CARD International Journal of Medical Science and Applied Biosciences (IJMSAB)
ISSN: 2536-7331 (Print): 2536-734x (Online)
Volume 2, Number 2, June 2017
http://www.casirmediapublishing.com

Proximate composition and Microbial Quality of Street-Vended Roasted Yam and Plantain from Nekede Communities in Imo State

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ABSTRACT

Proximate composition and microbial qualities of street-vended roasted yam and plantain from three different sources in *Nekede* (*Umuerim, Umunkoto* and *Umuokomoche*) were evaluated. The proximate analysis of the roasted yam/plantain samples were Moisture content 39.00-43.08/48.58-49.033%, Dry matter 56.92-60.97/50.687-51.417%, Ash 1.82-2.147/ 1.727-2.0467%, Crude Protein 3.63-3.887/2.947-3.1467%, Ether extract 8.53-10.67/6.91-9.7467%, Crude fibre 2.173-2.423/1.803-1.91% and Carbohydrate 38.6-44.14/34.443-37.233% respectively. The outcomes of microbiological assessment indicated a range of2.50×10^3-2.89×10^4/ 7.5×10^3-3.64×10^4cfu/g as heterotrophic counts for roasted yam and plantain samples respectively. Fungal counts range between 2.21×10^2-2.76×10^5/ 1.06×10^5-2.69×10^5cfu/g respectively for the roasted yam and plantain samples. All determinations were in three replicates. The values obtained in the microbial assessment suggest concerns with regular consumption of such food items stemming from handling/preparatory practices of the vendors.

Keywords: Roasted yam, roasted plantain, proximate analysis, pathogenic micro-organisms, food safety

INTRODUCTION

Roasting is a cooking method that uses dry heat where hot air envelopes the food, cooking it evenly on all sides with temperatures of at least 150°C from an open flame, oven, or any other heat source (Wikipedia, 2017).Yam is a carbohydrate food that is commonly consumed in Nigeria. It is consumed in various forms such as boiled, pasted, fried or roasted. The commonest form of roasting yam in Nigeria is by open flame roasting (Olayaki *et al.*, 2007).

Plantain (*Musaspp.*) is a major food crop in the humid and sub-humid parts of Africa and a valuable source of energy which provides more than 10% and 25% of the daily calories and carbohydrates respectively, for more than 70 million people in sub-Saharan Africa. It is highly perishable and is commonly rapidly processed for immediate human consumption via boiling or steaming, baking or roasting and frying (Rose-Monde *et al.*, 2013).

Njaya (2014) defined street food as a ready-to-eat food or drink sold on a street or other public places, such as a market or fair by a hawker or vendor often from a portable stall. FAO (2016) stated that the main reason driving consumers to patronize street food is convenience based on the availability and accessibility of street-vendor foods over space and time. Oranusi and Braide (2012) concurred that these foods are easily available, affordable, provide diverse/variable food source, employment and with a potential for improving food security and nutritional status and general social security; however, they mentioned that street foods are veritable sources of food-borne pathogens. It is against these backdrops that this study seeks to determine the proximate and microbial qualities of street-vended roasted yam and plantain from three different places in *Nekede* (*Umuerim, Umuokomoche* and *Umunkoto*) considering the high-density of students in the area, so as to make suggestions on the premises of food safety with regards to handling, preparatory methods and sanitation to enhance the well-being of the consuming populace.

MATERIALS AND METHODS

Sources of Samples

Three locations in *Nekede* community around Federal Polytechnic Nekede, Owerri(*Umuerim, Umuokomoche* and *Umunkoto*), where people frequently consume roasted yam and plantain, were selected as the sources of sample collection. Worthy of note is that these spots record massive patronage on a daily basis, hence necessitating their choice by the research.

Sample Collection

Three samples of each food item were collected from each location for analysis in a two-week period. The samples were randomly chosen and placed in sterile *Ziploc* polythene bags which had been properly pre-labelled and expressly conveyed to the laboratory within an hour of collection.

Analyses of Sample

Proximate Analysis

The proximate compositions of all the samples were performed in three replicates according to the standard methods described by AOAC (2000).

Microbiological Assessment

Heterotrophic Count

The method of Oranusi and Braide (2012) was used. 10mLof food was blended in a sterile blender (Kenwood brand) and homogenized in 90mL sterile distilled water. Further ten-fold serial dilutions of the resultant homogenates were made to obtain 10^{-2}, 10^{-3}, 10^{-4} and 10^{-5} respectively. From these dilutions, aliquots of 0.2mL were inoculated in replicate plates of different media using the spread plate technique.

Enumeration of Fungi

The method adopted by Adeyeye andOmoniyi (2015) was applied. Appropriate dilutions of Saboraud dextrose agar plates (Oxoid) were poured over 1ml of the homogenate and dilutions (of both roasted yam and plantain samples separately). The plates were subsequently incubated at 25°C for 3 days and colonies were counted.

Statistical Analysis

Analysis of Variance was used to ascertain the significant difference between means. Least significant difference (LSD) test was used to ascertain if there was any significant difference between means. Significance was accepted at $P<0.05$.

RESULTS AND DISCUSSION

Proximate Composition

Table 1 shows the result of the proximate composition of roasted yam samples obtained from the different locations in Nekede. The samples obtained from *Umuerim* (UER) generally had the highest values of Moisture content (Mean, 43.08%), and Crude fibre (Average, 2.423%) which may have arisen from processing method and varietal differences respectively. The mean values for Ash, Crude protein and carbohydrate (2.147%, 3.887% and 44.14%) were highest in the samples obtained from *Umunkoto,* and may have been so, due to intra-specie variations (as all samples were of the white yam cultivar) or heat treatment in the course of roasting. Only that obtained from *Umuokomoche* had the highest ether extract value of 10.67% average, probably a result of the extraneous addition of oil by the seller. Table 2 shows the proximate composition of roasted plantain gotten from three separate sites in *Nekede*. The range of values for Ash (1.727-2.0467%) and crude protein (2.947-3.1467%) were close to those obtained by Adetunde *et al.,* (2012) (1.57% and 5.25% respectively), though the samples from *Umunkoto* and *Umuerim* had the highest values for the parameters respectively. All the samples were generally high in carbohydrates (as is expected), since plantain is an energy-dense food material. Generally, there were no significant differences amongst the samples on the bases of Moisture content and dry matter (overall).

Microbial Quality

Tables 3 and 4 display the mean values of heterotrophic and fungal counts obtained for the roasted yam and roasted plantain samples respectively. Overall, the heterotrophic counts obtained for roasted plantain were highest for the samples obtained from *Umuerim* and *Umuokomoche* (3.64×10^4 and 3.55×10^4cfu/g respectively), indicating the poor level of hygiene associated with the open display of the food items and suggesting inadequacy in handling conditions by the handlers.

The values obtained for roasted yam correlated with those obtained by Afehomo *et al.,* (2015) for fungal count ($2.4 \times 10^5 - 2.8 \times 10^5$cfu/g); nonetheless, they indicate possible contamination. The samples from *Umunkoto* and *Umuokomoche* were the culprits in this regard, having values of 2.76×10^5 and 2.6×10^5cfu/g respectively.

Table 1: Proximate Composition Of Roasted Yam

Sample	MC (%)	DM (%)	Ash (%)	CP (%)	EE (%)	CF (%)	CHO (%)
UER	43.08±0.624^{a}	56.92±0.6238^{c}	1.82±0.00^{c}	3.80±0.0346^{a}	10.267±0.01155^{b}	2.423±0.025^{a}	38.6±0.669^{c}
UNK	39.00±0.7825^{c}	60.97±0.764^{a}	2.147±0.023^{a}	3.887±0.0757^{a}	8.533±00.144^{c}	2.293±0.0115^{b}	44.14±0.771^{a}
UOK	41.097±0.06863^{b}	58.90±0.686^{b}	2.093±0.058^{b}	3.63±0.0173^{b}	10.67±0.036^{a}	2.173±0.0231^{c}	40.34±0.658^{b}
LSD	1.590	1.534	0.018	0.106	0.146	0.045	1.595

Means ± SD with different superscripts within the same column are significantly different at $p<0.05$

Key:

UER =Umuerim, UOK = Umuokomoche, UNK = Umunkoto, MC = Moisture Content, DM = Dry Matter, CP=Crude Protein, EE = Ether Extract, CF = Crude Fibre, CHO = Carbohydrate

Table 2: Proximate Composition Of Roasted Plantain

Sample	MC (%)	DM (%)	Ash (%)	CP (%)	EE (%)	CF (%)	CHO (%)
UER	49.033±0.673^{a}	50.967±0.673^{a}	1.727±0.0115^{c}	3.1467±0.1155	9.7467±0.0461^{a}	1.91±0.01732^{a}	34.443±0.6671^{b}
UNK	48.98±0.711^{a}	50.687±0.631^{a}	2.0467±0.0115^{a}	2.98±0.0529^{b}	6.913±0.0461^{c}	1.847±0.0057^{b}	37.233±1.207979^{a}
UOK	48.58±0.161^{a}	51.427±0.161^{a}	1.8367±0.0153^{b}	2.947±0.0896^{b}	8.553±0.1966^{b}	1.803±0.0153^{c}	36.2767±0.329^{ab}
LSD	1.174	1.114	0.028	0.1173	0.2198	0.029	1.675

Means ± SD with different superscripts within the same column are significantly different at $p<0.05$

Key:

UER =Umuerim, UOK = Umuokomoche , UNK = Umunkoto, MC = Moisture Content, DM = Dry Matter
CP = Crude Protein EE = Ether Extract CF = Crude Fibre CHO – Carbohydrate

Table 3: Microbial Quality of Roasted Yam

Sample	Heterotrophic Count (cfu/g)	Fungal Count (cfu/g)
UER	$2.14 \times 10^4 \pm 0.02^b$	$2.21 \times 10^2 \pm 0.012^c$
UNK	$2.50 \times 10^3 \pm 0.2^c$	$2.76 \times 10^5 \pm 0.091^a$
UOK	$2.89 \times 10^4 \pm 0.036^a$	$2.6 \times 10^5 \pm 0.04^b$
LSD	0.058	0.1046

Means $\pm$ SD with dissimilar superscripts within the same column are significantly different at $p<0.05$

Key:

UER =Umuerim, UNK = Umunkoto, UOK = Umuokomoche

Table 4: Microbial Quality of Roasted Plantain

Sample	Heterotrophic Count (cfu/g)	Fungal Count (cfu/g)
UER	$3.64 \times 10^4 \pm 0.139^a$	$2.69 \times 10^5 \pm 0.01^a$
UNK	$7.5 \times 10^3 \pm 0.30^b$	$1.06 \times 10^5 \pm 0.02^c$
UOK	$3.55 \times 10^4 \pm 0.087^a$	$1.253 \times 10^5 \pm 0.012^b$
LSD	0.3992	0.0308

Means $\pm$ SD with unidentical superscripts within the same column are significantly different at $p<0.05$

Key:

UER =Umuerim, UNK = Umunkoto, UOK = Umuokomoche

CONCLUSION

The assessment of the proximate composition of street-vended roasted plantain and roasted yam shows that, in general terms, both differed significantly in most parameters. Overall, roasted yam was found to possess more dry matter than the roasted plantain. The two food items are, however, generally good sources of energy, but would require complementation with good dietary sources of protein and vitamins during consumption.

Furthermore, this study has revealed high microbial loads in the samples obtained randomly from the three sites in *Nekede*. This may probably be due to the handling practices by the vendors and open display of the commodities. Microbiological guidelines for cooked food stipulates that the plate count must be $<1.0 \times 10^4$cfu/g for plant products. Thus, these items as they are currently sold are microbiologically unfit for human consumption.

Conclusively, there is need for enhanced frequency of enlightenment campaigns and the increased enforcement drives by extension services agencies and local health inspectors, as well as probable unionization of these vendors so as to check unwholesome practices to ensure the safety of items (roasted yam and plantain, in this case) on sale to the unsuspecting consuming populace – a bulk of which are students.

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