



MINERAL AND ANTI-NUTRIENT CONTENT OF “AKARA-AKPU” FORTIFIED WITH WATER MELON SEED FLOUR

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ABSTRACT

“Akara-akpu” is a deep fat fried ball, it’s origin is from the Eastern region of Nigeria. The Cassava was peeled, washed grated and fried in palm oil to produce “akara - akpu” which was formulated in ratios of 95:5, 90:10, 85:15 Cassava – watermelon seed blends while 100% cassava served as the control. The mineral and anti-nutrient contents were analyzed using standard laboratory procedures, Result for mineral

INTRODUCTION

Cassava is essential to food security as is a subsistence crop, its roots and leave contain vitamin c and some minerals but are deficient in protein and amino acid (UNDP 2010). Although cassava is cultivated by about 63% of the population, cyanogenic, glycoside and other anti nutritional factors threaten food safety (Bandana, 2013). It is a staple food in many poor and developing countries but its major handicap is the presence of cyanogenic glycoside (Nweke and Enett 2014).

As a food ingredient, cassava roots is somewhat similar to potatoes indeed and can be prepared in similar ways. It can be boiled, mashed, fried or baked (Ugwu 2016). Watermelon seed, which is grown extensively as a rain feed crop, mainly for its, water content and not as a desert fruit, as it is usually in other parts of the world. It is envisaged that a study of its nutritive value and limitations may enhance its used in effectively meeting part of the protein needs (Max, *et al.*, 2010).



compositions showed that calcium, magnesium, phosphorous, potassium and sodium values increased significantly ($p \leq 0.05$), while the anti-nutrient composition showed that nitrate, phytate and cyanide increased significantly ($p \leq 0.05$), with addition of watermelon seed flour. Nutritious and organoleptically acceptable “akara - akpu” was successfully produced from Cassava-watermelon Seed blends. This research work recommended Sample A because it was the best product in term of nutritional quality and acceptability.

It is used effectively in meeting part of the protein seed needs (Max, et al., 2016). Watermelon seed is reported to be high in protein and has excellent functional properties and also has been found to be effective in baking (El Adewy 2017). It is usually consumed in form of flesh and seed discarded yet it has high protein content that can alleviate rampant malnutrition in the area. (Ubbor and Akobundu 2019).

“Akara akpu” is a deep fat fried ball prepared from cassava paste flavored with pepper and salt. It is mainly consumed by the inhabitants of eastern region of Nigeria. Research studies have been carried out to enhance the sensory and chemical composition of of “Akara akpu” as well as their storage stability when packaged in a polyethylene bag under ambient condition (Chima, et al., 2008). Also the effect of frying temperature and duration of frying “akara akpu” on the degree of starch gelatinization, consumer acceptability and microbiological quality of “akara akpu” was studied (Chima, et al., 2008) this study however, is based on the mineral and anti-nutritional content of akara-akpu fortified with watermelon seed flour.

STATEMENT OF THE PROBLEM

Malnutrition is a very serious global health problem among the rural populace especially the pregnant women and children in developing countries. “Akara-akpu” is lacking in protein and micronutrient, Global food nutrient deficiency has been a pressing challenge towards achieving steady wellness. “Akara akpu” is a cassava product that is consumed by both adult and children among the Igbo people of Nigeria and people from other developing countries. Its nutritional improvement is therefore important.



JUSTIFICATION

Watermelon seeds are considered to be highly nutritious as they are also rich in amino acids, proteins and vitamin B complex (Nzembei et al, 2018), adding watermelon seed flour to cassava in the production of “Akara Akpu” is likely to improve the nutritional quality of the product.

AIM

The aim of this study is to investigate the mineral and anti-nutritional content of “akara-akpu” enriched with watermelon seed flour.

OBJECTIVES

1. To produce enriched “akar-akpu”
2. To determine the mineral content of enriched “akara-akpu”
3. To determine the anti-nutrient content of enriched “Akara akpu”.

MATERIALS AND METHODS

Materials to Used

Sweet cassava, watermelon seed, water, onion, pepper, salt, palm oil for deep frying.

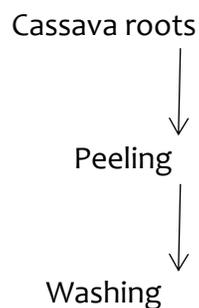
Sample Collection

Freshly harvested mature cassava root, onion, pepper, salt and palm oil were purchased from old market in Bida Niger State Nigeria. Watermelons were purchased from new market Bida Niger State Nigeria.

Sample Production/Preparation of Flow chart

Production of Cassava Mash

Cassava root were peeled, washed and grated into mash.



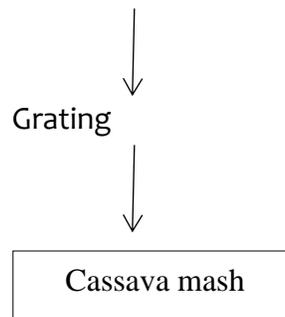
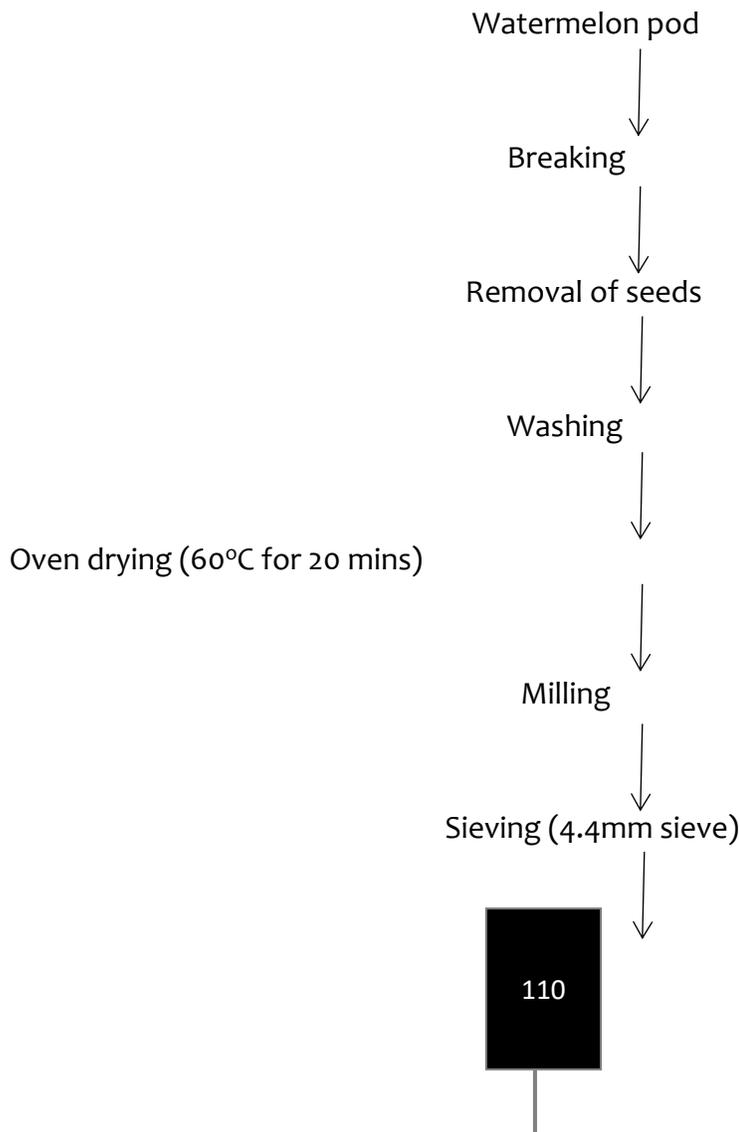


Fig 1: Flow Chat for Production of Cassava Mash

Source: Eze, *et al.*, (2005).

Production of watermelon seed flour

The watermelon pods were broken and the seeds were extracted, washed, oven dried at 60°C for 20 minutes. After which the dried seed were milled and sieved using 0.45mm mesh sieve.





Watermelon seed flour

Fig 2. Flow chart for production of watermelon seed flour
Source: Ubbor and Akobundu (2013)

Preparation of “Akara-akpu”

Flour blends and ingredients were mixed then shaped into small balls ready for frying in hot palm oil for about five to ten minutes.

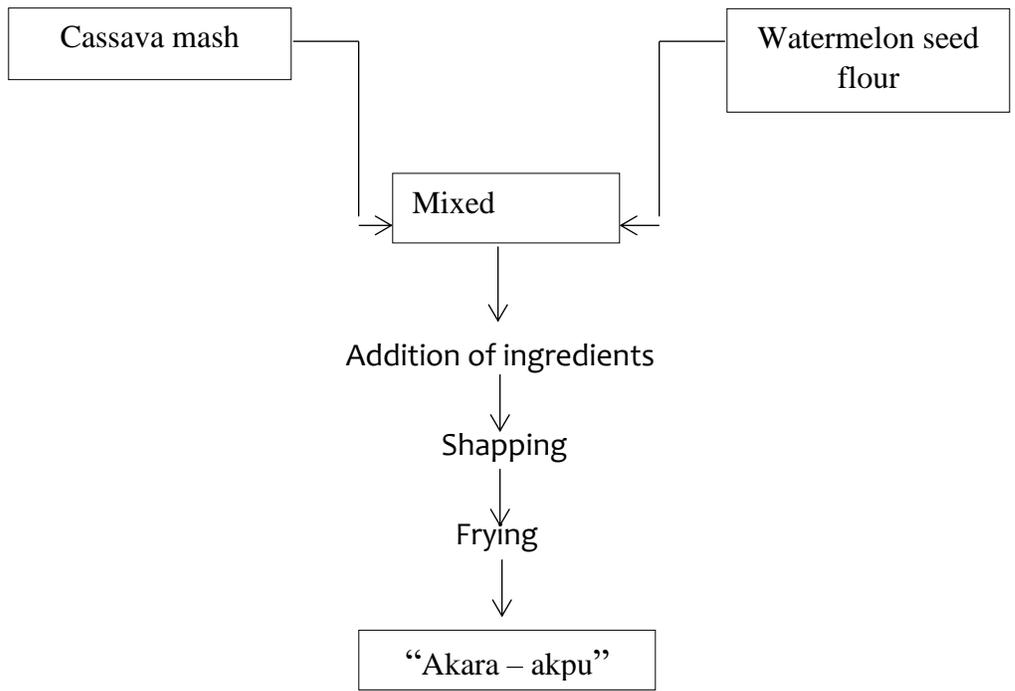


Fig 3: Flow chart for preparation of “Akara-akpu”
Sources: Eze *et al* (2005).



Table 1: formulation of blends

Sample	cassava mash (g)	watermelon seed flour (g)
A	100	-
B	95	5
C	90	10
D	85	15

Table 2: Ingredient proportion for production of “Akara Akpu”

Ingredients	Proportion
Cassava Melon-seed flour	100.0g
Pepper	5.0g
Onion	5.0g
Salt	2.5g
Oil	10.0ml

Sources: Chinma et al., (2008)

Statistical analysis

Data collected was subjected to Analysis of Variance (ANOVA) and means separated using Duncan Multiple Range Test. (DMRT).

RESULTS

Table 3: Mineral Content of “akara – akpu” fortified with Watermelon Seed Flour (mg/100g)

Samples	Sodium (Na)	Potassium (k)	Magnesium (Mg)	Phosphorus (S)	Calcium (Ca)
A	0.8190 ^b ±0.001	0.4350 ^d ±0.005	0.1745 ^c ±0.002	0.1090 ^c ±0.001	0.4350 ^b ±0.372
B	0.9100 ^b ±0.015	0.5500 ^c ±0.20	0.2070 ^b ±0.029	0.1220 ^b ±0.000	0.5500 ^a ±0.02
C	1.0580 ^{ab} ±0.028	0.6480 ^b ±0.003	0.2375 ^b ±0.008	0.1280 ^{ab} ±0.001	0.6480 ^b ±0.003
D	1.3560 ^a ±0.194	0.7475 ^a ±0.01	0.4155 ^a ±0.828	0.1365 ^a ±0.005	0.7575 ^b ±0.017

Means with the same superscripts are not significantly different at P>0.05 level.

Key

A = 100% of Cassava

B = 95% of Cassava and 5% of Watermelon Seed Flour

C = 90% of Cassava and 10% of Watermelon Seed Flour



D = 85% of Cassava and 15% of Watermelon Seed Flour

Table 4 Anti-nutrient content of “AkaraAkpu” fortified with watermelon seed flour

Samples	Phytates	Cyanide	(mg/100g)
A	0.6535 ^{b±} 0.009	0.846 ^{c±} 0.387	
B	0.7440 ^{c±} 0.032	0.8723 ^{b±} 0.235	
C	0.8300 ^{a±} 0.004	0.904 ^{b±} 0.393	
D	0.8650 ^{a±} 0.16	0.910 ^{b±} 0.930	

Means with the sample superscripts are not significant different at P >0.05 level

Key

A = 100% of cassava

B = 95% of cassava and 5% of watermelon seed flour

C = 90% of cassava and 10% of watermelon seed flour

D = 85% of cassava and 15% of watermelon seed flour

DISCUSSION

Mineral Analysis

Calcium is a constituent of bones and helps the body to function correctly, blood clotting, regulating heartbeat, nerve impulses transmission and fluid balance within cells. (Aliyu, Musa and Oshaniyi 2012). Current guidelines for adults recommend consuming 1,000 mg a day, and 1,200 mg for women aged 51 and over. In this study calcium values increased from 0.5500-0.7575mg/100g among formulated blends(samples B to D) with the addition of watermelon seed flour among formulated blends, this finding is similar with Oseni and Okoye,(2013).

Magnesium is beneficial for regulation of blood pressure and helps to prevent sudden heart attack, cardiac arrest and stroke, it is also an important component of bone and contributes to its structure development and supporting the immune system. (Guthrie, Asamel and sneff2015). Adult females need 320mg of magnesium each day, and adult males need 420 mg(Connie and , Kathleen 2013) . The magnesium content among formulated blends(samples Bto D) increased from 0.2070-1.0915mg/100g with substitution of water melon seed flour which is similar with the findings of Hegarty, (2012).



Sodium regulates fluid balance in the body and helps in the proper functioning of muscles and nerves, it also helps to maintain the balance of physical fluid system. Current guidelines recommend consuming no more than 2,300 mg of sodium a day, or around one teaspoon (Payne and Mac 2012). The finding of the study is however similar to the report by (Rude, 2014)

Potassium is an essential mineral and a major electrolyte found in the human body, it plays an important role in electrolyte regulation, nerve function, muscle control and blood pressure (Mahan, Escott- Stumps and Raymond 2012). The *Dietary Guidelines for Americans* recommend that adults consume 4,700 milligrams (mg) of potassium each day. The result is similar to the findings of institute of medicine, food and Nutrition (2010).

Phosphorus is essential for all forms of life and needed for highly important biological functions and components such as the RNA, DNA, cell membranes and bones. (Edeoga and Okwu 2005). The finding is similar to (Etong and Ayeni 2013). Phosphorus plays an important role in how the body uses carbohydrates and fats, it is also needed for the body to produce protein (Kayode, *et al.*, 2011). In this study the values of minerals increased with the addition of watermelon seed flour and values obtained were also similar with Recommended Daily Value (2014).

Anti –Nutrient

Phytate is Found in plant seed and serve as the main Storage form of phosphorus in the seed, phytic acid impairs absorption of iron and Zinc (Roubhia and Fehdic 2010). The phytate content in this study increased with the addition of watermelon seeds flour. The Values obtained ranged from (0.635-0.865mg) however this value falls within the acceptable limit of phytate(100-400mg/Kg) as approved by FAO (2018). The phytate content is the study in similar to the finding of Damardjati (2014)

Cyanide is used in a number of industries and it is found at low levels in air from car exhaust cyanide is extremely toxic in humans. Chronic (long term) in halation and exposure of humans to cyanide affects the Central Nervous System (C N S) other effects in humans include cardiovascular and respiratory effects are enlarged thyroid gland and causes irritation to the eyes and skin. (Scientific Committee on Food 2013). The cyanide content in this study increased with the addition of watermelon seed flour however, the value obtained from this study is within the acceptable limit (50mg/Kg) of cyanide as reported by FAO\WHO (2014).

CONCLUSION

- Organoleptically acceptable and nutritious “Akara- Akpu” was successfully produced



- The mineral composition showed similarities as there was significant increase in sodium, magnesium, phosphorus while potassium, calcium content decreased significantly
- The Anti-nutrient properties also showed similarities as there was significant increase in phytates, cyanide, nitrates of the sample

RECOMMENDATIONS

From the work carried out the following recommendations are made.

- This research work recommends sample A because it was the best product in terms of nutrition quality and acceptability
- Further studies should be conducted on the storage stability of “Akara-akpu” enriched with watermelon seed flour.

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Akara-akpu balls.
Final Product