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Entomophagy: A Panacea for Protein-Deficient-Malnutrition and Food Insecurity in Nigeria

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Abstract

The paper posits that Nigeria like most developing countries is not immune to protein deficiency among its population because of the often prohibitive prices and overdependence on conventional animal protein source which are in limited supply. The consumption of edible insects is a way out of this predicament. Entomophagy is common practice in the tropics only varying with location, insect(s) consumed, and ethnic group. Again, it posits that insects as a source of protein is better than many conventional sources of protein; it juxtaposes the protein value of some edible insects with conventional animal protein sources like beef, pork, fish, eggs, and milk. Furthermore, many advantages that go with entomophagy are indicated. It identified some militating factors against entomophagy, and maintained that people are not eating insects because of prejudices and not because insects are inferior nutritionally. Finally, it offers practical recommendations that could lead to more people consuming insects.

Keyword: mini-livestock, edible insects, nutrition, protein, prejudice

1. Introduction

The global food crises have made scholars to reassess some unconventional approaches to food production, especially protein production (Durst & Shono, 2010). The health situation in Africa nay Nigeria is characterized by high rate of malnutrition and most common of these is protein deficiency (WHO, 1999). This has been aggravated by prohibitive prices and excessive dependence on conventional protein sources (Olaofe et al., 1998), which are limited in supply (Umoh & Bassir, 1977). Protein-energy malnutrition (lack of protein and energy food) is a range of mild, moderate to pathological conditions arising from a deficiency of protein and energy, and no other disease compares in importance with it (DeMaeyer, 1976). Protein-energy malnutrition is affecting over 100 million people in Africa and an additional 200 million are at risk (Maletnlema, 1992). It is a crucial public health problem for many developing countries (Dulger et al., 2002). Edible insect species mainly belong in the traditional and informal food systems (Roos, 2012). Insects constitute about 75% of all known animal species (Yoloye, 1998). Edible insects have played an important role in the history of human nutrition (Lyon, 1991; Bodenheimer, 1951). Archaeological evidences as well as analysis done on fossilised faeces reveals beyond doubt that the human race has evolved as an ant-eating species (Ramos-Elorduy, 2009). Though some insect species are poisonous (Adamolekun, 1993), most are not (Meyer-Rochow, 2010). Edible insect groups that provide nutrition for people in Africa are: ants, termites, caterpillars, water bugs, beetle larvae, flies, crickets, katydids, cicadas and dragon nymphs (Srivastava et al., 2009). Insects are classified under non-timber forest products (FAO, 1989). Insects are very adept in converting what they have eaten into tissues that can be consumed by others – about twice as chicken and pigs, and more than five times as efficient as beef – the food conversion efficiency of insects may be 20 times that of cattle (Durst & Shono, 2010). Furthermore, Insects constitute quality food for humans and emit low levels of green house gasses (van Huis, 2013). However, a lot of effort has been put into the elimination of insects rather than on its preservation and production (Ogunlabi & Agboola, 2007).

Entomophagy literally means the consumption of insect by humans. It is a term derived from the Greek word entomos (insect) and phagein (to eat), the practice is a well-established although a diminishing custom of many parts of the world (Sutton, 1998; DeFoliart, 1999), the practice seems to be culturally universal, only varying with

location, type of insect and the ethnic group involved (Johnson, 2010). Insect consumption is part of a population's cultural heritage, and that 1391 insect species are eaten worldwide, of which 524 are eaten in 34 countries of Africa representing 38% of all species consumed globally, she maintained that Mexico consumes 348 species which is the highest number recorded for a single country (Ramos-Elorduy, 1997). Jongema (2012) holds a contrary opinion and posits that about 1900 species of insects are eaten worldwide, mainly in the developing countries. Bodenheimer (1951) maintained that the people of Madagascar love to eat fried grasshoppers, Bahuchet (1990) posits that caterpillars are a very important food item for the Pigmies, Kitsa (1998) wrote that in a certain city in Southwest DR Congo 28% of its inhabitants eat insects, Roulon-Doko (1998) maintained that about 15% of the meat diet of the Gbaya people in Central African republic consist of insects. Adriaens (1951) reported that between 1954 and 1958 close to 300 tonnes of dried caterpillars were consumed yearly in the Kango district of DR Congo. Furthermore, some tribes in Colombia, Venezuela, and South Africa preferred certain insects to fresh meat (Quin, 1959). Though insects are seen as food for the poor and backward by some but they are sought after and served in the best restaurants in most countries of Asia, Australia, and Europe (Ramos-Elorduy, 2009; Yen, Hansboonsong, & van Huis, 2012). Robert (1989) indicated that a 10% increase in the world supply of animal protein through the mass production of insects for food can to a large extent reduce if not eliminate the malnutrition problems of the world and also decrease the pressure on conventional protein sources. According to Olaofe et al. (1998) one of the possible ways to counter protein energy malnutrition in Nigeria is to promote the utilisation of lesser known and cheaper source of animal proteins such as those from insects.

Scholars have written enormously on entomophagy among several tribes in Nigeria, however, most writers maintained that the practice is more prevalent among rural populations than urban population (Fasoranti & Ajiboye, 1993). There is a significant trade in, and consumption of edible insects among some ethnic groups in Nigeria. Akingbohungbe (1992) and Banjo et al. (2006) maintained that grubs of palm weevil are fried and eaten in several parts of Western Nigeria, Edo, and Delta state. Also and Adamolekun (1993) posits that larvae of *A. venata* are eaten among the people of South-western Nigeria. The larvae of the Saturnid Caterpillar (*Cirina forda*) known locally as *kanni* is widely eaten among the people of Kwara state, again. It is believed that this caterpillar is the most widely marketed edible insect in Nigeria and sells for about twice the price of beef and is used for vegetable soup. Other widely marketed insect in Nigeria include termites and dragon flies (Fasoranti & Ajiboye, 1993). The Gwari people of Niger state eat the larvae of dung beetle (*Aphodius rufipes*) and to them are a delicacy and serves as an alternative source of protein (Paiko, 2012). Ene (1963) maintained that a number of insects or their products were used as food in some parts of Nigeria and to a large extent eaten as titbits or exclusively by children.

'Ordinarily, insects are not used as emergency food during shortage, but are included as planned part of the diet throughout the year or when seasonably available' (Banjo et al., 2006). Banjo et al. (2006) further gave the following as the list of commonly eaten insects in South-western Nigeria; *Macrotermes bellicosus*, *Brachytrypes spp.*, *Cyrtacanthacris aeruginosa unicolor, trisfasciata (F.), Oryctes boas, Rhynchophorus phoenicis, Apis mellifera* (*oyin*), and *Cirina forda* (*ekuku*).The most abundant, most preferred, and most consumed insect by the people of Benue State, Nigeria is *Macrotermes natalensis* followed by *Brachytrupes membranaceus* and then *Cirina forda* (Agbidye et al., 2009). In Borno state, northern Nigeria, *Zonocerus variegatus* is widely eaten and seen as a delicacy; the grasshoppers are readily displayed in the market and sold like meat (Solomon et al., 2008). With the 'rising global population and limited pasture lands, production of animal protein is becoming ever unsustainable and one of the possible ways to overcome this problem is to adopt the entomophagy practice' (T. Abassi & S. A. Abassi, 2011). More so, whether insects are eaten or not does not depend on low nutritional value of insects, but often such is tied to customs, preference, or and prohibitions (van Huis, 2003), and in some societies it is just a taboo (Weiss & Mann, 1985; McElroy & Townsend, 1989). Awareness of entomophagy and its advantages are required as part of the solution to protein deficient malnutrition in the developing countries, Nigeria inclusive.

2. Protein Value of Insects in Human Nutrition

The nutritional benefit of insects is often overlooked, and some do not even know that insects are of any nutritional importance. Insects are good sources of essential nutrients which could help alieviate the nutritional problems among the populations that consume them (Ekpo, 2011) Documentation of the nutritional importance of insects to human diet is sparse (Roos, 2012). The prejudice against eating insects is not justified from nutritional point of view (van Huis, 2003). According to Meyer- Rochow (2010), Bodenheimer (1897-1959) was the first scholar to write about nutritional importance of insect in his book 'Insects as human food' in 1951. Insects are a source of protein for the improvement of human diet; they are an important source of protein for people who are malnourished. Some insects contain more protein than meat (Johnson, 2010). Bergeron et al. (1988) maintain that the crude protein of three aquatic insects eaten around the Lake Victoria Uganda to be 67%. Insects contain a high

amount of crude protein. In g/100g dry weight caterpillars contain 50-60, palm weevil larvae 23-36, Orthoptera 41-91, ants 7-25, and termites 35-65 (Bukkens,1997). According to Santos et al. (1976) 100 grams of caterpillar would provide 76% of an individual's daily protein requirement, and more than 100% of daily requirement for many of the vitamins and minerals. For example, the mean values in protein percentages of insects in their mature stages, and adult stages have been found to be 36, and 38 respectively, and some are as high as 72 and 69 (wet weight). Tsvangirayi (2013) posits that the Emperor moth (Mopane worm) contains three times the amount of protein as beef. The crude protein value of *Rhynchophorus* sp. is as high as 71.6% (Bride & Nwaoguikpe, 2011). In a study of 94 edible insects by Ramos- Elorduy and Pino Moreno (1990) they found out that 50% of the insects have higher caloric values than soyabeans, 63% were superior to beef, and 70% were better than fish and beans.

Many insects are low in cholesterol and fat (Srivastava et al., 2009), they are herbivores and have clean eating habits which makes them cleaner than chicken, pigs, and many other conventional protein sources, in fact , the grasshopper is one of the cleanest animals (Abbasi & Abassi, 2011). Most often than not, most insect consumed are harvested from the wild, or come from the wild and are gathered for food, hence, they are mostly free from pesticide and other chemical contaminant which abound in places where conventional source of protein are found (Durst & Shono, 2010). When insects feed on vegetation they are able to transform phytomass into zoomass much more efficiently than conventional livestock; more than 10 times more plant nutrients are needed in order to produce one kilogram of meat than one kilogram of insect zoomass (Nakagaki & DeFoliart, 1991; Taylor, 1979). Furthermore, when insect are generally eaten by most in the society insects especially those of them that are edible would be seen not as pest but as source of much needed protein. The use of pesticide and other chemicals which have adverse effect on heath and the environment would be brought to its barest minimal. More so, some locust species despised and considered dangerous to crops in tropical Africa are seen as delicacies by people of other land and culture (Owen, 1973).

3. Some Factors Militating Againts Entomophagy

Though the eating of insects has unquantifiable benefits, some factors have been hindering its acceptance. Some edible insects are very expensive and cost twice the price of beef. Also, in many circles people see eating of insect as a practice that is associated with poverty, hunger, unavailability of meat and fish and other prejudices (Owen, 1973). Seasonality of most edible insects have a negative impact on entomophagy; availability of most edible insects is dependent on some plant cycles, hence, these insects are not available all year round. Furthermore, some customs and religions forbid the eating of insects, or some certain species of insects (Fasonranti & Ajiboye, 1993). Some people who are educated and in the cities have come to see insects as been dirty and as pest and a nuisance, hence, not ideal as food. Also, modernisation and changing attitudes have had negative impact on the practice of entomophagy; those who have practiced entomophagy at one time or the other have had to jettison the practice because they now see it as a practice that belongs to the past.

4. Recommendation and Conclusion

Aside from the nutritional value of insect and the prospect in them in assuring food security, eating of insects can be enhanced through the promotion and adoption of modern food technology and standards to ensure that insects are safe and attractive for human consumption. When promoting insects as food they should be farmed like any other conventional protein source like chicken, beef, pigs, and fish instead of relying on natural harvesting; micro-livestock have the potential of increasing household protein consumption (Barwa, 2009). According to Fasonranti and Ajiboye (1993) this would allow a continuous supply. Raloff (2008) reported that this have proved successful in Northeast Thailand where agricultural extension agents have taught locals low-cost insect rearing techniques, and with this technique 400 families from two villages produced 10 metric tons of crickets in the summer of a single year. Nigeria can take a cue from this feat and initiate an insect rearing program on a national scale. Due to their high level of protein, edible insects especially those common in a locality could be used to fortify grains like sorghum (Nigerian Stored Products Research Institute is presently working on this) to counter protein-energy malnutrition in children. Srivasta et al. (2009) alluded to this when they maintain that in some part of the world flour made from a certain caterpillar is mixed to prepare pulp given to children to fight malnutrition.

There should be a concerted effort at all levels to make harvesting of insects as human food a better option and the use of insecticides should be deemphasised unless on extreme occasions (Ledger, 1987). Nigerian entomologists, in tandem with Agricultural extension agents, nutritionists and health workers should make a comprehensive list of all edible insects in the country and adjoining countries. There should be enlightenment campaigns at all levels as a matter of policy to disabuse the mind of people about the negativities associated with entomophagy which are often not true. People should be made to know that eating of edible insects is less taxing on the environment than eating beef, pork, and chicken; apart from fact that it takes far lesser leaves to produce insects than it does to

produce the same amount of beef (Fiala, 2008). Food consumption patterns have been known to be greatly influenced by the mass media (Ramos- Elorduy, 1990), hence, the mass media too has a great deal to do to see to it that edible insects are consumed by the Nigerian populace in general ,and consumption of it should not be restricted to the rural populace. Furthermore, because most edible insect species occur seasonally, and because harvest can be more than what can be consumed in a short time, more research is needed on storage and preservation of these edible insects. All factors militating against eating of edible insect in the country should be looked into and addressed accordingly. Conclusively, because insects have high nutritional value they are a good alternative to solving the PEM problems facing the third world countries, hence, efforts should be made to encourage and retain the practice of entomophagy (Ekpo, 2011).

Table 1. Crude protein content of some insects on a dry weight basis

	Common English name of insect	Scientific name of insect*	Crude Protein %
1	Leaf hoppers	*Graphocephala sp.*	56
2	Yellow mealworm beetle larvae	*Tenebrio molitor*	47
3	Darner larvae	*Aeshna umbrosa*	56
4	June beetle larvae	*Phyllophaga sp.*	42
5	Agave billbug larvae	*Scyphophorus acupunctatus*	55
9	Water boatman adults	*Notonecta glauca*	53
10	Leaf cutting ants	*Acromyrmex octospinosus*	58
11	Paper wasp pupae	*Polistes humilis*	57
12	Red-leg locust	*Melanoplus femurrubrum*	75
13	Corn earworms	*Helicoverpa zea*	41
14	White agave worms	*Aegiale hesperiaris*	30 - 35
15	Red agave worms	*Hypopta agavis*	45 - 46
16	Tree hoppers	*Ceresa taurina*	45 - 46

Source: Ramos – Elorduy (1988).* Content in this column is ours.

Table 2. Crude protein (nx6.25) of some commonly eaten dried insects in southwestern nigeria

	Insects (Scientific name)	Crude protein	Yoruba name*	English name*
1	*Macrotermes bellicosus*	20	Esusu	Termite
2	*Brachytrypes spp.*	6	Ire	Cricket
3	*Turrita (L.)*	12	Tata	Grasshoppers
4	*Zonocerus variegatus*	26	Tata	Short horn Grasshoppers
5	*Analeptes trifasciata*	29	Ipe	Rhinoceros beetle
6	*Anaphe infracta*	20	Ekuku	Caterpillar
7	*Anaphe recticulata*	23	Ekuku	Caterpillar
8	*Anaphe venata*	25	Ekuku	Caterpillar
9	*Cirina forda*	20	Ekuku	Caterpillar
10	*Apis mellifera*	20	Oyin	Honeybee
11	*Oryctes boas*	26	Ogongo	Scarab beetle
12	*Rhynchophorus phoenicis*	28	Munimuni	Snout beetle

Source: Banjo et al (2006). * Content in these Colums is ours.

Table 3. Protein value of some insects based on 100 grams serving

	Insect	Scientific name of insect*	Protein (grams)
1	Giant water beetle	*Lethocerus americanus*	19
2	Red ant	*Solenopsis geminata*	13
3	Silk worm pupae	*Bombyx mori*	9
4	Meal worms	*Tenebrio molitor*	20
5	Wax worm	*Galleria mellonella*	15
6	Super worms	*Zophobas morio*	17
7	Dung beetle	*Circellium bacchus*	17
8	cricket	*Brachytrypes ssp.*	21
11	June beetle	*Phyllophaga crinita*	13
13	Termite	*Reticulitermes sp.*	14

Source: Berenbaum (1996) *Content in column is ours.

Table 4. Protein value of some conventional protein sources (dry weight)

	Protein source	Protein %
1	Beef	17 - 19
2	Pork	15 - 17
3	Fish	19
4	Eggs	13
5	Milk	4

Source: www.ent.orst.edu.

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