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Assessment of the Chemical Composition and Phytochemicals of *'Nyatɔ'* and Traditional *'Nyatɔ'* (*Solanum aethiopicum*) Meals as Eaten in Oron Community, Akwa Ibom State.

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Abstract

This study was carried out to assess the chemical composition and phyto-chemical of "Nyatɔ" and "Nyatɔ" meals. The study revealed low content of lipid (1.25%) and carbohydrate (13.51%), kilocalories of (93.21%) in 'nyatɔ' (N), without accompaniment of boiled cassava and ekpang iwe. 'nyatɔ' blended with boiled sweet cassava, fresh green pepper, crayfish (NB) scored high protein of 25.85%, ash 5.44%, carbohydrate 68.38% and 403.36%: nyatɔ blended with "ekpang iwe" crayfish, green pepper without dried unripe plantain peel ash extract (NBC) had protein 19.99%, ash 4.95%, carbohydrate 68.91%, fibre 2.93%, and kilocalories of 388.36; while 'nyatɔ' blended with crayfish, green pepper, red palm oil and dried unripe plantain peel extract (NBD) had protein 19.99% with the highest ash content of 9.05% among the samples due to inclusion of the extract. Iron content of 'nyatɔ' (2.98mg) was slightly lower than iron values in NB (3.42mg), NBC (3.43mg) and NBD (3.43mg). Sodium content of 'nyatɔ' (5.76mg) was lower than NB (11.24mg), NBC (10.99mg) and NBD (26.15mg) phosphorus in 'nyatɔ' (4.62mg) was lower than NB (10.96mg), NBC (10.96mg), and NBD (10.96mg). Phytochemicals of 'nyatɔ' in Alkaloid (26.34mg) value was higher than Alkaloid in 'nyatɔ' meals of NB (4.24mg), NBC (4.24mg) and NBD (9.13mg). Cyanide content of all the samples was very low to prevent toxic problem. 'nyatɔ' values (19.25mg) and (14.56) respectively for oxalate and phytate were higher than the 'nyatɔ' meals with very low values that cannot interfere the absorption of food in the body. The chemical composition and phytochemicals of the 'nya' and 'nyatɔ' meals are adequate and suitable for prevention of nutritional diseases.

Keywords: Chemical composition, phytochemicals, *'nyatɔ'*, *'nyatɔ'* meals

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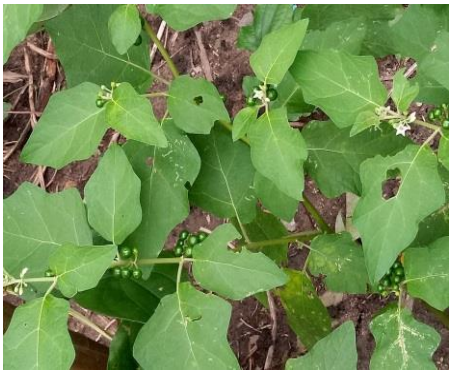
Benchmark Journals

Introduction

'Nyatɔ', as popularly called in Oron, Akwa Ibom State and *'Nya'* in Efik, Cross River State are small seeds species of garden egg (*Solanum aethiopicum*) found in the backyard, farmland or those widely grown by the road side. They are often consumed by the elderly people, pregnant women as well as other family members as uncooked sauces to accompany staple foods such as boiled cassava or *"ekpang iwe"*. Aside from this, they are served with drinks to welcome visitors or as snack with crayfish. Adult and elderly people are fun of chewing this anytime in raw state especially when *'nyatɔ'* fruits are in season.

Some people take *'nyatɔ'* as a quick way of satisfying hunger when the proper ingredients for *otong soup* or a good sauce for eating boiled cassava is not handy in the household, for '*ekpang iwe'* and boiled cassava respectively. The suitability of *'nyatɔ'* meal as a substitute for quick meal is worth investigating to encourage good nutrition. Good nutrition is a key to developing and maintaining an optimal health of individuals. Report from Isokpunwu (2016) on review of National Strategic Plan of Action for Nutrition cited nutritional indices in Akwa Ibom State from 2015 in NNHS to include stunting 24.1%, wasting 5.3% and underweight 21.4% in 2015 while severe acute malnutrition caseload for the year in south south zone reported 5.3% of wasting and 8,202 caseload for Akwa Ibom State. Furthermore, some specific objectives are indicated with emphasis on how to improve the nutritional status throughout the lifecycle of Nigerian people, with a particular focus on vulnerable groups including women of reproduction age and children under five years of age; also to contribute to the control of diet related non-communicable diseases, and to promote and strengthen research, monitoring and evaluation (NSPAN, 2014 - 2019). Nutritional composition of food refers to the nutrients (chemical substances) that the food is made up of varying amount (Thompson, 2015). Phytochemicals are those chemicals found in foods that when consumed, has or provides additional health benefits beyond the traditional nutrients present in the food (Escott-Stumps, 2008).



AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS

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Benchmark Journals

Figur1:*'nyatɔ'* plant

Thus, it has been observed that increased reliance on plant foods especially where animal foods are not readily available has increased the need to provide and encourage varied sources of nutrients from plant foods within the community and the world at large (Nnam, 2003). Moreover, fruits and vegetables have plenty of natural antioxidants especially Vitamin C and E. Also, fruits have been found to contain anti-carcinogenic properties (HOU, 2003, HOU etal, 2004; Kang etal, 2003, Bomser etal 1996).

Phyto-chemical have been linked with bioactive principles responsible for medical activities of most medicinal plants and herbs and this dictates why efforts have been expanded in studies at elucidating their levels in medicinal plants (Doega etal, 2006). The traditional small special of garden eggs is not widely study as the hybrid. Literature has shown scanty works on phytochemical analysis by Naga Oka etal 2001) on sesquiter periods in root exudates of *solanum aethiopicum*, while Saba etal (2003) worked on Pharma cological activity that was carried out on

the aqueous leaf extracted from *solanum aethiopicum* on isolated pig ileum. Documentation on the chemical composition and phytochemicals on the utilization of the traditional small round species *'nyatɔ'* (*Salanum aethiopicum*) fruits with these meals are not found in the literature reports. The present study is on uncooked sauces using the small round specie of *'nyatɔ'* seeds. (*solanum aethiopicum* seeds) as applied by Oron people to accompany boiled cassava and *ekpang iwe* as popularly eaten as quick meals.

Materials and Methods

Preparation of Samples for Chemical Composition and Phytochemical Analysis.

Collection of Samples

Small round species of traditional garden egg, fresh green and red pepper were harvested in the backyard of an elderly woman in Oron, Akwa Ibom State. Dried unripe plantain peel ash powder was also collected from the woman while iodized salt, palm oil and cassava were obtained from the market in Oron Town, Akwa Ibom State.

1. **Preparation of Samples**

(a) Special specie of cassava "*payan*" harvested and stored for 24hours was peeled and cut up in chunks, thoroughly washed under running tap water, placed in a sauce pan, covered with water and boiled till done but firm. Water was drained off, and then placed in airtight plastic container for chemical analysis.

(b) Special specie of cassava called "*nkoyo okon*" harvested and stored for 24hours were peeled, washed through running tap water, grated and wrapped in the steamed plantain leaves. Grated

AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS
ISSN e-2536-751x, ISSN p-2536-7501
Benchmark Journals

cassava was taken in small amount to wrap with leaves and placed in the pot, covered with water and boiled till done but firm, then placed in airtight plastic container for chemical analysis

Preparation of Sauces

1. One cup of freshly harvested '*nyatɔ*' was thoroughly washed under the running tap water. This was pounded in washed and cleaned mortar and pestle until smooth then scooped into the air tight plastic container, covered and stored for analysis.

Figure 2 '*nyatɔ*' seeds for '*nyatɔ*' sauces

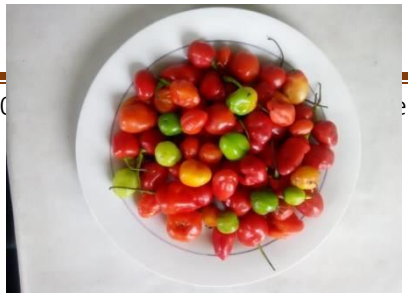
2. Basic Ingredients for '*Nyatɔ*' Sauce

One cup freshly harvested ground '*nyatɔ*' seeds

¼ cup ground mixed fresh green and fresh red pepper

2 cups ground crayfish

1 tablespoon iodized salt

The  above basic ingredients were thoroughly mixed together

AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS
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Benchmark Journals

in the mortar, with pestle and one tablespoon water and then scooped into the sterile plastic container to accompany cassava.

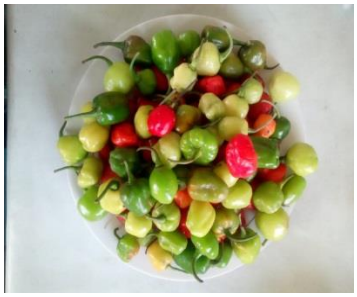

Figure 3: Fresh red and green pepper

Figure 4: Crayfish

Figure 5: Boiled cassava

3. The basic ingredients above were measured out and one cup of cold water was stirred into the mixture, and then scooped into the air tight plastic container to accompany '*ekpang iwe'*. This was stored for chemical analysis.

Figure 6: *'Ekang Iwe'*

4. A cup of dried unripe plantain peel ash was measured out and soaked in two cups of water to stand for ten minutes. The basic ingredients as in number two was measured out and mixed with one cup extract of dried unripe plantain ash. This was well blended with half cup red palm oil without being

separated from each other. It was further thin down with one quarter cup of hot water and poured into the sterile air tight plastic container to accompany *'ekpang iwe'*. This was stored for chemical analysis.

Chemical Analysis

Proximate composition of the ash, crude protein, ash, fat and crude fibre was determined using standard methods of the Association of Analytical Chemist (AOAC 2005). The analyses were performed in triplicate for each proximate component. The macro kjeldahl was used for determination of protein content. The fat content was determined by weighing 5g of charred sample into tarred porcelain crucible which was incinerated at 60 degree Celsius for 6 hours in an ash muffle furnace until ash was obtained. The crude fiber was determined by exhaustive extraction of soluble substances in sample using 1.25% H2SO4 acid and 1.25% NaOH solution after the residue was ashed and the loss in weight was recorded as crude fiber. The carbohydrate content was calculated by difference.

Determination of Vitamin C

2, 6-dichlorophenol indophenol titration method was used for the determination of vitamin c on 5g sample as described by Pearson (1991). Beta carotene was determined by A.O.A.C (2005).

Determination of Minerals

The concentrations of selected minerals in the samples were determined using atomic absorption Spectrometer (AA320N), while sodium was determined using flame photometer. The minerals were determined after wet oxidation of 2g of the sample powder using concentrated nitric acid and per chloric acid as described by Osborn and Voogt (1978).

Determination of Photochemical Compositon

Phytate content was determined using the method described by maga (1982) Spectrophotometric method of Trease and Evans (1989) was used in the determination of tannin in the sample.

Alkaloids were determined by gravimetric method of Harbone (1973).

The titrimetric method of Day and underwood (1986) was used in the determination of oxalate in the sample.

Saponin content of the sample was determined by the double solvent extraction gravimetrical method (Harbone, 1973).

AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS

ISSN e-2536-751x, ISSN p-2536-7501

Benchmark Journals

Assessment of Anthocyanin was carried out by the method of Harbone, J.B (1973).

Data collected were analyzed using the statistical package for social science (SPSS) software version 17. Means and Standard Deviation were calculated for triplicate determination. (Package for social science (SPSS) software version 17)

Results and Findings

Table I: proximate composition of *'nyatɔ'* and *'nyatɔ'* meals

S/N	Samples	Moisture	Protein	Ash	Lipid	Fibre	CHO	Kilocalories
		%	%	%	%	%	%	
1	N	86.69 ± 0.02	6.98 ± 0.02	3.53 ± 0.01	1.25 ± 0.04	1.72 ± 0.02	13.51 ± 0.05	93.21
2	NB	56.32 ± 0.38	25.85 ± 0.02	5.44 ± 0.10	3.16 ± 0.10	2.93 ± 0.04	68.38 ± 0.05	403.36
3	NBC	65.41 ± 0.21	19.99 ± 0.04	4.95 ± 0.04	3.14 ± 0.05	2.93 ± 0.02	68.91 ± 0.05	383.86
4	NBD	65.41 ± 0.21	19.99 ± 0.04	9.05 ± 0.025	5.12 ± 0.001	3.10 ± 0.04	63.26 ± 0.05	377.88

KEY:

1) N – *'nyatɔ'*
2) NB – *'nyatɔ'* blended with boiled sweet cassava, fresh green pepper, crayfish
3) NBC – *'nyatɔ'* blended with Ekpang Iwe, fresh green pepper, crayfish without palm oil and dried burnt unripe plantain peel extract
4) NBD – *'nyatɔ'* blended with ekpang iwe, fresh green pepper, crayfish, dried burnt unripe plantain peel extract.

AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS

ISSN e-2536-751x, ISSN p-2536-7501

Benchmark Journals

Table 2: Chemical Composition - Minerals and vitamins in *'Nyatɔ'* and *'Nyatɔ'* meals

S/N	Samples	Na mg/100	Ca mg/100	P mg/100	Fe mg/100	K mg/100	Vit. C mg/100	Beta Carotene mg/100	Mg mg/100
1	N	5.76 ± 0.02	2.55 ± 0.02	4.621 ± 0.04	2.98 ± 0.02	221.17 ± 0.04	43.35 ± 0.02	22.48 ± 0.03	1.79 ± 0.02
2	NB	11.24 ± 0.004	4.99 ± 0.04	10.96 ± 0.02	3.42 ± 0.02	221.55 ± 0.04	52.15 ± 0.04	25.55 ± 0.05	1.53 ± 0.03
3	NBC	10.99 ± 0.005	4.99 ± 0.02	10.96 ± 0.04	3.43 ± 0.005	220.99 ± 0.005	52.15 ± 0.005	25.55 ± 0.005	1.51 ± 0.003
4	NBD	26.15 ± 0.002	4.98 ± 0.02	10.96 ± 0.02	3.43 ± 0.04	258.79 ± 0.002	52.15 ± 0.04	38.95 ± 0.05	1.53 ± 0.03

Key

1) N – *'nyatɔ'*
2) NB – *'nyatɔ'* blended with boiled sweet cassava, fresh green pepper, crayfish
3) NBC – *'nyatɔ'* blended with Ekpang Iwe, fresh green pepper, crayfish without palm oil and dried burnt plantain peel extract
4) NBD – *'nyatɔ'* blended with ekpang iwe, fresh green pepper, crayfish, dried burnt plantain peel extract

Table 3: Phytochemicals of 'Nyatɔ' and 'Nyatɔ' meals

S/N	Sample	Saponin mg/100	HCN mg/100	Phytate mg/100	Oxalate mg/100	Akaloid mg/100	Anthocyanin mg/100	Tanin mg/100g
1	N	3.44 ± 0.001	0.42 ± 0.02	14.56 ± 0.04	19.25 ± 0.05	26.34 ± 0.05	0.54 ± 0.004	8.87 ± 0.41

2	CS	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00		0.00
3	NB	0.30 ± 0.02	0.01 ± 0.00	2.05 ± 0.02	3.41 ± 0.04	4.24 ± 0.02	0.48 ± 0.52	7.87 ± 0.04
4	NBC	0.24 ± 0.04	0.01 ± 0.00	2.07 ± 0.03	3.41 ± 0.04	4.24 ± 0.02	0.48 ± 0.5	7.82 ± 0.02
5	NBD	0.91 ± 0.04	0.02 ± 0.00	4.12 ± 0.02	5.92 ± 0.02	9.13 ± 0.04	0.52 ± 0.001	7.91 ± 0.03

Key

1) N – *'nyatɔ'*
2) CS - Cassava
3) NB – *'nyatɔ'* blended with boiled sweet cassava, fresh green pepper, crayfish
4) NBC – *'nyatɔ'* blended with "ekpang iwe", fresh green pepper, crayfish without palm oil and dried burnt unpeel plantain peel extract
5) NBD – *'nyatɔ'* blended with "ekpang iwe", fresh green pepper, crayfish, dried burnt plantain peel extract

Discussion of Findings

Figures 1, 2, 3, 4, 5 and 6 show the pictures of *'nyatɔ'* and the foodstuffs used for the *'nyatɔ'* meals in the analysis. Table 1 presents the chemical composition - proximate composition of the *'nyatɔ'* and *'nyatɔ'* meals. *'Nyatɔ'* without accompaniment had the protein content of 6.98%, Ash 3.58% but low in lipid (1.25%) and carbohydrate (13.51%). The high protein content in the *'nyatɔ'* meal as shown in sample NB (25.85) is as the result of the addition of ground crayfish. Sample NBD has the highest ash content of 9.05 due to the inclusion of dried unripe plantain peel extract. Sample NBD (5.12%) also had the highest lipid value because of additional lipid source from red palm oil. The CHO content (13.51%) of N was the lowest because there was no additional carbohydrate source as in NB with boiled cassava (68.38%), while NBC (63.26%) and NBD (68.91%) were blended with ekpang iwe. N scored the lowest calories (93.21) since there was no additional carbohydrate source from *"ekpang iwe"* or boiled cassava as in NB and NBD (403.39) (377.88) and NBC (383.86).

AFRICAN JOURNAL OF EDUCATIONAL ASSESSORS

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Benchmark Journals

Protein content here will support growth and maintenance of body tissues; it will help in the formation of enzymes, hormones, and antibodies, fluid and electrolyte balance (Murano, 2003). The high carbohydrate and kilocalorie contents will spare protein to be used in the body to function properly and enhance growth and development. However, the high content of ash in NBD (9.05%), NB (5.44%), NBC (4.95%) denote high contents of vitamins and minerals.

Table 2 shows the highest mineral contents from both 'N' and the meals but the '*nyatɔ*' meal NBD with inclusion of extract and palm oil scored 258.79mg potassium while other samples NBC (220.99mg) NB (221.53mg) and N (221.17mg). All *'nyatɔ'* meals were high on Vitamin C because of the green peppers that were added into the mixture, Beta carotene content was also meaningful, all minerals and vitamins when taken enough are capable of preventing diseases. Beta carotenen, content of *'nyatɔ'* meals when eaten will be converted to vitamin 'A' in the body to fight against infections by keep mucous membrane in a healthy condition which act as a barrier to infection. According to Roday, (2010). Vitamin A is also required for normal bone, and tooth development and proper growth. The low sodium content has been reported by Litchenstein (2006) to be beneficial in prevention of high blood pressure while high potassium has been reported to have a protective effect against excessive sodium intake. It is the major cation of the intracellular fluid. Potassium functions within the cell as a cation for neutrality regulation, regulator of osmotic pressure, and a catalyst in many biological reactions (Vishwanath, 2012).

High vitamin C derived from *'nyatɔ'* and *'nyatɔ'* meals in this study are capable of inhibiting oxidative damage in living cells in human. Both epidemiological and clinical studies have shown that phenolic antioxidants present in plant materials, including some food grains, fruits, vegetables and spices are principal contributing factors accounting for reduced incidence of many chronic diseases encountered by population whose diets are composed of high intake of many of these plant products (Maillard et al, 1996; Shahidi and Naczk, 1996; Halvorsen et al, 2002).

Vitamin C and Beta carotene are high on antioxidant that is noted to prevent degenerative diseases. Vitamin C lowers the risk of cancers of the stomach, larynx, oral cavity and pancreas (Cooper, 1996) while studies have associated beta carotene with protection against cancers of the esophagus, bladder, rectum skin (melanoma) and lung (Copper, 1996). Without magnesium, many enzymes in the human body would function less efficiently. Magnesium contributes to calcium and potassium metabolism and therefore essential for bone strengthening (Mclean, 1994) Calcium is important for teeth, bone and muscle metabolism. (Turan etal, 2003)

Table 3 has shown low saponin values of 3.44mg, 0.01mg 0.41mg, 0.41mg, 0.30mg, 0.24mg respectively for N, NB, NBC. NBD and NBN. Low values were also observed in cyanide sample. They were all at zero toxic level and safe for consumption.

Phytochemical analysis showed that phytate oxalate, alkaloid and tannin were higher in N sample with 14.56mg, 19.25mg, 26.34mg, respectively, while NBC with the value of (4.12mg), NB of (5.92mg), (9.13mg) and (7.91mg) were very low. The value scored in phytate and oxalate were low to prevent

interference with calcium, magnesium, iron and zinc absorption. Sofowora (1993) reported the roles of these Phytochemicals as analgesic, anti-inflammatory, ant-hypertensive and anti-microbial. Alkaloids, content in the N and all the N meals are reasonable amount to have antioxidant property that helps in prevention of cancer (Harwood etal, 1993). The Saponin values were at the level whereby haemolysis cannot occur. However, it has been reported that Saponin form insoluble complexes with cholesterol and bile, making them unavailable for absorption. The chemical and Phytochemical contents of *'nyatɔ'* and *'nyatɔ'* meals will help to meet the target plan of NSPAN, 2014-2019 to reduce and maintain childhood wasting to less than 10% beyond 2019, reduce under five children who are stunted by less than 20% beyond 2019; reduce anaemia in women of reproduction age to less than 50% beyond 2019. It will also contribute as the diet related to control non-communicable diseases.

Conclusion

'Nyatɔ' and *'nyatɔ'* meals contain appreciable amounts of nutrients and phytochemicals. The specie of this *'nyatɔ'* and application of this in meals (*'nyatɔ'* meals) when adequately consume will provide nutritional, health and therapeutic benefits to humans. The use of this specie should be advocated through nutrition education.

Recommendations

1. The consumers from Oron and other users should be encouraged to use enough crayfish as applied here to attract adequate protein intake for good growth development and maintenance of body tissues. Also to prevent nutritional diseases.
2. They should also include the '*nya'* fresh green pepper, and crayfish to benefit from vitamin C, as well antioxidants to prevent degenerative diseases; also to support absorption of iron in order to prevent anemia.
3. They should be encouraged to eat as prepared and acquire these vitamin and minerals to prevent diseases. Also the high potassium content in the extract will help to provide their functions as described in the body.
4. Phytochemicals contents here will prevent diseases as discussed to neutralize certain potentially cancer-causing enzymes in the digestive tract and other part of the organs and tissues.

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