DETERMINATION OF THE NUTRITIONAL PROPERTIES OF PROCESSED COW HIDE *(KPOMO)*

BY

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2003/14819EA

DEPARTMENT OF AGRICULTURAL AND BIORESOURCES ENGINEERING

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

NOVEMBER, 2008.

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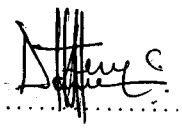
BEING A FINAL YEAR PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN AGRICULTURAL AND BIORESOURCES ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

NOVEMBER, 2008.

DECLARATION

I hereby declare that this project is a record of a research work that was undertaken and written by me. It has not been presented before for any degree or diploma or certificate at any University or Institution. Information derived from personal communications, published and unpublished works of others were duly referenced in the text.



18/11/08

Jeremiah Chuks Daniel

Date

(2003/14819EA)

CERTIFICATION

This project entitled "Determination of the Nutritional Properties of Processed Cow Hide *(Kpomo)*" by Jeremiah Chuks Daniel, meets the regulations governing the award of the 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.

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Date

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External Examiner

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Date

DEDICATION

This research work is dedicated to Almighty God, the author and the giver of my faith, who has been my strength and solace since the beginning of my studies in this great institution to acquire a Bachelors Degree in Agricultural and Bioresources Engineering.

To my Uncles, Mr. Obi Ikeme & Late Shedrack Onyemaino for the great financial support. To my mother Mrs. Joy Jeremiah for her prayers, words of encouragement and advice which were the sources of motivation in actualizing my aim of being a graduate.

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I wish to acknowledge all my course mates for their support and help through my study; I wish you whatever you wish yourselves. Lastly to my good friends, Victoria, Innocent, Nkasi, Peter, Amaka and Dr. (Mrs.) Jerome; may God bless you all.

ABSTRACT

This research work presents the basic nutritional compositions of traditional Nigerian cow hide *(kpomo)* after undergoing various degrees of treatments which include roasting and cooking. Results obtained from the nutritional analysis of cow hide indicate that cow hide cooked without roasting contains 34.59% protein, 2.41% crude fibre, 27.06% lipids, 0.47% ash, 37.46% carbohydrate, 74.60% moisture, 0.08% vitamin C and energy value of 525.74 kcal. Roasted cow hide contains 50.96% protein, 2.72% crude fibre, 18.37% lipids, 0.89% ash, 8.26% carbohydrate, 2.59% moisture, 0.08% vitamin C and energy value of 395.50 kcal. The results showed significant differences (except for vitamin C) between the nutritional compositions of the two forms of cow hide. It was concluded that the popular belief that "kpomo" has no food value was erroneous.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

As it is highly popular in the manufacturing of different ornamental products used for the decoration of homes and body beauty, animal hides need to undergo some forms of analyses to determine its suitability for utilization.

The history of animal hides processing in Africa dates back as 15th century when pastoralist and nomadic people seeking for simple means of clothing themselves and furnishing their homes conceived the idea of animal hides processing and development (Muwambe,1994) Recent studies reveal that some animal hides have some chemical properties which make them suitable for many applications in tropical countries. Different methods have been developed for the production and processing of animal hides. These include roasting the hide after it has been removed from carcass or the immersion of the raw product in hot water followed by the removal of the hairs on the hide using sharp-blade knives and then spreading it under solar radiation to reduce the moisture content of the hide.

In most parts of West Africa counties such as Nigeria, animal hides are mainly used for the preparation of meals, the cow hides in particular. Other uses of animal hides are in the manufacturing of leather shoes, drums, bags, mats and harts.

The processed cow hide (*kpomo*), is a product made in Nigeria by the Hausas and Fulani and consumed largely in the western and southern parts of the country. The cow hide (*kpomo*) product is merely seen by many consumers as an ingredient with less of nutritional importance when compared with fish and meat in the meal. This study presents the findings of the analyses

conducted on cow hide to ascertain the nutritional properties of Nigeria traditional processed cow hide (*kpomo*).

1.2 Statement of the Problem

The use of Agricultural products involves the critical determination of the nutritional properties of the product. This is because processing, packaging and storage of an agricultural product affect to varying degrees the nutritional qualities. Cow hide (*kpomo*) is a product consumed locally in Nigeria, but the consumption of this product is usually carried out without the knowledge of the nutritional properties of *kpomo*. Hence, this study was carried out to determine the nutritional compositions of a traditional Nigerian cow hide (*kpomo*).

1.3 Objective of the Study

To determine the nutritional compositions of processed cow hide (*kpomo*).

1.4 Justification of the Study

The ultimate aim of Agricultural product consumption is to provide the human body the necessary nutrients it requires to function effectively. Hence, it is important to determine the nutritional contents of each product before consumption.

1.5 Scope of the Study

This study is limited to the determination of the nutritional compositions of processed cow hide (*kpomo*).

CHAPTER TWO

2.0 LITERATURE REVIEW

Anthropologist believes that animal hides provide an important source of clothing to prehistoric human. Animal hides were also frequently believed to be used for shelter by primordial people. Many American Indians used animal hides to build houses such as *tepees* and *wigwams*. The artic Indians use these materials for water proof clothes and kayaks as well as for their houses (Rehman, 2005). Animal hides have always been used as a status symbol fur and was to demonstrate wealth by some American Indians.

The hides and skins are the basic materials of leather. The outer covering of a small animal is referred to as skin whereas those of a bigger animal as hide. Almost all the world output of leather produced is from cattle hides and calf skins. Other hides and skins used include those of horse, pig, kangaroo, deer, reptile, seal and walrus, but they amount significantly fewer when compared with those of cattle (Rehman, 2005). The raw materials used by the leather industry originate largely as by-product of meat industry and livestock sector. India has a large livestock population out of which it has 16% of the global cattle population, 59% of Buffaloes and 18% of Goats while Sheep population is little less, which stands at about 5% of the world sheep stock (Discovery Channel Television, 2005).

The estimate for the year 2000 shows that India ranks first in the world for its cattle and buffaloes populations, second for its goats and fourth in sheep population. Hides and skins produced in Africa largely amount to a host of socio-economic and cultural factors, such as the health of the animal and demands from it. Most of the skins i.e. 90% and half of the hides required by the leather industry arrived from the slaughter houses (Muwambe, 1994). However,

another big part of the hides recovered comes from fallen animals. India is annually producing 90 million of goat skins, 30 million of sheep skins, 25 million of cattle hides, 18 million of buffalo hides (Rehman, 2005).

The availability of skins and hides is very less against the ever-increasing demand by the leather industries. A national wide survey conducted during 1986-87 by the Central Leather Institute of the madras points out that about 9 million hides and skins are lost due to non availability of the recovery centres or the socio-economic reasons in the villages. Factually, there is still the lack of market with basic damage; these altogether result in non-recovery of the hide and skins that are indeed a big economic loss.

The skin or hide is composed of about 60% of water, 35% of fibrous and non-fibrous proteins and the rest are lipids, carbohydrates and minerals salt (Rehman, 2005). The health of the skin or hide that solely marks the type of leather produced depends on the animal, its age, sex, breed, feeding habits, climate and care of the animals. But the variety of skins and the way they are processed can produce leather as soft as fabric or as hard as a shoe sole. Cattle hides, which are the major raw material for leather productions, range from being light weight and supple to tough and strong.

Hides are processed for the production of tough and durable leather used for sole of shoes, machine belting, engine gaskets, and harnesses (Rehman, 2005). Calf skin is lighter and finer grained and is used for making fine leather suitable for such articles as shoe uppers. Sheep skin is soft and supple; it yields the type of leather suitable for gloves, jackets and other apparels.

Since ancient times, human beings used animal skins and learned to make them leather. The process of using chemicals to turn skins into leather is called tanning. Tanning is a process that involves conversion of the participle matter. This is achieved by treating the skin with the

aqueous extract of trees, plant materials or with the solution of chromium (III) salt.

The leather making is a combination of series of processes that start from skin recovery to curing, soaking and unhearing, declaiming and bathing, to vegetable or mineral tanning lubrication and dyeing and finally to finishing. Since skins or hides are highly susceptible to biodegradation that normally begins to decompose within few hours of animal's death; the curing becomes highly important to check the decay before transportation to tannery. The first step starts with wet-salting or brine-curing (faster curing of raw skins with brine), hair drying, or packing them with salt (sodium chloride). In wet-curing the skins are liberally salted and piled on top of one another until they form a pack, which is then left for about a month to allow the salt to thoroughly penetrate the skin.

Brine-curing is a much faster procedure in which skins are placed in large vats (called raceway) combining a disinfectant and water saturated with salt (i.e brine). After about 16 hours in the raceway, the skins are completely penetrated by the salt. The cured skins are soaked for a period of few hours to seven days in pure water to eliminate salt, blood and dirt and to gain moisture lost during the course of processing. The flesh is then removed by mechanical scraping (fleshing) from the inner surface. The hairs are removed through immersing the skin in the solution of lime and sodium supplied.

Declaiming the skin is done by soaking in a weak solution of H_2SO_4 acid, which reduces the swelling caused by the lime. The enzymatic application by bathing treatment to the skins provides a smoother grain and renders the skins soft and flexible. The tannins (also called tannic acid) occur in many trees and are used as tanning agent that renders the skin immune to decay. The tannins are extracted from the bark, wood, fruit and leaves of many species of trees in different parts of the world. The best sources include oak galls and hemlock bark and are the

major domestic sources of the tanning in North America. Other sources include the wood of the *quebracho* tree of South Africa, and *myrobala* fruit from India

Tannins are yellow-white to brown in colour and have a faint characteristic odour. The colour depends on when it is exposed to light, the chemical properties that provide the basis for most uses of tannins, is it readily formation of precipitates with albumin, with gelatin and with many alkaloid and metallic salts. The ability of tannins to transform protein into insoluble product resistant to decomposition leads to their uses as tanning, the hides are cased in rocking frames and consecutively suspended in a series of vats containing increasingly stronger tannin solutions, called liquors. After several weeks, the hides are transferred to a "lay way" section (largest vats) consisting of stronger liquors. Each week, more tannin is added to the liquors, until the hides absorb enough tannin to complete the process. The last stages of the process may be accelerated by application of warm liquors. Flexible-vegetable tanned leathers are used for belting, luggage, upholstery, or harnesses, as well as shoe soles (Rehman, 2005).

2.1 Types of Animal Hides and Skins

In Nigeria, there are many different types of animal hides and skins. These include: cow hide, Horse hide, camel hide, Donkey hide, goat skin, sheep skin, antelope skin, pig skin and kangaroo skin. Each of these hides and skins selection and utilization is determined by their physical and chemical properties. In Nigeria, the cow, donkey and camel hides are the most dominant in utilization for the preparation of meal and ornamental applications (Mohammed, 2008).

2.2 Principles of Cow Hide Processing

The cow hide is one out of the many animal hides in Nigeria predominantly in use. It finds its applications in meal preparation for local consumption. There are two basic principles of cow hide processing. They are:

a. Processing by roasting

b. Processing with the use of hot-water

Processing of cowhide by roasting involves complete immersion of the raw hide into a glowing flame and then followed by scraping of the roasted hide with the use of knives-blade. After this roasting operation, the hide is immersed in water where it is washed with detergent and sponge. It is important to note that the use of detergent for the washing operation may have negative effects on the health of the consumer. It is therefore recommended that the use of detergents should be discouraged and replaced with a more safer and efficient cleaning agent such as brine solution or lime orange juice since most detergents contain some active ingredients such as phosphate.

Again the use of condemned automobile tyres as sources of fuel for roasting cow hide should be replaced with the safer fire wood, since tyres contain heavy chemical elements derived from hydro-carbons which are also dangerous to human health.

On the other hand, the hot water method of cow hide processing appeared to be safer in the sense that it does not require the use of detergents for cleaning and roasting with tyres. It involves complete immersion of the raw hide in hot water immediately it has been separated from the carcass and then followed by slow removal of the hide hair with specialized knives. After this operation the hides are spread under the sun to reduce the moisture content. The essence of this is to avoid any microbiological spoilage during storage.

2.3 Uses of Animal Hides

In general term, animal hides are used for different purposes and this may be determined by the choice of the user. In Nigeria, cow hides are used for the manufacturing of leather bags, shoes, hats, drums, mats and horse weeps (Mohammed, 2008). Other used include production of clothes and edible cow hide *(kpomo)*. In other parts of the world, cow hides and other animal hides are used for leather seats production, for interior decoration, machine belting, engine gaskets and harnesses. All these uses could bring about income generation to boost the country's economy (Discovery Channel Television, 2005).

2.4 Techniques of Cutting Cow Hides *(kpomo)*

The cutting of cow hides (*kpomo*) is not standardized. There are many variations in the sizes and shapes which are determined by the individual choice of cutting. After roasting or heating the cow hide in hot water, the individual hides are then cut into uniform shapes as may be preferred by the market forces of the products.

2.5 Methods of Packaging and Storage of Cow Hides

Traditionally, the dried cow hides *(kpomo)* are packaged in traditional brown papers or water proof material that can prevent moisture penetration into the product (*kpomo*) (Mohammed, 2005). Generally there are other numerous materials used for the packaging of cow hides (*kpomo*). These include textiles, cellophanes, aluminum foil and vacuum packaging system. The dried product (*kpomo*) is stored traditionally by hanging using iron woven baskets, bags and drums. Care must be taken to prevent the stored products under hanging condition from touching the floor or any other material around that may have a negative impact on the

rganoleptic properties of the product. These properties include taste ash content and water. A ell stored cow hide can last up to a period of seven to ten years and still maintain its desirable roperties (Mohammed, 2008).

The cow hides *(kpomo)* can also be stored under a controlled temperature for example efrigeration, but the cost of installation of this equipment is expensive and difficult to maintain n developing countries like Nigeria. Hence, the traditional method of storage is usually preferred by most producers of the product. It is important to note that the cow hide is not uniformly distributed all over the body of the animal. A survey operation carried out by the researcher during this study, revealed that the neck region of the animal is covered with hide of thick dimension, this same situation was also discovered in the legs and tail of the animal where there was a hide-covering of tougher texture.

The cowhide (*kpomo)* prepared for longtime storage are usually distributed to their final place of consumption using traditional papers, textiles and polythene materials. The products are arranged in batches and tied up before they are transported to their final places of utilization.

2.6 Animal Hides and Skins Diseases

There are many diseases affecting animal hides and skins, but for the purpose of this study, only the Lumpy-Skin Disease (LSD) will be considered because of its economic importance.

2.6.1 Lumpy-Skin Disease

It is a viral disease of cattle caused by *Capri-pox* virus and is typically characterized by

nodules or lumps on the skin of the infected animal. All cattle breeds in Nigeria can be affected. It is usually occurs during wet season and autumn months, when flies are in abundance. The disease occurs throughout Africa.

2.6.2 Importance of Lumpy-Skin Disease

It is a noticeable disease, which means the state veterinarian must be informed because there are specific control schemes for this disease. Up to 45% of a herd can be infected and the mortality rate may reach 10% (Thomas, 2002). The disease causes emaciation (loss of body condition because of unwillingness to feed); temporary or permanent loss of milk production, lowered or complete loss of fertility in bulls and cows, abortion as well as permanent damage to hides and skins.

There is loss in income because of decreased production (death, milk and meat, abortions, lowered breeding potential, and damage to valuable hides) and the costs of drugs to treat sick animals.

2.6.3 Animals Susceptible to the Disease

1. Cattle of all ages can be affected
2. Cattle which are vaccinated annually are protected and cannot be infected again (immune).
3. Calves under six months of age are protected against the disease if their mothers were vaccinated or had the disease previously.

2.6.4 Mode of Infection

Biting flies such as tsetse fly play the most important role in spreading the virus. Infections increase during the wet season and autumn months when there are more flies. The disease can also spread through the saliva of infected animals when they use the same drinking trough and also through breast feeding from infected cow.

2.6.5 Symptoms of Lumpy-Skin Disease in Cattle

According to Thomas (2002), any one or more of the following are the symptoms of LSD in cattle. Skin modules and ulcers can vary from a few to hundreds.

1. The size ranges from 0.5 to 5 cm
2. They occur anywhere on the skin, including the nose, udder and vulva in cows, the scrotum in bulls as well in mouth (the gums). Legs become swollen and develop sores and lymph nodes.
3. Pneumonia and coughing.
4. Nasal discharge thick, watery to pussy fluid from the nose.
5. Infertile bulls-due to orchitis (infection of testes).
6. Infertile cow.
7. Mastitis-This lowers milk production.
8. Lachrymation - Infection of the eye or even blindness, fever, emaciation, salivation and nodules all over the body.

2.6.6 Diagnosis of Lumpy-Skin Disease

A basic diagnosis can be made by the presence of the typical lesion on the skin and in the

mouth. In longhaired animals one should feel for the nodules on the skin or one can wet the hair so that the nodules could be seen more easily. A definite diagnosis can only be confirmed by a veterinarian by taking samples of the skin to a laboratory where they can identify the virus (this has to be done because there are other diseases which cause similar signs in cattle and therefore require different methods of control and treatment) (Thomas,2002).

2.6.7 Misconception of Lumpy-Skin Disease with Others.

The following diseases are usually misconceived with the Lumpy-Skin disease (LSD) (Thomas, 2002):

1. *Pseudo-Lumpy-Skin disease*
2. *Demodiaosis (Demodex)*
3. *Besnoitiosis*
4. *Oncocercariasis*
5. *Insect bite allergies*
6. *Bovine virus diarrhea' mucosal disease*
7. *Bovine malignant catarrhal fever (snotsiekte).*

2.6.8 Lumpy-Skin Disease Preventive Measures

There is no treatment for lumpy-skin disease. No specific treatment (antibiotics, anti-inflammatory drugs and vitamins infections) is usually directed at treating the secondary bacterial infections, inflammation and fever, and improving the appetite of the animal. Prevention is the cheapest and the best method of control of the disease. If animals are protected, one will not suffer any production or financial losses as a result of the ill effects of the disease.

The attenuated Nettling strain vaccine is a product that contains awakened Lumpy-Skin disease (LSD) virus. When this vaccine is administered the animal will develop protective anti bodies (made by white blood cells). These anti bodies then resist the actual virus that is transmitted or immune. Animals that had the disease and recovered are immune and therefore do not have to be vaccinated (Thomas, 2002). It is unpractical and almost impossible to control all the flies in a product that contains in insecticides, make sure that the dip includes insecticides effective against flies. Read and follow the instructions on the labels of the product. fly repellants can be sprayed on cattle.

Fly control will not prevent all cattle from being infected by Lumpy-Skin disease (LSD), the only way to ensure that all cattle are protected is by vaccination alone (Thomas, 2002).

CHAPTER THREE

3. 0 MATERIALS AND METHODS

3.1 Materials for Processing Cow Hide (*Kpomo*) Production

a) Knives

b) Fire woods

c) Brush or sponge

d) Detergents

e) Wood ashes

f) Hooks

g) Water

h) Bowl

i) Potash

j) Petri dish

k) Oven

l) Weighing balance (Citizen, sensitivity: 0.01g)

m) Selenium tablets

n) Sulphuric acid

o) Soxhlet extractor

p) Digestion plate

q) Digestion flask

3.2 Method, Analysis and Storage of Cow Hide (*Kpomo*)

3.2.1 Experimental Procedure

Samples of cowhide *(kpomo)* both roasted & cooked were collected from a producer immediately after production; samples were cut into smaller pieces using a sterilized scissors. Two tablets of selenium (digestive agent) were added to the samples, sulphuric acid was also added and the samples were subjected to a range of laboratory analysis and result obtained AOAC Official method of analysis was used for the determination of moisture content, ash content, lipid content, and crude fibre.

3.2.2 Crude Protein

The amount of crude protein contained in cowhide *(kpomo)* can be obtained by multiplying the nitrogen content of the animal by 6.25, the factor 6.25 owes its origin to the assumption that all animal protein contains 16% nitrogen and that all nitrogen in a feed is present as protein. Although these assumptions are not entirely valid, the protein contained in animal tissue may vary in terms of nitrogen content from 13 – 18% in many cases, a factor other than 6.25 would be more valid.

The accepted standard method for the determination of nitrogen in any sample involves complete digestion of sample in hot concentrated acid, and in the presence of an appropriate catalyst. The catalyst is to convert all nitrogen in the nitrogenous materials in the sample into ammonium ion. Upon the addition of alkali to the digest ammonia is released which may then either be distilled out of the sample and determined by simple acid – base titration or the ammonia can react with an appropriate reagent such as phenol and sodium hypochlorite, to give a colored derivative which can be measured with colorimeter or spectrophotometer.

The kjeldahl digestion is usually performed by heating the sample with H_2SO_4 containing substances which promote oxidant of organic matter by increasing the boiling point of the acid (K_2SO_4 or $NaSO_4$) and se or cu which increase the state of oxidant of organic matter. These reagents here, is referred to as a digestion catalyst

It is necessary to digest the sample for certain period until you obtain a clear solution to ensure accurate results.

3.2.3 Crude fibre

Crude fibre was originally thought to be indigestible position of any main food. It is known however that fibre consists of cellulose which can be digested to a considerable extent by both ruminants and non ruminants. The interest in fibre in food has increased, based on the noticed number of serious illnesses associated with diet low in fibre

3.2.4 Lipid Content

Fats are mixtures of various glycericide of fatty acids, which are soluble in certain organic solvents. Extraction is carried out with soxhlet apparatus with ether or petroleum ether. Direct extraction gives the proportion of free fat but gives no clue to the particalar fatty acids.

3.2.5 Ash Content

The ash of biological materials is analytical term for the inorganic residue that remains after the organic matter has burnt off. The ash is not usually the same as the inorganic matter present in the original material since there may be losses due to the volatilization or chemical interaction between the constituents.

The importance of the ash content is that it gives an idea of the amount of mineral elements present and the content of organic matter in the sample. The organic matter accounts for quantitative constituents of proteins lipid or fat, carbohydrate, plus nucleic acid. Sample rich in organic matter can be preheated on the flame or hot plate.

3.2.6 Carbohydrate Content

This is group of compounds that contains the elements of carbon, hydrogen and oxygen being present in the same proportions as in water. Carbohydrates are found in food either as sugar or as starches and glycogen. These materials are long straight or branched chain of the many sugar molecules joined together. The chemical nature of sugars determines their properties, functions in living tissues and how starches are formed and broken down. The sugar includes the monosaccharide, disaccharides and polysaccharides. The only polysaccharides of major nutritional importance are starches and glycogen because they can be digested in the human gut. Glucose is the keystone of metabolism in both plants and animal.

3.2.7 Moisture content

The determination of moisture content is one of the most important and widely used measurements in samples that absorb and retain water. Chemical analysis are normally made on dry matter basis, moisture content determination took very simple in concept, but in practice the accurate determination is complicated by number of factors which vary considerably from one sample to another.

Among the factors are the relative amounts of water available and the ease with which the moisture can be removed. Methods that are based upon the removal of water from the

sample and its measurement by loss of weight or the amount of water separated. Air or vacuum oven drying at 70-80°c are considered to be reliable methods provided that there is no chemical decomposition of the sample and water as the only volatile constituent removed.

3.2.8 Vitamins

Vitamins are organic substances or compound needed in many foods and essential to health and growth of plants and animals. Water soluble vitamins are those soluble in water and are heat labile they include vitamin c, vitamin A (retinol).

CHAPTER FOUR

4. 0 RESULTS AND DISCUSSION

4.1 Results

Table 4.1: Mean Proximate Composition of Cooked and Roasted Cowhide (*Kpomo)*

S/No	Parameter (%)	Cooked Cow Hide	Roasted Cow Hide	(p-value)
1	Crude Protein	34.59±1.813	50.96±2.922	0.001*
2.	Crude Fibre	2.41±0.010	2.72±0.044	0.000*
3.	Lipids	27.06±1.934	18.37±1.348	0.003*
4	Ash	0.47±0.006	0.89±0.023	0.000*
5.	Carbohydrate	37.46±2.469	8.26±1.244	0.000*
6.	Moisture	74.60 ±2.157	2.59±1.49	0.000*
7.	Energy (Kcal)	525.74±23.789	395.50±15.865	0.001*
8.	Vitamin C	0.08±0.000	0.08±0.000	

- Significantly different at 5% level of significance ($P \leq 0.05$)

  P- Value is less than or equal to 0.05

4.2 Discussion of Results

Table 4.1 shows the mean proximate composition of cooked and roasted cowhide (*kpomo).*

The official method of the Association Official Analytical chemist (AOAC) was used to determine moisture content (MC), ash content, crude fibre and crude protein.

A one-way ANOVA revealed that there were significant differences for moisture content of cooked and roasted cow hide (*kpomo).* ($P \leq 0.05$).

Cooked cowhide is significantly higher in moisture content than roasted cow hide because it contains water.

The result obtained for ash content as indicated in Table 4.1 above shows that the significant difference for the available ash content in cowhide (*kpomo*). The roasted version of cowhide shows the ability to maintain a stable ash content of the product, hence, the value obtained could be attributed to the organoleptic properties of cowhide. Therefore, it can be seen that the results obtained for ash content for both roasted and cooked cowhide shows that ash content is significantly higher in roasted cowhide than the cooked cowhide (*kpomo*).

According to Table 4.1, the results obtained for crude fibre shows no significant difference for both roasted and cooked cowhide. These results can be attributed to the fact that cowhide *(kpomo)* contain a considerable amount of fibre, this makes it more useful and palatable in the preparation of meals. However, the crude fibre content of cowhide can be preserved by adopting the roasting method of cowhide preparation.

The analysis conducted for cowhide (*kpomo)* for crude protein shows that the product contained a higher amount of protein. The high value for protein is because the hide contains collagen, which is a fibrous protein that makes up hide. The collagen is the main protein constituent in the hide; it is made up of amino acids such as lysine, praline, hydroxylysine and hydroxproline (plummer, 1978). It is true that *kpomo* is made up of protein as shown in the result. The hair which is not completely removed from the hide would have dissolved during digestion and added to the main sample.

Therefore, the protein content that could be absorbed may be minimal, indeed, collagen content in the hide is the principal structural protein holding the hide together (Dr. Todorov, 2008). There is high protein content in the roasted cowhide than the cooked cowhide (kpomo). These differences could be attributed to the fact that protein is very sensitive to temperature as demonstrated in the film documentary on cow hide processing by discovery channel television in

cooked cowhide, the raw product was heated in water to a temperature of approximately 100°C for two hours, while the roasted cowhide was also heated in water to a temperature of approximately 100°C for two hours thirty minutes; this heating operation may have an effect of temperature increase which leads to a decrease in the available protein content of the cooked cowhide *(kpomo)*. Rehman (2005) shows the effects of temperature on the suitability of animal hides in relation to its mineral composition. It is therefore recommended that to maintain the protein content of cowhide, a method which employs a lower temperature such as the roasted method should be adopted for the preparation of cowhide (*kpomo)*.

The one-way ANOVA revealed that there were significant differences for lipid content of cooked and roasted cowhide (*kpomo)*. The result shows that the cooked cowhide contained significantly higher lipid content than the roasted cowhide (*kpomo)*.

According to the results shown in the table, there is significant difference of carbohydrate for both the cooked and roasted cowhide (*kpomo)*. These results demonstrate that high temperature does not affect the available content of carbohydrate for cooked cowhide, but does in the case of roasted cowhide. Carbohydrate content is low compare to the protein content because carbohydrate serves as energy to the body.

The result obtained for energy value shows that there were significant reduction in the energy content of the product, with the cooked cowhide having higher-energy value than the roasted cowhide.

Result for vitamin C shows no significant difference as the values remains constant and relatively low. These results indicate the low content of vitamin C available in cowhide, either roasted or cooked.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In Nigeria where the socio-economic development of the country is still at the slow pace, most families find it difficult to put a complete meal with all the necessities for good health together. Having carried out this study, it can be concluded that cowhide though not so endowed with nutritional values could still be used as a major component part of the meal consumed by the populace and it application in the leather industry. It is also of great economic important with its immense benefit from foreign earning.

5.2 Recommendation

1. Due to inherent problem of using automobile tyres which poses serious health hazard arising from its parent material from hydrocarbon, it is therefore recommended that firewood should be employed in the roasting operation of the product (*Kpomo*)

2. It is recommended that in the preparation of cowhide (*kpomo*) salt solution or lime orange juice should be used for the washing of roasted cowhide, as this poses no serious health hazard on the consumers as different from the use of detergent.

3. It is also recommended that better processing facilities should be installed to ensure continuity in the production and storage of the product, cowhide (*Kpomo*)

REFERENCES

AOAC (1984): Official Method of Analysis. Association of Official Analytical Chemist, Washington DC.

Discovery Channel Television, (2005): A Film Documentary on Cow Hides Processing

Dr. Todorov G. (2008): Smart Skin. The McGraw –Hill Companies U.S.A

Ibitoye A. (2005): Basic Method in Plant and Animal Analysis, Akure, Ondo State Nigeria

Mohammed I. (2008): Assessment of cattle Hide Production (kpomo). Animal Record, Minna Township Abattoir Niger State Nigeria

Muwanbe D. (1994): Production and Assessment of Cattle Hide in East Africa, Institute of Animal Research and Development, Dare-Sallam, Uganda

Plummer, D. (1978): An Introduction to Practical Biochemistry U.S.A

Rehman S. (2005): Agro-Ecosystem. Tanery and Leather Industry, Greater Kashmir India

Thomas L (2002): Lumpy-Skin Disease, A Disease of Socio-Economic Importance, Onderstepoort Veterinary Institute, Animal Health For Developing Farmer Department of Agriculture South Africa

APPENDIX

AOAC official method of analysis. Association of official analytical chemist (A.A Ibitoye, 2005) was used to determine moisture content, ash content and lipid content.

$$\% \text{ Moisture} = \frac{\text{Loss in weight X 100}}{\text{Weight of sample before drying}}$$

$$\frac{W_2 - W_3 \text{ X } 100}{W_2 - W_1}$$

$$\% \text{ Ash} = \frac{W_2 - W_3 \text{ X } 100}{W_2 - W_1}$$

$$\% \text{ Lipid} = \frac{W_2 - W_3 \text{ x} 100}{W_2 - W_1}$$

Where: W_1 = weight of container (Petri dish)

W_2 = weight of container plus weight of sample

W_3 = weight of sample after

Crude fibre was determined by using the formula below:

$$\% \text{ Crude fibre} = \frac{W_2 - W_1 \text{ X } 100}{W_1}$$

Where : W_1 = weight of sample used

W_2 = wieght of crucible plus sample

Carbohydrate = % Soluble carbohydrate =100 – (% Ash + protein + fibre + lipid)

Energy Content (kcal) = (4 x protein) + (9 x lipid) + (4 x carbohydrate)

Where 4 and 9 are constant factor

$$\% \text{ Nitrogen} = \frac{M \times T \times N \times V_1 \times 100}{W \quad V_2}$$

Where M =molarity of Hcl acid used

T = titre Value

N = Nitrogen Value (0.014)

V1 = Volume of digest = 100 mls

V2 = Volume of digest used = 10 mls

Nitrogen value obtained, multiply by the factor of meat and fish (6.25), that gives percentage protein.

RAW COWHIDE

UNDERGOING FORM OF HOT WATER TRANSFORMATION