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Determination of Proximate Composition of Selected Street Vended Fried Foods Sold in Wudil Town Kano State, Nigeria

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Abstract The research was conducted to investigate the proximate composition of four selected street vended fried ready-to-eat food types (Yam, Sweet potato, *Akara* and *Masa*) sold freely and openly at various zones in Wudil town along Maiduguri road Kano, Nigeria were analyzed using standard procedures from April to August, 2017. From the total of 200 samples examined, proximate composition of such selected street vended fried food samples were analyzed based on percentage moisture, Ash, Fat, protein and carbohydrate. The results showed that fried yam had a high moisture content, followed by akara, sweet potato and rice masa, there was high percentage of ash content in fried akara, followed by fried yam, fried rice masa, and fried potato with least, high Fat content where found in fried sweet potato followed by fried yam, rice masa and least in fried akara, in terms of protein content it is higher in fried akara followed by fried rice masa, fried yam and fried sweet potato has the minimal protein content. Carbohydrate content is high in fried sweet potato which differs with that of fried rice masa, followed by fried yam and fried akara with least carbohydrate content. Statistically there was Significant difference (p<0.05).

Keywords Proximate analysis, fried food, carbohydrate, ash, moisture content

1. Introduction

Proximate composition is the term usually used in the field of feed/food and means the 6 components of moisture, crude protein, ether extract, crude fiber, crude ash and nitrogen free extracts, which were expressed as the content (%) in the feed, respectively [1]. The measured values of these 6 components in feed are important factors to understand the nature and the properties of the subject feed. Proximate composition and it's substances in respective composition are moisture which involved water and volatile substances, crude protein: Pure protein, amino acids and non-protein compounds. Dry matter or Organic matter it include: Crude fat: (Ether extract) Fat, complex lipid, sterols, fatty acids, fat soluble dyes. Crude fiber: Cellulose, hemicellulose, lignin, Nitrogen free extracts: Soluble carbohydrate, hemicellulose, lignin, pectin, organic acids, tannin and water-soluble dyes Inorganic matter: Crude ash: Pure ash, organic residue, soil [1].

Street foods are defined as ready to eat foods and beverages prepared and or sold by vendors and hawkers especially in street and other similar public places [2]. These are very popular worldwide and provide readily available delicacies at a cheaper rate [3]. Street vended foods are prepared and/or sold by vendors on the street and in other

public places for immediate consumption or for consumption at a later time without further processing or preparation [4]. However, yam tubers constitute an important food crop in tropical countries including South America, the Asia and Africa. West Africa is the world's most prominent region for the production of yams, being only second to cereals in importance [5]. Yams are species of *Dioscorea* and belong to Dioscoreaceae family. Yams can be grown from seeds, but such cultivated varieties tend to be sterile not producing flowers and seeds [5,6]. Recently, on-farm trials of new yam growing technique was started by Nigerian farmers in collaboration with the International Institute of Tropical Agriculture (IITA) which involves propagating yam through vine cuttings on farmers' fields in Niger State of Nigeria [7]. White Guinea yam and water yam are the most important food yams in terms of cultivation and utilization [8]. This variety of yam is used by the Ijebu's of the South-West region of Nigeria to prepare a type of porridge 'Ikokore' which is peculiar to the area and is also used by the Efik/Ibibio people of the South South region of Nigeria to prepare a delicacy known locally as 'ekpang nkukwo'. Yams are generally consumed boiled, with stew or sauce, palm oil and salt or with vegetables. They can also be roasted, fried or baked. For domestic purposes, yam is also useful for feeding livestock especially the peel, for industrial starch, manufacture of gums and adhesives and in textile industry for finishing cloth and printing fabrics with paste made from starch and dye. It is also used in the paper industry during pulping [9,10,11]. Although regarded mainly as a source of carbohydrate, some species of yam are nearly as rich in protein as rice and maize [12]. Yam is of higher nutritional value than some other root and tuber crops such as cassava. Its protein content is about 3 to 5% as compared to 1 to 2% in cassava [13]. *Dioscorearotundata* has been reported to be rich in vitamin C, dietary fibre, vitamin B6, potassium, manganese and low in saturated fat and sodium [14]. Peeling and frying are the processes that best preserve the chief nutrients in yams while grilling and preparation of 'biscuit' from yam flour result in largest losses of nutrient [15]. The fat levels of *D. rotundata* varieties has been reported to ranged from 0.1 to 0.9g/100g while the starch levels range from 72.4 to 80.9g/100g [15].

Akara (fried bean cake) is popular food in Nigeria and other West African Countries [16,17] and form part of diet for most ethnic groups in Nigeria. Nigerians usually eat it as breakfast with *ogi*, or lunch with *gari* or even dinner with *eko. Akara* is a traditional African food made by deep frying cowpea paste that has been whipped and seasoning with salt, pepper, onions and other optional ingredients. The outer crust of *akara* is crisp and the interior is spongy like bread. It is considered to be the most commonly consumed cowpea based food in West Africa [17,18]. *Akara* is made mainly from cowpea and other sources like maize ―Monsa‖. Seeds of cowpea can be cooked in the dried form, sprouted or ground into flour in intermediate product. Being in the class of legumes, they are often referred to as 'poor man's meat'due to their use as primary protein sources [17,19]. The study was aimed to investigate the proximate composition of four selected street vended fried ready-to-eat food types (Yam, Sweet potato, *Akara* and *Masa*) sold freely and openly at various zones in Wudil town along Maiduguri road Kano, Nigeria

2. Materials and Methods

2.1. The Study Area

This research was carried out at Wudil town, along Maiduguri road Kano state, Nigeria. Where travelers stop over to buy foods by the road side (street food), Wudil is situated at 11.81^0N latitude8.85^0E longitude and 375 meters above the sea level [20]. Five different vending sites were selected for the study (from Wudil bus-stop, along Maiduguri road to Kano University of Science and Technology Wudil mini-market).These sites were chosen due to the level of commuters and other people patronizing.

2.2. Sample collection

A total of 200 samples comprising of four different fried food types, i.e. Yam, Sweet potato, Beans ball (*Akara*), and Rice *Masa* collected in batches, were collected using random sampling technique [21]. The five sampling sites were visited on different occasions for sample collection within the period of this study in Wudil town (from bus-terminal along Maiduguri road to KUST, mini- market) in same quantity. Fifty (50) samples of each food type were purchased in sterile brown bag envelopes directly from sellers and immediately brought to laboratory of the

Department of Microbiology, KUST Wudil for analysis. Each fried food samples were purchased in batches (10 pieces per batch for ten weeks i.e. two weeks interval per each sampling).

2.3 Determination of pH

The pH of each sample was determined using pH meter by titrating sample homogenate with 0.1N sodium Hydroxide and phenophthalin indicator to the end point [1].

2.3.1. Determination of Moisture Content

Moisture content was determined by oven drying. A clean flat platinum dish was dried in an oven and cooled using desiccators. The cool dish then weighed as W_1, about 5 grams of the sample were introduced into the dish and weighed accurately as W_2. The dish and its content are placed into an air oven at 105^0C and dried for about 3 hours. After removing the dish from hot air oven it was allowed to cool in the desiccators and weighted as W_3,[1]. Percentage moisture was calculated as follows:

Calculation:

$$\% \text{ moisture } = \frac{(W_2 - W_3)}{(W_2 - W_1)} X\ 100$$

This value is the same as % loss on drying / % matter volatile at 105 °C

2.3.2. Determination of Ash Content

A clean silica dish was dried, cooled using desiccators and weighed as W_1, about 5 grams of each four different street vended fried food samples were weighed accurately and directly into the dish as W_2. Then the dish was transfer using a pair of tongs into a muffle furnace at 500 °C until fully ash. (Grey color ash). The dish containing ash cooled using desiccators and weighed as W_3, [1]. The ash content was calculated as follows:

$$\% \text{ Ash } = \frac{(W_3 - W_1)}{(W_2 - W_1)} X\ 100$$

2.3.3. Determination of Nitrogen and Crude Protein

The micro kjeldhal method was employed. A part of each four different selected food samples was weighted and transfer into a kjeldhal flask. Using a measuring cylinder, about 15ml concentrated sulphuric acid were added to the flask. 1 tablets of kjeldhal catalyst was also added. The flasks in an incline position were heated in a fume cupboard, using heating mantle and Swirling the flask occasionally. When the initial vigorous reaction has died down, the heat was increased and continued digestion until the liquid observed clear and free from black or brown colour. Swirling the flask from time to time and washing down charred particles from the sides of the flask. The flask was then allowed to cool and contents were transferred to 100ml volumetric flask and diluted to the mark with distilled water and then 10ml of the sample aliquot and 15ml of 40% Sodium Hydroxide were transferred into the distillation apparatus consisting of the flask (500ml capacity), stopper carrying a dropping funnel and a splash head adaptor: a vertical condenser to which is attach a straight delivery tube. 10ml of 2% boric acid solution were measured into a 250ml conical flask, and a few drops of screened methyl red indicator was also added to the flask and then placed on the receiver so that the end of the delivery tube below the level of the boric acid. A few pieces of granulated zinc and some antidumping granules were added to the distillation flask. The apparatus was shaken gently to ensure complete mixing of the contents. The flask was boiled vigorously until about 25ml were distilled over. The receiver was removed and titrated with the standard acid(0.025M H_2SO_4) to pink colour end point called TV, [1].

Calculation:

$$\% \text{ Ash } = \frac{0.014 \text{ x TV x } 100 \text{ x } 0.025}{0.2\text{x}10} X\ 100$$

% Crude Protein = N x 6.25

2.3.4. Determination of Fat

About 5 grams of each street vended food samples were accurately weighed as W, using analytical weighing balance. A clean flat bottomed flask weighed as W_1 and the extractor was mounted on it. Then the thimble was hold half way into the extractor and carefully the weighed samples were transferred into the thimble. The weighed dishes were rinsed with the solvent (pet. Ether) and poured into the thimble and the thimble was plugged with cotton wool, and dropped fully into the extractor. The solvent were poured to reach about two thirds of the volume of the flask and continuously extracted for five hours. When extraction is complete, the solvent were completely evaporated off by a water bath. The flask containing residues were cooled and weighed as W_2,[1]. The percentage fat content was calculated using the formula below; Fat = (W_2-W_1) **x** 100/W

2.3.5. Determination of Available Carbohydrate

This was determined by subtracting the following parameters from one hundred percent (100). Such illustration is as follows:

Available Carbohydrate = 100- (Moisture + Ash + Fat + Protein).

2.4. Statistical Analysis

Data were analyzed using two way analysis of variance (ANOVA) using statistical software openstat version 08.12.14. Probability level was set at $p<0.05$.

3. Result and Discussion

A total of 200 street vended fried food samples were collected in different batches (i.e 10 samples for each batch), 40 samples per sampling site of 5 different sites and total of 50 samples for each food type sold in Wudil town were examined (yam, sweet potato, *akara* and rice *masa*). The results showed the proximate compositions of selected street vended fried foods (yam, sweet potato, Akara and rice masa), in which percentage moisture, percentage Ash, percentage Fat, percentage protein and percentage Carbohydrate were presented based on sampling sites, however, high moisture content were found in fried yam, followed by fried akara, fried potato and lastly fried rice *masa* which are similar with work of Watts, [22] and Sinful et al. [23]. There was high percentage of ash content in fried akara, followed by fried yam, fried rice masa, and fried potato with least and is in agreement with reports of Osundahunsi, [24], Dixit *at el*. [25] and Abioye *at el*. [26]. High Fat content where found in fried potato followed by fried yam, rice masa and least in fried akarais in contrast with Padmaja, [27], this may happen as a result of the differences in frying process and changes in the environmental condition but in agreement with research of Dixit *et al*. [25] and Abioye *et al*. [26]. Moreover, in terms of protein content it is higher in fried akara followed by fried rice masa, fried yam and fried potato has the minimal protein content these are in line with Osundahunsi et al. [24], Padmaja, [27], Dixit*et al*. [25] and Abioye *et al*. [26]. In other hand carbohydrate content is high in fried potato which slightly in contrast with that of fried rice *masa*, followed by fried yam and fried *Akara* with least carbohydrate content which is in agreement with Osundahunsi et al. [24], Padmaja, [27], Dixit *et al*.[25] and Abioye *et al*.[26]. Statistically the mean±standard error with the same letter within column are not significantly different from each other (Least significant difference $p>0.05$), using ANOVA.

Table 1: Mean distribution of moisture content across the food type

	Food type	Site 1	Site 2	Site 3	Site 4	Site 5
1	Fried yam	57.054 ± 0.028^{a}	56.646 ± 0.533^{a}	56.070 ± 0.151^{b}	57.054 ± 0.028^{a}	56.646 ± 0.533^{a}
2	Fried potato	38.851 ± 0.156^{j}	40.947 ± 1.841^{g}	42.618 ± 0.008^{f}	42.629 ± 0.030^{f}	42.618 ± 0.008^{f}
3	Akara	49.505 ± 0.000^{c}	48.723 ± 0.683^{d}	48.142 ± 0.009^{e}	49.400 ± 0.334^{c}	48.148 ± 0.069^{e}
4	Rice masa	41.303 ± 0.107^{h}	40.597 ± 0.696^{g}	39.922 ± 0.007^{i}	40.024 ± 0.113^{i}	40.025 ± 0.09^{i}
	LSD	0.504				

Key: Values having same superscript across the rows and column are not considered significantly different from each other (Least Significant Difference $p<0.05$)

Table 2: Mean distribution of ash content across the food type

S/N	Food type	Site 1	Site 2	Site 3	Site 4	Site 5
1	Fried yam	1.857±0.084^{c}	1.698±0.210^{d}	1.450± 1.450^{f}	1.857 ±0.084^{c}	1.698± 0.210^{d}
2	Fried potato	1.857±0.084^{c}	1.698±0.210^{d}	1.450± 1.450^{f}	1.857 ±0.084^{c}	1.698± 0.210^{d}
3	Akara	2.274±0.135^{b}	2.306±0.143^{b}	2.423±0.022^{a}	2.274±0.13^{bb}	1.610±0.123^{de}
4	Rice masa	1.610±0.123^{de}	1.610±0.143^{de}	1.534±0.077^{ef}	1.707± 0.067^{d}	1.610 ±0.123^{de}
	LSD	0.13				

Key: Values having same superscript across the rows and column are not considered significantly different from each other (Least Significant Difference p<0.05)

Table 3: Mean distribution of fat content across the food type

S/No	Food type	Site 1	Site 2	Site 3	Site 4	Site 5
1	Fried yam	17.835±0.024^{ab}	17.854±0.087^{ab}	17.863± 0.013^{ab}	17.835±0.024^{ab}	17.854± 0.087^{ab}
2	Fried potato	18.108±0.548^{a}	18.215±0.094^{a}	18.158±0.004^{a}	17.108±3.710^{b}	18.215±0.094^{a}
3	Akara	17.093±0.473^{b}	17.490±0.668^{ab}	17.779±0.010^{ab}	17.018±0.485^{b}	17.611±0.597^{ab}
4	Rice masa	17.063± 0.008^{b}	17.448± 0.427^{ab}	17.902± 0.017^{ab}	17.063±0.008^{b}	17.448±0.427^{ab}
	LSD	0.89				

Key: Values having same superscript across the rows and column are not considered significantly different from each other (Least Significant Difference p<0.05)

Table 4: Mean distribution of protein content across the food type

S/N	Food type	Site 1	Site 2	Site 3	Site 4	Site 5
1	Fried yam	6.444±0.164^{c}	6.759± 0.280^{c}	6.830± 0.170^{c}	6.444±0.164^{c}	6.759±0.280^{c}
2	Fried potato	4.336±0.139^{d}	4.626±0.340^{d}	4.922 ±NAN^{dc}	4.336±0.139^{d}	4.626±0.340^{d}
3	Akara	16.619±1.338^{a}	17.646±0.349^{a}	17.969± 0.000^{a}	16.619± 1.338^{a}	17.646± 0.349^{a}
4	Rice masa	7.948±0.172^{bc}	8.114±0.121^{bc}	8.203±NAN^{bc}	7.948±0.172^{bc}	8.114±0.121^{bc}
	LSD	1.962				

Key: Values having same superscript across the rows and column are considered not significantly different from each other (Least Significant Difference p<0.05)

Table 5: Mean distribution of Carbohydrate content across the food type

S/N	Food type	Site 1	Site 2	Site 3	Site 4	Site 5
1	Fried yam	16.724± 0.164^{d}	17.603± 0.463^{d}	17.687±0.031^{d}	16.724±0.164^{d}	17.603±0.463^{d}
2	Fried potato	32.614±0.086^{b}	32.205±0.253^{c}	33.000±0.011^{a}	32.614± 0.086^{b}	32.731±0.212^{b}
3	Akara	13.542±0.162^{e}	13.538±0.230^{e}	13.713±0.018^{e}	13.542±0.162^{e}	13.538±0.230^{e}
4	Rice masa	32.180±0.120^{c}	32.205± 0.212^{c}	32.243±0.030^{c}	32.180±0.120^{c}	32.205±0.212^{c}
		LSD	0.211			

Key: Values having same superscript across the rows and column are not considered significantly different from each other (Least Significant Difference p<0.05)

Table 4.6: Mean distribution of proximate composition across the food type

S/N.	Food Type	S/Site	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)
A	Fried Yam	1	57.054±0.028^{a}	1.857±0.084^{c}	17.835±0.024^{ab}	6.444±0.164^{c}	16.724± 0.164^{d}
		2	56.646±0.533^{a}	1.698±0.210^{d}	17.854±0.087^{ab}	6.759± 0.280^{c}	17.603± 0.463^{d}
		3	56.070±0.151^{b}	1.450± 1.450^{f}	17.863± 0.013^{ab}	6.830± 0.170^{c}	17.687±0.031^{d}
		4	57.054±0.028^{a}	1.857 ±0.084^{c}	17.835±0.024^{ab}	6.444±0.164^{c}	16.724±0.164^{d}
		5	56.646±0.533^{a}	1.698± 0.210$_{d}$	17.854± 0.087^{ab}	6.759±0.280^{c}	17.603±0.463^{d}
B	Fried Potato	1	38.851± 0.156^{j}	1.422± 0.224^{f}	18.108±0.548^{a}	4.336±0.139^{d}	32.614±0.086^{b}
		2	40.947±1.841^{g}	1.378± 0.124^{g}	18.215±0.094^{a}	4.626±0.340^{d}	32.205±0.253^{c}
		3	42.618±0.008^{f}	1.300±0.002^{g}	18.158±0.004^{a}	4.922 ±NAN^{dc}	33.000±0.011^{a}
		4	42.629±0.030^{f}	1.413±0.152$^{f\ g}$	17.108±3.710^{b}	4.336±0.139^{d}	32.614± 0.086^{b}
		5	42.618±0.008^{f}	1.302± 0.006^{g}	18.215±0.094^{a}	4.626±0.340^{d}	32.731±0.212^{b}
C	Akara	1	49.505±0.000^{c}	2.274±0.135^{b}	17.093±0.473^{b}	16.619±1.338^{a}	13.542±0.162^{e}
		2	48.723±0.683^{d}	2.306±0.143^{b}	17.490±0.668^{ab}	17.646±0.349^{a}	13.538±0.230^{e}
		3	48.142±0.009^{e}	2.423±0.022^{a}	17.779±0.010^{ab}	17.969± 0.000^{a}	13.713±0.018^{e}

		4	49.400±0.334^{c}	2.274±0.13^{bb}	17.018±0.485^{b}	16.619± 1.338^{a}	13.542±0.162^{e}
		5	48.148±0.069^{e}	1.610±0.123^{de}	17.611±0.597^{ab}	17.646± 0.349^{a}	13.538±0.230^{e}
D	Rice Masa	1	41.303±0.107^{h}	1.707±0.067^{d}	17.063± 0.008^{b}	7.948±0.172^{bc}	32.180±0.120^{c}
		2	40.597±0.696^{g}	1.610±0.143^{de}	17.448± 0.427^{ab}	8.114±0.121^{bc}	32.205± 0.212^{c}
		3	39.922±0.007^{i}	1.534±0.077^{ef}	17.902± 0.017^{ab}	8.203±NAN^{bc}	32.243±0.030^{c}
		4	40.024±0.113^{i}	1.707± 0.067^{d}	17.063±0.008^{b}	7.948±0.172^{bc}	32.180±0.120^{c}
		5	40.025±0.09^{i}	1.610 ±0.123^{de}	17.448±0.427^{ab}	8.114±0.121^{bc}	32.205±0.212^{c}
LSD			0.504	0.13	0.89	1.962	0.211

Key: Values having same superscript across the rows and column are not considered significantly different from each other (Least Significant Difference $p<0.05$)

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