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Proximate Composition and Social Acceptability of Sun-Dried Edible Frog (*Rana esculenta*) In Odeda Local Government Area, Nigeria

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ABSTRACT

This paper compared the proximate composition of Sun-dried Edible Frog (Rana esculenta) with that of Catfish and assessed the social acceptance of Edible Frog for consumption in the study area. Proximate composition and social evaluations were analysed using standard laboratory methods, while a set of questionnaire were used to collect data on social related issues. Data collected were analysed using descriptive statistics while Chi square was used to test for associations. Results reveal that the Protein (6.95% and 7.3%), Fat (2.09% and 2.14%) and Moisture (9.0% and 9.11%) contents of Edible Frog and Catfish respectively are almost the same. Comparison of Ash content of the sun-dried meat types however varies significantly at P<0.01.). More than halve (53%) of the total population are unaware of the safety of R. esculenta for human consumption. Chi-Square analysis shows a significant difference ($p<0.05$, $X^2=21.841$) among various family sizes in willingness to accept Edible Frog (R.esculenta), if it is more nutritious than other bushmeat types.

***Keywords**: Edible Frog, Rana esculenta, Acceptability, Bushmeat*

Introduction

The inadequate supply of animal protein in developing countries has been attributed to inadequate products and high cost of conventional sources of animal protein (poultry, goat meat, beef, mutton and pork), hence an average Nigerian consumes only about a quarter of his minimum daily animal protein requirement (Oke *et al.*, 2004). To solve this problem of shortage of conventional meat, alternatives have been sourced for. To this end, there have been increases in the consumption of bush meats. The increase has helped in bridging the gap created due to increasing demand for animal protein (Abulude, 2004). Many people consume bushmeat because it is cheaper than alternative sources of protein (Walsh *et al*., 2003). Davies (2002) reported that 50% of people from the third world countries are found insecure and therefore cannot afford to buy meat. The nutritional status of many Nigerians is characterized by low calorie and protein intake (Eekeran 1995; Apantaku *et al* 1998). Many of the rich, especially in urban areas of Nigeria also consider bush meat a delicacy (Abulude, 2007) and therefore prefer it to conventional meat types. Bush meat, therefore serves as an important source of animal

protein in both rural and urban households throughout Africa. In southern Africa, the bushman do not keep any domestic stocks and rely heavily on wild animals for their protein (Maliehe, 1993). In Tanzania, people living around forests and grasslands are provided with food security in the form of cheap bushmeat (Chihongo 1992).

Findings by McNeely *et al* (1994) revealed that many rural areas of Africa are plagued with chronic food shortages and malnutrition. The real problem has not been attributed to so much scarcity of carbohydrate foods but inadequacy of high quality protein food supply. Kwashiorkor condition resulting from protein/calorie imbalance is rife in Africa and in many areas the total animal protein intake is far below the recommended levels (FAO, 1995). Despite the heavy instrument in conventional agriculture by governments, aid agencies and multilateral organizations, domestic livestock production has not succeeded in meeting the protein demand in Africa. The situation is compounded by the increasing human population pressure. Almost all food sources have become significant and people in rural Africa today are actually exploiting most of the wild resources traditionally known to be edible.

Bowen Jones *et al* (2003) described bush meat as an economically important but ecologically unsound source of animal protein. The population of many wild animal species in Africa is on the decrease while it is very difficult to come across many in the wild. Edible Frog (*Rana esculenta*) however, has a comparative advantage of abundance; as it is in great abundance and widely distributed in most West African countries especially in the swampy, rainforest, and savannah eco-zones (IUCN, 2012). Its abundance could be traced to the number of eggs it lays and hatched at once; inability of some potential consumers to distinguish between edible frog and the poisonous and irritating common toad (*Bufo bufo*) as well as probable negligence of some persons to consume edible frog.

Several researches (Abdullahi, 2000; Adeyeye, 2002; Oke *et al*, 2004; Omojola *et al*, 2004, Abulude, 2004 and 2007) on animal protein production and utilisation in Sub Saharan Africa, including Nigeria, are focused on edible domestic animals and big games, neglecting the edible frog, whereas it is relatively more abundant and can be easily harnessed at little or no cost in many rural areas. The objectives of this study, therefore, are to: Evaluate the proximate composition of edible frog; Compare the nutritional composition of edible frog with Cat fish, a conventional animal protein source in the study area; and to assess the social acceptability of edible frog as a source of protein among households in the study area.

Taxonomy of Edible Frog (Rana esculenta)

Frogs are amphibians in the order Anura (meaning “tail-less”, from Greek an- without; oura, tail), formerly referred to as Salientia (Latin salere (salio), “to jump”). The order

Anura contains 4,810 species in 33families, of which the Leptodactylidae (1100 spp.), Hylidae (800 spp.) and Ranidae (750 spp.) are the richest in species. About 88% of amphibian species are frogs (Pough *et. al,* 1992).

The use of the common names "frog" and "toad" has no taxonomic justification. From a taxonomic perspective, all members of the order Anura are frogs, but only members of the family Bufonidae are considered "true toads". The use of the term "frog" in common names usually refer to species that are aquatic or semi aquatic with smooth and/ or moist skins, while the term "toad" generally refers to species that tend to be terrestrial with dry, warty skin. An exception is the fire bellied toad (*Bombina bombina*): while its skin is slightly warty, it prefers a watery habitat (Pough *et. al,* 1992).

Frogs and toads are broadly classified into three suborders: Archaeobatrachia, which includes four families of primitive frogs; Mesobatrachia, which includes five families of more evolutionary intermediate frogs; and Neobatrachia, by far the largest group, which contains the remaining 24 families of 'modern frogs', including most common species throughout the world. Neobatrachia is further divided into *Hyloidea* and *Rnoidea*. (Ford and Cannatella, 1993). This classification is based on such morphological features as the number of vertebrae, the structure of the pectoral girdle, and the morphology of tadpoles. While this classification is largely accepted, relationships among families of frogs are still debated. Further studies of molecular genetics will provide further insights to the evolutionary relationships among Anuran families (Ford and Cannatella, 1993).

Some species of anurans hybridize readily. For instance, the Edible Frog (*Rana esculenta*) is a hybrid of the pool Frog (*Rana lessonae*) and the marsh Frog (*Rana ridibunda*). *Bombina bombina* and *Bombina variegate* similarly are from hybrids, although these are less fertile, giving rise to a hybrid zone (Faivovich *et al*., 2005). Table 1 shows the taxonomic category of edible frog (*Rana esculenta*).

Table 1: Taxonomic Categorization of Edible Frog

SCIENTIFIC	CLASSIFICATION
Kingdom	Animalia
Phylum	Chordata
Class	Amphibian
Order	Anura
Family	Anuran
Genus	Rana
Species	esculenta

Material and Methods

Study Area

Odeda Local Government Area is one of the twenty local governments in Ogun State of Nigeria. It lies within latitude 7^0 and 7^0 5'N and Longitude $3^0$3'E and $3^0$37'W. It shares boundaries with Oyo State and Ewekoro, Obafemi – Owode Local Government to the South, Yewa North, Odeda Imeko Afon Local Government areas (all in Ogun State) to the West East and North respectively. Though predominantly occupied by Yoruba ethnic group, Odeda Local Government is generally inhabited by people from all sub – ethnic group in Nigeria and neighbouring West African States and endowed with physical and human resources.

Two important rivers in the study area are the Ogun and Oyan rivers, both flowing from Oyo North around Igbeti and Saki respectively in Oyo State forming a confluence at Abeokuta North Local Government Area (Popoola, 1990). The annual rainfall, which normally spreads over eight (8) months between April and November, ranges between 100mm to 200mm, having bi – modal pattern with the peaks at May /June and September / October, (Oluwalana 1997). The relative humidity is high all the year and generally above 80% during the wet season and ranges between 60% and 80% during the dry season. The average maximum daily temperature varies from 28^0C in the rainy season to 32^0C in the dry season (Onakomaiye *et al,* 1992).The study area is inhabited with people of diverse occupations such as agriculture, Trading, Dyeing, Pottery, Fashion designing, Hunting, Fishing, Driving, Teaching and Civil Services.

Collection and Preparation of specimen

Analysis: Sun-dried Edible Frogs and Sun-dried Cat fish samples were purchased at Alogi market of Odeda Local Government Area. Sun - dried samples of the species were used because that is the form with which the food stuffs are available to retailers in the area. Sun-dried cat fish was used for comparison because it is the most common animal protein source that is also regarded as a delicacy in the study area. Other materials used include mortal and pestle, hand grinder, transparent nylon bags.

Proximate Composition: Proximate composition of samples was determined using AOAC methods (1990). Moisture content was measured by weighing differences before and after oven-drying at 100^0C-105^0C for 16 hours. Protein content (%N X 65) was determined by the Kjeldahl Methods. Ash content was determined using dry ashing procedures. Fat content was measured by drying the samples in 100^0C oven and extracting the crude fat with petroleum ether in a Soxhlet extractor for 4 hours. All samples were done in triplicate.

Sampling Procedure (Social Data)

Data were collected by administering a set of 210 questionnaires in the study area. Half (105) of the total number of questionnaires were randomly administered in classified urban areas and the other half in rural areas of selected Local Government Areas, for fair representation of respondents. Questionnaires were administered randomly in two of three markets where sun-dried Edible frog is sold in the study area. One of the two sun-dried Edible frog markets in urban area was randomly chosen along with the only one in rural areas. Questionnaire were randomly administered to human population irrespective of what they came to purchase or sell in the market. Information collected via questionnaire include, the socio-economic status of respondents - age, gender, family size, educational background, tribe, religion and financial status. Questionnaire was also used to collect data on respondents' willingness to accept Edible Frog (*Rana esculenta*).

Data collected were presented in form of descriptive statistics using Statistical Package for the Social Sciences, while Chi square was used to test for associations between socio-economic variables and willingness to accept edible frog.

Results and Discussion

Figure 1 compares the Mean Proximate composition of *Rana esculenta* and *Clarias gariepinus.* The mean percentage content of fat, Ash, protein and moisture in *R. esculenta and C. gariepinus* were 2.09% and 2.14%, 43.23% and 31.69%, 6.95% and 7.3%, 9.0% and 9.11% respectively. Table 1 reveals that the Protein, Fat and Moisture content in the two samples are almost the same. The ash content of the sun-dried meat types however varies significantly ($P<0.01$). This result revealed that Percentage Protein, Calcium, Pottasium, Magnessium and Iron content of Edible frog (*R. esculenta*) competes favourably with Catfish. Results on Figure 2 reveal that for the Mean value of minerals measured, Edible Frog (*R.esculenta*) had the highest values (mg $100g^{-1}$DM) of Calcium (2337), Magnesium (1701), Potassium (982) and Iron (390) compared with Calcium (1325) Magnesium (1406), Potassium (1253) and Iron (273) of *R. esculenta* (Figure 2).

Social Acceptability of Edible Frog

Unlike the catfish which is popularly being exploited both in the wild and in captivity (Aquaculture), the safety of edible Frog for consumption still remains unknown to many in the study area (Table 2). Most respondents (53%) are unaware of the safety of *R. esculenta* for human consumption. This can be attributed to the reason while there has been less exploitation of the species for consumption in the study area unlike the Chinese Edible Frog *Hoplobatrachus rugulosus* which is being greatly exploited and

consumed in China, Japan, Taiwan and some other Asian countries as noted by Amphibiaweb (2012).

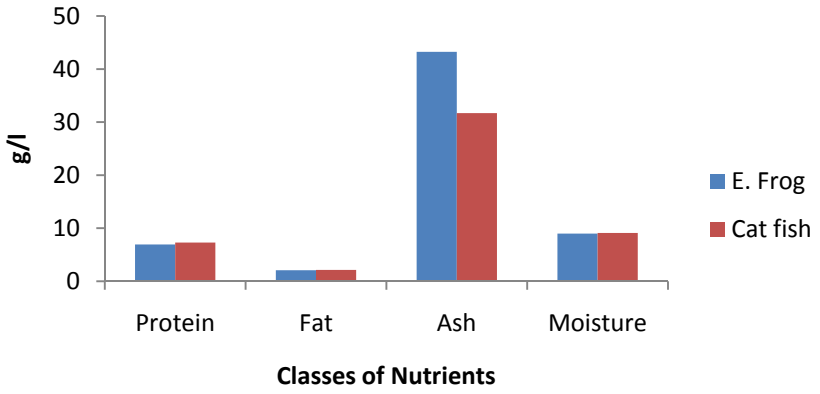

Figure 1: Comparison of Proximate Composition of Edible Frog and Catfish

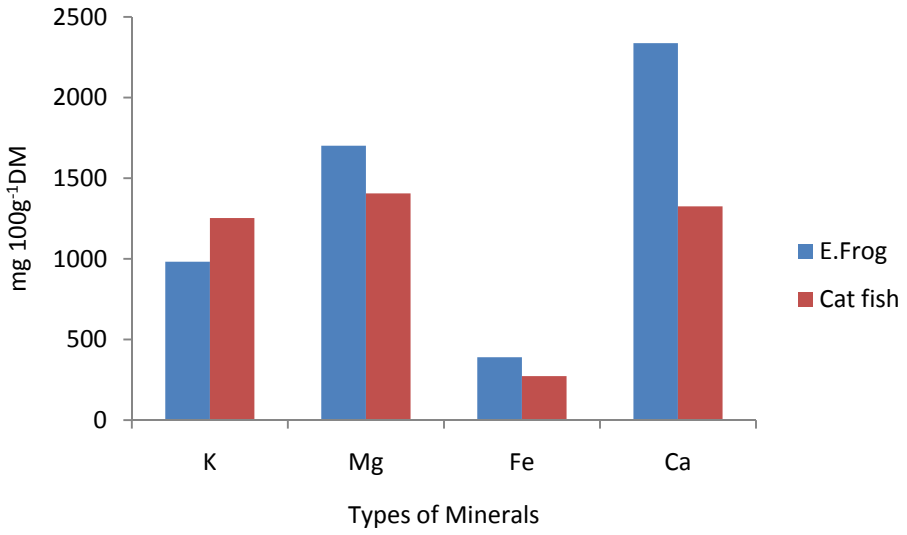

Figure 2: Comparison of Mineral Composition of Edible Frog and Catfish

Table 2: Respondents' Views on the Safety of Edible Frog for Human Consumption

Question: Is Edible Frog safe for human consumption?			
Family size	I do not know (%)	It is not safe (%)	It is safe (%)
2-3	52.8	1.2	46
4-6	53.3	3.3	43.3
≥7	57.1	-	42.9
Total	53.0	1.5	45.5

Social acceptability test of Edible Frog (*R.esculenta*) show that 85.7% of respondents with family size of seven and above were very willing to accept Edible Frog for regular consumption, if it is proved comparatively more nutritious than other sources of animal protein (Table 3).

Chi-Square analysis shows a significant difference ($p<0.05$, $X^2=21.841$) among various family sizes in willingness to accept Edible Frog (*R.esculenta*), if it is more nutritious than other bushmeat types.

Table 3: Assessment of Respondents' willingness to accept Edible Frog for consumption Among Various Family Sizes

	If, More Nutritious						Total
Family size	neutral	Never	not very willing	not willing	very willing	Willing	
1-3	13	12	1	21	48	68	163
	8.0%	7.4%	.6%	12.9%	29.4%	41.7%	100.0%
4-6	4	0	1	0	7	18	30
	13.3%	.0%	3.3%	.0%	23.3%	60.0%	100.0%
≥7	0	0	0	0	6	1	7
	.0%	.0%	.0%	.0%	85.7%	14.3%	100.0%
Total	17	12	2	21	61	87	200
	8.5%	6.0%	1.0%	10.5%	30.5%	43.5%	100.0%

The result in Table 3 cannot be unconnected with the fact that families with many members will likely have more economic pressure and nutritional demand. This agrees with the findings of Akinyemi and Oduntan (2004) that wildlife harvesting and utilization in Nigeria are not activities in which people engage in for the purpose of deriving leisure, rather it is an activity associated with the upliftment of living standard of people.

Conclusion and Recomendation

This study reveals that Edible frog *(Rana esculenta)* which man has not substantially exploited for food in Nigeria can serve as a competent source of animal protein and other vital nutrients in human diets. However, there is need to create awareness in Nigeria about safety and nutritional status of *R. esculenta*, so as to serve as an economical source of animal protein, since it is cheap, widespread, abundant and readily available in most eco-zones of Nigeria. Further studies will seek to establish the economic feasibility of Edible Frogs (*R.esculenta*) with catfish and other bush meat.

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