably activates sodium ion-calcium ion anti-porter in cardiac muscle [37]. The calcium ion influx through this anti-porter strengthens the concentrations of heart muscle [37]. The alkaloid, flavonoid, tannin and saponin contents of Mberiworagwo" in the present study are significantly ($p<0.05$) lower than those "Nduduagworagwo", "Ntubiri" and "Ntiti-ikpa" traditional foods (Table 5).

Table 2. Proximate composition of "Mberiworagwo" compared to those of "Nduduagworagwo", "Onunu" and "Mgbam" traditional foods.

Proximate content	"Mberiworagwo"	"Nduduagworagwo"	"Onunu"	"Mgbam"
Moisture content (%)	5.50±0.10 ^a	5.20±0.02 ^a	13.80±0.48 ^c	12.20±0.27 ^b
Ash content (%)	4.50±0.33 ^b	4.81±0.01 ^c	3.80±0.26 ^a	6.85±0.14 ^d
Crude protein (%)	9.80±0.16 ^a	12.12±0.04 ^a	13.12±1.42 ^b	30.63±2.32 ^c
Crude fiber (%)	2.69±0.10 ^a	3.15±0.09 ^a	9.90±1.03 ^b	3.78±0.12 ^a
Crude fat (%)	12.77±0.64 ^a	18.75±0.06 ^b	11.65±0.53 ^a	36.35±2.32 ^c
Carbohydrate (%)	79.60± 0.13 ^c	59.00±0.01 ^a	47.71±1.03 ^b	10.20±0.48 ^a
Energy value (Kcal/100g)	470.13± 0.90 ^b	453.19±0.15 ^a	499.39±48.73 ^c	499.39±48.73 ^c

Values are mean and standard deviation of triplicate determinations. Values with different letters of alphabet along the same row are statistically significant ($p<0.05$).

Note: Data for "Nduduagworagwo" was adopted from Duru et al. [16] while those of "Onunu" and "Mgbam" were adopted from Amadi et al. [15]

Table 3. Total fatty acid and total vitamin of “Mberiworagwo” traditional food

Parameters (%)	“Mberiworagwo”
Total free fatty acid	12.81±0.16
Total vitamin	22.39± 2.04

Values are mean and standard deviation of triplicate determinations

Table 4. Phytochemical contents of “Mberiworagwo” traditional food

Phytochemical content (mg/100g)	“Mberiworagwo”
Alkaloids	1.22±0.11
Flavonoids	2.04±0.09
Tannins	0.22±0.04
Saponins	0.41±0.06

Values are mean and standard deviation of triplicate determinations

**Fig. 1. Picture of prepared “Mberiworagwo” traditional food**

Kerry [39] noted that sensory evaluation is the use of all five senses together. It compares similarities and differences among dishes and

food products [40]. Sensory evaluation is a scientific method that evaluates dishes for improvements, determines acceptable, and unacceptable nature of food samples [40-41]. Table 7 shows the sensory evaluation of “Mberiworagwo” traditional food. Appearance (6.01±0.14), taste (8.00±0.52), aroma (8.00±0.27), texture (7.80±0.31), colour (9.25±1.02), and overall acceptability (7.73±0.14) are among the attributes evaluated in the studied food (Table 6). Aroma, colour, and texture of “Mberiworagwo” are significantly ($p<0.05$) higher than those of “Nduagworagwo”, “Ntubiri” and “Ntiti-ikpa” traditional foods (Table 7). Its taste is significantly ($p<0.05$) higher than those “Ntubiri” and “Ntiti-ikpa”; and compares to that of “Nduagworagwo” traditional food. The appearance of “Mberiworagwo” is the lowest against those of “Nduagworagwo”, “Ntubiri” and “Ntiti-ikpa”; While its overall acceptability is significantly ($p<0.05$) lower than that of “Nduagworagwo” and compares to those of “Ntubiri” and “Ntiti-ikpa” (Table 7).

**Fig. 2. Picture of ground sample of “Mberiworagwo” traditional food****Table 5. Phytochemical contents of “Mberiworagwo” compared to those of “Nduagworagwo”, “Onunu” and “Mgbam” traditional foods**

Phytochemical content (mg/100g)	“Mberiworagwo”	“Nduagworagwo”	“Onunu”	“Mgbam”
Alkaloids	1.22±0.11 ^a	7.65±0.38 ^d	5.06±1.05 ^c	1.82±0.10 ^b
Flavonoids	2.04±0.09 ^a	12.70±0.71 ^b	23.76±0.18 ^c	77.88±2.00 ^d
Tannins	0.22±0.04 ^a	54.16±1.20 ^c	43.20±1.10 ^b	93.60±2.00 ^d
Saponins	0.41±0.06 ^a	24.70±0.12 ^d	12.70±0.20 ^c	10.65±0.120 ^b

Values are mean and standard deviation of triplicate determinations. Values with different letters of alphabet along the same column are statistically significant ($p<0.05$).

Note: Data for “Nduagworagwo” was adopted from Duru et al. [30]; while those of “Onunu” and “Mgbam” were adopted from Amadi et al. [15]

Table 6. Sensory evaluation of “Mberiworagwo” traditional food

Attributes	“Mberiworagwo”
Appearance	6.01±0.14
Taste	8.00±0.52
Aroma	8.00±0.27
Texture(Mouth feel)	7.80±0.31
Colour	9.25±1.02
Overall acceptability	7.40±0.14

Values are mean and standard deviation of 39 panelists

Table 7. Sensory evaluation of “Mberiworagwo” compared to those of “Nduduagworagwo”, “Onunu” and “Mgbam” traditional foods

Attributes	“Mberiworagwo”	“Nduduagworagwo”	“Ntubiri”	“Ntiti-ikpa”
Appearance	6.01±0.14 ^a	7.59±0.25 ^b	7.59±0.60 ^b	7.35±0.67 ^b
Taste	8.00±0.52 ^b	8.01±1.37 ^b	7.20±1.10 ^a	7.50±1.24 ^{ab}
Aroma	8.00±0.27 ^c	6.39 ±0.82 ^a	7.35±0.95 ^b	7.45±0.76 ^{bc}
Texture (Mouth feel)	7.80±0.31 ^b	7.75 ±0.17 ^b	6.75±0.78 ^a	7.50±0.76 ^b
Colour	9.25±1.02 ^c	7.93±1.10 ^b	6.75±1.02 ^a	7.60±0.68 ^b
Overall acceptability	7.73±0.14 ^a	8.96 ±0.49 ^b	7.80±0.62 ^a	7.85±0.74 ^a

Note: Data for “Nduduagworagwo” was adopted from Majesty et al. [27] while those of “Ntubiri” and “Ntiti-ikpa” traditional foods were adopted from Amadi et al. [38]



Fig. 3. Picture of oil extracted from “Mberiworagwo” traditional food

4. CONCLUSION

This study has shown the presence of important nutrients and phytochemicals in “Mberiworagwo” traditional food. The food also exhibited better sensory evaluation attributes when compared to other existing traditional foods. It could therefore be deduced that the food could offer nutrients and as well protects the body when consumed. However studies on “Mberiworagwo” should be extended to accommodate other nutritional constituents such as individual fatty acids, amino acids, minerals, and anti-nutrient ratios; and its inherent effect in biological system on consumption by using rat models.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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