CHAPTER ONE
INTRODUCTION

Background of the Study

Food plants are the most important dietary sources for meeting the nutritional needs of majority of the population in Nigeria (Obizoba, 1998). A variety of plant foods are consumed in Nigeria. However, where the food is in abundance and the choice wide, men eat first for palatability and nutritional value. Of all durable plants, legumes represent the most effective source of vegetable and provide a significant portion needed in many parts of the world (Siegel and Fawcet, 1975). These differences are related in part to ethnic backgrounds, customs and traditions. Ihekoronye and Ngoddy, (1985); and Okoh (1998) also indicated, that in spite of the variety and diversification in diets, malnutrition would only be curbed if indigenous food production, capacity and knowledge of the nutritional value of some local foods and their production improves drastically. Some of these local foods includes seasonings. Over 500 seasonings are made up from plants, some are cultivated while some grow wild.

Seasoning is something used to add taste or flavour to food, such as condiment, herb or spice(Wikipedia,2009).Seasoning is also
the process of imparting flavor to or improving the flavor of food (Wikipedia, 2009). There are over 2,000 known food seasonings in Africa. Some of these are valued for their bulking effects while others may be used as garnishes or spices. Seasonings are derived from vegetables and plants.

Seasonings that come from vegetables, particularly the leafy vegetables abound everywhere that there are enough water and the soil conditions are not limiting (Berry, 2009). Some are cultivated but many are gathered wild. Leafy seasonings are generally grown and widely eaten in Nigeria. Examples are cabbage, celery, curry. They are characterized in excessive quantity and cheap in their season and scarce and costly out of seasons (Fiesta, 2009). In the dry season, these seasonings from wild vegetables assume greater importance especially in areas where lack of facilities for irrigation prelude dry season.

Seasonings are of two types, fermented (local food seasonings) and non-fermented food seasonings. Fermented food seasonings or local seasonings are those food seasonings which undergo traditional food processing method that involves biochemical changes brought about by microbes inherent in grain or derived from a starter culture
and their enzymes (Mazza and Biliaderis, 1989). Fermentation may be used to convert cereals, legumes, roots, tubers, fruits and vegetables to more desirable and storable products under controlled conditions. Fermented or local seasonings are good source of nutrients and could be used to produce complementary food supplements. Macronutrient in fermented legumes contribute to enhance food quality. Traditional fermented seasonings used in Nigeria includes African oil bean (Pentaclethra Macrophylla) Ogiri (fermented castor oil or melon paste), African locust bean (Dawadawa), and Okpeye (Prosopis Africana).

These traditional fermented seasonings used in Nigeria are of great benefits, which include toxin removal, preservation, easing marketing and distribution tasks, and increasing food flavor. Local seasonings can also add extra nutrients such as vitamins B do to traditional processes which it undergoes. In addition, it increases seasonal availability of many foods, enables transporting of delicate perishable foods across long distances and makes many kinds of food safe to eat by de-activating spoilage and pathogenic micro-organisms.
Prosopis Africana (okpeye) one of the traditional fermented seasonings belongs to the family leguminosae. Prosopis Africana is a seed of common woody tree that grows in arid and semi arid areas of the world (Wikipedia, 2007). It grows either wild or domesticated in parts of the middle belt states of Nigeria. The tree reaches 4-20m in height, has an open crown and slightly round buttresses. The bark is very dark scaly slash orange to red brown with white steaks. Prosopis Africana is the only tropical African Prosopis species occurring from Senegal to Ethiopia in the zone between the Sahel and Savannah forests. The fruits occur as pods containing five to eight brown-coated seeds within a fibrous pulp.

For the fact that trees are being cut down for domestic purposes, like house building, cooking of food and land preparation for agriculture, Prosopis Africana are going into extinct in Africa. According to Vogt (1995), due to extensive exploitation, Prosopis Africana has disappeared from extensive parts of the Southern Sahel to the adjacent Sudan Savannalis. The local names for Prosopis Africana are (kiriya) in Idoma languages, (Okpeye) in Hausa and Ibo languages respectively. Despite the fact that in many areas where the trees are grown and are available, the fermented seeds of Prosopis
Africana are well known but very little on the nutritional evaluation and functional properties as a local seasonings in food.

The use of fermented vegetable proteins as seasonings is wild spread in Africa and Asia (Sanni, 1993). The fermented vegetable protein has potential food used as protein supplements and as functional ingredients in fabricated foods (Achi, 2005). Okpeye (Prosopis Africana) is a seasonings produced from the seeds of Prosopis Africana by traditional fermentation process (Orji, 2007). These seasonings are being increasingly marketed throughout the country and beyond in formal ways.

Castor bean plant (Ricinus Communis) “ogiri”, is a native of tropical Africa, cultivated in several varieties for the oil found in its leaves and for its bold foliage (Alber and Alber, 2009). The “stalked” leaves consist of usually eight radiating, pointed leaflets with slightly serrated edges and prominent central veins. Many varieties are green, but some are reddish brown (Cooper and Johnson, 2009). The flowers are green and inconspicuous, but pink or red in the pigmented varieties. Many stamens are near the base and branching pistils are near the top of the flower. The soft-spined fruits containing attractively mottled seeds are distinctive features of the plant. It is
grown as an ornamental in gardens, sometimes as a houseplant and also grows as a weed. It is an annual plant in the south and a perennial in the tropic and it may reach “15 feet tall out doors”. It is a woody herb belonging to the family of Euphorbiacea (spurge).

“Ogiri” is a seasonings produced from Castor oil bean (Ricinus Communis) by traditional fermentation processes (cooper, 2007). “Ogiri” is use as a flavoring agent in soups, sauces and vegetable dishes especially by the Ibos, precisely the Anambra people. The seeds from the castor bean plant (Ricinus Communis), are poisonous to people, animals and insects. One of the main toxic protein is “ricin” named by Stillmark in 1888 when he tested the beans extract on red blood cells and saw them agglutinate. Now we know that the agglutination was due to another toxin that was also present, (R C A) Ricinus Communis Agglutinin. Ricin is a potent cytotoxin but a weak hemagglutinin, while as RCA is a weak cytotoxin and a powerful hemagglutinin. Poisoning by ingestion of ricin, not RCA, because RCA dose not penetrate the intestinal wall, and dose not affect red blood cells unless given intravenously. Castor beans are used as an ingredient in some animal feeds after the oil has been extracted or inactivated by heating for 20 minutes at 140°C.
Both “okpeye” (Prosopis Africana) and “ogiri” (castor bean) seeds are inedible in their raw unfermented or cooked state. Both of them undergo fermentation process, before they become edible. The processing of “okpeye” involves cleaning to remove extraneous materials. The seed are boiled for 10 to 12 hours, dehulled to separate the cotyledon from the hulls. The dehulled cotyledons are boiled in little water for about 10 minutes, drained through a raffia basket. They are left to cool and allowed to ferment for 6 days under the sun. The fermented seeds are ground or pounded to form a dark paste and molded into balls or round shapes. They are dried under the sun and stored in an airtight container for use or sale.

While the processing of “ogiri” involves breaking the shells of the castor oil seed to release the cotyledons. This is normally done carefully with non-sharp objects to make sure that the cotyledons are brought out whole without physical damage. The cotyledons are washed and cooked with water at moderate heat until they are soft and have no sour taste. Cooking may be done 6 to 12 hours preferably overnight. The cooked seeds are drained, allowed to cool at room temperature and placed inside a calabash, basket or bowl with banana leaves and covered with the same type of leaves.
heavy object is placed on the container and seed are allowed to ferment for 3 to 4 days in a warm place, preferably near the fireside or under sun. When odour from the fermenting seeds is pronounced, the seeds are ground or pounded to form a paste and sifted ash from burnt palm bunch is added to the paste to give a glossy appearance. The pastes, now called ogiri is wrapped with special leaves such as ‘abosi’, ‘ububa’, or ‘uma’ and tied with string preferably palm leaves. The wrapped ogiri is placed near the fireplace 1 to 2 days for further flavor development before use.

The different between “okpeye” and “ogiri” is that okpeye is mounded into balls after grounding while ogiri is wrapped with banana and string of palm leaves after grounding. Secondly, “okpeye”Prosopis Africana is used for cooking ogbono soup while “ogiri” castor oil bean is used for cooking onugbu soup.

Statement of the Problem

Despite the huge nutritional values and availability of local seasonings such as Prosopis Africana, castor oil bean as food seasonings, some developing countries like Nigeria require more information on the needs for increasing their utilization. Most of the consumers do not know much about the nutritional values, therefore
use them as functional ingredient in foods for the purposes of tastes or aromatic characteristics. Hence strong emphasis on the nutritional values of both “okpeye” Prosopis Africana and “ogiri” Castor oil bean are required in Nigeria so as to reduce the intake of industrial seasoning such as maggi.

However, fear of the unknown in the components of maggi is the major factor that inhibits its maximum usage in Nigeria. Recently in Nigeria, there has been series of controversial publications and debates over the use of maggi and monosodium glutamate as a cancer inducing seasoning (Umunna, 1999: Nnanyelugo, 1996 & 1998, and Ajinomotor, 1994). Olney (1969) observed that brain lesions, obesity and other disturbances are in food mice treated with monosodium glutamate which might be detrimental to health. Some other reports even asked for the ban of maggi because they contain monosodium glutamate while some maintain that the amount of monosodium glutamate in maggi is negligible, so it is safe (Frank, 1984). However, many Nigerian still use industrial food seasonings such as maggi more than the local food seasonings such as “ogiri”, “okpeye”, as flavor enhancer, their nutritional differences not withstanding. This work exists as a result of inadequate information
with regard to the nutrient content of these local seasonings. The question then is whether the nutritional values of “okpeye” and “ogiri” used in preparing meals in Nigeria can be analyzed and compared.

**Purpose of the Study**

The study was designed to analyze and compare the nutritional composition of both Prosopis Africana “okpeye” and Castor oil bean “ogiri”. Specifically, the study will;

1. Analyze the nutrient composition of fermented Prosopis Africana “okpeye”.
2. Analyze the nutrient composition of fermented Castor oil bean “ogiri”.
3. Comparing the nutritional composition of both castor oil bean “ogiri” and Prosopis Africana “okpeye”.

**Significance of the Study**

Local seasonings such as “okpeye” and “ogiri” are used to enhance the flavor of food. Therefore a number of benefits will be derived from a comparative analysis of Prosopis Africana “okpeye” and castor oil bean “ogiri”. The result of this study will be beneficial to homemakers, Home Economists, health worker, nutritionist, dietitians, general public and the government.
The findings will be of great value to homemakers by bringing to their awareness the nutritional values of both Prosopis Africana “okpeye” and castor oil bean “ogiri”. With these findings the homemakers from different states of Nigeria will know the best local food seasonings to use and the one that will be more nutritious among people of different age groups. And this could be achieved through seminar workshops or women conference such as August meeting and demonstration programme in any state.

Further, the finding of the study will help Home Economists through Home Economists Extension programmes where homemakers are educated on ways of solving national problems associated with nutrition or other diseases. Secondly Home Economists will have the opportunity to educate the homemakers and others on the poisonous or harmful nature of these local seasonings when they are not properly fermented. Finally castor oil bean plant in a garden should not be allowed to flower and seed. A good practice is to “nip it in the bud”, because it kills both adult and children alike.

This study will also help the nutritionist and the dietitians to know the type of seasonings to recommend for people that lacks some nutrient in the body and also to the people that have health problems.
The result of this finding will help the health workers to know the health implications of both Prosopis Africana (okpeye) and castor oil bean (ogiri).

Finally, the result of this study will also help the Government to advice the general public on the type of local seasonings to use.

Research Questions

1. What are the nutritional compositions of fermented Prosopis Africana (okpeye)?
2. What are the nutritional compositions of fermented castor oil bean (ogiri)?
3. What are the mean differences and similarities that exist in the national compositions of the two seasonings?

Hypothesis

The study will be tested at 0.05 level of significance.

$H_0$: There will be no significant difference between the mean nutritional values of fermented Prosopis Africana (okpeye) and fermented castor oil bean (ogiri).
CHAPTER TWO

REVIEW OF RELATED LITERATURE

This literature review will focus on the following subheadings

1. Conceptual Framework

2. Theoretical Framework

   Uses of Prosopis Africana and Ricinus Communis

   Prosopis Africana and Ricinus Communis as legumes.

   Processing Techniques of legumes

   Traditional fermented condiments used in Nigeria.

   Nutritional quality of fermented condiments.

   The effect of processing on the nutritional quality of legumes

3. Related Empirical Study


Conceptual Framework

Basic Concept of Nutrition

- Nutrition is the food you eat and how the body uses it. We eat food to live, to grow, to keep healthy and well, and to get energy for work and play.

- Food is made up of different nutrients needed for growth and health. All nutrients needed by the body are available through
food. Many kinds and combinations of food can lead to a well-balanced diet. No food, by itself, has all the nutrients needed for full growth and health. Each nutrient has specific uses in the body. Most nutrients do their best work in the body when teamed with other nutrients.

- All persons, throughout life, have need for the same nutrients, but in varying amounts. The amounts of nutrients needed are influenced by age, sex, size activity, and the state of healthy suggestions for the kinds and amounts of food needed are made by trained scientists.

- The way food is handled influences the amount of nutrients in food, its safety, appearance and taste. Handling means everything that happens to food while it is being grow, processed, stored and prepared for eating.

There are seven major classifications of nutrients they are carbohydrates, fiber, fats, protein, minerals, water and vitamins. These classes of nutrients are categorized as macronutrients are needed in relatively large amounts micronutrients’ are carbohydrates, fats, fibers, water ad protein while micronutrients are vitamins and minerals.
The macronutrients provide energy, which is measured in joules or kilocalories and written with a capital C to distinguish them from gram calories. Carbohydrates and Proteins provides 17kg (4 Kcal) of energy per gram, while fats provide 37kj (9 kcal) per gram. Vitamins, minerals, fiber, and water do not provide energy, but are necessary for other reasons.

Other nutrients include antioxidants and photochemical. These substances were recently discovered which have not have been yet recognized as vitamins or contribute to health but they are necessary in our bodies. Photochemical may act as antioxidant, but not all of them are antioxidants.

Antioxidants are a recent discovery. Different antioxidants are known to function in cooperative works. Some antioxidants are more effective than others at neutralizing different free radicals. Some cannot neutralize certain free radicals. When interacting with a free radical, some antioxidants produce a different free radical compound that is less dangerous or more dangerous than the previous compound. Having a variety of antioxidants allows any by product to be safely dealt with by more efficient antioxidants in neutralizing a free radicals butterfly effect.
A growing area of interest is the effect upon human healthy of trace chemicals, collectively called photochemical. These nutrients are typically found in edible plants, especially colorful fruits and vegetables, but also other organisms including seafood, algae, and fungi. The effects of photochemical increasingly survive rigorous testing by prominent health organizations. One of the principal classes of photochemical is polyphenol antioxidants, chemicals which are known to provide certain health benefits to the cardiovascular system and immune system. These chemicals are known to down-regulate the formation of reactive oxygen species, key chemicals in cardiovascular disease.

**Theoretical Framework**

A theory according to Karl (1963), is a set of sentences which consist entirely of true statements about the subject matter under consideration. However, the truth of any one of these statements is always relative to the whole theory. Karl continued that the same statement may be true with respect to one theory, and not true with respect to another. Karl also said that theories are constructed to explain and predict.
Olaitan (2004) said that a theory is a set of related statements that are managed so as to give functional meaning to a set of series or event. He maintained that the set of related statements may take the form of functional definitions, operational constructs, assumptions, hypothesis, generalization, laws or theorems.

Among theories which relates to this study is the fermentation theory. Fermentation according to Hawking (1996) refers to any process by which large organic molecules are broken down to simpler molecules as the result of the action of microorganisms. The most familiar type of fermentation is the conversion of sugars and starches to alcohol by enzymes in yeast. This type of fermentation processes is known as ethanolic fermentation (Hawking, 1996). He continued that enthanolic fermentation was one of the first chemical reactions observed by humans. In nature, various types of food “go bad” as a result of bacterial action.

Food is any substance, usually composed of carbohydrates, fats, proteins and water that can be eaten or drunk by an animal or human for nutrition or pleasure. Items considered food might be sources from plants, animals or other categories such as fungus,
fermented products like alcohol. Although many human cultures sought food items through hunting and gathering, today most cultures use farming, ranching and fishing, with hunting, foraging and other methods of a local nature included but playing a minor role (John Wiley, 2005)

Most traditions have a recognizable cuisine, a specific set of cooking traditions preferences and practices, the study of which is known as gastronomy. Many cultures have diversified their foods by means of preparation, cooking methods and manufacturing. This also includes a complex food trade, which helps the cultures to economically survive by-way of food, not just by consumption. Many cultures study the dietary analysis of food habit ‘While humans are omnivores, religion and social constructs such as morality often affect which food they will consume (Obanu, and Onuoha, 1993). Food safety is also a concern with food borne illness claiming many lives each year in many languages; food is often used metaphorically or figuratively, as in “food for thought”.

Food sources: Almost all foods are plant or animal origin, although there are some exceptions. Foods not coming from animal or plant sources include various edible fungi, such as mushrooms.
Fungi and ambient bacteria are used in the preparation of fermented and pickled food such as leavened bread, alcoholic drinks, cheese, pickles and yogurt. Many cultures eat seaweed, a protest or blue green algae (cyanobacteria) such as spirulina. Additionally, salt is often eaten as a flavoring or preservative and baking soda is used in food preparation. Both of these are inorganic substances, as is water, an important part of human diet.

**Food from Plant Sources**

Many plants or plant parts are eaten as food. There are around 2,000 plant species, which are cultivated for food, and many have several distinct cultivars (Ugwu, and Ekeocha 1998). Seeds of plants are a good source of food for animals, including humans because they contain nutrients necessary for the plants initial growth. In fact the majority of foods consumed by human beings are seed-based foods. Edible seeds include cereals (such as maize, wheat and rice) legumes (such as beans, peas, and lentils), and nuts. Oilseeds are often pressed to produce rich oils, such as sunflower, rapeseed (including Canola oil), and seaame (Smart. 1995). Fruits are the ripened ovaries of plants, including the seeds within. Many plants have evolved fruits that are attractive as a food source to animals, so
that animals will eat the fruits an excrete the seeds some distance away. Fruits, therefore, make up a significant part of the diets of most cultures. Some botanical fruits such as tomatoes, pumpkins and eggplants are eaten as vegetables (Fetuga, 1984).

Vegetables are a second type of plant matter that is commonly eaten as food. These include root vegetables (such as potatoes, and carrots), leaf vegetables (such as spinach and lettuce), stem vegetable (such as bamboo shoots and asparagus) and inflorescence. Vegetables (such as globe artichokes and broccoli). Many herbs and spices are highly flavorful vegetables (Onweluzo. 1993).

Production: Food is traditionally obtained through farming, ranching and fishing, with hunting, foraging and other methods of subsistence locally important. More recently, there has been a growing trend towards more sustainable agricultural practices. This approach, which is partly fueled by consumer demand, encourages biodiversity local self-reliance and organic farming methods (Zakaria, 1996).
Preparation

While some food can be eaten raw many foods undergo some form of preparation for reasons of safety, palatability or flavor (Wikipedia, 2007). At the simplest level this may involve washing, cutting, trimming or adding other foods or ingredients such as spices. It may also involve mixing, heating or cooling, pressure-cooking, fermentation or combination with other food (Ahiligwo, 1995). In a home, most food preparation is done to enhance the taste or aesthetic appeal; other preparation may help to preserve the food; and others may be involved in cultural identity. A meal is made up of food, which is prepared to be eaten at a specific time and place. Some of the fermented foods that add flavors or that are used as seasonings include “okpeye” and “ogiri”.

Prosopis Africana are pod bearing trees or shrubs that occur in arid and semi arid zones of America, India, Africa and Asia where 44 species which can be found growing wild in Northern and middle belt of Nigeria and its tree is up to 18m high. The fruit of Prosopis Africana is a thick-walled glossy seeds each about 1 to 2cm long. After a preliminary boiling treatment that lasts for about 5 hours, the seeds are dehulled, fermented into “okpeye” cake a popular product that is
widely used as a food condiment in Nigeria and many parts of West African (Achi, 1992).

Castor plant is a member of the genus *Ricinus* in the spurge family, Euphorbiaceae. Beside *Ricinus Communis*, 2 other species are known in African; *Ricinus percicum* which has some economic potential and *Ricinus Zamzibarensis*, a perennial with indehiscent fruits (Uguru and deckers, 2001). The major producers of castor seeds and oil are India, Brazil, and China etc. The contribution of Africa to the world production of castor seed is very small with Ethiopia, Tanzania and South Africa being the largest exporters on the continent. Castor is best grown at a moderately rainfall of 600-1,200mm with a moderate high temperature of 20-30°C. It is grown as an annual crop in an intercropping system.

Practically, the forms of castor seeds are distinguished by the size of the seed with which differences are associated with different in oil content, the smaller the seed, the richer in oil (Trochain, 2003). The seeds from castor bean plant are poisonous to people animals and insects. One of the main toxic proteins is “ricin” named by still mark in 1888 when he tested the beans extract on red blood cells and saw them agglutinate. Now we know that the agglutination was due to
another toxic that was also present, (RCA) *Ricinus Communis* Agglutinin. Ricin is a potent cytotoxin but a weak hemagglutinin, where as RCA is a weak cytotoxin and a powerful hemagglutinin. Poisoning by ingestion of ricin, not RCA, because RCA does not penetrate the intestinal wall, and does not affect red blood cells unless given intravenously. Castor beans are used as an ingredient in some animal feeds after the oil has been extracted or inactivated by heating for 20 minutes at 140\(^0\)c.

**Food Processing**

Food processing is the set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption by humans or animals either in the home or by the food processing industry. Food processing typically takes clean, harvested crops or slaughtered and butchered animal products and uses these to produce attractive, marketable and often long-life food products. Food processing dates back to the prehistoric ages when crude processing incorporated slaughtering, fermenting, sun drying, preserving with salt, and various types of cooking (such as roasting, smoking, steaming, and oven baking) salt-preservation was
especially common for foods that constituted warrior and sailors’ diets, up until the introduction of canning methods.

**Food Processing Methods**

Common food processing techniques include:

- Removable of unwanted outer layer, such as potato peeling or the skinning of peaches
- Chopping or slicing e.g. diced carrots
- Mincing and macerating
- Liquefaction, such as to produce fruit juice
- Fermentation e.g. in okpeye, beer breweries.
- Emulsification
- Cooking, such as boiling, broiling, frying, steaming or grilling.
- Deep frying
- Baking
- Mixing.
- Addition of gas such as air entrainment for bread or gasification of soft drinks
- Proofing
- Spray drying
- Pasteurization
Packaging

**Uses of *prosopis Africana* and *Ricinus Communis***

Food: In many areas, the fermented seeds are used as food condiments

Fodder: Young leaves and shoots are used as fodders. Branches are frequently broken off on lopped and cattle eat the pods

Fuel: The wood has a high calorific value of about 1720 joules/kg and produces excellent charcoal firewood.

Timer: In Senegal, it is preferred for art and craft work (Von Maydell, 1986) while in Ghana, it is use for pestles, mortars, mallets, cudgets and furniture, construction of railway lines, boat building and axe handles. In Nigeria it is also used for furniture construction of railway lines, axe handles, mortars, and pestles.

Gum or resin: *Prosopis Africana* yields a gum, tannin or dye stuff (Katende, 1995). The roots and barks contain tannin that gives reddish tint to leather.

Poison: Pounded dry fruits are suitable as a fish poison.

Medicine: The leaves are used for treatment of headache and tooth ache. The leaves and bark are combined and used to treat rheumatism. Remedies for skin diseases, fevers and eyewashes are
obtained from the bark (Abbiw, 1990). The roots are used to treat gonorrhea, tooth and stomachache, dysentery and bronchitis. The bark can also be used for wound dressing lotion and as a source of potash for soap making.

**Prosopis Africana and Ricinus Commnus as legume**

Both *Prosopis Africana* and *Ricinus Commnus* belongs to the family leguminosae and they are the second most important source of food and fodder, next only to the family gramineae, the cereal grain. The family leguminosae is however a very important crop in terms of production system since grains and fodder can be obtained with minimal investment in terms of nitrogenous fertilizers.

Generally, legumes contain 17 to 25 % protein (about double that in most cereals) except soybeans, which contain about 40% protein. Legume seed are also good sources of minerals such as phosphorous and iron (Enwere, 1998).

**Production and Utilization of Legumes**

Legumes as a group have very wide range of adaptability with respect to latitudes, temperature, humidity and day length (Elegbede, 1998). They are highly susceptible to insect attack both in farm and during storage.
Some benefits of legumes include the following:

They are utilized either as fodder for animals or as food for human consumption.

Some legumes are grown for brief periods and ploughed into the soil to improve soil structure organic matter and the fertility of the soil.

Legumes with extensive foliage e.g. Peas and cowpea proved protein rich food for cows and horses.

Some dry grains of legumes are sources of Vegetable oil and they can also be made into flour and used for various dishes.

Some species of lotus, vicia and other genera are usually used for decorations in temperate region of the world.

**Processing Techniques of Legumes**

Legumes go through several primary processes before they are used in different food preparations. Some legumes are processed to detoxify the antinutritional factors, increase palatability and improve bioavailability of the nutrient. Among the processes are:

1. **Soaking**

Soaking is one of the preparatory methods of processing legumes for consumption. The seeds are allowed to imbibe water over a long period of time. This helps to soften the cotyledons and
reduce cooking time. Different legumes take different periods to absorb water depending on the hardness of the seed coat. The ones with tough seed coat take 5 to 12 hours to absorb water while soft seeds take 5 to 15 minus to imbibe water. Sometimes warm water is used to quicken the soaking time of seeds with hard tough seed coats (Aykroyed, 1981). The soaking of seed grain in water leads to losses in minerals, pertinacious substances and other soluble solutes from the cell wall and middle lamella of cells located in the brain layer of the seed. Also, some of the antiphysiological substances may be leached out into water. Soaking has been shown to decrease calcium and iron in legumes by 18.5% and 34% respectively (Ene Obong, 1992).

2. **Scarification of seeds**

   Legumes sometimes require additional techniques like scarification to break their hard coats. Scarification involves breaking, scratching, or softening the seed coat to allow moisture penetration. This allows the seed coat to absorb water; the embryo expands and ruptures the protective coat causing the seed to sprout. The methods of scarification commonly used are mechanical and hot water scarification. Mechanical scarification involves breaking or weakening
the seed coat with a file or sand paper. This normally works well for larger seeds. Hot water scarifications involve placing seeds in water at between 490C to 980C and then allowing soaking seeds for 12 to 24 hours to sprout. However, the use of hot water may lead to loss of some nutrients example vitamins, and minerals depending on how permeable the seed coat are to water. It can also affect the functional properties of proteins, which can lead to inactivation of some enzymes presented in the seeds, and also lead to a decrease in viability of the seeds.

3. **Sprouting**

   This is a natural, simple and long-time process of improving the nutritional worth of legumes and cereal food (Obizoba, 1991). Sprouting of seeds triggers of the enzyme systems of the seed, leading to breakdown of complex macromolecules of protein, carbohydrates and lipids into sprouting not only increase the nutritive value of legumes. It also increases its relative nutritive value (RNV). The enzyme polyphenol oxidase hydrolyses protein, tannin complexes and tannin enzymes complexes to release free tannin. This consequently decreases tannin level with a consequently decrease in protein availability. Amylolytic enzyme residues in
seed/malts can be resourcefully applied for the purpose of viscosity thinning to facilitate the design of high nutrient density porridges.

4. **Dehulling**

Dehulling is the removal of the outer coat of food legumes or cereals. It is a common method of processing food legumes for the preparation of some foods. In most homes in Nigeria, it is manually done by rubbing off seed coat by hand after soaking for a few minutes. The dehulling treatment applied to grain legumes can be either dry or wet treatment. Both treatments are aimed at loosening the seed coat. The dry method involves treating the grain with a little amount of oil and then drying for 2 to 3 days under the sun. The oil penetrates through the husk to the cotyledon and releases its binding under the mild heat during drying. The dry dehulling treatment has disadvantage of high dehulling loses due to breakage and powdering.

In the traditional processing of prosopis africana into fermented “okpeye”, the wet dehulling method is normally used. It has the advantage of facilitating easy and good dehulling splitting of the cotyledons easily with less breakage. However, the disadvantage is that it consumes a lot of heat energy (fuel) during the predehulling boiling.
Dehulling removes some of the anti-nutritional factors that are located in the seed coat and enhances nutrient availability. Dehulling soybeans were reported to have lower fibre, relatively higher amount of protein but smaller amino acid composition than whole soybeans (Cabral et al, 1995).

5. **Drying**

Legumes are dried to remove water and concentrate the nutrients. Drying is also a method of preserving foods (Ihekoronye and Ngoddy 1985). Open air / sun drying leads to possible contamination of food materials by the activities of rodents. The infestation of food by insects or exposure to the environmental elements i.e. rain and wind causes spoilage and losses.

6. **Size Reduction / Milling:**

According to Enwere (1998), size reduction involves the breakdown of solid materials to smaller particles through the application of mechanical force using different methods and equipment. Size reduction aids in the extraction of a desired constituent from a composite structure and it reduces product to a definite size range required for that product. It increases the surface area of the solid, which facilitates drying time of moist solid foods.
Processing tie required for certain operation such as cooking, blanching, frying etc and finally initiates intimate mixing or blending trending to a more homogeneous blend of the product.

7. **Fermentation:**

Fermentation is a traditional food processing method that involves biochemical changes brought about by microbes inherent in grain or derived from a starter culture and their enzymes. Fermentation may be used to convert cereals, legumes, roots, tubers fruits and vegetable to more desirable and storable products under controlled conditions. These inherent microorganisms are found mostly at surface of the cereal grains or cotyledons of legumes. The organic acid, lactic acid and acetic acid produced by lactic acid bacteria are very effective microbial agents that prevent the growth of the hazardous food microorganisms by reducing the PH of the food (Lee, 1994). The techniques of fermentation vary from region to region depending on the availability of material and the consumption pattern (Steinkrause, 1997). Fermentation is used to preserve foods and to improve their palatability. It also increases the acidity level and there by preventing pathogenic microorganisms from multiplying in
the food which keeps the food safe and makes it last longer (Latham, 1997).

According to Enwere (1998), fermentation may significantly improve the nutritive value of foods by:

Increasing the digestibility of protein through hydrolysis of proteins and amino acids.

Conversion of oligosaccharides such as raffinose and stachyose to simple sugars thereby reducing flatulence.

Increasing the availability of minerals such as calcium and phosphorus through hydrolysis of phytate and oxalate as in “okpeye” production.

Increasing the nutrient level through microbial synthesis especially of the B vitamins.

The improvement in flavour may occur as a result of the formation of odour and flavour components or compounds. Similarly, fermentation imparts a desirable sour or acidic taste to many foods. The texture of the raw materials is also altered as a result of the hydrolysis of proteins and carbohydrates.
Traditional Fermented Condiments used in Nigeria

Traditional diets in West Africa often lack variety and consist of large quantities of the staple foods (cassava, yam maize) with supplement of plantain, cocoyam, rice and beans depending on the availability and season (Achi, 1999). Soups eaten with stables are essential components of diets and may contain a variety of seeds, nuts, pulses and leaves. Legumes account for 80% of dietary protein when consumed in their cooked form. They are either eaten as meals or used in fermented forms as condiments to enhance the flavour of foods with high contents of proteins. Legume condiment can serve as a tasty complement to sauces and soups and can also substitute for fish or meat. Fermented traditional condiments have not attained commercial status due to the very short shelf life, objectionable packing materials, stickiness and the characteristics putrid odour (Arogba et al, 1995). Fermented condiments often have a stigma attaché to them and are often considered as food for the poor. The convectional substrates for condiment production are diverse and each can be produced from more than one raw material. Almost any edible plant material can be subjected to fermentation. Quite often,
seeds that are used for fermentation are inedible in their raw unfermented or cooked state.

**Nutritional quality of Fermented Condiments**

Protein utilization measured as protein efficiency ratio (PER) and the digestibility of soybeans and some legumes are hardly improved by fermentation on the nutritional content of locust bean showed that protein and fat increased where as the quantity of carbohydrates decreased. Increase levels of amino acids were also reported except for arginine, leucine and phenylalanine. Soluble products increased during fermentation resulting in high digestibility of the fermented product. Improved nutritive values were attributed to the increase in amino acid profiles due to fermentation.

Food condiments made from vegetable protein may be a good source of certain B vitamin, but are deficient in ascorbate and some fat-soluble vitamins, which are lost during fermentation. It is evident that fermented condiments are good source of nutrients and could be used to produce complementary foods supplements. Macronutrients in fermented legumes contribute to enhance food quality.
The effect of Processing on the Nutritional Quality of Legumes

Nutritionally, the main effects of processing are detoxification, increasing palatability and bioavailability of nutrients. However, there are still other individual effects caused by specific process (Walker and Kochhar, 1982).

Nutritionally, soaking affects legumes either adversely or beneficially. According to Siegal and Faw Cett (1976), soaking reduces antinutritional factors such as trypsin inhibitors of legumes; water-soluble minerals, vitamins, amino acids, proteins and sugars are solubilized by the soak water. Long soak also causes enzyme driven changes in proteins, starch and cell wall materials, thereby inducing changes in physico chemical and functional properties of foods (Kent, 1975). Long soak also increases Nitrogen solubility and foaming ability but decreases Jelling and swelling capacity (Uchendu, 1982, Edijiala 1980).

In drying, the effect on quality of legumes depends on the moisture content, temperature, time and exposure (Kent, 1975). Sun drying temperature less than 540C causes little or no change in the physico chemical and nutritional quality of starch and protein while high temperature drying in mechanical devices changes these
qualities by changing the nature of the basic constituents of seeds such as starchy proteins are denatured at temperature above 600°C.

In dehulling, the main nutrient less in this process is calcium especially in chicken pea. Dehulling reduces the oligosaccharide components and alkaline used in soaking in some cases might have its trace on the seed coat.

In fermentation, the process produces wholesome edible products essentially free of toxic materials. It also inactivates unfavorable substance like haemagglutinns, and saponnins. During the analysis of locust bean of proximate composition, it was reported that fermentation causes increase in crude protein and fat but there was decrease in carbohydrate (Eka, 1980).

Traditional fermentation foods used as condiments in Nigeria;

Ukpaka (*Pentaclethra macrophylla*) African oil bean known as ukpaka by Ibos’ is processed by prolonged cooking of the seeds, dehulling and slicing of cotyledons. The sliced cotyledons are cooked again, dewatered, washed and fermented for one to four days to produce edible delicacy of some Igbo’s called ugba or ukpaka. It can be eaten by itself or mixed with palm oil, tapioca (cassava slice) and other ingredients. The ugba, which has reached an advanced stage
of fermentation, in about 3 to 4 days is an ingredient in vegetable soups, yam pottage, potato dishes, corn and other cereal foods especially maize.

2. Ogiri (*Ricinus Commnui*) castor oil or melon paste.

Ogiri is used as a flavoring agent in soups, sauces and vegetable dishes especially by the Ibos. The processing involves breaking the shells of the castor oil seed to release the cotyledons. This is normally done carefully with non-sharp objects to make sure that the cotyledons are brought out whole without physical damage. The cotyledons are washed and cooked with water at moderate heat until they are soft and have no sour taste. Cooking may be done 6 to 12 hours preferably overnight.

The cooked seeds are drained, allowed to cool at room temperature and placed inside a calabash; basket or bowl with banana leaves and covered with the same type of leaves. A heavy object is placed on the container and seed are allowed to ferment for 3 to 4 days in a warm place, preferably near the fireside or under sun. When odour from the fermented seeds is pronounced the seeds are ground or pounded to form a paste and sifted ash from burnt palm bunch is added to the paste to give a glossy appearance. The paste,
now called ogiri is wrapped with special leaves such as abosi, ububa or uma and tied with a string but preferably palm leaves. The wrapped ogiri is placed near the fireplace for 1 or 2 days for further flavour development before use.

Castor oil seed raw

Decortications

Cooked for 8 hours

Fermented for 24 hours

Grounded and blended with wood ash

Wrapped in wilted plantain leaves.

Fermented for 3, 4 and 5 days.
3. Dawadawa (*Parkia Biglobosa*) African locust bean: The African locust bean (*parkia Biglobosa*) is used as a flavoring agent in soup and sauces. The seeds are boiled for 12 to 24 hours, dehulled to separate the cotyledons from the hulls. The loosened hulls are removed by flotation. The dehulled cotyledons are boiled in excess water for another 2 hours drained through a colander or a raffia basket or a calabash while still hot. They are covered with leaves or jute bags depending on the ambient temperature, salt can also be added. He resulting product is called dawadawa, which may be used, fresh or moulded into balls or round flat shapes. They are either sun dried or dried over he fire place and store for use or sold.

Dawadawa is a flavoring agent that is extensively use in Nigeria by both the rich and the poor and virtually all ethnic groups for flavoring soups, stews, porridges and other foods.
1. Okpeye (*Prosopis Africana seeds*)

Prosopis africana

\[ \downarrow \]

Cleaning

\[ \downarrow \]

Boiling

\[ \downarrow \]

Dehulling

\[ \downarrow \]

Washing

\[ \downarrow \]

Parboiling and allowing to cool

\[ \downarrow \]

Fermentation

\[ \downarrow \]

Drying

\[ \downarrow \]

Milling/grinding

\[ \downarrow \]

Moulding

\[ \downarrow \]

Drying

\[ \downarrow \]

Packaging

Source; Oral interview [Grand Mother.]
Okpeye is use as a flavoring agent in soup, sauces, stews and vegetable dish especially by the Ibos. The processing involves cleaning to remove extraneous materials. The seeds are boiled for 10 to 12 hours, dehulle to separate the cotyledons from he hulls. The dehulled cotyledons are boiled in little water for about 10 minues, drained through a raffia basket. They are allowed to cool and are covered with special leaves, and are allowed to ferment for 6 days under the sun. The fermented seeds are grinded or pounded to form a dark paste and will be moulded into balls or round shapes. They are dried under the sun and stored, in an airtight container for use or sold.

**Related Empirical Studies**

There is paucity of research on nutritional composition of *prosopis Africana* and castor oil beans but some studies have been carried out in relation to fermented legume like locust bean, castor oil seed and oil bean generally. However these studies reviewed some relationship to the present study.

Obizoba and Atu (1992) carried out study on the production and chemical evaluation of some food condiments of Nigeria. The study was aimed at investigating the nutrient and tannin composition
of fermented legume seeds (oil bean, castor oil bean and African locust bean) used as food condiments in Nigeria. The legume seeds were purchased from local retailers, cleaned and subjected to varied fermentation periods. Standard assay techniques were adapted to analyze the parameters selected for use. The study shows that 4-day fermentation period caused the highest increases in protein and tannin and decreases in ash, lipids and non-protein nitrogen (NPN). The pulp of African locust bean has more protein and ash, and the oil bean seeds less lipids and NPN. The result shows that fermentation for 4 days offers a greater advantage over other periods for production of nutritious and cheap food condiments in Nigeria.

Aneke (2003) investigated on the effect of varying fermentation periods on 2 varieties of locust bean seeds (parkia spp) and castor oil seed (Ricinus communis). The purpose of the study was to determine the effects of varying fermentation periods on the nutrient content of two varieties of locust bean seed (parkia spp) and castor oil seed (Ricinus communis). The parkia biglobosa seed (dawadwa) was brought from the local small market in Mbu-Amon, Enugu state and the castor oil seed was purchased from retailers at Ogige main market in Nsukka town, Enugu State. These seeds were
leaned, cooked and subjected to varied fermentation periods. The products were analyzed for different nutrients using modern assay techniques. The result showed that 4days fermentation increased the ash in all products and caused decreases in nutrients beyond 4days in dawadawa and castor oilseeds. Beyond 4d fermentation all nutrients decreased. On the other hand, all nutrients increased except CHO on the 5th day. It was founded that fermentation increase acceptability of the products and improved their flavour and aroma.

Orji (2007) carried out a study on the effect of pre dehulling treatment on selected chemical characteristics of prosopis Africana and its product okpeye. The purpose of the study was to devise a method for efficient conservation of time and energy during the dehulling of prosopis Africana. Okpeye a traditional soup condiment was produced from prosopis Africana seeds using 3 different treatments (methods). The first treatment involved soaking the seeds for 12 hours to soften the seed coat before dehulling. In the second treatment, the seeds were dehulled after sprouting while in the third treatment; the seed were boiled for 10 hours to detach the hulls before dehulling as generally done traditionally. Samples for the treatment were cooked/boiled, fermented and analyzed for chemical
composition to evaluate the relationship of the various treatment processed on the dehulling efficiency and nutritional composition of the fermented sample. The sprouted okpeye showed a slight lower content crude fat and fiber content which compared with the commercial okpeye. The result shows that sprouting is an effective method of decreasing dehulling time, increasing nutrient content and enhancing the utility potential of prosopis Africana as a food condiment.

**Summary of Related Literature Review**

The review literature noted that Aneke (1999) determined the effects of varying fermentation periods on the nutrient content of two varieties of locust bean seed (*parkia spp*) and castor oil seed (*Ricinus communis*), and deduced that fermentation increases acceptability of the products due to their flavor and aroma. Obizoba and Atu (1992) did some work on the production and chemical evaluation of some condiments of Nigeria and found out that fermentation for 4 days offers a greater advantage over other periods. Finally Orji (2007) did some work on the method for efficient conservation of time and energy during the dehulling of *prosopis Africana*, and found out that sprouting is an effective method of decreasing dehulling time,
increasing nutrient content and enhancing the utility potential of *Prosopis Africana* as a food condiment.

While the researchers dwelt on the production and chemical evaluation of some food condiments; varying fermentation periods on the nutrient content of two verities of locust bean seed and castor oil seed; and method for efficient conservation of time and energy during the dehulling of *Prosopis Africana* none considered the nutritional composition of ‘okpeye’ and ‘ogiri’. The study tends therefore to analyze the nutritional composition of ‘okpeye’ and ‘ogiri’ comparatively. This research believes will avail Nigerians the opportunity of determining either of the food enhancers that would attend more to their health requirements.
CHAPTER THREE

METHODOLOGY

This chapter presents the design of the study, sampling technique, experimental procedure, proximate analysis and method of data analysis.

Design of Study

Experimental research design were used for the study. According to Osuala (2001) experimental research design is a method of seeking knowledge about the present time. The use of this design is very appropriate because analyzing the nutritional components of okpeye and ogiri respectively is a current issue. The nutritional composition of “okpeye” and “ogiri” were analyzed in the laboratory using proximate analysis.

Materials for the Experiment

Three cups each of “okpeye” and “ogiri” were purchased from Nsukka (ogbete) main market.

Experimental Procedure

The “okpeye” seeds were boiled for 10 to 12 hours, dehulled to separate the cotyledons from the hulls. The dedulled cotyledons were boiled in little water for about 10 minutes, drained through a raffia
basket. They were allowed to cool and were covered with special leaves, and allowed to ferment for 6 days under the sun. The fermented seeds were grinded or pounded to form a dark paste and were moulded into balls or round or desired shapes. They were dried under the sun and stored in an airtight container for use. This process is shown below:

- Okpeye seed
  - Cleaning
  - Boiling
  - Dehulling
  - Washing
  - Parboiling and allowing to cool.
  - Fermentation
  - Drying
  - Milling/grinding
  - Moulding
  - Drying
  - Packaging

The processing of “ogiri” involve breaking the shells of the castor oil seed to release the cotyledons. This is normally done
carefully with non-sharp objects to make sure that the cotyledons are brought out whole without physical damage. The “ogiri” seed are released from the cotyledon. The cotyledons were washed and cooked with water at moderate heat until soft and have no sour taste. The cooked seeds were drained, allowed to cool at room temperature and placed inside a calabash; basket or bowl with banana leaves and covered with banana leaves. A heavy object were placed on the container and seed were allowed to ferment for 3 to 4 days in a warm place, preferably near the fireside or under sun. When odour from the fermented seeds is pronounced, the seeds were ground to form a paste and sifted ash from burnt palm bunch were added to the paste to give a glossy appearance. The paste, now called ogiri were wrapped with special leaves such as abosi, ububa or uma and tied with a string but preferably palm leaves. The wrapped ogiri were placed near the fireplace for 1 or 2 days for further flavour development before use. The process is shown below:
Ogiri seed
Decortications
Cooked for 8 hours
Fermented for 24 hours
Grounded and blended with wood ash.
Wrapped in wilted plantain leaves
Fermented for 3, 4 and 5 days

**Coding of the Local Seasoning**

The local seasoning “okpeye” and “ogiri” will be coded with the following letter; $O_A$ as “okpeye” and $O_B$ as “ogiri”.

**Proximate Analysis**

The proximate composition of “Okpeye” and “Ogiri” will be determined using the AOAC (1995) procedure.

- Moisture content will be determined.
- Crude protein will be determined
- Fat content will be determined
- Fibre will be determined.
- Ash content will be determined.
- Carbohydrate content will be determined
Method of Data Analysis

The mean ($\bar{x}$) value and standard deviation (SD) will be used for data analysis. The mean values will be compared using ANOVA.
This chapter deals with the presentation and analysis of data. The data will be presented and analyzed according to research questions that guided the study.

Research question 1: what is the nutritional composition of fermented prosopis Africana (okpeye)?

Table 1: Nutritional Composition of Fermented Prosopis Africana okpeye

<table>
<thead>
<tr>
<th>Samples</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture_Okpeye</td>
<td>32.7</td>
</tr>
<tr>
<td>Ash_Okpeye</td>
<td>5.20</td>
</tr>
<tr>
<td>Fat_Okpeye</td>
<td>8.00</td>
</tr>
<tr>
<td>CrudeFiber_Okpeye</td>
<td>8.90</td>
</tr>
<tr>
<td>CrudeProtein_Okpeye</td>
<td>12.0</td>
</tr>
<tr>
<td>Carbohydrate_Okpeye</td>
<td>33.4</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 above shows the nutritional composition of fermented prosopis Africana(okpeye). Moisture content of ‘okpeye1 is 32.7% while ‘okpeye2 contains 32.4%. Based on this, their mean moisture
content was deduced, which is 32.6%. Therefore, the mean moisture content of 'okpeye_1' and 'okpeye_2' is 32.6%.

Ash content of 'okpeye_1' is 5.2% and 5.2% is for 'okpeye_2'. The average of the two samples which is 5.2% makes up the mean ash content. In 'okpeye_1' the fat content is 8.0% and 8.0% is for 'okpeye_2'. The average of the two samples of 'okpeye' which is 8.0% is the mean of the fat content of 'okpeye'.

For 'okpeye_1', 9.0% is the crude fiber of and 8.8% is the crude fiber of 'okpeye_2'. The average of the crude fiber in okpeye_1 and 'okpeye_2' is 8.9% which indicate on the table as the mean of the crude fiber of 'okpeye'. Crude protein of okpeye_1 is 11.9% while 12.0% is for 'okpeye_2'. The average of the two sample 12.0% is then the mean content of the crude protein in 'okpeye' seasonings. Finally the carbohydrate content of 'okpeye_1' is 33.1% while 33.6% is for okpeye_2. The average of carbohydrate in the two samples is 33.4%. This implies that the mean content of carbohydrate in 'okpeye_1' and 'okpeye_2' is 33.4%.

Based on this observation, it means that 'okpeye' contains large quantities of carbohydrate and moisture while the quantities of ash in 'okpeye' is very small.
Research Question 2: What is the Nutritional Composition of Fermented Castor Oil Bean (Ogiri)?

Table 2: Nutritional composition of fermented Castor oil bean (Ogiri)

<table>
<thead>
<tr>
<th>Samples</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture_Ogiri</td>
<td>4.00</td>
</tr>
<tr>
<td>Ash_Ogiri</td>
<td>3.40</td>
</tr>
<tr>
<td>Fat_Ogiri</td>
<td>13.6</td>
</tr>
<tr>
<td>CrudeFiber_Ogiri</td>
<td>.00</td>
</tr>
<tr>
<td>CrudeProtein_Ogiri</td>
<td>16.2</td>
</tr>
<tr>
<td>Carbohydrate_Ogiri</td>
<td>26.9</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>Valid N (listwise)</td>
</tr>
</tbody>
</table>

The table above shows the nutritional composition of fermented castor oil bean (ogiri). The moisture content of ‘ogiri1’ is 39.8% while 40.2% is for ‘ogiri2. The average of the two samples (ogiri1 and ogiri2) which is 40.0% makes up the mean of moisture content of ‘ogiri’.

For ‘Ogiri1, 3.2% is for ash content while 3.6% is for ‘ogiri2. Based on this, the mean ash content was deduced, which is 3.4%. Therefore, the mean ash content of ‘ogiri1 and ‘ogiri2 is 3.4%.
Fat content of ogiri1 is 13.4% and 13.8% is for ogiri2. The average of the two samples (ogiri1 and ogiri2) 13.6% is then the mean content of ogiri seasonings.

Quantities of crude fiber in ogiri1 are 0.0, while 0.0 is for ogiri2. The average of the two samples (ogiri1 and ogiri2) which is 0.0 which is indicated on the table as the mean of the crude fiber of ogiri.

Crude protein of ogiri1 is 16.4% and 15.9% is for ogiri2. The average of crude protein in ogiri1 and ogiri2 is 16.2% that makes up the mean crude protein. Finally, 27.2% is the carbohydrate content of ogiri1, 26.5% is for ogiri2. The average of the carbohydrate in the two samples (ogiri1 and ogiri2) is 26.9%.

From this analysis, it shows that ogiri has large moisture content and small ash. Finally, ogiri has no crude fiber in it.
Research Question 3: What are the mean Differences in the Nutritional Composition Of Seasonings?

Table 3: Mean differences of the nutritional composition of Okpeye and Ogiri

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>T</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogiri</td>
<td>16.7</td>
<td>2.73</td>
<td>5</td>
<td>.041</td>
<td>16.7</td>
<td>.99 32.4</td>
</tr>
<tr>
<td>Okpeye</td>
<td>16.6</td>
<td>3.18</td>
<td>5</td>
<td>.024</td>
<td>16.6</td>
<td>3.22 30.1</td>
</tr>
</tbody>
</table>

The one-sample T-test table above shows the mean and the mean difference between Ogiri and Okpeye.

Table 4: One-way ANOVA Table of the significant difference between the nutrient compositions of the two seasonings

<table>
<thead>
<tr>
<th>ANOVA</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogiri</td>
<td>Sum of Squares</td>
<td>df</td>
<td>Mean Square</td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Between Groups</td>
<td>2224.4</td>
<td>9</td>
<td>247.1</td>
<td>3.09</td>
<td>.00</td>
</tr>
<tr>
<td>Within Groups</td>
<td>.160</td>
<td>2</td>
<td>.080 Within Groups</td>
<td>.160</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2224.6</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The table shows that F-ratio calculated is 3.09 which is significant at 0.00. This implies that there is a significant difference between the mean nutrient content of Okpeye and Ogiri.

**Discussion of Result**

In determining the result of the proximate analysis of both fermented Okpeye and Ogiri, the ranks of the various nutritional content of both seasonings was collated and analyzed. The result in table 1 and 2 was determined using descriptive statistics, and this was in order to determine the Mean and standard deviation of each of the nutritional content used for the study, thereby answering the research question 1 and 2 which seeks to determine the nutritional content of Okpeye and Ogiri, respectively.

The Mean values gotten in research question 1 and two (i.e table 1 and 2), was used to determine the mean differences that exist in the nutritional composition of both seasonings. This was achieved using One Sample T-test, and was reflected in table 3 above, and the table shows the Mean, t, df (degree of freedom), the 2tailed significance and the mean differences.

Finally, one way ANOVA was used to determine the hypothesized significant difference between the nutrient compositions
of the two seasonings. In the ANOVA table (table 4), the F-ratio calculated is 3.09 which is significant at 0.00. This implies that the significant difference between the mean ratings of the nutrient contents of Okpeye and Ogiri is relatively low.
CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Restatement of the Problem

Despite the huge nutritional values and availability of local seasonings such as Prosopis Africana, castor oil bean as food seasonings, some developing countries like Nigeria require more information on the needs for increasing their utilization. Most of the consumers do not know much about the nutritional values, therefore use them as functional ingredient in foods for the purposes of tastes or aromatic characteristics. Hence strong emphasis on the nutritional values of both “okpeye” Prosopis Africana and “ogiri” Castor oil bean are required in Nigeria so as to reduce the intake of industrial seasoning such as maggi.

However, fear of the unknown in the components of maggi is the major factor that inhibits its maximum usage in Nigeria. Recently in Nigeria, there has been series of controversial publications and debates over the use of maggi and monosodium glutamate as a cancer inducing seasoning (Umunna, 1999; Nnanyelugo, 1996 & 1998, and Ajinomotor, 1994). Olney (1969) observed that brain lesions, obesity and other disturbances are in food mice treated with
monosodium glutamate which might be detrimental to health. Some other reports even asked for the ban of maggi because they contain monosodium glutamate while some maintain that the amount of monosodium glutamate in maggi is negligible, so it is safe (Frank, 1984). However, many Nigerian still use industrial food seasonings such as maggi more than the local food seasonings such as “ogiri”, “okpeye”, as flavor enhancer, their nutritional differences not withstanding. This work exists as a result of inadequate information with regard to the nutrient content of these local seasonings. The question then is whether the nutritional values of “okpeye” and “ogiri” used in preparing meals in Nigeria can be analyzed and compared.

Summary

The prevailing population pressure in Nigeria, as in other less-developed countries, has resulted in an increasing demand for wild under-exploited nutritious plant products with aesthetic and organoleptic appeal in the daily diet (Enujiugha, 2005). The common edible portions of most under-utilized plants are the seeds, which in some cases are cooked or roasted and eaten directly as snack foods e.g. conophor nut and bambara groundnut, while some are cooked and fermented for use as soup and sauce ingredients e.g. African oil
bean, locust bean, castor bean and melon. There are various plant seeds that are fermented and used as food in some rural parts of Nigeria, among which are, ‘ogiri’ from castor bean (*Ricinus communis*), and ‘okpeye’ from mesquite seed (*Prosopis africana*) and.

The need to carry out a comparative analysis of Okpeye and Ogiri is to find ways of obtaining a hygienic and safe seasoning, which has on the other hand led to the search for various ways of producing these local fermentations.

These traditional fermented seasonings used in Nigeria are of great benefits, which include toxin removal, preservation, easing marketing, distribution task, increasing food flavour and many more factors which are found to be advantages of locally made fermented seasonings over the foreign made ones.

Number of factor have been found to be the difference between the locally fermented Ogiri and Okpeye. More of the factors is that Okpeye is mounded into balls after grinding, while Ogiri is wrapped with banana and string of palm leaves after grinding. Secondly, Okpeye is used for cooking Ogbono Soup while Ogiri is used for cooking Onugbu Soup.
Despite the utilization of the huge nutritional values and availability of these local seasonings, some developing countries like Nigeria require more information on the needs for increasing their utilization.

Finally, the nutritional content of these fermented seasonings were determined, the mean difference between these seasonings were also determined and the hypothesis tested using SPSS statistical package, as can be evident in chapter 4 above.

Educational Implications of the Study

The broad aim of this study is to measure the nutritional composition of fermented Okpeye and Ogiri. This study has however found that there is a slight variation in the nutritional composition between the two seasonings under review. However, the findings are far more numerous than can be anticipated. Therefore, in order to do justice to the depth and complexity of the study, a summary of the educational implications are listed accordingly:

1. The nutritional values of the seasonings where brought to light, thereby bringing to the awareness of the school dieticians on how to make best use of these seasonings.

2. The health implications of both seasonings were made known. This will help health workers in both the local, state or federal
level to educate the masses on the health implications of both Okpeye and Ogiri through conferences, seminars and other means of public awareness campaign.

3. The differences that exists between the two seasonings (i.e Okpeye and Ogiri) determined in this study will help the government to carry out awareness campaign on how best the two seasonings can be used in the family.

4. This study will also help the classroom teachers/lecturers in Home Economics and nutrition and dietetic class to know how to best apply his teaching and practicals in the laboratory.

5. This research will go a long way in helping the Ogiri and Okpeye producers on how best each should be fermented and made readily available for consumption.

6. The research will help to educate the cafeterians and the general public on which type of food to apply a particular type of seasoning.

Recommendations

1. Sellers should ensure that they do not expose the fermented foods during display because this may predispose them to contamination.
2 During sales and production, sellers and local processors must always wear gloves to discourage contamination.

3. Fermentation should be considered safe for consumption because food pathogens such as *Salmonella*, *Shigella*, *E. coli*, *Campylobacter jejuni* and *Clostridium* were not isolated from them, although their safety can be insured.

5 Appropriate material resources to conduct the research; e.g firewood, water, and local made materials should be made available or improvised, for a smooth conduct of this kind of research.

6 Fermentation of Ogiri or Okpeye should be mostly carried out during the dry seasons so as to increase fermentation and also reduce the difficulty of drying them during rainy seasons.

7. Information concerning the use of seasonings in some areas/homes should be made available through public awareness campaign.

**Limitations of the Study**

By the end of this study, the researcher experienced some limitations such as:
1. Lack of appropriate material resources to conduct the research; e.g. firewood, water, and local made materials.
2. Difficulty of drying the castor oil
3. Difficulty of separating the cotyledons from the hulls
4. Inadequate knowledge of the application of the seasonings
5. Lack of information concerning the use of seasonings in some areas/homes
6. Financial constraints
7. Difficulty of representing the experiment/proximate analysis into numerical form for analysis.

**Suggestions for further Studies**

As with any study, there are design constraints, whether by choice or externally determined, that limit and focus the research. Furthermore, through reviewing the literature and conducting the research, in addition to addressing the research propositions, other shortcomings of the study emerge.

The focus of this study places the researcher’s self-confidence as the outcome variable in the SPSS analysis. Clearly, there is additional understanding to be gained by developing alternative
models that places people’s attitude towards a collective experiment and indepth outcome variables.

However, due to the small samples, the data are not suitable for the statistical and modeling techniques employed in a developing countries and advanced research findings. Nonetheless, using methods appropriate for the data, analysis and comparison to the developing countries and advanced research may yield valuable findings. A follow-up study in the cities and not only remote villages can also be highly beneficial. This study is limited to researchers experiment and findings. However, it does not mean that consulting different homes, dietician and nutritionists are any less important.

This study poses many challenges in the experiment and analysis of data, which operate at multiple levels and on multiple occasions, where appropriate methods of analysis are not widely known or well established. The management of these challenges, together with the practical and theoretical implications of the study, should re-inform original theory and design, with the underlying premise that change is sustainable and that innovation in homes and cafeteria practices should be ever evolving. By doing so, this investigation provides a substantial and significant contribution to the field of educational innovation where research does inform practice.
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Ijabadeniyi AO, & Omoy FO (2006b). Safety of Small-Scale Food Fermentations in Developing Countries.


COMPARATIVE ANALYSIS ON THE NUTRITIONAL COMPOSITION OF PROSOPIS AFRICANA (OKPEYE) AND RICINUS COMMUNIS (OGIRI)

BY

UGWUARUA, BLESSING .N
PG/PGDTE/SD/08/48083

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UNIVERSITY OF NIGERIA, NSUKKA

NOVERMBER, 2010
COMPARATIVE ANALYSIS ON THE NUTRITIONAL COMPOSITION OF PROSOPIS AFRICANA (OKPEYE) AND RICINUS COMMUNIS (OGIRI)

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF VOCATIONAL TEACHER EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF PGDTE DEGREE IN HOME ECONOMICS EDUCATION, UNIVERSITY OF NIGERIA, NSUKKA

NOVEMBER, 2010.
This research project has been approved for the Department of Vocational Teacher Education for the Award of PGDTE Degree in Home Economic Education, University of Nigeria, Nsukka.

By

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Project Supervisor

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CERTIFICATION

Ugwuarua, B.N is a student of the Department of Vocational Teacher Education with Registration Number PG/PGDTE/SD/08/48083, has satisfactorily completed the necessary requirements for the course work and the research project for the Award of the PGDTE in Home Economics Education, University of Nigeria, Nsukka. The research report embodied here in the project is entirely original.

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.................................
Ugwuarua, B.N
(Student)

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Dr. (Mrs) N. Eze
(Supervisor)
DEDICATION

To my parents and my family
ACKNOWLEDGEMENTS

I want to use this medium to express my heartfelt gratitude to the almighty God for his benevolence, divine grace and guidance throughout my years of study in this University.

I specially wish to convey my gratitude to my project supervisor, Dr. Mrs. N. Eze, whose self sacrifice, wisdom and immeasurable inputs made for a successful completion of this work.

My exclusive and special prayers of thanksgiving, undying love and regard to my Husband and my Children (names) for their support, encouragement and love. May the almighty God grant them long life, in order to live and see the goodness that my heart echoes for them. My indebtedness also goes to everyone who has helped in one way or the other for the successful completion of this work and for their academic assistance during my times of academic turbulence, I cannot appreciate that enough.

Finally, my regards to my nephews, all my cousins, friends and well wishers, I love you all.
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Abstract

This study was carried out to analyze comparatively, the nutritional composition of Prosopis Africana (Okpeye) and Ricinus Communis (Ogiri). Three research questions guided the study. The two local seasonings Prosopis African (Okpeye) and Ricinus Communis (Ogiri) were analyzed using proximate analysis to find out the nutritional composition of the two seasonings under review. These two local seasonings are mainly used as condiments in soups, sauces and porridges among mainly the Ibos in Nigeria. In determining the result of the proximate analysis of both fermented okpeye and ogiri, the ranks of the various nutritional content of both local seasonings were collected and analyzed. The results showed that the mean difference between the two local seasonings is relatively low. It also showed that ogiri has large moisture content and small ash and no crude fibre. It was therefore recommended that information concerning the use of local seasonings in some areas/homes should be made available through public awareness campaign.