‘Ugba na ngbam’ – Food Heritage of Mbaise People: Implications for Classroom-Based Ethnoscience and Sustainable National Development

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Abstract
The processing of ‘Ugba’ (*Pentaclethra macrophylla Benth)*, seeds for food, is almost a ritual in Mbaise. Mbaise is a prominent enclave of the Ibo extraction of the present Imo state of South-Eastern Nigeria. Like any other people, they have prominent cultures including foods, and their preparation rituals. The ritual of preparing ‘ugba agworo agwo’(oil bean salad delicacy) has some ‘dos’ and ‘don't. It involves many stages and different handling procedures for the best effects. This paper examined in detail, the ritual of processing oil bean seeds, the possible science of the stages, chemical compositions, nutritive and economic values of the seed, the dish and the tree. The paper ends with a look at the implications on instructions in ethnoscience and also tries to answer the question: Is it justifiable and plausible to integrate ethnoscience into formal science classrooms as a way towards sustainability, preservation of cultural heritages and national development?
Keywords: Oil bean salad, Ugba, Mbaise, Ethnoscience, Food heritage.
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1. Introduction.

‘Ugba agworo agwo’, popularly known as ‘oil bean salad’ delicacy, prepared from oil bean (*Pentaclethra macrophylla Benth*), seeds, is typically a food heritage of Mbaise and her surrounding peoples, if served with ‘Ngbam’. ‘Ngbam’ in Mbaise palance, is not just melon seed cake but that which has been prepared with a good serving of dried pepper and baked in no less time than one market week, over the fireplace. The rich ‘ugba’ salad, garnished with crunchy flakes of ‘ngbam’ evokes nothing more than a serving of a cup of fresh, bubbling palm wine, slightly tinged brown because of ‘nche’. ‘Nche’ is the powder of a dried and grounded back of Nche tree (*Sacoglottis gabonesensis Baill*), placed in the tapper’s pot in which the wine is collected all day or night for its invigorating effects. ‘Nche’ gives Mbaise palm wine a characteristic brownish hue. Traditionally, that is for the people of Mbaise, palm wine is tapped from raphia palm (*Raphia farinifera Gaertn*) tree and served undiluted. ‘Ngbam’ is processed from melon seeds in a straightforward way. However, preparing ‘ugba agworo agwo’ is taught as a long lesson to the youths of the community in an ethno scientific manner. Only the properly groomed can be trusted to handle it because the dish often makes its way to great occasions and many a high table.

Food heritage or food culture contains strong survival codes that a culture passes on from generation to generation. There is no better way to preserve a culture than to dig out its knowledge codes and relate them with universal disciplines.

The purpose of this paper is to examine the botanical, physics and chemistry aspects of ‘Ugba’ as a tree, processing of its seeds as food by Mbaise and her surrounding ethnic people and their implications for culturally based science instructions in schools. The central question this paper tries to answer is whether the ritual of processing oil bean seeds and preparing it as food by Mbaise people contain discernible knowledge nodes that can be integrated into formal science classrooms for development and sustainability. Is such an integration even justifiable.?

2.0. Literature Review.

2.1. *Botanical expositions and economic importance of ugba:*

The botanical name of Ugba tree is *Penthaclethra macrophylla.* It is a medium-sized to fairly-large tree reaching up to 35 metres in height and 100 cm in diameter. It belongs to the leguminosae family and the subfamily *minosoideae* (Okwulehie, 2004). The plant is recently cultivated by peasant farmers in rural communities in Southern and middle belt regions of Nigeria. It is popularly known as Ukpaka or Ugba in Igboland, Apara in Yorubaland and called Ukana by the Efiks. It is found in savannah locations including the derived Savanna at the fringes of forest vegetation (Alinnor & Oze, 2022). The leaf is large, 20-45 cm with a petiole 3-8 cm in length. Leaflets are paired, opposite, sessile, oblong to elliptical, apex rounded; glabrous. The inflorescence is a terminal or axillary panicle up to 30 cm long bearing multiple flowers (Chidozie, 2016). The fruit is linear-oblong; long pods up to 50 cm bear 5-8 seeds.

Figure 1: African Oil Bean (*Pentaclethra macrophylla)*

The tree grows to about 21 metres in height and to about 6 m in girth. The leaves possess a stout angular petiole. The compound leaves are usually about 20-45 cm long and covered with rusty hairs. The flowers are creamy yellow or pinkish white and sweet swelling. The main flowering season is between March – April with smaller flushes in June and November. Fruits are available at most periods of the year and produce large woody pods, which are persistent. The pods are 40-50 cm long and 5-10 cm wide. The pods contain between 6-10 flat flossy brown seeds. The seeds are up to 7 cm long. The trunk provides timber used for structural work. The tree yields forest products for wooden household utensils (Okwu, 2005). The flat glossy brown edible seeds (of about 6-10 in number) are contained in a brownish flattened pod which explodes at maturity and disperses the seeds. The mature dispersed seeds are harvested by gathering or picking them manually from around the tree. They can also be harvested off the tree and gathered to dry and be broken to gather the seed. The kernel (a dicotyledon) which is grey in colour is embedded in a glossy brownish seed coat. The seeds are irregular or oval in shape and lie flat in their natural position (Isiguzo *et al*., 2015).

Figure 2: African oil bean seeds
Source: Wikipedia, 2023.

The seed is cooked, sliced and allowed to undergo fermentation before being used for preparing assorted delicacies in which ugba is served with okporoko, (stockfish) nkwobi,(cow legs bits) porridge, abacha (tapioca) salad, okra and other soups as well as boiled or roasted yam.

Ashes from ugba pods can serve as local cooking salt while the seeds can be ground into powdered flour for making bread. Some parts of the plant have medicinal values (Okwu, 2004). In Cameroon, the seeds are used to treat infertility while the pods are used to treat convulsion. In Nigeria comparative study of cancer risks and cancer levels have been carried out between the Easterners who ate fermented oil beans and those who did not (Famurewa, Ainabebholo, Onuoha, and Ugah, 2015). An improvement index was also measured between cancer patients who ate ugba as a meal supplement and those who did not, the result indicated that the fermented form of *P. macrophylla* seed as a food supplement has greatly reduced the risks of cancer and some tobacco related diseases (Chimezie & Olasupo, 2013). It was discovered that cancer patients who regularly ate fermented oil bean seed as a food supplement showed marked improvements in regaining quality health (Ogueke, Nwosu, Owuamanam, and Iwouno, 2016).

2.2.1. *Physic-chemical expositions on ugba processing:*

African oil beans are a protein-rich food. It is a nutrient-packed food condiment native to Eastern Nigeria (Enujiugha, Akanbi, and 2018). It is an excellent source of energy, protein, amino acids, phosphorus, magnesium, iron, vitamins, calcium, manganese and copper as well as an excellent source of phytonutrients such as tannins, alkaloids, flavonoids, steroids, glycosides and saponins (Asoegwu, Asoegwu, Ohanyere, Kanu, and Iwueke, 2006). The oil extract is heart-friendly. Some studies however, showed that the seed contains some anti-nutritional factors which include cyanide, phytate, tannin and oxalates. Hence, before it becomes fit for consumption, it must undergo a thorough thermal and fermentation process to eradicate any unwanted toxins (Nwokocha, *et al*., 2023). Some aspects of the processing ritual of 'ugba agworo agwo'(oil bean salad delicacy) are purely chemical processes.

African oil bean seeds are processed differently for food, depending on the local community. However, there are basic stages for the processing of oil bean seeds as rigorously followed by Mbaise people which are sorting, thermal treatment, hulling, slicing, fermentation and packaging. The anti-nutritional contents of ugba, like indigestible oligosaccharides, anti-nutritional factors (ANFs) and phytate, make its painstaking processing ritual inevitable so as to have digestible and nutritionally safe products. The processing stages and their scientific backgrounds include the following:

2.2.2. *Thermal treatment:*

The first stage in the processing is sorting to separate harvested damaged seeds from wholesome ones. Thermal treatment of beans then follows. This is first of all targeted at softening of the cotyledon for the next stage of slicing. Thermal treatment is also targeted at some anti-nutritional factors (ANFs) particularly, Trypsin Inhibitors(TI) which are thereby denatured and hence increase digestion and absorption of dietary protein by the formation of indigestible components. Thermal treatment of the seeds therefore, is carried out by heating them in water for 8-14 hours. This ensures the breaking of their very strong inter-molecular bonds holding the trypsin inhibitors components together. In this way the active site conformation of the trypsin components are changed or denatured. Enijiugha *et al.*, (2002, 2004) stated that the raw seeds contain both α-amylase and lipase. Cooking reduces the Trypsin inhibitive properties of raw oil bean by controlling the activation and catalytic reactions of protein thus making it more digestible. Adequate cooking also prevents the darkening of the sliced oil bean due to slow adsorption of pigments by the carbohydrate components.

2.2.3. *Hulling and slicing:*

This stage consists of allowing the properly boiled and hot seeds to cool down followed by the removal of the cotyledons from the seed coats and washing the same. The cotyledons are thereafter sliced very skillfully, then again boiled for 2-4 hours or overnight, over a low flame. This stage is targeted at further increasing the surface area of the cotyledons for more effective denaturing of the still active trypsin components. The cotyledons are washed several times over, after cooling to remove its bitterness due to water soluble alkaloidal constituents.

2.2.4. *Fermentation:*

At this stage, the sliced cotyledons are slightly salted and placed in a closed container. Salting is targeted at building salt bridges at the epidermal layers so that the slices will not totally collapse or become too soft as a result of fermentation. Salting also gives the finished product a seasoned flavour and palatable for those who consume it without making salad from it. Fermentation is carried out at room temperature between two to three days at the maximum. Reports show that fermentation for up to four days increases cholesterol levels that may be detrimental to patients of cholesterol related-cardiovascular disease and manifests itself in over softened and over digested slices that cling together and hence are unpalatable. The fermentation stage is an anaerobic digestion process that leads to the conversion of the organic degradable materials by enzymatic microbial tissue breakdown in the absence of oxygen. Chemically speaking, this stage involves alkaline hydrolysis which is an enzyme mediated breakdown of higher molecular mass compounds (e.g lipids, proteins and polysaccharides) into suitable monosaccharide compounds like sugars, used by microorganisms as a source of energy and acidogenesis that involves microbial conversion of the lower molecular mass intermediate compounds into acids, (Ngozi-Olehi, 2012):

$$nC_6H_{12}O_6 \longrightarrow 3nCH_3CO_2^- + 3nH^+ \quad \text{(exothermic)}$$

These monomers metabolise and move into microbial cells using up oxygen trapped in the system. However, oil beans have less sulphur containing amino acids than other protein plants but have high levels of other essential amino acids. Na^+ from NaCl lowers the action of the amylase and lipase (Enijiugha et al., 2004) in the fermentation process and this is desirable for the reasons earlier stated.

2.2.5. *Packaging:*

Traditionally, in Mbaise, ugba is packaged for sale or storage in units of usable quantities artfully wrapped in any of the following special green leaves: Akwukwo-ugba (*Alchormea laxifora Benth*) or Akwukwo-etere (*Thaumatococcus danielli*). Due to the high adsorbent nature of the sliced and processed ugba, it comes tinged chlorophyll green when unwrapped, which tinge makes it highly acceptable to Mbaise people as wholesome and properly handled. However, in this era of polymer technology and globalization in which processed ugba is widely distributed across Nigerian cities and even overseas, ugba is now often presented in large quantities, wrapped in polyvinyl chloride packaging, popularly referred to as 'waterproof packaging'. Waterproof packaging of ugba has made the product lose its 'natural' green tinge. It has also been discovered that waterproof packaged ugba has longer shelf life and hence has come to be accepted by the locals and can be seen in popular Mbaise markets like Orie Mbaise, Eke Ise and so on.

3. Preparation of 'ugba agworo agwo' (African oil bean salad)

3.1. Oil bean salad delicacy, an exalted Dish: Oil bean salad delicacy popularly called 'Ugba agworo agwo' in Mbaise parlance, is an exalted dish, often served as an appetiser, especially if combined with 'mgbam' and 'manyi ngwo': Spiced flakes of melon cake and fresh palm wine.

3.2. *Materials:* Materials needed to prepare 'ugba agworo agwo' are sliced and fermented oil bean seeds, Palm oil, Water extracts from the ash of dried palm fruit bunch peduncle or from dried plantain skin or sieved from ground potash, ground 'ehu' (*Monodora myristica*) seeds, Nutmeg (*African calabash*), animal protein (dried tilapia, ground crayfish, stockfish, dried meat) and ngbam (melon cake)

3.2.1. Steps:

I. Prepare the sauce (Ngu) by mixing some quantity of palm oil with sieved out water extract from ash of the dried palm fruit bunch peduncle or dried plantain skin or from ground potash. This mixture is stirred vigorously into a slurry foamy paste. Chemically speaking, the process of preparing the sauce is saponification (the reaction between a long chain organic acid, e.g. palm oil and an alkali, e.g. extract from ash of an organic source, to produce soap as an 'organic salt'. In other words, the sauce (ngu) used to prepare ugba is simply edible soap. In some communities this sauce is rightly referred to as 'ncha' (soap).

II. Mix a generous quantity of the sliced and fermented ugba with the ngu. Mix thoroughly and vigorously with spoon in a bowl or cooking pot on till it becomes foamy, then add,

III. The other ingredients, like ground ehu, pepper, salt, crayfish, stock fish and so on.

IV. Place in a cooking pot and warm slightly, still turning the mass as in a convolution: Hot mixtures homogenise more properly than cold ones and as food, it also tastes better.

V. Serve on a clean plate and garnish with ngbam and or sliced garden eggs. A bubbling keg of palm wine standing by is a deserving compliment.

4. Implications of 'ugba' food heritage for instructions in ethnoscience

Ethnoscience encompasses the secret codes (knowledge and their applications) upon which the preservation of life in a particular culture depends. According to Merriam Webster dictionary (retrieved from https://www.Merriam-Webster.com, August 29, 2023) the term gained prominence in 1956 and has since come to mean "the study of a culture's system of classifying knowledge". The term has also come to be associated with "such a system in a particular culture". Language is a very significant aspect of a culture and therefore, encodes its knowledge. Ethnoscience also studies the language of cultures. Ethnoscience, therefore in its broad sense, is anthropological.

In this paper however, ethnoscience is considered as a concept in education, which "connotes the use of a student's home, community, or culture-centred experiences to teach concepts or relationships in science", (Hime, 1977:259: Retrieved from https://doi.org on 4th September, 2023). Consequently, ethnoscience could be a veritable starting point to fan students' interest in science or even to sustain the curiosity of students already in science. Treating ethnoscience as an educational concept is the only hope it has of converging its opposing parts into a symphony that can bring in and formulate concepts like 'ugba na mgbam' into a formal science classroom setting. This is because 'ethno' which connotes culture as a localised entity and 'science' which is accepted as universal knowledge beyond the confines of any particular culture should not cohere (Stewart, 2014). As an educational concept, therefore, ethnoscience could be seen as the knowledge of the people for the people as a gateway to universal knowledge. Imagine an introductory science class in a school in Mbaise where the teacher introduces 'Ugba na mgbam' and asks the learners to make contributions and from there takes them on a journey to explore the biological, chemical and the physics knowledge embedded in their everyday practice. Activation, participation and exploration in such a class can easily be imagined. The long term effect on the learners, especially if continued as a classroom norm, can only be imagined. Research into 'Ugba' as a food heritage will be a natural consequence of such a class.

4.1. Call to include ethnoscience in the basic science curriculum

Many national Basic science programs have drawn concepts and activities only from the formal science curricula of different eras. In Nigeria for instance, it started as nature studies, Primary Science projects, Integrated science and now basic science. In none of these reforms were any meaningful concepts or activities drawn from the cultural practices of the people of the immediate school environment. This unfortunate oversight has produced one consistent notion of science in the minds of the students: Science is a foreign study. It belongs to the schools and their teachers, tolerated only for the purpose of passing examinations to be promoted to the next level. It is equally remarkable to note that some countries in their education program reforms have looked up to ethnoscience as a way to bridge the gap between the universal knowledge of science and the people's science or cultural science concepts, (Aikenhead & Michell, 2011). If classroom science instructions do not harness the people's way of thinking, relating and perceiving the world around them, then it is useless in meaningfully engaging its students to make progress from where they already stand or what knowledge they already possess. Improving where they already stand is the only immediate benefit of science studies. According to Abonyi, *et al* (2014) Science, if seen from its constructivists' view point can equally be defined as a way of thinking and not merely as a body of knowledge. Inclusion of ethnoscience in formal science classrooms, could also stir up the entrepreneurial potential in students as they will definitely be motivated to bring in the investigative and curious natures of formal science to bear as they seek to improve on cultural practices of their immediate environment.

Ethnoscience as a hybridised scientific practice, as can be clearly seen in the 'ugba agworo agwo' food culture of Mbaise people, includes the cosmology of a people and is very adaptable to formal science classroom. Abonyi, *et al* (2014), even advocate reforms where ethnoscience classrooms will be specific in knowledge disciplines being investigated. These could include Ethno-botany, ethno-chemistry, ethnomedicine, ethno-physics, ethnoecology, to name but a few, some of which are already discernible in the 'ugba agworo agwo' food culture of Mbaise people. In formal situations, ethnoscience becomes a way of acculturation. According to Putra (2021), ethnoscience becomes "whatever it is one has to know or believe in order to operate in a manner acceptable to its members and do so in a manner acceptable to its members, and do so in a role that they accept for any one of themselves"(2). For people to accept cultural practices, an unbiased understanding of such elements of the culture is key. Knowledge-based expositions of such practices are best done in formal school settings. Many cultural biases among ethnic-nations boxed into one country like Nigeria, could be bridged through integrating ethnoscience into basic science school curriculum.

In responding to the 2003 call by International Conference of Associations of Science Education (ICASE) that science education should be made more relevant to the perceived interests of the students, reflecting a balanced vision of the importance and socio-scientific functioning of industry for and awareness of students' careers and meeting the needs of society and culture (Abonyi, Achumugu, et al 2014), ethnoscience should be integrated into basic science curriculum. For a truly holistic and futuristic Science curricular educational reforms at all levels, should include ethnoscience. National educational policy statements should treat 'ethnoscience' as an educational concept to be expounded on and make manifest in real classroom situations. This call is necessary now in Nigeria and all other developing nations, who are beginning to look inwards for answers to national identity, integrity, sustainability of their relationship with and dependency on their environment for national development and progress.

Many empirical studies on the effect of incorporating ethnoscience into students' learning activities abound. All point to the positive effects of treating ethnoscience as an educational concept. Ardiati and Raida(2022) after studying the project learning with ethnoscience approach on science conceptual understanding, came to the conclusion that ethnoscience approach had a positive effect on science concept understanding on the learners. On their own part, Dwi, *et al* (2021) came to a similar conclusion that "ethnoscience learning significantly increased students' scientific literacy in schools" and hence "is very important to improve students' scientific literacy skills in developing science education for students in 21st century and to keep environment" (1). These studies and conclusions only corroborated Dewi, Khery and Erna (2019) who, after carrying out an ethnoscience study in chemistry learning concluded that "development of scientific literacy needs to be done by focusing on the preparation of future generations … with curriculum content that pays attention to culture and daily life to make it more contextual". Such curricular offering will no doubt positively influence the attitude of students toward science. Fassi (2017) studied effects of ethnoscience instructions combined with other parameters and came to the same conclusions: "Ethnoscience instruction promoted learners' attitude to science. Therefore, its use in educational instruction, especially among traditional science learners should be explored"(1).

5. Methodology

The methodology employed in this paper is literature review. Literature was reviewed along the lines of the basic concepts of the paper, seeking clarification of concepts and driving towards opinions that illuminate the questions raised in the purpose of the paper. This method paved the way to organising literature in specifics that dealt with key issues raised in the paper.

6. Conclusions

From relevant and consulted literature, this paper concludes that:

I. The ritual of processing oil bean seeds and preparing it as food by Mbaise people contain clearly discernible knowledge nodes classifiable as biology, botany, chemistry, physics, technology to mention but a few as can be seen in the sub-titles of the literature review.

II. Ethnoscience, if adopted as an educational reform for national science programs, especially as part of Basic Science curriculum, this unique food heritage of Mbaise people and many other such cultural heritage of other ethnic peoples can be integrated into formal science classrooms.

III. Integrating ethnoscience into formal science curricula can be justified from its potential to galvanise students' interest in their culture, deepen their local and cultural knowledge and relate the same to the universal knowledge of science which will lead to the preservation of cultural heritage of peoples and sustainable national developments.

7.0. Recommendations and Future Research

This paper recommends that science curricula of developing nations like Nigeria, looking inwards for harnessing indigenous resources, knowledge and skills for sustainable national developments, should reform their school based science curricula to integrate ethnoscience as an educational concept. The authors advocate for empirical studies in which scientific knowledge could be taught to students using culturally based practices as against the formal science classroom practices.

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