EFFECT OF PROCESSING ON NUTRITIONAL VALUES OF LOCUST BEAN

BY

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NOVEMBER, 2008.

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BEING A FINAL YEAR PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN AGRICULTURAL AND BIORESOURCES ENGINEERING

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

NOVEMBER, 2008.

DECLARATION

I hereby declare that this project is a record of a research work that was under taken and written by me. It has not been presented before for any degree or diploma or certificate of any university of institution. Information derived from personal communication, publishment and unpublished works of others were duely referenced in the text.

21/11/2008

NDAMAN ABDULLAHI MOHAMMED **DATE**

CERTIFICATION

This project entitled "Effect of Processing on Nutritional Values of Locust Bean" by Ndaman Abdullahi Mohammed meets the regulations governing the award of degree of Bachelor of Engineering (B.ENG.) of the Federal University of Technology, Minna, and it is approved for its contribution to scientific knowledge and literary presentation.

19/11/2008

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DEDICATION

This research project is dedicated to Almighty Allah who has given me the strength and made me successful in this programme.

ACKNOLEDGEMENT

I am most grateful to the almighty God for infinite mercies and protection, may his name be glorified and exalted forever, and ever. Amen.

My thanks goes to my project supervisor which is also Head of Department of Agriculture and Bioresources Engineering, who took me has her son and her student, spared her time to read through my fattened manuscript and made recommendations on what to do and make sure every single item in this project is within the range of accuracy. Thank you ma. And to all lecturers and staff of the department of Agriculture and Bioresources Engineering, F.U.T Minna. God bless you All.

Words can not express, numerals can not quantify, and emotions can not reveal my gratitude to my parents Mal. Mohammed Kodagba, Mal. Mohammed Usman, and mallama Fatima Usman, who gave me all the moral, physical, psychological support throughout the course of my study. May Allah let not your effort be in vain and reward you abundantly. Amen

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To my friends and course mates who we started this long journey together with, may Allah honour and bless our friendship forever. Alhassan Mamudu, Musa, shuaibu, Mohammed Haruna Madaki, and in particular Isah Abubakar who helped in discovering all the humanly potentials in me.

Last but not the least, my appreciation to every one I have come in contact with that has improve or added value, no matter how small, to my academic, social, psychological and mental well being .

MAY ALLAH BLESS YOU ALL. Amen

ABSTRACT

In this research work, the nutritional composition of African locust bean *[Parkia-bigloyosa]* and two different types of Dadawa were determined and analyzed with the view of ascertaining its edibility and suitability in various processes and applications. Under standard laboratory conditions and using standard procedures and instruments experiments were conducted and results obtained. The results showed that locust bean has the following nutritional composition such as 5.17% moisture, 38.2% lipid, 2.00% ash content, 30.0% crude protein, 4.33% crude fibre, 24.63% carbohydrate. For the two different type of Dadawa, flat Dadawa also has the following nutritional composition which include 6.00% moisture, 26.3% lipid, 1.5% ash content, 1.16% crude fibre, 34.98% crude protein, and 31.2% carbohydrate. While Round Dadawa contains, 12.5% moisture, 25.5% lipid, 1.17% ash content, 30.4% crude protein, 0.75% crude fibre and 30.7% carbohydrate. Generally, the result shows both locust bean and two different type of Dadawa has higher percentage of lipid, crude protein, and total carbohydrate. The lipid content reduces during of locust bean to flat Dadawa and round Dadawa from 38.2%, 26.3%, to 25.5%. The protein content increase from 30.0% to 34.98% during processing from locust bean to flat Dadawa. Also crude protein is reduced from 34.98% to 30.4% for flat and round Dadawa. The carbohydrate also increased from 24.63% to 31.2% during processing from locust to flat Dadawa. And also reduced from 31.2% to 30.7% for flat and round Dadawa.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The African locust bean tree which belongs to the family *Leguminosae* is a large tree with a very broad, sometimes pendent crown, supported by a trunk. There are two botanically related species, *Parkia biglobosa* occurring in the Sahel, and *Parkia clappertoniana* occurring typically in wet savanna regions.

The leaves are compound, and the leaflets themselves are composed of many simple, smaller leaflets about 1.5cm long by 0.5centimetres wide. The leaflets are sub-Rectangular with rounded tips (Dupriez Hugus, 1989) the number of leaflets decreases and their size increase as one moves south-ward from the semi arid savanna to the humid equatorial zone, suggesting that they may be ecotypes of the same species. The flowers, red in colour, like dropping balls appear in the dry season after the leaf fall.

The locust bean fruits are up to 45cm long narrow pods, 2cm wide slightly curved, hanging in clusters from the flower stalks. They usually flattened, brown or black when ripe. They contain black seeds embedded in yellow pulp (Dupriez Hugus, 1989). The locust bean pods or seeds contain yellow pulp which envelops thin membrane which converts or changes the brownish black seed coat. It is known that locust bean contain 39-40% protein, 31-40% oil, 11.7-15.4% carbohydrate. The black seeds of the locust bean contain around 26 percent protein and they are rich in calcium (Campbell-platt, 1980).

1.2 Uses OF Locust Bean

The yellow pulp of the fruits is rich in carbohydrates, and its used in strews. African locust beam seeds are rich in protein and usually fermented to a tasty food condiments called Dadawa which is used as a flavor intensifier for soups and stews and also add protein to a protein poor diet. After drying, the pulp is roasted and ground into a powdery. Locust bean gum is less soluble and lower viscosity than guar gum as it has fewer galatose branch points. It needs heating to dissolve but is soluble in hot water. The seed gum is employed in the manufacture of cosmetics, pharmaceutical products, detergent, paints, and photographic paper (Ikenebomen and Kok, 1984; Odunfa, 1986). The leaves and the bark are also used in remedies, for treating skin infections and burns (Dupriez Hugus, 1989).

1.3 Local Method of Processing Locust Bean

A necessity, the local farmers over the years washed their locust beans tissue in streams, ponds, and lakes or sometimes in reservoirs near their home. This processing involves shelling of the pod and removal of the pulp to obtain the seed for boiling and pounding. The seeds are hard and elaborate cooking process have been claimed to remove unpleasant odour from the seeds.

The cooking, fermenting and moulding processes must be carried out under hygienic conditions to avoid contamination of material with dirt and unwanted foreign matter. The fermentation period must not go beyond three days to avoid producing undesirable odours. Sometimes the mounded balls are given one or two days drying to further stabilize the product during storage.

1.4 Objectives of the study

The objectives of this study are

1- to determine the effect of processing on nutritional, values of locust bean

2- to determine the physio-chemical changes during fermentation process.

3- Evaluate the difference in nutritional content between the Dadawa and locust bean.

1.5 Justification of the Study

Locust bean tree is found almost in all part of the country, and processing of locust bean itself is being done by rural women in the village. Yet the utilization of the locust bean has not been achieved despite its economic importance. The production of locust bean is in the increase within our community due to its economic importance, it's not an over statement to say that locust bean "iru" production has received a boost within the last few years. Therefore, the objectives of this project are to determine the effect of processing on nutritional values of locust bean and also to asses the effect of locust beans processing on nutritional content of Dadawa.

1.6 Scope of the Study

The scope of this work is limited to the determination of nutritional values of Dadawa and (locust bean) in the biochemistry laboratory.

CHAPTER TWO

2.0 LITERATURE REVIEW

Rural dwellers in developing countries like Nigeria cannot afford animal products which are rich sources of protein because they are either too expensive or simply unavailable. Staple diets consist mainly of cereal grains or starchy roots and tuber crops thus leading to various health problems associated with protein and vitamin/minerals deficiencies in the search for plant protein and vitamin substitutes the African locust bean *(Parkia Biglobosal)* has found very popular use especially in the fermented "Dadawa" form which is a product of the seeds however, the yellow dry powdery fruit pulp called "Dorowa" in Hausa has not attracted much attention. Many workers (Fetuga et al. 1974; Campbell-Platt, 1980; Eka, 1980; Odunfa, 1986; Oke and Umoh, 1987) have reported the nutritional adequacy of the African locust bean seeds with a proximate composition of 30.00% of protein 15% of fat, 4% of crude fiber, 2% of ash and 49.00% carbohydrate.

According to (Uwaegbute,1996) the powdery fruit pulp contains more carbohydrate than the seed, the carbohydrates being primarily reducing sugars (19.00%) non –reducing sugars (9.00%) and other complex carbohydrates (36.00%).

2.1.0 Environmental Requirement of Locust Bean

The African locust bean is a light loving tree. It requires deep well drained soil, and can withstand drought reasonably well once it is firmly established

2.1.1 Planting the Seeds

The seeds needed for the planting should be collected from the freshly fallen pods from strong, healthy trees. Viability is short so it is best to plant the seeds as soon as possible. Germination is improved water or seeds scalding for about 7 minutes seedling raised in port are ready for planting in the field after 10-14 weeks. Growth rate is moderate, 22 years old tree can have a trunk diameter of about 17-20cm. spacing 5x5m, followed by thinning from the 8^{th} to 10^{th} year, to leave a population of 500 tree/ha.

2.1.2 Recommended Species of African Locust Bean.

The following species have been recommended by the food and agricultural organization (FAO, 1988).

A. Parkia biglobosa

B. Parkia filicoidea

C. Parkia clappertoniana

D. Parkia bicolou

2.1.3 Harvesting of Locust Bean

The pods are picked from the tree, or the seeds collected from the ground after pods have been blown down by high wind or have split. After harvesting the seeds are removed from the dry pulps and the pulp filled husks are stored in large granaries.

2.1.4 Storage of Locust Bean

The dry pods keep along time. The flur (pulp) and the balls of ferments' dried seeds may be kept in polythene bags and sealed. This will protect them from external contamination or moisture uptake. Since the product is fermented with a strong odour, this difficult to known when the produced has spoiled but it is claimed that the shelf life may range between six and eight months (Margaril and Brian 1994).

2.1.5 Nutritional Contents of Locust Bean

The seeds of the African locust bean are however, red brown to black flattened and is embedded in a yellow floury pulp.

The fruit pulp of the African locust bean is sweet to the fast, which indicates the presence of natural sugars and thus a potential energy source. The yellow colour indicated the presence of photo-nutrients possible carotenoids, which are important precursors of retinol (vitamin A). It has a sour taste which indicates the presence of ascorbic acid (vitamin C)

Literature reveals that the fruit pulp is used in rural African during emergencies, when the grain stores are empty which is an indication of its edibility and non toxicity (Owoyele *et al* 1987; A koma *et al.* 2001). It may also be used as an ingredient in the preparation of various stews, soups and sauces for the consumption of cereals; pressed into cakes and preserved for later use or used in the preparations of some indigenous drinks (Muller, 1988). And is more than adequate to meet the FAO/WHO recommended daily allowance of protein of 0.5g/kg body weight for an average healthy individual and

0.88g/kg body weight for children 1 to 10 years (Shakuntal and Shadaksharaswamy, 1987).

Carbohydrates content was found to be 67.30%. This is much higher than the seeds (49.49%) as reported by(Fetuga *et al.* 1974); and is in agreement with the findings of (Uweagbute 1996) that the fruit pulp contains more carbohydrates than the seeds. It is also higher than most legume seeds with only lentils and Bambara groundnuts coming close with a value of 65.0% (Muller, 1988) though proteins and fats also provide energy, carbohydrates are much cheaper and more easily digested and absorbed. (Fox and Cameron 1989). With this content of carbohydrate the African locust bean fruit pulp is potential good source of energy given the recommended daily energy intake (Muller, 1988).

The crude fiber was found to be 11.75% which is on the high side. Though crude fiber does not contribute nutrients or energy, it is a source of dietary fiber which is essential for good bowel movement and helps in preventing obesity diabetes, cancer of colon an other ailments of the gastro-intestinal tract of man though the crude fiber obtained for the pulp is less than that of seeds (18.00%) as reported by (Uwaegbute, 1996) it is much higher than for most food legumes, which range from 2.10% in groundnut to 7.60% in kidney beans (Ihekoronye and Ngoddy, 1985). This makes the Africa locust beans fruit pulp a potential good source of dietary fiber.

Crude fat was found to be 1.8%. This is in conformity with most legumes, which apart from groundnuts (45.30%), soybeans (17.70%) and winged bean (17.00%) all have less than 3.00% fat with lentils having as low as 0.60% (Ihekoronye and Ngoddy, 1985). (Stein 1982) also reported a fat content of 0.5% for Mediterranean locust bean (Ceratonia Silligua) fruit pulp. This low fat content is an indication that the fruit pulp an store for long periods at the right temperature and moisture with out spoilage by rancidity, which is characteristic of many legumes.

The ash content of 4.18% is within the range for most legumes of 2.00% in peas to 5.00% in soybeans. This figure is much higher than the 1.00% obtained for the fruit pulp of the Mediterranean species by (stein 1982); and is an indication that the African locust bean fruit pulp is a good sources of minerals required by the body.

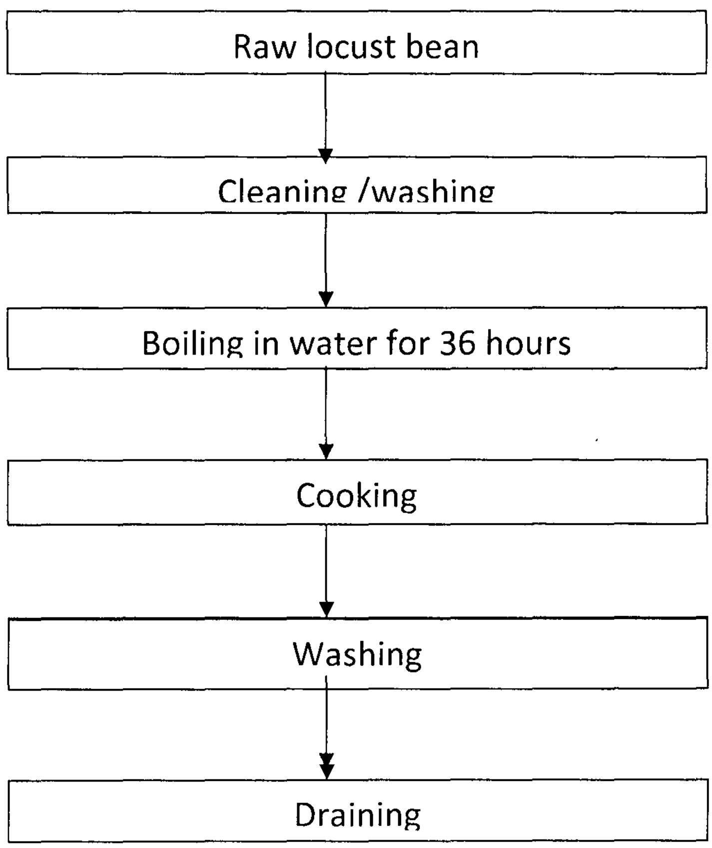
Table 2.1: Nutritional composition of African locust bean source. (Fetuga *et al*; 1974),

CONTENTS	PERCENTAGE COMPOSITION
Carbohydrate	49.00%
Protein	30.00%
Ash content	2.00%
Crude Fibre	4.00%
Fat	15.00%
Reducing Sugar	19.00%
Non-reducing Sugar	9.00%
Other Complex Carbohydrates	36.00%

2.1.6 Locust Bean Processing

African locust bean has distinct physical and mechanical properties when compared to other legumes. The beans are enclosed in hard, tough and relatively thick coat that has semi-permeable characteristics, easy movement though the coat is restricted.

The local production processed subject the pulp to soaking to remove the sweeten yellowish tissue from the seed, after which the dry bean are subjected to one or two days of continuous intensives cooking to soften the hard seed coat. After softening the seeds are then left for two to three days to ferment and sun dried. (Campbell 1980). Process of locust beans by fermentation is done by submerging and boiling cleaned beans in adequate amount of Water for at least 18 hours until soft. The cooked locust is then allowed to cool down completely before dehulling (that is processing between the palms to remove the tough fibrous testa). The dehulled seeds are then washed and cooked for another 3 minutes to avoid producing undesirable odours which they are drained, cooled and prepared for fermentation by packing into various incubation materials and weighed down keep the cover in place. The beans are then allowed to ferment under incubators of ones choice.



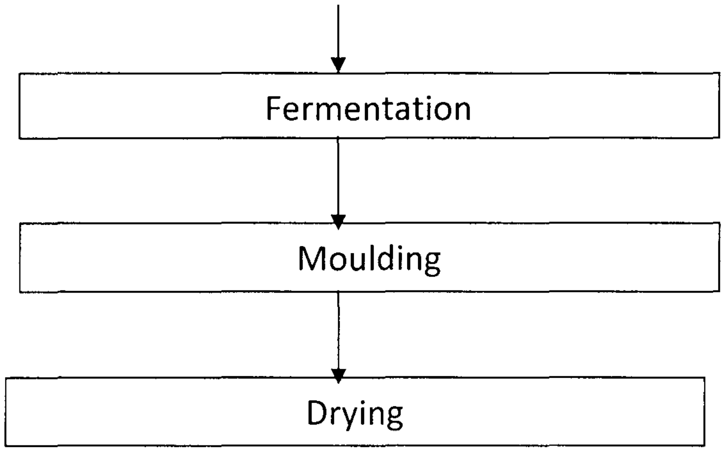


FIGURE 2.1 FLOW CHART FOR PREPARATION OF LOCUST BEAN

2.2.0 Locust Bean Boiling

The African locust bean was boiled for 12 hours and further soaked in the boiling water for another 12 hours (preferably overnight) excess water was drained off and the seeds were dehulled by marching the seeds by foot in a large worden morter and further removal of the seed coat was achieved by rubbing the cotyledons between the palms of the hand and washing with water. The cotyledons were again cooked for another 6 hours. The hot boil water was drained off and diecotyledons were then spread into calabash trays, covered with wooden trays, wrapped with jute sacks and ferment for 3-4 days to produce iru.

2.2.1 Traditional Processing Method

The local method of locust bean processing involves the roasting of the kernels mixed with smaller pieces of stones to prevent burning. Thereafter, kernels are crushed and sieved using sieve which is made up of piassava outer layer. The crushed and sieved kernels are boiled for at least 2-4 hours depending on the heat process. The boiled kernels are sieved in order to remove away the pericap of the kernels and other unwanted materials before it is stored for fermentation process. The product is stored in around made basiscet using the tough grasses which is sprinkled on top of the product in the basket and then covered with broad leaves in order to ascertain in the fermentation which last over 2 – 3 days. After the fermentation , the beans are then pounded in a mortar using wooden pistle of which the beans are thoroughly compounded together to easy the mold thereby pressing with the hands to enhance the drying process.

2.2.2 Traditional Open Sun Drying Techniques

Drying of processed locust beans (Dadawa) has long been practiced traditionally by the local farmers, mostly in the sub-Sahara northern parts of Nigeria, there is high intensity of sunshine's and low relative humidity of the year. In particular traditional open sun drying of Dadawa is carried out on an open flat container for easier drying which is extensively increasing commercially and many are now using dried Dadawa for food unlike before.

2.2.3 Advantages of Drying Dadawa

Drying of Dadawa has a number of advantages some of these are:-

1. It allows the product to resist spoiled due to the presence of moisture percent
2. To keep off the flies due to distinct odour as a result of fermentation

3. To reduce the distinctive odour
4. Gives an advantage of easy pounding based on an attempt for soup or stew preparation.

2.2.4 Limitation of the Local Method

The method is proven to waste during the process of kernels crushing after roasting and subsequent poor fermentation method or procedure. Most importantly there is the problem of low nutritional constituent e.g level of protein which is due to the broken kernels and over fermentation which produces the strong distinctive odour.

2.2.5 Electrically Powered Boiling Of Locust Beans.

Electric boilers are noted for being clean, quiet, easy to install, and compact. Beans and there are no combustion considerations, an electric boiler has minimum complexity (no fuels or fuel handling equipment) with easily replaceable heating elements. An electric boiler may be the perfect alternative to supply hot water where the custom is restricted by emission regulations. In areas where the cost of electric power is minimum, the electric boiler could be the best choices

A heating element converts electricity into heat through the process of joule heating. Electrical current running through the elements use nichrome wire or ribbon as the conductor. Nichrome is an ideal material as it is inexpensive, has relatively high resistance, and does not break down or oxidize in air in its useful temperatures range.

2.2.6 Improvement Efforts On Manufactured Of Dadawa.

Methods have been reported, aimed at improving the nutritional contents of Dadawa as well as removing the kernels odour after fermentation. The unwanted kernels odour is principally considerate to be as a result of lipid oxidation catalyzed by lipoxidaze enzyme (IITA 1989). This reaction quickly takes place whenever the beans are exposed to moisture during fermentation at a temperature below instant enzyme in activation. For this purpose, unbroken kernels are best for Dadawa preparation while beans should be broken during and after crushing process.

The low nutritional of Dadawa from the unimproved technique is due to the presence of some heat growth as a result of fermentation which represents the trypsin inhibitors for hermoagglutinins and others present in the raw locust bean. Although there has been much problem encountered nevertheless efforts are still being done to overcome the storage problems thereby using the traditional open sun drying of Dadawa in order after fermentation process and store well for a longer periods of time to provide for the off season. The use of drying techniques is believed to be the solution as this is nutritionally acceptable and applicable instead of using the fresh fermented Dadawa in preparation of soups and stews which contains less number of nutritional constituents that have been destroyed during the process of over fermentation.

2.2.7 The Effect of Drying/Processing on Nutritional Contents

Food drying is a units operation aimed at removing all the water present in food stuff. It could be described as a heat and mass transfer processes and vaporization of water from the food product. Food dehydrating is a form of preservation because the moisture in food is reduced to a level where no microbiological activity can occur. And deteriorative biochemical reactions are reduced to minimum. It also reduces the weight and bulk of foods for cheaper transport and storage. Dried foods can have poorer nutritional and eating qualities than corresponding fresh foods

Sun-drying is traditionally carried out in places where an average year climate allows food to be dried and stored and spoiled. If drying is not traditionally done in an area it is usually because the climate is not suitable and the food does not dry fast enough to prevent spillage. The level of dryness of air is termed humidity the lower the level humidity, the dryer the air.

Hot, dry air must be blown over food so that it can pick up water from the surface of food and remove it. Faster moving air carries moisture away from the food more quickly than slow moving or stationery air. However, not all foods need a high rate of drying. Some, for example fruits and fish, undergo case hardening if the rate of drying is too high when this happens, a layer of sugars and mineral forms on the surface of the food and the food has a tough, dry skin but is wet inside. Further drying is not possible or very slow and during storage the moisture gradually moves to the surfaces and the food spoils. To prevent this, the rate of drying is reduced the rise o f the pieces of food also has an important effect on the rate of drying. Smaller pieces dry faster than larger pieces. Another effect of drying is that there is insufficient control over drying conditions in a solar dryer to produce high value foods of consistently high quality. The growth of micro-organisms are seriously prevented as a result of drying Dadawa in order to enhance storability for the long period of time of which the shelf life may range between six and eight months. Peter fellows (1997)j.

2.2.8 Effect of Drying On Protein Retention.

Heating grinding and over drying for example has the effect of dissolving the proteins, hence proteins are complex polymer of amine acids. The amino acids monomers are joined together by polypeptide bonds. To retain protein during or after processing there is the need to avoid the kernels breakages and excessive drying which leads to the reduction of amino acids protein supply the nitrogen which is required by the body cell metabolism and so they feature prominently in qualities evaluation of dadawa generally nitrogen exists in protein in the ration 100:16 or 6:25 the value is usually used as a factor in calculating the protein in food products.

Proteins are sparingly soluble in aqueous solvents especially water the solubility of proteins increase with temperatures and its extraction from plant sources is therefore possible under aqueous conditions. (Prachuab 1983), stated that excessive drying however leads to denaturation of proteins.

Desirable and some times undesirable changes take place in food proteins when processed. Some chemical changes lead to compounds which are non hydrosanable by intestinal enzymes. Some on the other hand lead to improved f nutritional value by inactivation of anti-nutritional component.

Protein denaturation is the partial or completes disruption of the primary, secondary or tertiary structure of protein molecule. In nature, protein losses some specific biological property such as enzymatic or hormonal activity the effect of denaturizing can be summarized as follows:-

i. Polypeptide bonds of protein are made readily available for proteolytic enzyme hydrolysis.
ii. Solubility is reduced
iii. Intrinsic viscosity is increased
iv. Crystallization of protein is no longer possible

CHAPTER THREE

3.0 Materials and methods

3.1 Raw material and sources

African locust bean and two different types of Dadawa (Flat and Round) were bought at kasuwan Gwari in Minna Niger state .the raw samples were transferred in different cello phone bag labeled A, B and C under ambient temperature. The test and analysis were carried out in the biochemistry department laboratory, Federal University of Technology Minna.

3.2 Reagents and Instruments

In the course of the practical work carried out on the project, the reagents and instruments are listed below.

3.2.1 Reagents

Textraoxosulphate (iv) acid (H_2SO_4)

Sodium hydroxide (NaoH)

Calcium chloride ($CaCl_2$)

Calcium hydroxide (Ca $(OH)_2$

Methyl orange indicator

Ammonium chloride solution (NH_4CL)

Petroleum ether

copper sulphate ($CUSO_4$)

3.2.2 Instruments /Apparatuses

Crucibles

Furnace

Filters paper

Water bath

Petri dishes

Desiccators

Weighing balance (with sensitivity of 300g)

Bunsen burner

Oven (Gallenkamp oven 3,000, plus series) soxhlet extractor flat bottom silica dishes beakers

Thimbles

Pipette

Conical flasks

Muffle furnace

3.2.3 Method (Proximate Analysis of Locust Bean and two different types of Dadawa (Flat and Round)

3.2.4 Determination of Ash Content and Organic Matter (%)

Principle

The ash of a biological material is an analytical term for the inorganic residues that remain after the organic mater h as been removed. The value is for assessing the quality or grading certain edible materials. The importance of the ash contents is that it gives an ideal of the amount of mineral elements present in the sample while organic matte gives an estimate of proteins, lipids, carbohydrate and nucleic acid content in the sample. The method used is described by (Pearson 1981).

Procedure

A dry porcelain crucible heated in a muffle furnace for about one minute was transferred to a desiccator to cool and weighed to a constant weight (W_1). A known weight of the samples (2g) was placed into the crucible and weighted (W_2). The crucible with the sample was gently heated on the Bunsen flame until smoke, ceased after which it was transferred to a muffle furnace and burnt at 600^0C to white ashes. The crucible was then removed and placed in a desiccator to cool after which it was weighted (W_3)

$$\% \text{ ash content} = \frac{\text{weight of ash}}{\text{weight of sample}} x\ 100$$

3.2.5 Determination of Crude Protein (%) (A.O.A.C, 1980)

Principle

Protein is the major compound containing nitrogen (amino acids, purines, ammonium salts etc), so nitrogen is used as an index of the protein termed crude protein as distinct from true protein. The nitrogen content of protein varies from 15-18 %, but if an average value of 1.6% nitrogen is assumed, crude protein is estimated by nitrogen x 6.25 (conversion factor). The stages involved are:

A) Digestion

2g of the sample weighted into a digestion flask, 5g of copper sulphate pentahydrate, 100g of Na_2SO_4 anhydrous, aspeck of selenium and $25cm^3$ of conc. Sulphuric acid were all added together in the flask. The mixture was the boiled for 1 ½ -2 hours, using Bunsen burner.

After frothing has subsided the solution changed color from black to brilliant green and this shows complete digestion. The digest was diluted to $5cm^3$ with distilled water in a volumetric flask after cooling

Reaction

$R\text{-}NH_2+H_2SO_4 \xrightarrow[catalyst]{Se} (NH_4)2SO_4+CO_2+H_2O$

B) Distillation

A liquor + ($5cm^3$) of the digest was pipetted and delivered into Markhain distillation apparatus $10cm^3$ of 60% NaoH was added and distilled with ($5cm^3$) 2% boric acid in the receiving flask to trap the liberated ammonia. The distillate was collected in a $50cm^3$ beaker.

Reaction

$(NH_4)\,2SO_4 + 2NaoH \longrightarrow Na_2SO_4 + 2NH_3 + 2H_2O$

C) Absorption

$3NH_3+H_3Bo_3 \longrightarrow (NH_4)_3Bo_3$

D) Titration

The distillate was titrate against 0.01M HCL and the tire value recorded. Reaction

$(NH_4)\,3BO_3 + 3HCL \longrightarrow 3NH_4CL + H_3BO_3$

Calculations

$1000cm^3$ of 1m HCL = 14g Nitrogen

$1cm^3$ of 0.01MHCL= $0.00014Gn^2$

$5cm^3$ of digest will contain (0.0014 x 5)g of N_2 if the titre value is Vcm^3 then $250cm^3$ of the digest will contain

$1.4 \, x \, 10^{-4} x 250/5 \;\; x \, V x 1 (w) g N_2$

Wg of the samples will contain

$(1.4x\ 10^{-4})\ x\ ^{250}/_{5}\, x\ V\ x\ \frac{1}{10})gN_2$

$\%\ protein = (1.4x\ 10^{-4})\ x\ ^{250}/_{5}\, x\ V\ x\ \frac{100}{10})x\ 6.25$

3.2.6 Determination of crude fibre (%)

The crude fibre estimation was done by the method described by(A.O .A .C 1980) the bulk of roughage in foods, referred to as the fibre is estimated as crude fibre.

Principle

What left after other constituent has been removed from original sample the chemical fibre not true fibre for crude fibre estimation.

Procedure

This is in accordance with the method described by (A.O.A.C 1980). A known weight of the sample (2g) was taken and defatted with petroleum ether for 8hrs. It was boiled under reflux for exactly 30 minutes with $200cm^3$ of 1.25% H_2SO_4. It was filtered and washed with boiling water till the washing are no longer acidic. The residue was boiled in around bottom flask with $200cm^3$ of 1.25% NaoH for another 30 minutes. It was filtered into a previous weighed crucibles and the crucible with sample (residue) was dried in the oven at 1000^0C. It was left in a desiccators to cool and weighed (C_2). It was then incinerated in a muffle furnace at about 600^0C for 3 hours. Left in a desiccator to cool done and weighed (C_3).

At 100^0C . It was left in a desiccators to cool and weighed (C_2). It was then incinerated in a muffle furnace at about 600^0C for 3hours Left in a desiccator to cool down and weighted (C_3).

Calculation:

Weight of fibre = (C_2-C_3)

$$\% \text{ fibre} = \frac{C_2 - C_3}{\text{weight of original sample}} x\ 100$$

3.2.7 Determination of carbohydrate (%)

Carbohydrates values are obtained by subtracting the total percentage of water mineral, protein and fat from 100. This is known as carbohydrate by differences and is use because no satisfactory method exists for determining carbohydrate by direct analysis (Halen Andrews Guthrie, 1979). This method was used to determine the percentage carbohydrate of sample A, B and C.

Calculation:

(%) carbohydrate = 100 – (P + L M + MC)%

P = (%) protein

L = (%) Lipid (fat)

M = (%) mineral

MC = (%) moisture contents

3.2.8 Determination of Moisture Content or Dry Matter (%)

Clean and dried wet Petridish was weighed empty (Xg). The petridish was weighed again with wet samples (X_1g) the petridish and sample were dried in the oven at 60^0C for 48hrs t a constant weight and the weight taken (X_2g)

Calculation:

Weight of empty petridish = Xg

Weight of petridish + fresh sample = X_{1g}

Weight of petridish + dry sample = X_{2g}

Weight of fresh sample = (X1-X) g

Dry weight of sample = (X2- X)g

Thus

$$\% \text{ Dry matter} = \frac{\text{Dry weight}}{\text{Fresh weight}} x\ 100$$

$$\text{i.e } \frac{(X_2 - X)}{X_1 - X} x100$$

3.2.9 Determination of lipid (%)

The lipid content of a biological material can be estimated by directly extracting the dry material exhaustively using a suitable lipid solvent. e .g petroleum (40^0C -60^0C), diethylether etc. in a convenient continues extractor, such as soxhlet, Bolton or Bailey walker type. Direct extraction gives the proportion of free fat.

About 5g of the sample powder is taken into a thimble of known weight (W_l). They together weigh W_2. The thimble with sample is placed inside a soxhlet extractor 300ml of acetone ethanol mixture (1:1) is poured into a 500ml round bottom ground joint flask, the soxhlet extractor with the thimble plus sample is filled into the flask, which is sitted in electrically connected heating mentle, the mentle is switched on and the heat increased carefully and slowly until the solvent boils (condensed solvent vapour collects in the thimble and dissolves the lipid in the sample. The solvent with lipid will continuously run back into the flask). The heating and so the extractive process is continued for about 24hours when the thimble with contents is removed, dried in a even at 50^{0}C for 24 hours, cooled in desiccator and weighed (W_3), calculated lipid (%) = $\frac{100(W_2+W_3)}{W_2-W_1}$

The solvent is distilled off to about 20m., the lipid in solvent solution is quantitatively transferred on to an evaporating dish, cooled, dried in a desiccator. The lipid thus recovered may be weighed and lipid (%) calculated.

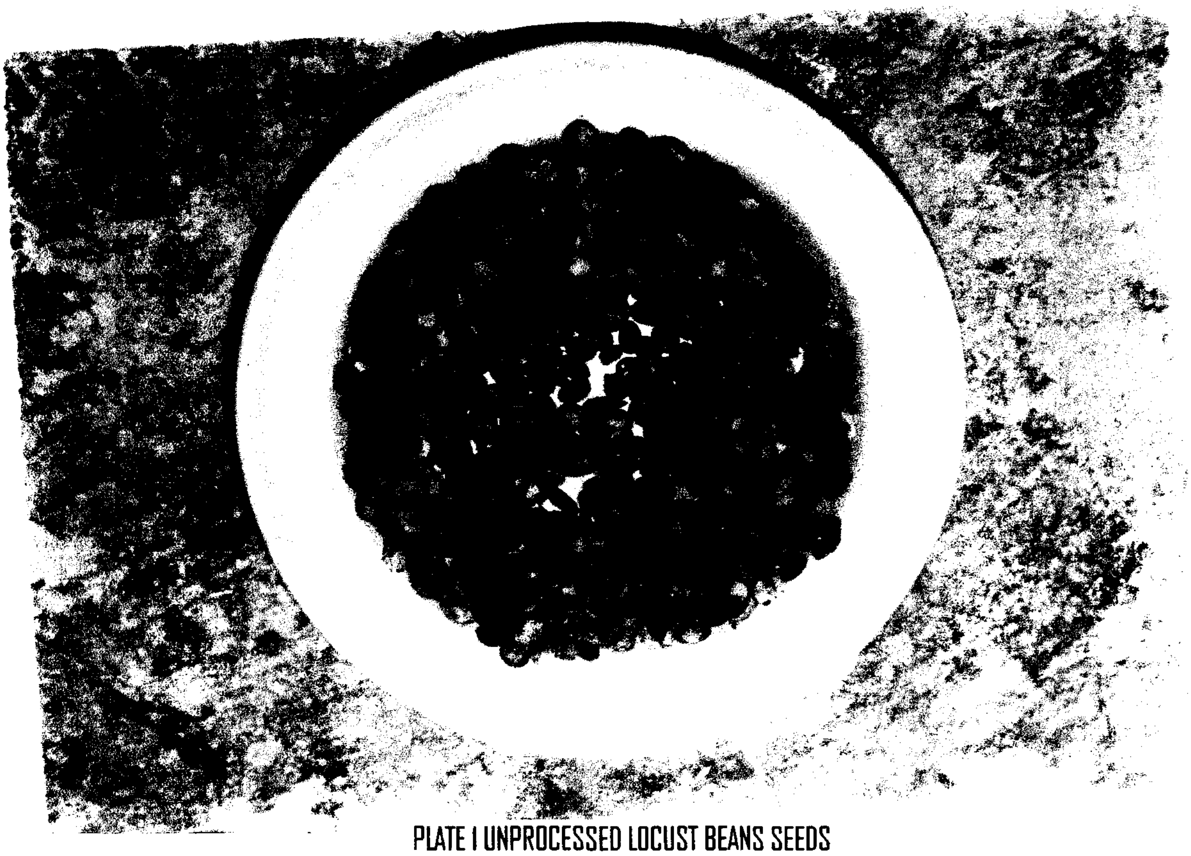


PLATE I UNPROCESSED LOCUST BEANS SEEDS

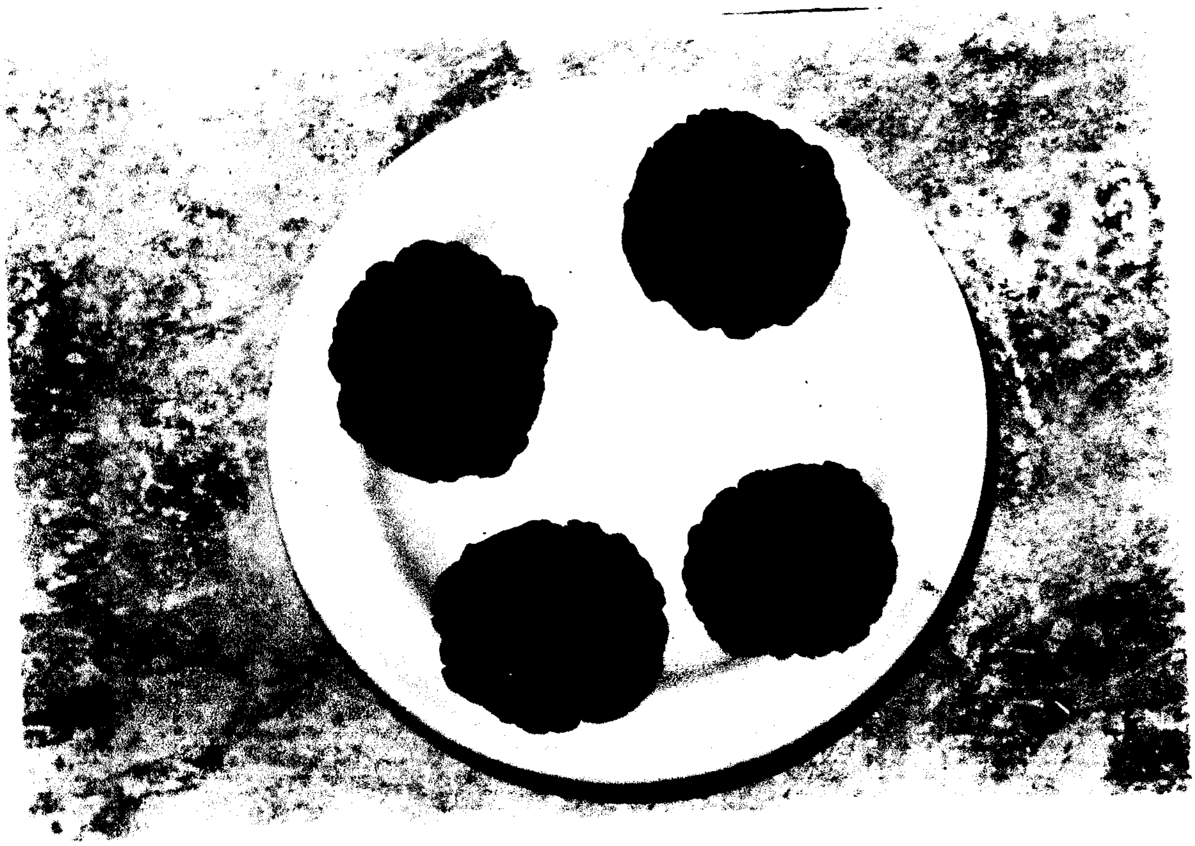


PLATE 2 FLAT DADAWA

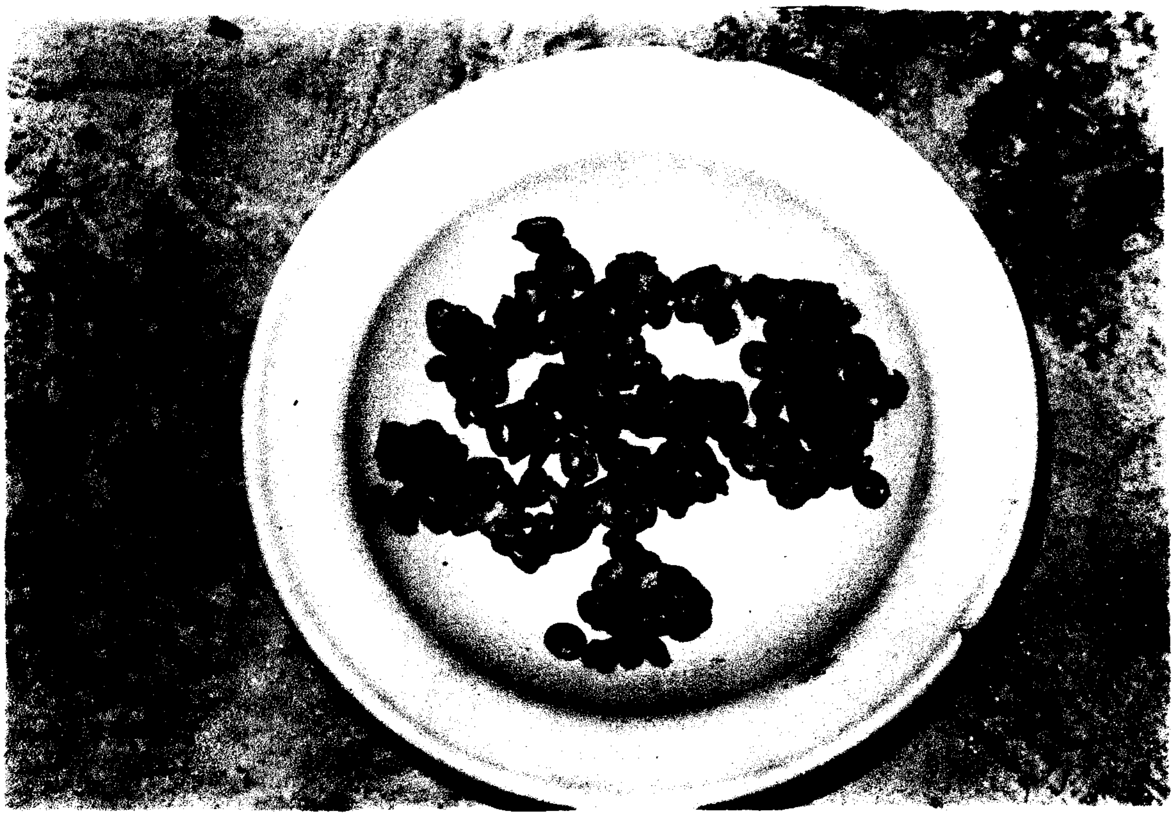


PLATE 3 ROUND DADAWA

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Data Presentation and Analysis

The proximate composition of African locust bean and two different types of Dadawa are presented in table 4.1. Sample A and B were determined in three triplicates, while sample C were determined only two times.

Table 4.1 Nutritional composition of African locust bean and two different types of Dadawa

Parameters	Locust bean (%)	Flat Dadawa (%)	Round Dadawa (%)
Moisture content	5.17	6.00	12.5
Lipid	38.2	26.3	25.5
Ash content	2.00	1.5	1.17
Crude protein	30.0	34.98	30.4
Crude fibre	4.33	1.16	0.75
Carbohydrate	24.63	31.2	30.7

4.2 Discussion of Results

The nutritional composition of African locust bean and two different types of Dadawa are presented in table 4.1. The moisture content was determined by using the air oven method. Three samples were used for determination and result showed a variation of moisture content between 5.17%, 6.00%, and 12.5% for sample A,B,andC respectively. From the result, it can be seen that there were slight difference between the moisture of African locust bean and flat Dadawa. But on the other hand, the moisture content of sample C (Round Dadawa) is high when compared to sample B (Flat Dadawa) due to drying process that sample B undergone. The main purpose of drying is to preserve them by removing the water that is needed for microbial growth and enzyme activities.

The result shows that, the total lipid of African locust bean studied in this research work is higher when compared to flat and round Dadawa respectively. This could be done to metabolism of fat into their components during processing (F A O1988).

The ash content of African locust bean in this research work is similar to those reported in previous work (Fetuga et al, 1974, Campebell-plattt, 1980).From the result obtained from table 4.1, it was observed that sample A (African locust bean) as higher ash content percentage when compared to sample B (Flat Dadawa) and sample C (Round Dadawa).The reduction in ash content could be related to fermentation. Ash contains macro-mineral elements such as magnesium, phosphorous, calcium, and nitrogen. That is why African locust bean fruit pulp is a potential source of minerals required by the body.

The result presented in the table 4.1 also show the percentage crude protein using micro-kjeldan nitrogen method. From the result obtained, there is higher percentage proteineous content in sample B (Flat Dadawa) when compared to sample A (locust bean) due to process of fermentation undergone. This result agreed with previous works done by (F A O 1988) .

However, the percentage protein in sample A (locust bean) is also higher when compared to sample C (round Dadawa).The increase in protein content in sample B (Flat

Dadawa) could also be the production and release of Amino acids during fermentation process.

From the result presented in table 4.1, in this research work, it was observed that crude fibre of sample A (African locust bean) is higher than that of sample B(Flat Dadawa) and sample C (Round Dadawa).The percentage crude fibre in this work is higher when compared to previous those works reported by (Eka,1980 and Odunfa,1986). Though, crude fibre does not contribute nutrients or energy, it is a source of dietary fiber which is essential for good bowl movement and helps to prevent obsesity, diabetes, cancer of the colon and other ailments of the gastro-intestinal tract of man. As reported by (Uwaegbute 1996.it is much higher than for most legumes such as ground nut. This makes the African locust bean fruit pulp a potential good source of dietary fiber.

The result obtained in this research work, showed that percentage carbohydrate was obtained by direct analysis (Helen Andrews Authrie, 1979).From the result in table 4.1, the carbohydrate content shows an Increase from locust bean to flat Dadawa during processing. However, the percentage carbohydrate of sample B (Flat Dadawa)is higher when compared to sample C (Round Dadawa).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In the course of this research work, the nutritional content of African locust bean and two different types of Dadawa were studied.

Thus, the result shows both locust bean and two different types of Dadawa has higher percentage of lipid. The lipid content reduces during processing of locust bean to flat Dadawa and round Dadawa, from 38.2%, 26.3%, to 25.5% respectively. The protein content increases from 30.0% to 34.98% during processing from locust bean to flat Dadawa. Also crude protein is reduced from 34.98% to 30.4% for flat Dadawa and round Dadawa. The carbohydrate also increased from 24.63% to 31.2% during processing from locust bean to flat Dadawa. And reduced from 31.2% to 30.7% for flat Dadawa and round Dadawa.

5.2 Recommendations

Based on the study, the following recommendations are given,

1. Because of high protein content and other nutritional qualities present in fermented product (flat Dadawa) and its readily availability for consumption,improvement should be made on how to process the product in a good hygienic way and condition to retain its high percentage nutritional qualities concentration unaffected, thus, increasing its demand.
2. There should be need that processing of locust bean should be done mechanically to reduce drudgery, cost and to save time.

3. Further research work should be done on other nutritional composition not mentioned in this research work; such nutritional composition includes calcium, phosphorus, and phytic acid because of their importance in locust bean safety.

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APPENDICES

Appendix 1

Determination of Moisture Contents (%)

Sample A	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Drying W_2 (g)	Weight of Crucible + Sample After Drying W_3 (g)	% Moisture Content $\frac{W_2 - W_3}{W_2 - W_1} X100$	Avei
Locust Bean					
1	18.47	20.47	20.37	5.00	
2	15.16	17.16	17.06	5.00	5.17
3	17.28	19.28	19.17	5.50	

Sample B	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Drying W_2 (g)	Weight of Crucible + Sample After Drying W_3 (g)	% Moisture Content $\frac{W_2 - W_3}{W_2 - W_1} X100$	Average
Flat Dadawa					
1	19.91	21.91	21.79	6.00	
2	20.09	22.09	21.97	6.00	6.00%
3	18.92	20.92	20.80	6.00	

Sample C	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Drying W_2 (g)	Weight of Crucible + Sample After Drying W_3 (g)	% Moisture Content $\frac{W_2 - W_3}{W_2 - W_1} X100$	Average
Round Dadawa 1	24.50	27.50	27.12	12.67	12.5%
2	24.80	27.80	27.43	12.33	

Appendix 2

Determination of Lipid Content (%)

Sample A	Weight of Thimble W_1 (g)	Weight of Thimble + Sample Before Extraction W_2 (g)	Weight of Thimble + Sample After Extraction W_3 (g)	%Lipids $\frac{W_2 - W_3}{W_2 - W_1} X100$	Average
Locust Bean					
1	1.52	3.52	2.77	37.50	
2	1.57	3.57	2.79	39.00	38.2%
3	1.61	3.61	2.85	38.88	

Sample B	Weight of Thimble W_1 (g)	Weight of Thimble + Sample Before Extraction W_2 (g)	Weight of Thimble + Sample After Extraction W_3 (g)	%Lipids $\frac{W_2 - W_3}{W_2 - W_1} X100$	Average
Flat Dadawa					
1	1.64	3.64	3.12	26.00	
2	1.48	3.48	2.95	26.50	26.3%
3	1.56	3.56	3.03	26.50	

Sample C	Weight of Thimble W_1 (g)	Weight of Thimble + Sample Before Extraction W_2 (g)	Weight of Thimble + Sample After Extraction W_3 (g)	%Lipids $\frac{W_2 - W_3}{W_2 - W_1} X100$	Average
Round Dadawa 1	1.64	3.69	3.17	26.00	25.5%
2	1.48	3.48	2.98	25.00	

Appendix 3

Determination of Ash Content (%)

Sample A	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Ashing W_2 (g)	Weight of Crucible + Sample After Ashing W_3 (IX g)	% Ash Content $\frac{W_3 - W_1}{W_2 - W_1}$ X100	Average
Locust Bean					
1	10.96	12.96	11.00	2.00	
2	11.25	13.25	11.30	2.50	
3	12.08	14.08	12.11	1.50	2.00%

Sample B	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Ashing W_2 (g)	Weight of Crucible + Sample After Ashing W_3 (IX g)	% Ash Content $\frac{W_3 - W_1}{W_2 - W_1}$ X100	Average
Flat Dadawa					
1	11.86	13.86	11.89	1.50	
2	12.13	14.13	12.15	1.00	1.50%
3	11.25	13.25	11.29	2.00	

Sample C	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Sample Before Ashing W_2 (g)	Weight of Crucible + Sample After Ashing W_3 (IX g)	% Ash Content $\frac{W_3 - W_1}{W_2 - W_1}$ X 100	Average
Round Dadawa					
1	20.24	23.24	20.28	1.33	
2	18.89	21.92	18.92	1.00	1.17%

Appendix 4

Determination of Crude Protein (%)

ample	Sample Weight (g)	1st Titre Value (ML)	2nd Titre Value (ML)	Average Titre Value (ML)	% Crude Protein	Averaį
ocust ean						
1	0.25	12.16	12.15	12.16	30.1	
2	0.25	12.12	12.10	12.11	30.0	30.0%
3	0.25	12.11	12.10	12.11	30.0	
lank (H_20)	0.25	0.1	0.1	0.1	-	

ample B	Sample Weight (g)	1st Titre Value (ML)	2nd Titre Value (ML)	Average Titre Value (ML)	% Crude Protein	Aveı
lat Dadawa						
1	0.25	13.98	14.02	14.00	34.75	
2	0.25	13.99	13.97	13.98	34.70	34.9
3	0.25	14.40	14.20	14.30	35.50	
lank (H_20)	0.25	0.1	0.1	0.1	-	

ample C	Sample Weight (g)	1st Titre Value (ML)	2nd Titre Value (ML)	Average Titre Value (ML)	% Crude Protein	Ave
ound Dadawa						
1	0.25	12.27	12.24	12.26	30.4	
2	0.25	12.29	12.24	12.27	30.4	30.4
lank (H_20)	0.25	0.1	0.1	0.1	-	

Appendix 5

Determination of Crude Fibre Content (%)

Sample A	Weight of Sample M (g)	Weight of Empty Crucible W_1 (g)	Weight of Crucible + Dried Residue W_2 (g)	Weight of Crucible + Ashed Residue W_3 (g)	% Crude Fibre $\frac{W_2 - W_3}{M} X100$	Average
Locust Bean						
1	2.00	10.25	20.02	19.93	4.50	
2	2.00	12.11	21.69	21.60	4.50	4.33%
3	2.00	10.33	19.90	19.82	4.00	

Sample B	Weight of sample M (g)	Weight of empty Crucible W_1 (g)	Weight of crucible +Dried Residue W_2 (g)	Weight of crucible + Ashed Residue W_3 (g)	% Crude Fibre $\frac{W_2 - W_3}{M} X100$	Average
Flat Dadawa						
1	2.00	11.23	14.97	14.95	1.00	
2	2.00	10.98	14.69	14.65	2.00	1.16%
3	2.00	09.95	13.81	13.80	0.50	

Sample C	Weight of sample M (g)	Weight of empty Crucible W1 (g)	Weight of crucible +Dried Residue W2 (g)	Weight of crucible + Ashed Residue W3 (g)	% Crude Fibre $\frac{W_2 - W_3}{M} X100$	Average
Round Dadawa						
1	2.00	20.17	23.17	23.15	1.00	
2	2.00	19.60	21.60	21.59	0.5	0.75%

Appendix 6

Determination of Carbohydrate (%)

Percentage Carbohydrate = 100 – (P + L + M + MC) %

Where P = percentage Protein; L = Percentage Lipid; M = Percentage Mineral/Ash Content; and MC = Percentage Moisture Content

Sample A	% protein	% lipid	% ash	% moisture content	% carbohydrate
Locust bean	30.0	38.2	2.0	5.17	24.63

% carbohydrate for sample A

=100 – (30.0 + 38.2 +2.0 + 5.17)

=100 -75.37

=24.63

Sample B	% protein	% lipid	% ash	% moisture content	% carbohydrates
Flat Dadawa	34.98	26.3	1.5	6.0	31.2

Sample C	% protein	% lipid	% ash	% moisture content	% carbohydrate
Round Dadawa	30.4	25.5	1.17	12.25	30.7