COMPARATIVE STUDY OFTHE NUTRITIONAL ADEQUACY OF ANIMBO MKPONG FUFU WITH THREE DIFFERENT SOUPS (MELON SOUP, OKRO SOUP AND PUMPKIN SEED SOUP)

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ABSTRACT

The study investigated the Nutritional Adequacy of Animbo Mkpong Fufu with three Different Soups (Melon Soup, Okro Soup and Pumpkin Seed Soup). Two specific objectives were formulated. The samples (food stuffs) were obtained from Akpan Andem market in Uyo, Akwa Ibom State. The items (animbo Mkpong, cooked Cow Meat, ground Crayfish, cooked Nkɔkɔ, Red Palmoil, Iodized Salt, ground pumpkin seeds, ground Okro, ground Melon Seed, washed and Shredded Pumpkin leaves, de-boned Tilapia fish, pepper to taste, water for cooking) were treated, prepared and ready to use at adequate quantity for the preparation of Melon Soup, Okro Soup, Pumpkin Seed Soup and Animbo Mkpong fufu. Chemical analysis was carried out to determine crude fibre, lipid,protein, Iron and Vitamin A as well as estimation of carbohydrate and caloric value. Statistical analysis was then performed on the data obtained and from the results it was observed that moisture (4.50), Crude Fibre Content ((9.59) and Vitamin A (6.28) were more in Animbo Mkpong fufu with melon soup, while Carbohydrate (68.93), Caloric Value (3796.4) and Fe (12.30) were richer in Animbo Mkpong fufu with okro soup and finally, Crude Protein (41.84) was richer in Animbo Mkpong fufu with pumpkin seed soup. The independent t-test analysis also proved that though there is slight difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Okro soup the difference is not significant. It also proved that there is slight difference but not significant in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed soup. One of the recommendations was that due to the nutritional values of protein, iron, colories, low lipid for children, pregnant, lactating women, underweight school age children and underfive should be encouraged to use this Animbo with the aforementioned soups for acquisition of nutrients and that they should also be encouraged to dry the Animbo especially when they are in season.

KEYWORD: Nutritional Adequacy, Animbo Mkpong Fufu, Melon Soup, Okro Soup, Pumpkin Seed Soup

Introduction

Adequate food combinations result in good diet for good nutrition which is capable of supporting growth and development, maintenance and regulation of the body processes. This will also help in the prevention of undernutrition among children under five and maternal population.

Researches (UNICEF, 2016) have shown that childhood undernutrition is a major global health problem contributing to childhood morbidity, mortality, impaired intellectual development, poor school achievement, sub optimal adult work capacity.

Report from Isokpunwa (2016) has shown that in every single day, Nigeria loses about 2,300 under five year olds and 145 women of child bearing age. This makes the country the second largest contributor to the under-five and maternal mortality rate in the world.

More over data have confirmed that malnutrition starts in utero and increase markedly from 3 - 23 months of age. Thus ensuring adequate nutrition during the 1000 days window of opportunity is critical in preventing long-term and irreversible damage to children's health, cognitive and physical development (Save the Children, 2012). Nigeria is rated one of the highest burdens of malnutrition in Africa and globally. Also Nationally, Nigeria Demographic and Health Survey (NDHS) 2013, reported prevalence of stunting 37%, under-weight 29%, and wasting 18% (CS-SUNN, August 2015-August 2018). Nigeria was ranked 38% out of 76 on the 2014 Global Hunger Index by IFPRI, 2014 while another report also indicated that about 17 Million people were food insecure, which is projected to rise to 43 million by 2022 if not addressed (Nnam, 2017).

Akwa Ibom State in 2015 had stunting 24.1%, wasting 5.3 and underweight 21.4 (Isokpunwu, 2016). Survey carried out by SMART (2018) has shown 25.7% stunting and other indices of malnutrition still on the high side. Akwa Ibom State is the land full of variety of foods both from the land and the sea/rivers, but unfortunately, malnutritional diseases or indices such as stunting, wasting, and underweight still prevalence among the under-five, as well as Iron and Vitamin A deficiencies among the mothers and children. Developing adequate recipe from our locally grown foods/staples to prevent malnutrition problems has been advised by National Policy on Food and Nutrition Policy (2016) by National Policy on Food and Nutrition Policy (2016) to prevent malnutrition. This paper investigated into developing and promoting the use of nutritionally adequate recipes using locally available ingredients for all age groups using one of the species of Coco-yam, Animbo grown and eaten in Akwa Ibom State with three different soups.

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Specifically, The Study Is Conducted:

1. To determine the difference in nutritional adequacy between Animbo Mkpong fufu with Melon Soup and Animbo Mkpong fufu with Okro Soup.
2. To find out the difference in nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed Soup.

Hypotheses

1. There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Okro soup.
2. There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufuwith Okro and Pumpkin seed soup.

Method

1. Collection of samples: All the food stuffs were procured from Akpan Andem market in Uyo Akwa Ibom State. These were treated, prepared and ready to use at this quantity:
    - Animbo Mkpong- 1000kg
    - Cooked Cow Meat (500kg for each soup)- 1,500kg X 3

- Ground Crayfish (Shrimp/100kg for each soup)- 100g X 3
- Cooked Nk⊃k⊃(clam/200g for each soup)- 200g X 3
- Red Palmoil (100ml for each soup)- 300ml X 3
- Iodized Salt (3 table spoons for each)
- Ground pumpkin seeds- 2 cups
- Ground Okro- 2 cups
- Ground Melon Seed- 2 cups
- Washed and Shredded Pumpkin leaves (1 packed cup for each) 3 cups
- De-boned Tilapia fish(2 packed cups for each 6cups
- Pepper to taste
- Water for cooking including the meat and fish stock (10cups for each or for desire thickness of the soup)- 30cups

2. Each soup was prepared as below:

a. Melon Soup:
   i. The cooked fish, meat, clam, pepper and salt were placed in the pot and boiled.
   ii. Melon was added as well as crayfish.
   iii. Pumpkin leaves were added while red palm-oil was stirred in and was boiled for 10mins till done and to desire thickness.

b. Okro Soup: The same procedure as above but was thickened with Okro.

c. Pumpkin Seed Soup: The same procedure as a and b but thickened with pumpkin seed.

d. Animbo Mkpong: they were thoroughly washed through running tap water, cut up, placed in the pot and water added. It was boiled till tender and soft. They were pounded and free of particles.

Each soup was added to Animbo, to make up 500g and taken to Akwa Ibom State Science and Technology laboratory. They were oven dried and chemical analysis was carried out there.

Statistical Analysis:

SPSS 20 was used for statistical analysis of the data at 0.05 level alpha level. This was used to perform descriptive and inferential statistics as in figure 1, 2 and 3.

Chemical Analysis

A.O.A.C (2012) method was used in the chemical analysis

Moisture Content Determination

1. A clean porcelain dish with lid was dried in a oven at 80 ^{0}C for about 30 mins, cooled in a desiccator and weighed (W_1).
2. About 5g of the sample was placed in the dish and weighed again (W_2).
3. The sample and dish, with lid open, was placed in an oven at 50 – 60^{o}C for about 5 hrs.
4. Further drying was carried out at 80^{o}C for 3 hrs
5. Finally, the temperature was raised to 105^{o}C for a further 3 hrs.
6. The container, with the lid covered, was quickly transferred to desiccator to cool, and quickly weighed with minimum exposure to atmosphere.

7. The last drying procedure was repeated till a constant weight (W_3) was obtained.

Calculation:

$$\text{Moisture content \%} = \frac{wt\ loss\ on\ drying}{intial\ wt\ of\ sample} X\ 100$$

$$= \frac{W2 - W3}{W2 - W1} X\ 100$$

DETERMINATION OF ASH CONTENT

The total ash content of a substance is the percentage of inorganic residue remaining after the organic matter has been ignited. 2g of the sample was placed in a crucible and ignited in a muffle furnace at 550^0C for 6 hrs. It was then cooled in a desiccator and weighed at room temperature to get the weight of the ash.

CRUDE FIBER DETERMINATION

1. About 2g (C_1) of the fat free sample was boiled under reflux for 30 mins with 200ml of 1.25% H_2SO_4.
2. The content of the beaker was filtered through cheesecloth on a fluted funnel.
3. The residue was washed with hot water until washings were no longer acidic.
4. The leftover residue was boiled in a round bottom flask with 200ml of 1.25% NaOH for another 30mins.
5. It was filtered through a previously weighed crucible.
6. The crucible with sample was dried in an oven at 103^{o}C, cooled in a desiccator and weighed (C_2).
7. The sample was ignited in a Muffle furnace at about 600^{o}C for 2hrs, cooled in a desiccator and weighed (C_3).

CALCULATION:

$$\text{\% Fiber} = \frac{(C2 - C3)}{C1} X\ 100$$

LIPID DETERMINATION

1. About 5g of the oven-dried sample was accurately weighed into the thimble.
2. About 200mls of petroleum ether was poured into a previously weighed round-bottom flask containing weighed anti bumping granules.
3. The flask was heated slowly on a heating mantle for about 24 hrs to ensure complete extraction.
4. The extracted lipid was concentrated by placing the flask on a water bath.
5. It was dried in a desiccator and weighed.

CALCULATION:

$$\text{Lipid content (\%)} = \frac{wt\ of\ extract}{wt\ of\ sample} X\ 100$$

PROTEIN DETERMINATION

1. Accurately weigh a suitable quantity of fine-grained material (ca 1.2 g for fishmeal, ca 2.5g for soluble of homogenized fish) and place in digestion flask.
2. Add sequentially 15g Na_2SO_4, 1g $CuSO_4$ one or two selenized boiling granules and 25ml of conc H_2SO_4 to the flask.
3. Digest until solution is almost colourless or light green (2 hrs for inorganic material) and then at least a further 30 minutes. Do not heat any part of the Kjeldahi flask above the level of the digestion mixture.
4. Cool (do not allow to solidify), and cautiously add 200ml water, add additional boiling granules (if necessary) to prevent bumping.
5. Pipette 100ml 0.1 N HCl into a 500ml Erlenmeyer flask, add 1ml Conway's indicator and place the flask under the condenser ensuring that the condenser tip is immersed in the acid solution. (Volume of standardized HCl used in distillation may be varied according to the expected nitrogen content of the sample).
6. Tilt the Kjeldahl flask containing the digested sample and add 100ml of 50% NaOH solution slowly down the side of the Kjeldahl flask so that it forms a layer underneath the digestion mixture. Immediately connect the flask to the distilling bulb of the distillation apparatus. Rotate flask to thoroughly mix contents.
7. Heat until all ammonia has passed over int the standard acid. Collect approximately 150ml. caution, flask will bump. Remove immediately (prolonged boiling and too rapid distillation of acid during digestion should be avoided as loss of ammonia may occur).
8. Wash tip of condenser and titrate excess standard HCL in distillate with NaOH standard solution.

CALCULATION:

$$\text{\% Nitrogen} = \frac{(A - B)\ x\ 1.4007}{wt\ of\ sample(g)} X\ 100$$

- A = vol. (ml) std. HCL x normality of std. HCL
- B = vol. (mL) std. NaOH x normality of std. NaOH

%PROTEIN =% nitrogen x 6.25

CARBOHYDRATE ESTIMATION

The carbohydrate content was obtained as the difference after subtracting the total organic nitrogen lipid, ash and fibre from the total dry matter.

Carbohydrate (%) = [100 – (%protein + %lipid + %ash + %fibre)]

CALORIC VALUE ESTIMATION

The caloric value of the sample was obtained by multiplying the values of crude protein, lipid and carbohydrate by 4, 9, and 4 respectively and taking the sum of the products.

IRON

Iron (Fe) was determined using Atomic Absorption Spectrophotometer (AAS). Manufacturer: Thermo Elemental; Model: Unicam Solar 969 AAS.

Vitamin A Determination

1. 18.20g of Antimony trichloride was dissolved in 100ml of chloroform by warming slightly on heating mantle. It was cooled in ice water until excess of reagent separated. The supernatant was used for colour development in all the test.
2. 1g of Vitamin A was dissolved in 100ml of chloroform. This solution contains 10mg/ml of vitamin A.
3. 1.0, 2.0. 3.0, 4.0 and 5.0ml were prepared from the stock making it to 10ml with chloroform. 2ml of Antimony trichloride was added to this standard to colour (blue) development. Their absorbances were read at 620nm using chloroform/Antimony Trichloride as blank.
4. 1g of powdered sample was placed in a beaker. 10ml of chloroform was added to extract the Vitamin A. the chloroform layer was taken in another test tube using pasture pipette. Antimony trichloride was added for colour development. Absorbance was read at 620nm using chloroform/Antinony trichloride as blank.
5. Calculation:

$$\frac{Abs\ of\ test\ x\ Conc\ of\ Std\ x\ DF}{Abs\ of\ Std\ x\ Vol\ of\ sample} = \frac{mg}{L}\ of\ Vit\ A$$

Results and Discussions

Table 1

Descriptive statistics of the nutritional adequacy of animbo mkpong fufu with three different soups (melon soup, okro soup and pumpkin seed soup)

	Sample I	Sample II	Sample III
Moisture Content (%)	4.50	4.43	2.10
Ash Content (%)	2.26	2.14	1.39
Crude Fibre (%)	9.59	8.30	6.17
Crude Protein (%)	19.27	16.35	41.84
Lipid (%)	5.16	4.28	3.21
Carbohydrate (%)	63.72	68.93	46.85
Caloric Value (Kcal/100g)	3784.0	3796.4	3836.5
Fe (mg/100g)	10.45	12.30	9.22
Vitamin A (mg/100g)	6.28	5.75	4.86

Source: Field Survey

SAMPLE I = Animbo Mkpong fufu with Melon soup

SAMPLE II = Animbo Mkpong fufu with Okro soup

SAMPLE III: = Animbo Mkpong fufu with Pumpkin seed soup

For Moisture content of Animbo Mkpong with Melon soup was the highest (4.50). This was seconded by Animbo Mkpong fufu with Okro soup (4.43) while the least was Animbo Mkpong fufu with Pumpkin seed soup (2.10). For the ash content, Animbo Mkpong fufu with Melon soup was the highest (2.26). This was seconded by Animbo Mkpong fufu with Okro soup (2.14) while the least was Animbo Mkpong fufu with Pumpkin seed soup (1.39). For crude fibre content, Animbo Mkpong fufu with Melon soup was the highest (9.59). This was seconded by Animbo Mkpong fufu with Okro soup (8.30), while the least was Animbo Mkpong fufu with Pumpkin seed soup (6.17). For crude protein, Animbo Mkpong fufu with Pumpkin seed soup was the highest (41.84). This was seconded by Animbo Mkpong fufu.

Hypotheses testing

Hypotheses one

1. There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Okro soup.

Table 2

Independent t-test Analysis of the difference in the nutritional adequacy between Animbo Mkpong with Melon soup and Animbo Mkpong with Okro soup.

Samples	N	X	SD	t
Animbo Mkpong with Melon soup	9	433.91	1256.43	
				-0.003**
Animbo Mkpong with Okro Soup	9	435.43	1260.53	

**** Not significant at 0.05 level; df = 16; N= 18; Critical t value = 2.101**

Table 2 presents the obtained t – value as (0.003). This value was tested for significance by comparing it with the critical t- value (2.101) at 0.05 levels with 16 degree of freedom. The obtained t-value (0.003) was less than the critical t-value (2.101). Hence, the result was not significant. The result therefore means

that there is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon Soup and Animbo Mkong fufu with Okro Soup.

Hypotheses two

1. There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufuwith Okro and Pumpkin seed soup.

Table 3

Independent t-test Analysis of the difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed soup.

Samples	N	X	SD	t
Animbo Mkpong with Melon Soup	9	433.91	1256.43	-0.09**
Animbo Mkpong with Pumpkin seed Soup	9	435.19	1274.11	

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**** Not significant at 0.05 level; df = 16; N= 18; Critical t value = 2.101**

Table 1 presents the obtained t-value as (-0.09). This value was tested for significance by comparing it with the critical t-value (2.101) at 0.05 levels with 16 degree of freedom. The obtained t-value (0.09) was less than the critical t-value (2.101). Hence, the result was not significant. The result therefore means that there is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed soup. The result of the findings in tables 2 and 3 were therefore in agreement with the research findings of other researchers and research experts. In the other hand the results also disagreed with others.

The high protein will help for cell growth because new cells are laid down at a tremendous pace as the foetus grows and develops. This will spare carbohydrate for energy while protein will build and support growth, development, regulation of body processes, repairs in children adolescents, under-five, pregnant and lactating women as well as maintenance/repairs in adults.

The protein and iron help in the formation of good haemoglobin, formation of red blood cells to solve the problem of anaemia among school age children, pregnant women, under-five and others, studies have shown reduced physical and mental development, decrease attentiveness and intelligence in anaemic children (Black 2003, Sen A and Kanani S.J 2006). This impairment occurring at an early age may be irreversible, even after repletion of iron stored, thus reinforcing the importance of preventing this condition (Black 2003).

School age children are at risk of iron deficiency because of an expanding red blood cell and muscle mass that occurs as they grow (Herbert, 1992). The soups are very adequate for iron value needed by the body because the haem iron in animal sources is more easily absorbed than the non-haem iron present in plant sources. Non-haem iron absorption depends on the balance between iron absorption inhibitors and

enhancers in the diet (Thompson, Franko and Barton 2008). Fibres value from these soups are just adequate for movement of the bowels as well as mopping the cholesterol for healthy heart and system.

Conclusion

There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Okro soup. There is no significant difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed soup. Moisture (4.50), Crude Fibre Conten (9.59) and Vitamin A (6.28) were more in Animbo Mkpong fufu wirh Melon soup. Carbohydrate (68.93), Caloric Value (3796.4) and Fe (12.30) were richer in Animbo Mkpong fufu with Okro soup. Crude Protein (41.84) was richer in Animbo Mkpong fufu with Pumpkin seed soup. Though there is slight difference in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Okro soup the difference is not significant. It was also concluded that there is slight difference but no significant in the nutritional adequacy between Animbo Mkpong fufu with Melon soup and Animbo Mkpong fufu with Pumpkin seed soup.

Recommendation

1. Animbo Mkpong and the three soups are adequate for preventing and solving the problems of malnutrition because of the nutritional values of protein, iron, calories, low lipid for growth and development in children, pregnant and lactating women. Underweight school age children and under-five. It is therefore necessary, to encourage them to use this Animbo fufu with this soups for acquisition of nutrients. They should also be encouraged to dry the Animbo into flour and stored especially when they are in season.
2. The soups should be prepared even with small amount of cow meat (for absorbable source of haem-iron) sea foods and more so the seed oil such as melon, pumpkin seed for more protein.

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