ASSESSMENT OF NUTRITIONAL VALUES OF LOCUST BEAN AND DADAWA.

BY

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DEDICATION

This project work is dedicated to my parents expecially my Mother Ladi Jita Kobwa and my Father Ibrahim Babanyaro Kobwa and myentire family for their sacrifices in giving me a sound financial support and making my life worth living.

To my senior brother and his wife Hadiza for their Love and understandi accorded to me during my staying with them.

DECLARATION

I hereby declare that this project is an Original work of mine and has never been submitted anywhere for the award of Post Graduate Diploma.



STUDENT'S SIGNATURE.

CERTIFICATION

This work is duly certified by the underlisted as the original work of Ibrahim Idirisu Kuta submitted in partial fulfilment of the requirements for the award of Post graduate diploma to the Agricultural Engineering Department of Federal University of Technology, Minna.

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ABSTRACT.

An experiment to determine the percentage compostion of nutritional content of locust bean dadawa was carried out.

The result showed that the protein content was increased from 3.25% to 3.48% during processing from locust bean to dadawa. While, the lipid content reduces during processing of locust bean to dadawa from 39.49% to 22.8%. The ash content also reduces from 4.29% to 3.23% during processing from locust bean to dadawa.

Generally the result shows that both dadawa and locust bean have high lipid content.

CHAPTER ONE.

1.0 INTRODUCTION.

The dawadawa as it is commonly called dadawa is an aquaous extract of African locust bean. African locust beans are known to have protein, starch, fat, minerals and B Vitamins content. Whiel the dry pulp is rich in Vitamin C and carbohydrates some calcium and phosphorus. This gives the bean a unique status among the other beans.

In Nigeria, where soup and stew flavouring spices, are out of reach to the low income earners, because of its high cost, dadawa is of great importance since it is vithin the reach of many farmers.

Dawadawa, also called dadawa, Iru and Ogiri, is the most important of the products made commercially from African locust bean. It is produced in the area around Kafanchan near, Zaria in Nigeria. This fermented food is used to flavour soups and stews throughout West Africa. The parkia species occur throughout the African Savanna Zones.

1.1 DESCRIPTION OF THE AFRICAN LOCUST BEAN (parkia species) belongs to the family (leguminosae-mimosoideae) parkia biglobosa:-It is a deciduous tree of 10-20cm, with large umbrella - shaped crown. The bark is scaly and deeply fisured. Leaves are dark green, twice sub-divided. The smallest division of leaf about 1.5cm long, 5mm wide. Young trees and coppiced stems have bigger leaves, leaf stalks greyish-broun and velvety. The flowers are in from of a ball of red or orange flowers, about 5cm diamerter, hanging on a long stalk up to 30cm, sometimes clustered.

Fruits are long pods up to 45cm, 2cm wide slightly curved, hanging in clusters from the flower stalks. The pods split open when mature. Seeds are red-brown to black, flattened, and embedded in a yellow floury pulp.

Parkia species occur through out the African Savanna Zones, Four African species are parkia biglobosa, parkia clappertonniana, parkia fil coidea,parkia bicolor are usually described as different species, while parkia clappertoniana is now considered the same species as parkia biglobosa and given as its synonym. The distinction between the first three species is the degree of division of their leaves.

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.

1.2 AIM AND OBJECTIVES.

The aim of this project is to asses the effect of processing on the nutritional content of dadawa locally prepared maggi.

The specific objectives are:-

1. To analyze the nutritional content of dadawa which is locally prepared using one traditional method.
2. To analyze the nutritional content of locust bean which is the raw material for dadawa production.
3. Evaluate the difference in nutritional content between the dadawa and locust bean.
4. Recommendation of some improvement to the existing processing method.

1.3 JUSTIFICATION.

The vast majority of the Nigerian populace solely depends on the utilization of commercially made maggi to improve the flavour of soups and stews. According to Literature dadawa is said to have high nutritional constituents as fat, protein, starch, minerals and vitamins.

Also it is necessary to assess the effect of locust beans processing on the nurtitional content of dadawa.

1.4 SCOPE OF WORK.

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

The nutritional values to be assessed are protein, Ash and lipid content. This is based on availability of laboratory equipments and reagents. Also literature shows that protein, ash and lipid form the major nutrient of Locust beans.

CHAPTER TWO.

2.0 LITERATURE REVIEW

Considerable research is being conducted by the international livestocic central for Africa (ILCA) / Humid Zone programme Ibadan on the potentialities of tree legume as the (African locust bean) parkia biglobosa which is preserved on fallow fields or in compound gardens to provide edible fruits for humans with percentage crude protein in seeds which is about 30.

2.1.0 CULTURAL PRACTICE - (Growing African locust beans). In selecting site for planting soil Deep* heavy sands, clays, or silts (where sorghum grows well and will survive on poor rocky, stony or gravelly sites. The parkia species are often left standing in millet fields for their shade and fruits. Propagation is either by direct seeding, by transplanting wild plants or planting nursery raised seedlings.

2.1.1 PLANTING THE SEEDS

The seeds needed for planting should be collected from freshy 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 scalding for about 7 minutes. Seedlings raised in pot 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 5 x 5m, followed by thinning from the 8th to 10th year, to leave a population of 500 tree/ha.

2.1.2 RECOMMENDED SPECIES OF AFRICAN.

LOCUST BEANS:- The following species have been recommended by the food and agricultural organisation (FAO 1988). 1. Parkia biglobosa 2. Parkia clappertoniana 3. Parkia Filicoidea 4. Parkia bicolou.

2.1.3. HARVESTING.

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

STORAGE.

Seeds made into dadawa keep for a long time.

2.1.4. NUTRITIONAL COMPOSITION.

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

The African locust bean occupies a premier position as a world crop because of its high and virtually unrivaled fat content moderate starch, protein, minerals and B Vitamins. Whole locust beans have a good balance of the essential amino acids and are excellent dietary source of calories, minerals and vitamins.

From the results of this work and the available literature on the nutritional composition of dadawa and locust bean have high level of lipit content. Therefore, the lipid has been found to be of high nutritional value because of its high content of polyunsaturated fatty acids including the essential fatty acid, linoleic acid. The high content of polyunsaturated fatty acids of dadawa and locust bean including linoleic acid is also of value in the regulation of serum cholesterol and trigly cerides and hence can help in reducing or preventing coronary heart disease, hypelipemia and hence atherosclerosis (Fleck, 1976 white et al, 1978, cameron and Fox, 1987, callow and carpenter, 1981). Despite the above mentioned vlaue of dadawa and locust bean, excessive consumption may lead to fatty liver,

as said, too much of everything is bad. Natural lipids are usually mixtures of several classes of lipids and each class contins a wide range of fatty acids. Generally the fat is required for the provision of energy they travel in the blood stream from the fat depots. Protein of the liver and tissues which act as a kind of protein store to maintain the protein level in the diet soon leads to serious disorders. The ash of a biological material is an analytical term for the inorganic residue, that remains after the organic matter has been burnt away. The ash is not usually as the inorganic matter present in the original food since there may be losses due to the volatilisation or chemical reaction between the constituents. The value is useful in assessing the quality or grading certain edible materials Joslyn, M. A. 1970.

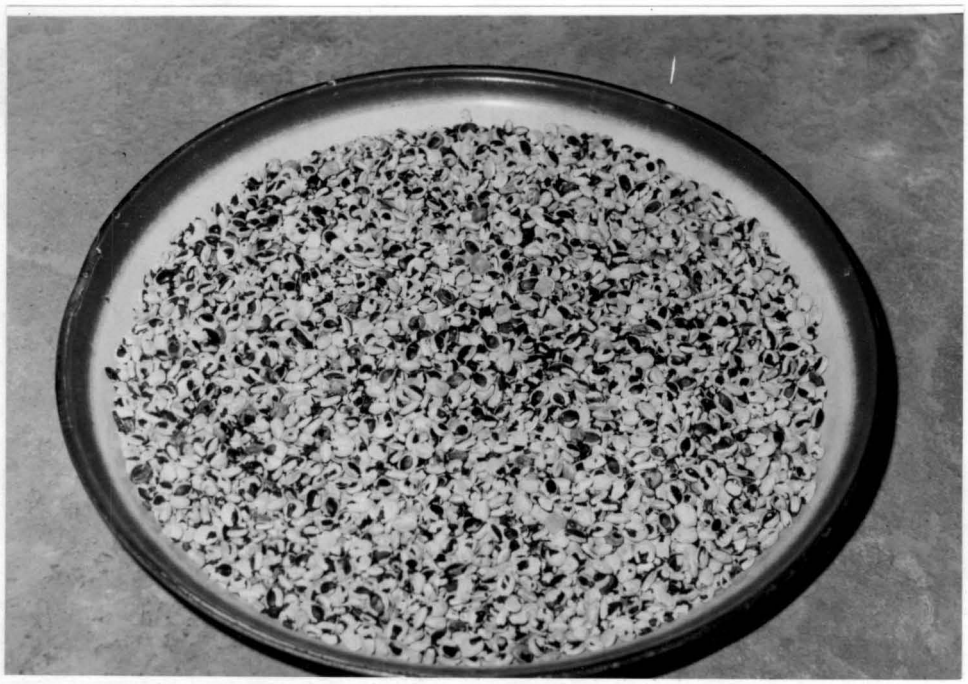

Figure 2.1 Unprocessed locust bean seeds.



Figure 2.2 Processed locust bean (dadawa).

Table 1: Nutrient Values of 100g of Edible Portion.

Nutrients	Values per 100g
Protein dried	3.09g
Fermented	3.05g
Fat dried	5.13g
Fermented	3.8g
Iron dried	3.01mg
Fermented	3.03mg
Calories dried	4.3
Fermented	4.31
Water dried	1.42
Fermented	4
Thiamine dried	3.33
Fermented	2.50
Roboflavin dried	0.02
Fermented	Trac mg
Niacin dried	3.33
Fermented	4.8mg
Ascorbic acid dried	1.6mg
Fermented	0.mg

Source. FAO (1988

2.2.0 DADAWA PROCESSING AND UTILIZATION.

The dadawa is a vary valuable and useful agricultural product. It is one of the main sources of protein, starch, fat, minerals and B Vitamins, which are essential to maintain good health. The conventional traditional method of processing or preparation of dadawa is that the seeds are lightly roasted then gently pounded and the seed coats removed by hand. They may also be boiled and grated on fine sieves. The crushed kernels are fermented then made into small balls and dried. This method was reported by F A O food and nutrition paper No. 42 (1988).

2.2.1 TRADITIONAL PROCESSING METHODS.

There is only one traditional method of dadawa processing which is just similar the methods of dadawa manufacture indicated in F A O paper number 42 (1988). This methods involved the roasting of the kernels mixed with small pieces of stones to prevent burning and ther after crushed kernels are sieved using traditional sieve which is made up of piasava outer layer of the fronds and then boiled for at least 2 - 3 hours depending on level of heat process. The boiled kernels are sieved inorder to remove away the pericarp of the kernels and other unwanted materials before it is stored for fermentation process. The product is stored in a round made basiscet using the tough grasses which is obtained from the swampy conditioned area or land. The white ashes is sprinkled on top of the product in the basket and then covered with the broad leaves inorder to ascertain 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 dadawa has long been practical traditionally by the local farmers, mostly in the sub - sahara northern parts of Nigeria, where there is high intensity of sunshine and low relative humidity of the year. In particular, traditional open sun drying of dadawa is carriedout 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 dadawa has a number of advantages some of these are:-

1. To reduce the distinctive odour
2. To keep off the flies due to distinctive odour as a result of fermentation.

3. Allowes the product to resist the spoilage due to the presence of moisture percentage.

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 prove 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.

2.3.0 IMPROVEMENT EFFORTS ON DADAWA MANUFACTURE.

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

The low nutritional of dadawa from the Unimproved techique is due to the presence of some heat labile growth as a result of fermentation which represents the trypsin inhibitor, hermoagglutinins and others present in the raw locust beans. 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 inorder to after fermentation process and to store well for a longer period and to store well for a longer period of tirm to provide for the off season.

The use of drying technique 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.

FIGURE 2.3. SHOWS THE FLOW CHART ON A METHOD OF DADAWA PROCESSING AS RECOMMENDED BY FELLOWS (1997).

PROCESS	NOTES
Kernels	Kernels containing seeds are collected after removal of yellow pulp by washing
↓ Dehusk	Boil kernels until soft, then pound in a motar and pestle to loosen husk from seeds.
Wash	Wash to remove broken testa
↓ Heat	Boil seeds in water for about 24 hours to soften
Ferment	Load seeds into a plastic or metal container, cover and allow to ferment for two to three days.
↓ Press	Manually mould and press the fermented product into balls.
↓ Pack	In polythene bags
↓ Store	In display box for sale.

2.4.0 THE EFFECT OF DRYING/PROCESSING ON NUTRITIONAL CONTENTS.

The main purpose of drying is to preserve foods by removing the water that is needed for microbial growth and enzyme activity. 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 carriedout in places where in an average year the climate allows foods 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 spoilage. it is possible to identify different groups of products for which drying is an important method of preservation. The level of dryiness of air is termed 'humidity' the lower the level humidity, the dryer the air.

Hot, dry air must be blown over foods so that it can pick up water from the surface of the 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 sygars and mineral forms on the surface of the food and seals it. This barrier stops further moisture from leaving 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 surface and the food spoils. To prevent this, the rate of drying is reduced. The size of 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/processing 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 inorder to enhance storability for the long period of time of which the shelf-life may range between six and eight months. peter fellows (1997).

2.4.1 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 Amino acids. The amino acids monomers are joined together by poly-peptide bonds. To retain protein during or after processing ther's the need to avoid the kernels breacages and excessive drying which leads to the reduction of amino acids. Proteins supply the nitrogen which is required by the body cell metabolism and so they feature prominently in quality evaluation of dadawa. Generally, nitrogen exists in protein in the ratio 100.16 or 6:25 the value is usually used as a factor in calculating the protein in food products.

Protein are sparingly soluble in aqueous solvents especially water. The solubility of proteins increases with temperature, and its extraction from plant sources is therefore possible under aqueous conditions. Prachuab kwanyuen (1983) 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-hydrosable by intestinal enzymes. Some on the other hand lead to improvement of nutritional value by inactivation of antinutritional components.

Protein denaturation is the partial or complete disruption of the primary, Secondary or tertiary structure of protein molecule. The natured protein losses some specific biological property such as enzymatic or hormonal activity. Ther effect of denaturation can be summarized as follows:-

i. Polypeptide bonds of proteins are made readily available for proteolytic enzyme hydrolysis.

ii. Solubility is reduced.

iii. Crystallization of proteins is no longer possible.

iv. Intrinistic viscosity is increased.

CHAPTER THREE.

3.0 EXPERIMENTAL WORK.

MATERIALS:- Materials used for this work are locust beans, dadawa, laboratory equipments and reagent as given for each test.

3.1.1 PROTEIN CONTENT DETERMINATION.

Procedure:- The protein content was determined by the micro kheldahl method, 0.25g of dry 100ml kheldahl flask. 6ml of concentrated sulphuric acid was added to the sample followed by some glass beads (anti - bumping granules). It was then carefully digested over electric heater (digesting block) in the hood (fume chamber) initially with low flame till the frothing subsided and then at higher temperature until it became clear with pale staw colour. Heating was then continued for more 60 minutes. The heater was put off and the flasks were allowed to cool and 15ml of distilled water was added to each of the flasks. The contents were transfered quantitatively to some volumetric flask. The kheldahl water but the glass beads were left in the digestion flask. The content of the digested sample was then made up to marked volume with distilled water and mixed thoroughly.

10ml of the digest was then pipetted into markam distiller and 10ml of 40% sodium hydroxide solution was added to the digest. The steam distilled Ammonia liberated was collected into 5ml boric acid solution containing 4 drops of mixed indicator (Bromocresol green, methyl red and Thymol-blue) in the conical flask. After the indicator turned green, the distillation was continued for the next 2 minutes. The distillate was removed and titrated with $\frac{N}{70}$ standard Hydrochloric acid, the end point been reached when the indicator changed from freen throughgrey to deginite pink. The amount of acid used (titre) was recorded (V, Ml).

A blank containing 6ml concentrated H_2 504 one tablet of kheldahl catalyst without any sample was prepared and the above procedure was carried out on it. The burette reading was recorded (V_2 M_1). The percentage (%) Nitrogen content is given by the formular.

$$\% \text{ Nitrogen } (N_2) = \frac{V_1 - V_2 \times 0.1 \times 0.0014 \times 100}{M} \quad \text{---- 3.1}$$

Where V_1 = titre value for sample

V_2 = titre valve for black and

M = weight of sample in grams.

The percentage protein was calculated by multiplying % N_2 by a factor of 6.25 S E M = $\sqrt{\frac{S^2}{N}}$

3.2.0 DETERMINATION OF LIPID CONTENT

a. Reagents:- Petroleum ether (40° - 60° B.P)

b. Apparatus:- Balance, watch galses, Round - bottomed flasks, oven, dessicator, sozhlex extractor, wharman extraction thimble, funnels, and whatman filter paper (No. 1).

c. Procedure:- The method used was in accordance with the outlines of TDRI (1984) A soxhlet extraction set was fitted up with a relfux condenser and a small round bottom flask. 4g of finely - powdered dried sample was weighed into folded whatman filter paper stappled at one end, that has been previously dired to constant weight and weighed (wl). The open end of the foilded filter paper was then stappled and the filter and its content were re-weighed (w_2). The filter paper with its content was then put into the extraction thimble and put into the barrel of the extractor. Petroleum ether was added into the barrel until it simphoned over twice into the round bottom flask. The condenser was then replaced into the barrel and the round bottomed flask placed on the heating mantle set at about 50°C

until the petroleum ether just boiled. The extraction was continued for 16 hours at the end of which it was waited until the petroleum ether hand just siphoned into the flask, thus leaving the extraction barrel empty. The condenser was removed with a force and placed on a clean, dry and dried to constant weight in the oven at $50^{\circ}C$. It was then cooled in a dessicator and reweighed (W^3). The determination was carriedout in triplicate and the results are shown in Table 5 and 6.

3.2.1. DETERMINATION OF TOTAL ASH CONTENT.

a. Apparatus:- Oven, Dessicator, crucibles with lids, Bunsen burner and muffle furnace (size1, Tactical 308, Gallen kamp).

b. Procedure:- The method used in based on that out lined by (1984). Three crucidbles with lids were dried in the oven at $105^{\circ}C$ for about 8 hours, colled in the dessicator and weighed. The sample in the crucibles were then heated on the bunsen flame in a fume chamber until smoking ceased. They were then transfered into the muffle furnace and heated at $570^{\circ}C$ for about 18 hours, at the end of which the ashes were white. The crucibles were then cooled in the dessicator and reweighed (w^3). The results are shown in Table 7 and 8.

CHAPTER FOUR.

4.0 RESULTS AND DISCUSSION.

The results of the analyses are shown in tables 2 - 8. All the parameters determined were in triplicates. Thus the mean and standard error of mean (S.E.M) were calculated. Table 2 summarises the percentage composition of the major nutritional values of dadawa and lucost bean, namely:- Protein content, total ash, lipid and carbohydrate free extract (CFE). The protein content was found to be 3.48% ± 0.014 and 3.25± 0.029, lipid content 39.49% 0.008 and 22.80± o.029, total ash 3.23%± o.01 and 4.29± 0.01 and carbohydrate free extract was 23.46% by difference.

Table 2a: The Major Nutritional Constituents of Dadawa

NUTRIENT	RANGE %	MEANT± S. E. M (%)
PROTEIN	3.50 - 3.47 - 3.47	3.48 ± 0.014
PROTEIN	3.26 - 3.26 - 3.22	3.25 ± 0.019
LIPID	39.49 -39.48 -39.50	39.49 ± 0.008
LIPID	22.79 -22.84 -22.77	22.80 ± 0.029
ASH	3.22 - 3.24 - 3.22	3.23 ± 0.01
ASH	4.30 - 4.30 - 4.28	4.29 ± 0.01
CARBOHYDRATE -	FREE EXTRACT	23.46

S.E.M = Standard Error of mean
The results obtained for the nutritional contents of dadawa.

Table 2b: The Major Nutritional Constituents of Locust Bean (Parkia species)

NUTRIENT	RANGE %	MEANT ± S. E. M. (%)
PROTEIN	3.50 - 3.47 - 3.47	3.48 ± 0.014
PROTEIN	3.26 - 3.26 - 3.22	3.25 ± 0.019
LIPID	39.49 - 39.48 - 39.50	39.49 ± 0.008
LIPID	22.79 - 22.84 - 22.77	22.80 ± 0.029
ASH	3.22 - 3.24 - 3.22	3.23 ± 0.01
ASH	4.30 - 4.30 - 4.28	4.29 ± 0.01
CARBOHYDRATE -	FREE EXTRACT	23.46

S.E.M = Standard Error of mean.
The results obtained for the nutritional contents of locust bean shown in table 3 - 8.

Table 3: Results for Protein Content Determination of Dadawa

Sample	Initial Burrete Reading (CM^3)	Final Burrete Reading (CM^3)	Titre Value CM^3	wt of Sample(g)	% Protein
1	0.00	10.00	10.00	0.25	3.50
2	10.00	19.90	9.90	0.25	3.47
3	19.90	29.80	9.90	0.25	3.47
Blank	0.00	0.1	0.1	0.25	-

Calculation: The % N content is given by the formular

$$\% N = \frac{V1 - V_2 \times 0.1 \times 0.0014}{M} \times 100 \qquad \text{-------- 4.1}$$

Where:

V_1 = titre value for sample

V_2 = titre value for blank and

M = weight of sample in grams

The % protein is calculated by multiplying the % N by a factor of 6.25

Thus, mean % protein = 3.48

Standard Error mean = 0.014

:. % total crude protein = 3.48±0.014(dry weight basis)

Table 4: Results for Portein Content Determination of Locust Bean.

Sample	Initiall Burrete Reading(CM^3)	Final Burrete Reading(CM^3)	Titre value (CM^3)	Weight of Sample	Percent Protein
1.	0.00	9.30	9.30	0.25	3.26
2	9.30	18.60	9.30	0.25	3.26
3	18.60	27.80	9.20	0.25	3.22
Blank	0.00	0.1	0.1	0.25	-

Calculation: The % N content is given by the formular,

$$\% N = \frac{V1 - V_2 \times 0.1 \times 0.0014}{M} \times 100, X \text{ where} \qquad \text{-----4.1}$$

V_1 = titre value for sample

V^2 = Titre value for the blank and

M = Weight of sample in grams

The % protein is claculated by multiplying

the % N by a factor of 6.25

Thus, mean % protein = 3.25

standard error mean = 0.019

:. % total crude protein = 3.25± 0.019 (dry weight basis)

Table 5: Results for the Total Lipid Determination Locust Bean.

Sample	weight of filter paper + staple (W1)	wt of filter paper, staple+ sample + 2nd staple before extraction(W^2	weight of filter paper, staple+ sample + 2nd staple after drying (W^3)	percent Lipid content
1	2.554	7.596	5.605	39.49
2	2.553	7.594	5.604	39.48
3	2.554	7.595	5.604	38.50

Calculations: The % lipid content is calculated using the formular,

$$\% \text{ lipid} = \frac{W_2 - W_3}{W_2 - W_1} \times 100 \qquad \text{------ 4.2}$$

Thus, mean % lipid = 39.49

S.E.M = 0.008

:. lipid = 39.49±0.008(dry wt basis)

Table 6: Results for the Total Lipid Determination of Dadawa

Sample	weight of filter paper + staple (W1)	weight of filter paper staple + paper + 2nd staple before extraction (W^2)	weight of filer paper staple + sample + 2nd staple after extraction and drying (W^3)	% lipid content
1	2.578	7.659	6.501	22.79
2	2.577	7.648	6.490	22.84
3	2.678	7.759	6.602	22.77

Calculations: The % lipid (dry w + basis) content is calculated using the formular.

$$\% \text{ lipid} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Thus, mean % lipid = 22.80

SEM = 0.029

:. % lipid = 22.80 ± 0.029

Table 7: Results for the Total Ash Determination of Dadawa

Sample	weight of Empty crucible(W1)	wt of crucible + sample before Ashing(W_2)	wt of crucible + sample after Ashing (W^3)	% Ash
1	13.661	18.661	13.822	3.22
2	13.771	18.771	13.933	3.24
3	13.664	18.664	13.825	3.22

Caculations: % Ash (dry weight basis is given by

$$\% \text{ Ash} = \frac{W_3 - W_1}{W_3 - W_1} \times 100 \qquad \text{---------- 4.3}$$

:. Mean % Ash = 3.23

SEM = 0.01

:. % Ash = 3.23 ± 0.01

Table 8: Results for the Total Ash Determination in Locust Bean

Sample	weight of empty crucible (W1)	wt of crucible + sample before Ashing(W2)	weight of crucible + sample after Ashing(W^3)	% Ash
1	13.773	18.773	13.988	4.30
2	13.764	18.764	13.979	4.30
3	13.862	18.862	14.076	4.30

Calculations: % ASh (dry weight basis is given

$$\text{by \% Ash} = \frac{W_3 - W_1}{W_2 - W_1} \times 100 \qquad \text{---------- 4.4}$$

:. Mean % Ash = 4.29

SEM = 0.01

:. % Ash = 4.29 ± 0.01.

CHAPTER FIVE.

5.0: CONCLUSION AND RECOMMENDATION.

The nutritional content of dadawa whish is locally prepared maggi and locust bean which is the raw material for dadawa production was studied The nutritonal content studied are protein, lipid and ash content. The reuslt shows that both dadawa and locust bean have high lipid content. The lipid content reduces during the processing of locust bean from 39.49% to 22.8% The Ash content also reduces from 4.29% to 3.23% during processing from locust bean to dadawa. The protein content increase from 3.25% to 3.48% during processing from locust bean to dadawa. Based on the study the following recommendation is given.

1. Further study should be done to assess the effect of different methods ot locust bean processing on the nutritional values of dadawa.

2. The possibilities of extraction of fat from locust beans, for consumption and/or for industrial use should be investigated.

3. Methods to improve the local methods of locust beans processing should be looked into.

Table 3 and 4 shows the pretein content of dadawa and locust bean. The result shows that the mean protein content in dadawa is higher that of locust bean. This could be due to the fermentation process, which the dadawa has passed through. This result is in agreement with previous work done (FAO, 1988). The increase in protein content could also be the production and release of amino acids during fermentation.

Table 5 and 6 shows the lipid content of dadawa and locust bean. The result shows that the mean lipid content in locust bean is higher than that of dadawa.This could due to metabolism of fat into other components during processing (F A O 1988).

Table 7 and 8 shows the ash content of dadawa and locust bean. From the result locust bean has high content of ash compared to dadawa which is the fermented product of locust bean. Ash contains mineral elements like Nitrogen, phosphorous, calcium and magnesium. The reduction in ash content could be related to the fermentation process.

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