

**UNIVERSITY OF PORT HARCOURT**

**BRIDGING THE PROTEIN GAP WITH  
WHAT YOU HAVE**

An Inaugural Lecture

By

**PROFESSOR (MRS.) BENE WILLIE ABBEY**

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## **ACKNOWLEDGEMENTS**

To God be the glory for the great things He has done in my life, keeping me alive and fighting all my battles! Thank you Lord for ever abiding in me. I must thank my parents Late Mr. Israel Willie Bob-Manuel and my mum Mrs. Celia Willie Bob-Manuel for their love and not sparing the rod when raising me. I also thank my younger sister, Mrs. Ibimonia Harry for her role as my stabilizer, personal assistant and lady in waiting and never being tired of my demands. To my children, Osaki and Omiete my gold and diamond, my computer wizards, I say thank you for always coming to my aid whenever I distort what has been typed.

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To my husband, Prof. Sam Douglas Abbey, for always tolerating my nuances and encouraging me to succeed, standing by me in thick or thin I say thank you very much. You are my role model for other men to emulate. I thank God for giving you to me.

To my business associate, Mr. Victor Nwabuzor and family, I say thank you for your encouragement and support. My numerous family and church members, friends and well wishers whose names have not been mentioned, I appreciate you all.

Lastly, to my teachers through the generations and my students I say thank you very much for without you this day would not have been.

Thank you Jesus.

PROF. (MRS) BENE WILLIE ABBEY

The Vice Chancellor  
Deputy Vice Chancellors  
Provost, College of Health Sciences  
Deans of Faculties  
Registrar  
Other Principal Officers of the University  
Distinguished Guests  
Colleagues  
Students  
Gentlemen of the Press  
My Lord Spiritual and Temporal  
Ladies and Gentlemen

**PREAMBLE**

Mr. Vice Chancellor Sir, I thank you for this opportunity to present the 48th Inaugural Lecture of the University of Port Harcourt.

Presently, the Department of Biochemistry has three major areas of specialization namely, Enzymology, Medical Biochemistry and Nutrition and Toxicology. May I seize this opportunity to felicitate my predecessors Prof. Emmanuel O. Anosike,(FAS), an erudite Professor of Enzymology whose inaugural lecture topic was, “In Praise of Enzymes”, and Eze, Sir, Prof. Gabriel I. Ekeke (FAS), and acclaimed Medical Biochemist whose inaugural lecture topic was “Blood is thicker than Water”. I appreciated your contribution towards the advancement of knowledge of Biochemistry and the support you have given me in my academic pursuit. Mr. Vice Chancellor Sir, I am proud to announce to you that this is the third inaugural lecture from the Department of Biochemistry and this time, from the third specialist discipline, Nutrition and Toxicology.

For the benefit of those who do not know the meaning of 'inaugural' and also to serve as a reminder to even those who are familiar with the word, an inaugural lecture affords one the opportunity to share publicly ones academic achievements, concerns and articulate ones expectations or aspirations in simple terms.

Mr. Vice Chancellor Sir, the topic for this lecture is – '*Bridging the Protein Gap with What You Have*'. Proteins are nutrients and they are found in food. The question is, why food? Is it not enough that we eat it?

Food is so important to our existence that it has been known to be responsible for the rise and fall of many nations since time immemorial. Our first parents on earth, Adam and Eve fell because they ate of the fruit which God forbade them to eat (Gen. 3:3). Esau sold his birthright for a bowl of lentil soup (Gen. 25: 31-32). Food has always been used as a weapon of mass destruction by nature or man. By nature, when there is natural cataclysm such as famine (Sudan) and earthquake (Tsunami flood) and by man, when there is politics of food by nations (USA and Russia) during the period of drought when Russia approached USA for wheat supply.

## **DEFINITION OF FOOD AND NUTRITION:**

"Tell me what you eat and I will tell you who you are". This statement serves to remind us that we are what we eat and that our bodies are built from the food we eat. We cannot escape from the fundamental importance of food in our lives. Though a few people may claim that they 'live to eat' everyone must acknowledge that they must 'eat to live'.

Of all the several wants of man, food is the most important. Indeed the importance of food in our lives is accentuated by the knowledge that on average

we consume about 60 tons of food in a lifetime of 70 years and consume about 70,000 meals. In the developing countries more than 80% of their daily income is spent on food. The Bible corroborates this in Ecclesiastes chapter 6 verse 7, and 1 quote,

*“ All the labour of man is for his mouth,  
and yet the appetite is not filled.”*

Thus we should not take food for granted nor treat it with so much levity. It is certainly to our advantage to know the fundamental principles about a subject which is so important to our existence.

*Scientifically, however, food is defined as; that substance which is necessary for health, growth and normal function of living organisms whether its unicellular or multi-cellular organisms like, bacteria, plants or man.*

*Nutrition on the other hand, is a broad subject which requires exploitation in the social, biological and physical sciences.*

*Nutrition can be compositely defined as; the usage of science to interpret the functions of food in a living organism with respect to uptake of food, energy liberation, waste elimination and synthesis for maintenance, reproduction, growth and a balance in health. To put it more simply, nutrition is the study of food and the way the body uses the food.*

You will agree with me that, food and water, and in cooler climates, adequate clothing are the only essential requirements for the survival of the human race. Research, in nutrition proceeds in biochemical, physiological, medical, agricultural, social, and political science laboratories throughout the world. The science of nutrition is a 20<sup>th</sup> century science and has advanced so

tremendously. What may be taught, as truth today will become error in a few years time. A classical example can be seen in the study of anemia. It was reported that the cause was due to the consumption of diets deficient in iron. Wheat bran and spinach have high iron content, so it was stated at one time that the diet would reduce anemia. However, it was found in 1937 for spinach and 1942 for wheat bran that this iron is not available to the human body. These foods also contain other chemical substances, called oxalic acid and phytic acid, which combine firmly with the iron and prevents its absorption from the intestine.

### **CONSTITUENTS OF FOOD:**

Food comprises of nutrients. Food must be eaten, digested, absorbed, and assimilated to facilitate the release of the nutrients for use by the body. Listen to this:-

*It's a very odd thing-*

*As odd as can be-*

*That whatever Miss T eats Turns into Miss T.*

*De la mare*

It is indeed a very odd thing-an extra ordinary and remarkable thing – that no matter what we eat, the structure of the body, both flesh and blood change very little. There is no obvious similarity between the nature of the food we eat and the nature of our bodies. Yet within a few hours of being eaten, food is transformed into flesh and blood. Approximately 97% of the cells in our bodies are replaced each year from the nutrients that we take in. what we ingest actually becomes part of the structure of our bodies. That is why proper nutrition is so important.

## CLASSES OF NUTRIENTS IN FOOD

The nutrients in food fall into six classes. You are probably familiar with the terms carbohydrates, lipids (fats and oils), proteins, vitamins, and minerals. These plus water make up the six classes of nutrients found in food.

Nutrients can be assigned to three functional categories namely;

- 1) For providing us with energy
- 2) For growth and repair
- 3) For keeping body functions running smoothly.

However, some overlap exists among these groupings as can be seen from Table 1.

**Table 1**

**Functional Categories of Nutrients in Foods**

<b>Functional Categories of Nutrients in Foods</b>		
Provide Energy	Promote Growth And Development	Regulate Body Processes
Carbohydrate	Proteins	Proteins
Proteins	Lipids	Lipids
Lipids	Vitamins	Vitamins
	Minerals	Minerals
	Water	Water

The energy yielding nutrients make up a major portion of most foods. That is not surprising because energy is the primary requirement of all living things.

## **PROTEINS AND AMINO ACIDS IN NUTRITION.**

Proteins are the very basis of life. The word 'protein' is from a Greek word '*proteios*' meaning, 'primary', and true proteins are of primary importance in all living things.

Proteins like carbohydrates and fats contain carbon, hydrogen and oxygen but in addition always contain nitrogen. While some contain sulfur as well, others contain phosphorus. Proteins are very complicated, and seem to be the most complicated substance known to science. In man, protein is the most abundant substance, next only to water.

Whether we get protein directly from plants or, second hand from animals who got it from plants the truth is that, all proteins ultimately come from plants, confirming the statement that "*All Flesh Is Grass*" (*Isaiah 40:6*).

Proteins are built from simpler substance known as amino acids. There are twenty amino acids which our body needs to build proteins but eight must be obtained from our food, hence they are called essential (indispensable) while the rest are non-essential (dispensable) because our body is able to synthesized them from metabolic intermediates. In children, histidine is also considered to be an essential amino acid since they are unable to make enough to meet their needs.

*The essential amino acid in smallest supply in a food or diet in relation to body needs is the limiting factor and is called, the limiting amino acid because it limits the amount of protein the body can synthesize.*

Lysine is the first limiting amino acid in cereal grains whereas, that in legumes is methionine (Elegbede, 1988). The limiting amino acid may lead to poor



utilization of amino acids by humans so that relatively more protein is required to meet the minimum requirement for protein synthesis.

## **HOW MUCH PROTEIN DO WE REALLY NEED TO TAKE EVERY DAY?**

People are so individual that experts do not agree on how much protein is best. Protein requirements differ according to your health, body size and activity level. However, the recommended dietary allowance (RDA) for adult men and women is 0.8g for each kg of body weight per day. This RDA works out to about 56 g of protein daily for a 70kg man and about 44g of protein daily for 55kg woman (Wardlow, 2003).

Children have a proportionally greater requirement than adults because they are growing and increasing the total amount of protein in their body. Additional protein intake should be provided during pregnancy (+ 6 g/d) and lactation (7.5-13 g/d).

Excess or inadequate consumption of dietary proteins over a period results in malnutrition and its attendant problems. *Malnutrition is a condition of impaired development or function caused by either a long-term deficiency or an excess in nutrient intake.*

## **CONSEQUENCES OF EXCESS INTAKE OF HIGH AND LOW QUALITY PROTEIN DIETS.**

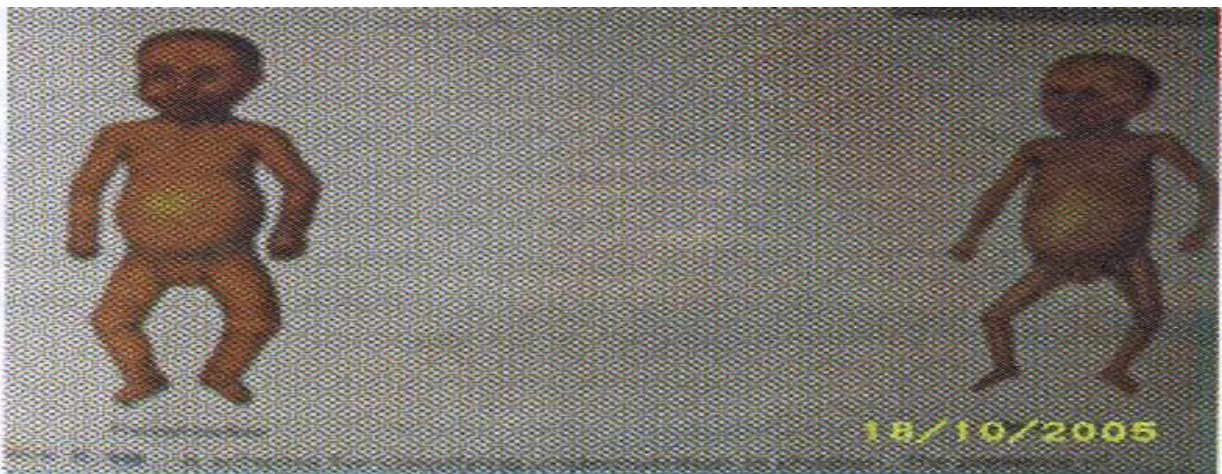
High quality proteins are obtained mainly from animal sources, meat, poultry, fish etc. They are not rich in protein but also in fat. Excessive intake of saturated fat has been linked to cardiovascular disease in humans. High quality protein diets can also increase calcium loss in the urine. The increased calcium

loss in the urine also may contribute to kidney stone formation. Excessive intake of red meat is also linked to colon cancer in population studies. A high protein diet also breaks down the pancreas and lowers resistance to cancer as well as contributes to the development of diabetes. Gout, arthritis, osteoporosis and premature aging have been reported (Dye, 1999). This condition is prevalent among the affluent.

People who regularly consume too little protein and energy can go on to develop protein energy malnutrition, also referred to as protein calorie malnutrition. This condition is prevalent among the poor, particularly in the developing countries such as Nigeria where the staple diet consists of mainly starch. Due to poverty, people can hardly afford the expensive animal proteins to augment their diet.

## **PROTEIN ENERGY MALNUTRITION.**

A deficiency disease called *kwashiorkor* and *marasmus* can occur where there is severe deficiency of protein and energy respectively. Both are primarily seen in children, but can also occur in adults. Symptoms of these two conditions can be seen in the same person.



**Kwashiorkor**



Kwashiorkor is a word from Ghana that means ‘the disease that the first child gets when the new child comes’. From birth, an infant is usually breastfed. However, by the time the child reaches 1 to 2 years of age, the mother is usually pregnant or has already given birth again, and breastfeeding is no longer possible for the first child. This child’s diet abruptly changes from nutritious human milk to native starchy gruels such as pap (akamu).



The major symptoms of kwashiorkor include failure to grow and gain weight, apathy, listlessness, withdrawal from the environment. *Many symptoms of kwashiorkor can be explained based on what we know about proteins. Proteins play important role in fluid balance, lipoprotein transport, immune function and production of tissues, such as skin, cell lining the gastro-intestinal tract, and hair.*

## **Marasmus**

Typically, it occurs in infants who are slowly starving to death. The word, marasmus means ‘to waste away’, in Greek. Victims have a ‘skin- and- bones’

appearance, with little or no subcutaneous fat. The main deficiency here is calories. It may occur at any age up to 4years, but in contrast to kwashiorkor, is more common during the first year of life.

*Majority of brain growth occurs between conception and the child's first birthday. In fact, the brain is growing at its highest rate at birth and if the diet does not support this process, it may not grow to its full size. This reduced or retarded growth may lead to diminished intellectual function.*

Both kwashiorkor and marasmus wreak havoc on infants and children; mortality rates in developing countries are often 10 to 20 times higher than developed countries. This is why protein foods are mandatory for infants. The infant mortality and life expectancy for selected countries is presented in table 2.

**Table 2**

**Infant Mortality and Life Expectancy for Selected Countries, 2004**

<b>Country</b>	<b>Infant Mortality<sup>1</sup></b>	<b>Life Expectancy <sup>2</sup></b>
<b>Developed:</b>		
Australia	4.8	80.3
Japan	3.3	81.0
United Kingdom	5.2	78.3
USA	6.6	77.4
<b>Developing:</b>		
Brazil	30.7	71.4
Mexico	21.7	74.9
China	25.3	72.0
India	57.9	64.0
<b>African countries</b>		
<b>Nigeria</b>	<b>70.5</b>	<b>50.5</b>
South Africa	62.2	44.2
Kenya	62.6	44.9
Egypt	33.9	70.7

1. *Infant deaths per 1, 000 live births*
2. *Life expectancy at birth, in years, both sexes.*

Sources: U.S Census Bureau, International Database.

## **THE VALUE OF PLANT PROTEINS**

It is a well known fact that animal proteins are in short supply, very expensive and the price is increasing daily. This situation is not surprising because the conversion of plants into animal protein in the bodies of cattle and other animals is an extremely inefficient and extravagant use of the world's food resources. Why not go directly to the plant since most mixed diets provided adequate supply of protein (Fox and Cameron, 1995).

Plant foods apart from supplying energy provide protein, magnesium and dietary fiber. Plant foods do not contain cholesterol rather they have abundance of unsaturated fatty acids. These unsaturated fats do not raise blood cholesterol as does saturated fats.

Presently, about 40% of the protein consumed per capita in developed countries is plant protein while in developing countries like Nigeria, plant proteins account for over 80% of the protein consumed (Table 3). This must be the reason the diseases of the affluent countries (USA, UK) such as obesity; cardiovascular diseases, diabetes etc. are at a minimum in Nigeria.

**Table 3**

### **Protein Supply per Caput per Day for Selected Regions %**

Region	Animal Protein	Plant Protein
<b>World</b>	36	64
Developing regions:		
<b>Africa</b>	20	80

Asia	25	75
Developed regions:		
North America	64	36
Western Europe	60	40

**Source: World Trade in Vegetable Proteins In The 1990's  
Proc. of the World Congress. T.H Apple-White.**

Also, in developed countries, animal products contribute more than a third of the daily calories and over a third of the major nutrients in the food supply. While in the developing countries, due to poverty, people cannot afford animal protein as they would like.

Nutritionally, plant proteins are inferior to animal proteins because of deficiencies in certain essential amino acids. The proteins of food legumes are particularly poor in the sulfur containing amino acid, methionine while the cereal proteins are low in lysine. Other factors that contribute to the poor quality of plant proteins include the presence of anti nutritional factors or toxicants which affect their utilization.

Despite their low quality, seed protein crops have certain advantages over animal protein production. Much higher yield of protein are obtained per acre of land, so relative production costs for plant protein are much lower than for animal proteins. In addition, plant proteins in the form of seed grains etc are much easier to handle, store and transport than animal proteins.

## **NATURAL PLANT TOXINS**

Plants spend their lives in one place, so they rely on elaborate chemical defence to ward off unwanted predators. For this reason, they have an amazing

array of thousands of chemicals toxic to bacteria, fungi, insects, herbivours and, even humans. Examples are protease inhibitors, phytic acids, cyanogenic glycosides, haemagglutins, oxalic acid and saponins. Fortunately for us, this chemical diversity also includes many compounds that are beneficial to human e.g. vitamins, nutrients, antioxidants, anticarcinogens and many chemicals with medicinal value.

Vice chancellor, Sir, most of these plant arsenals can be destroyed. In actual fact the quickest means of alleviating hunger and malnutrition is investment in plant foods.

## **UNDER NUTRITION IN THE DEVELOPING WORLD**

About 12million children under five die every year in developing countries, 55% of the deaths are attributable to under-nutrition. Emaciated children with bulging eyes and stomachs, too weak to cry, stare at us from news photos and television screens.

Today, nearly one in six people, worldwide, is chronically undernourished, too hungry to lead a productive life. The numbers of chronically hungry people currently occur in Eastern Africa, particularly hungry in Ethiopia, Sudan, Rwanda, Burundi, Sierra Leone, Kenya, Somalia and Tanzania. Their eyes haunt us (Wardlaw, 2003).





**The Food and Nutrition Situation in Nigeria**

Hunger and malnutrition in Nigeria are more severe now than ever before. It has been reported that the percentage of Nigerian households that are food insecure has risen from 18% in 1986, to over 40% in 1988. Malnutrition is widespread and its prevalence is high. Poverty, inadequate investment in the social sector, inadequate dietary intake, and disease has been identified as the



major causes of malnutrition in Nigeria. Recently, the extent of malnutrition has increased as a result of economic hardships faced in the country. Most Nigerian households spend more than 75% of their income on food alone, indicating a high prevalence of food insecurity (NPC, 2001).

President Olusegun Obasanjo formally launched the pilot programme of the Federal Government's Home Grown School Feeding in 2005 at Keffi Local Government Council in Nasarawa State. What was the reason for launching this programme? It was reported that a study conducted in the country indicated that Nigerian children were not eating enough nutritional foods while a lot of them were underweight. The programme was designed to cushion the deteriorating educational foundation and health of our future leaders, the children.

*It is pertinent, therefore, to promote habits and activities that will reduce the level of malnutrition. This can be done by introducing indigenous food cultures and dietary habits of Nigerian people for healthy living and development.*

## **MY SEARCH FOR SOLUTION**

I was privileged to be admitted to read Veterinary Medicine at the University of Ibadan in 1969. My filling Veterinary Medicine as my course of study was sequel to the information from a job related booklet I read as a student in A.C.M.G.S. Eledenwo. I observed that the highest paid job at that time in Britain was Veterinary Medicine followed by Medicine and so forth. I shot for the highest paid job oblivious of what it entailed.

At University Of Ibadan, the first year courses were the same for Veterinary Medicine, Animal Science and the Agricultural Sciences. After the first year examinations, I was awarded the University scholarship as a result of my brilliant performance. However, in the course of the second year, a female student was

seriously wounded by a cow she was working with during practical. That incident ended my interest in Veterinary Medicine. Despite the pressure put on me to continue with that discipline, I was determined in my resolve to change to Agricultural Biochemistry and Nutrition and even forfeit the award if need be.

My external examiner for my final degree examinations was Dyfed Lewis, Professor Emeritus of the University of Nottingham, England. While Professor V.A Oyenuka was trying to convince me to register for Graduate programme at University of Ibadan, my external examiner simply said to me and I quote. 'If you change your mind to go further in your studies, just give me a call.' So when Rivers State Government awarded me scholarship for higher degree programme, I took the challenge and gave Prof Lewis a call. The day my husband and I arrived at Loughborough Railway Station the two gentlemen waiting for us were to be my supervisors.

## **JOURNEY INTO THE LAND OF LEGUMES**

On that very day I arrived at Prof. Lewis' office, I was given a research topic which laid the foundation for the major part of my research. In their search for alternative plant protein Rank Hovis Mcdougall Company, Britain was in collaboration with the Department Of Biochemistry and Nutrition to research into the efficacy of a legume purported to have high protein content and grew well in Britain. Soybean has hitherto been making waves as the best plant protein next to animal protein. However, the British weather is not conducive to the growth of soybean. A legume that can easily grow in Britain was sought and the answer was found in field bean (*Vicia Faba*,L.)

## Legumes

Legumes belong to the family Leguminosae. They are the second most important source of food and fodder, the most important being the family Graminae - the cereal grains (Elegbede, 1998). Legumes are used for a variety of purposes such as, providing protein rich foods, improving the soil, as fodder, as sources of vegetable oil and as ornamentals (Sinha, 1977)

### Nutritional Quality of Field Bean (*Vicia Faba L.*)

The chemical composition of the dry field bean seeds were determined (Table 4). Also, toxic substances were extracted and purified from the seed (Abbey, 1976; 1982).

**Table 4**

Proximate Analysis of Field Bean meal used in this study and values obtained from other sources (Percent Dry Matter)

	1	2	3	4
Crude protein	22.90	26.97	26.50	26.70
Crude fiber	9.20	8.01	9.00	9.00
Ash	4.04	-	-	-
Ether extractable fat	1.42	1.06	1.50	1.60
Nitrogen free extract	62.44	-	59.00	-
Gross energy kcal/kg	4035	4321		

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- 1 From this study
- 2 Lord Rank Research Centre
- 3 Eden
- 4 Clark

Furthermore, physiological effect of toxic substances in the field bean was also investigated (Abbey, 1976). Our study showed that the pancreas of rats were enlarged (hypertrophy) when raw field bean meal was fed to rats but if heated (autoclaved) for 15 minutes, about 90% of the toxic substances in the bean were found to be degraded in the intestinal tract of the rat (Abbey et al, 1979a; Abbey et al, 1979b). Thus it was concluded that field bean can replace soybean in animal feeding and novel protein production. Consequently, the production and utilization of field bean crop was greatly encouraged because it is a British crop. It should be noted that soybean seeds contain 45-55% protein, double that in field bean. The advantage field bean has over soybean is that the climate favours its growth.

## **OBJECTIVE OF OUR STUDY**

Mr. Vice Chancellor, Sir, the need to make the best out of what one has was adopted in our studies here in Nigeria. The objective was to eliminate malnutrition. Our studies were targeted particularly at the rural people to alleviate their low protein intake by education and the introduction of cheap available food with simple preparatory methods. We chose to study the legume crops easily grown in Nigeria such as the black-eyed beans Cowpea (*Vigna unguiculata*. L.), African yam bean (*Sphenostylis stenocarpa*)-(Abbey and Berezi, 1988; Abbey and Ayuk, 1991; Nwinuka et.al. 1997; Onyeike et.al 1988, 1999, onyeike et. al., 1991) and brown bean (*Carnavalialia rosea*)-(Abbey and Ibeh, 1987). Of all these, we concentrated our studies more on the cowpea because it is a crop in our hands, available, popular, easily accessible, and a potential cash crop.

## **THE COWPEA (*Vigna Unguiculata* L, Walp)**

Cowpea is the most important cultivated grain legume of commercial importance in West Africa in terms of both areas harvested and level of production (Table 5).



**Table 5**

**Cultivate grain legumes of economic importance in West Africa, 1999**

Grain Legume	Area Harvested (‘000 ha)	Production (‘000 t)
Cowpea (dry)(vigna unguiculata [L.] Walp)	8130	2917
Soybean(glycine max [L.]Merr.)	584	3
Broad beans(dry) (vicia faba [L])	1	1
Bambara groundnut (Voandzeia subterraanea)		
[L.] thou.	57	43
Beans (dry) (phaseolus vulgaris [L.]	255	127

**Source: FAO 2000.**

Cowpeas are grown extensively in 16 African countries. Nigeria and Niger together produced 49% of the world crop. Available data (FAO, 2000) indicated that cowpea is a cash crop in Burkina Faso, Ghana, Nigeria, Mali, Mauritania, Niger and Senegal. Among these, Nigeria is the largest producer both in the West African sub-region and in the world as a whole (Table 6).

Recently, Babaleye (2006), the Head of Public Affairs at the International Institute of Agriculture reported that Nigeria as the world leading producer of cowpeas, produces more than 2.5 million metric tons of the product annually.

**Table 6**

**Estimated cowpea production in some countries**

<b>Country</b>	<b>Tons/annum</b>
Nigeria	850,000
Niger	271,000
Brazil	600,000
Burkina Faso	95,000
Ghana	57,000
Kenya	48,000
Uganda	42,000
Malawi	42,000
Tanzania	20,000-22,000
Senegal	20,000-22,000
Togo	20,000-22,000
United States of America	60,000.

**Source: Singh and Rachie, 1985.**

## **THE NUTRITIVE VALUE OF COWPEAS**

The diet of most people in developing countries is based on processed cereal grains such as maize, sorghum, rice, roots; such as cassava, yam and fruit; such as plantain. These are, mostly starchy foods and do not contain enough protein particularly for infants and lactating women. Food legumes, because their protein content is generally high constitute a natural protein supplement to staple diets, and in Africa, cowpea represent the legume of choice for many such populations.

Cowpea is a staple food for the poorest sector of many developing countries especially of those of the humid tropics, hence the adage, 'the poor man's meat'. It is eaten in the form of dry seeds, green pods, green seeds and tender green leaves. It is also used for fodder and as a quick growing cover crop under a wide range of conditions.

As a legume, cowpea has the ability to fix nitrogen providing a high proportion of its own nitrogen requirements and leaving a fixed N- deposit in the soil of up to 60-70 kg/ha for the succeeding crop. The cowpea is also highly compatible with a wide range of food and fiber crops. There are several varieties such as Ife brown, Dan Knarda and VITA. Some varieties mature in 60-65 days and some are drought tolerant as well as most soil stress. (Singh and Rachie, 1985).

## **CHEMICAL COMPOSITION OF COWPEA SEEDS**

The average chemical composition of cowpea seeds is presented in Table 6. Cowpea contains 24.8% protein, 1.9% ether extractives, and 63.6% carbohydrates. The essential amino acid content is also shown in Table 7. The

lysine content is relatively high, making cowpea an excellent improver of protein quality of cereal grains which are deficient in lysine.

**Table 6**  
Nutrient Content of Eight Cultivars of Cowpea.

<b>Nutrient</b>	<b>Average %</b>
<b>Protein</b>	<b>24.8</b>
Ether extractives	1.9
Crude fiber	6.3
Ash	3.6
Carbohydrate	63.6
Thiamin (mg/100g)	0.74
Riboflavin (mg/100g)	0.42
Niacin (mg/100g)	2.81

Source: Singh and Rachie,1985

**Table 7**  
**Essential amino acid content of cowpea (g/16gN)**

Amino acid	Soybean	Cowpea	WHO reference protein
Arginine	-	8.0	-
Histidine	-	3.4	-
Isoleucine	4.8	5.1	4.2
Leucine	8.0	7.4	4.2
<b>Lysine</b>	<b>6.4</b>	<b>7.8</b>	<b>4.2</b>
<b>Methionine</b>	<b>0.9</b>	<b>1.3</b>	<b>2.2</b>
<b>Cystine</b>	<b>0.8</b>	<b>0.5</b>	<b>2.0</b>
Phenylalanine	4.8	4.2	2.8
Tyrosine	3.2	2.0	2.8



Threonine	4.0	4.0	2.8
Tryptophan	1.3	1.1	1.4
Valine	4.8	5.2	4.2

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**Source: Adapted From Singh And Rachie,(1985)  
And Temple et al, (1991)**

However, cowpea protein like other food legumes, is deficient in sulfur containing amino acids. The deficiency is definitely important when the diet is on only legumes or mixed with root crops. Addition of methionine, the deficient amino acid to cowpea protein increased the protein quality significantly, demonstrating the need to increase the sulfur amino acid content in cowpea protein (Boulter et al 1975; Abbey, 1976). Furthermore, the carbohydrate fraction is relatively rich in total sugars and flatulence producing oligosaccharides.

Although, beans and peas are excellent sources of protein and water soluble vitamins, per caput consumption of beans and peas in the industrialized countries has fallen considerably in recent years. Even in developing countries where beans remain an important relatively affordable source of dietary protein, their consumption is minimized by those who can afford to replace them with animal derived foods.

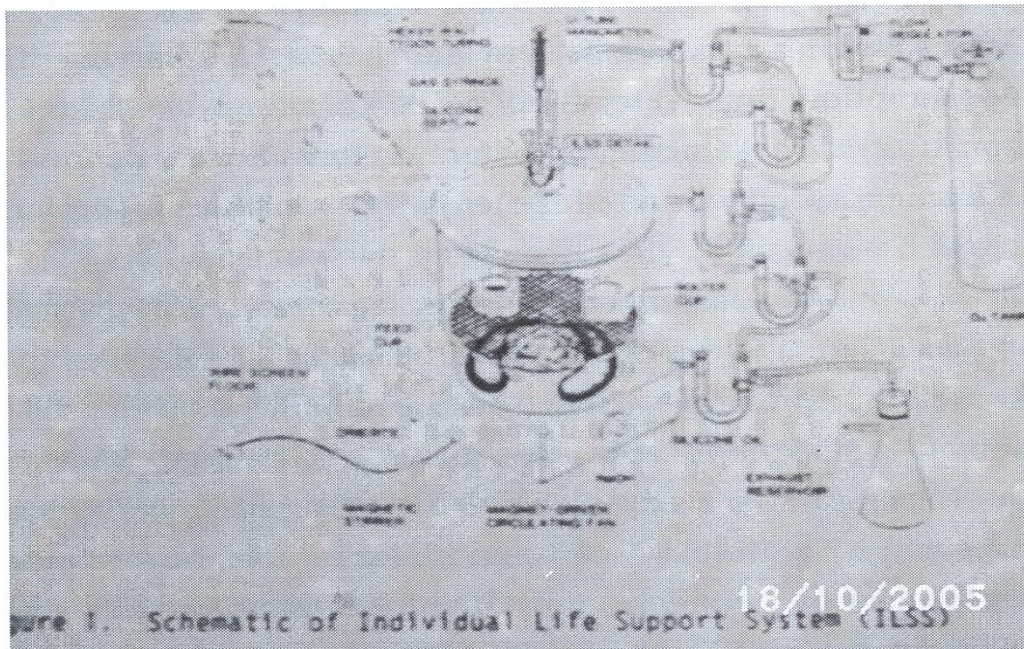
This trend is due to the time and labour required to prepare the dry seeds and to unpleasant physiological effects such as flatulence and diarrhea accompanying their consumption thus, relegating beans to a low status among consumers. These negative factors, in turn exert a depressing effect on production of potentially valuable leguminous crops.

A major reason for avoiding legumes is the difficulty experienced in digesting them. Flatulence is the most common symptom associated with bean

consumption, but its social implications are also many. Abdominal pain and diarrhea are often experienced by susceptible individuals, especially children, causing beans to be avoided. Unfortunately, children are often the most at risk from malnutrition, and beans may be the only affordable source of good quality protein available to them.

The greater part of my research has been on toxic constituents of plants particularly legumes. Vice chancellor sir, my sojourn to USA on Fulbright Research Fellowship was not unconnected with my desire to eliminate these flatulence factors and other toxic factors from beans and make them widely acceptable. Little wonder that the Griffin Daily News, Georgia, highlighted my research captioned, 'Researcher Hoping to Remove All Gas from Black Eyed Peas'.

Indeed, we went all out to develop a model system for determining flatus hydrogen gas production by experimental rats (Phillips et al 1988). Subsequently, the composition and flatus producing potential of commonly eaten Nigerian and American legumes were analyzed.



## **CARBOHYDRATES IN COWPEAS:**

Cowpea seeds contain carbohydrates ranging from 56-68% with starch contributing up to 48%. The oligosaccharides, raffinose, stachyose and verbascose were found to be the main culprits. *Due to lack of the enzymes  $\alpha$ -galactosidases in mammalian digestive systems, these oligosaccharides pass into the colon where they are fermented anaerobically to produce diarrhea. Flatus gas (carbon dioxide, hydrogen and methane) and their attendant discomfort.*

Drastic reduction of the oligosaccharides was achieved by processes which are economically and technologically feasible such as controlled germination, while at the same time preserving the functional and nutritional quality (Nnanna & Phillips 1988).

## **ANTI-NUTRIENTS (TOXICANTS) IN COWPEAS**

Cowpeas seeds were found to contain trypsin inhibitors, chymotrypsin inhibitors, heamagglutinins, tannins, polyphenols phytic acid (Ologhobo and Fetuga 1983, Abbey, 1976) and saponins. Trypsin inhibitors have low molecular weight (20,000-25,000) with relatively few disulphide bonds but possessing a specificity which is primarily directed towards trypsin. Chymotrypsin inhibitors on the other hand, have a molecular weight of 6,000-10,000 with high proportion of cystine residues and are capable of inhibiting trypsin as well as chymotrypsin at independent binding sites but possessing a specificity which is directed primarily at chymotrypsin (Leiner and Kakade, 1980). The trypsin inhibitor activity ranged between 19.6 and 28.2 TIU mg<sup>-1</sup> protein with an average value of 23.7.

Lectins are proteins which are characterized by their unique ability to bind specific sugars or glycoproteins. This reaction is manifested in vitro by the agglutination (clumping) of red blood cells from various species of animals and so

lectins are also called haemagglutinins. Cowpeas contain about (2.17g/kg) lectins. Lectins bind to the epithelial cells lining of the small intestine. Lectin toxicity can cause growth depression and ultimately in the death of the animal. Intestinal lesions and histopathological changes of some organs particularly in the kidneys have been observed (Ikegwonu and Bassir, 1977). The enzyme inhibitors and lectins are destroyed by sufficient heat treatment (Leiner, 1979, Abbey, 1976).

Polyphenols (condensed tannins) are fairly high in cowpeas. They are heat stable but are located mainly in the seed coats and can be significantly reduced by decortications/dehulling of the bean (Phillip and Adams, 1983). Tannins decrease protein quality by decreasing digestibility and palatability. Other nutritional effects which have been attributed to tannins include damage to the intestinal tract, toxicity of tannins absorbed from the gut, and interference with the absorption of iron and a possible carcinogenic effect (Butler, 1989). It has been suggested that tannins play a major role in the plant's defense against fungi and insects (Osagie, 1998).

Phytic acid is an important storage form of phosphorus. It is insoluble and cannot be absorbed in the human intestines. Phytic acid has 12 irreplaceable hydrogen atoms with which it could form insoluble salts with metals such as calcium, iron, zinc and magnesium. The formation of these insoluble salts renders the metals unavailable for absorption into the body. Phytic acid can also affect digestibility by chelating with calcium or by binding with substrate or proteolytic enzyme. Phytate is also associated with increased cooking time in most legumes. However, the local methods of food processing used in Nigeria minimized the concerns posed by metal chelation and protein-binding action brought about by the phytate naturally present in food materials of plant origin (Osagie, 1988).

Saponins are steroid or triterpenoid glycosides which are characterized by their bitter astringent taste, foaming properties and their hemolytic effect on red blood cells. They have both beneficial (cholesterol lowering) and deleterious (cytotoxic and permeabilisation of the intestine) properties (Messina and Barnes 1991). Although, some saponins can be shown to be highly toxic under experimental conditions, acute saponin poisoning is relatively rare both in animals and man. Alkaline washing or dry scouring and abrasive dehulling have been suggested as techniques of reducing saponins in legume. In general, saponins are not destroyed during cooking or processing (Osagie, 1988).

## **THE GOOD NEWS**

The toxic substances in cowpeas have their beneficial aspect. For instance, protease inhibitors are one of the most powerful cancer-protecting phytochemicals. They have been proven to be particularly protective against cancer of the colon, breast and prostate (Troll and Kennedy 1983). Tannins also show protection against cancer particularly cancer of the stomach and lungs when ingested orally (Yauclow et al, 1983). Some tannins have been shown to inhibit bacterial growth that cause tooth decay.

Furthermore, phytates slow down the absorption of sugars and regulate insulin levels. This is beneficial in the prevention and treatment of diabetes and hyperlipidemia, high blood fat (Kakiuchi et al 1986).

## **PROCESSING OF COWPEAS**

Like other food legumes, cowpeas seeds are processed before consumption. The processing method can be by simple boiling in water until the seeds are tender. The seeds can also be processed by soaking and germination (forming

sprouts) before cooking or by drying, autoclaving, roasting, toasting, milling, fermenting and by extrusion cooking (Dovlo et al 1976; Enwere & Ngoddy 1986; Abbey & Nkanga 1988; Abbey & Mark-Balm, 1988). The seeds can also be dehulled before going through the above processes. The ultimate aim is to destroy the anti-nutritional factors and improve the nutritional quality of the product by increasing the protein digestibility (Table 8).

**Table 8**  
**Effect of different heat treatment on the protein**  
**Quality of cowpeas**

Treatment	Protein Efficiency Ratio	Digestibility %	Available Lysine %
Raw	1.21	73.2	6.4
Autoclave, 15psi, 15min	1.33	77.4	5.7
Toasting, 30mins, 210oC	1.29	76.1	4.8
Extrusion	1.73	80.2	5.6

**Adapted from Singh and Rachie, 1975**

## **TRADITIONAL USES OF COWPEAS**

Cowpeas are used as fodder and green manure. The unripe fresh pods are consumed as vegetable. The dry seed or grains (pulses) are used for food. Cowpea seeds are used whole or dehulled and milled into flour or meal. The dehulling process eliminates the seed coat or testa and the helium which cause discoloration of the paste or flour and has also been associated with the incidence of flatulence among consumers of whole cowpeas.

Traditionally, cowpea paste is made into a breakfast snack Akara (fried cowpea paste). Successful use of the cowpea meal or flour is largely as a result of

its ability to function or being compatible with other food ingredients. There are a wide range of food products prepared from cowpeas in West Africa and elsewhere (Dovlo et al, 1976) such as moi-moi and gbegiri.

## **EXPANSION OF COWPEA UTILIZATION (NOVEL FOOD PRODUCTION)**

Apart from the traditional uses, cowpea meal and flour have been used in several food systems. The foods include;

1. Ground meat, where part of the meat was replaced with cowpea meal to reduce cost and increase product yield (Mc Waters, 1977; Mc Waters &Heaton, 1979).
2. In biscuit making. Cowpea meal was used to substitute milk protein.
3. In the preparation of cookies and doughnuts, cowpea flour substituted for wheat flour.
4. Snack foods, ready to eat cereals and meat analogues are prepared by extrusion cooking.

Extrusion cooking is an efficient way of converting starchy proteinaceous raw materials into finished foods or into intermediates that require only minimal further processing. Extrusion is versatile and used widely in food processing in developed countries. Different types of products can be manufactured due to the diversity of size and design of extruder.

### **Potential of cowpea as an export crop.**

Cowpea seed have export potential. Presently, cowpea usage in the USA is limited due to its inconvenience. If the appropriate product form for cowpeas could be found the demand could be promising owing to the increased

consciousness of the consumer concerning nutrition. Akara products made from cowpea paste have been shown to have potential for extending the utilization of cowpeas in the United States (Fletcher et al 1992).

## **WEANING FOODS**

Weaning foods rich in protein are lacking in the rural parts of the developing countries. Traditional weaning foods in West Africa are known to be of low nutritive value and are characterized by low protein, low energy density, and high bulk. In Nigeria, the usual first weaning food is called akamu, or ogi, or koko and is made from maize (*Zea mays*), millet (*Pennisetum americanum*) or guinea corn (*Sorghum spp*).

In Anambra State, Agu (1976), observed that pap contained only 0.5% protein and less than 1% fat, as compared to 9% protein and 4% fat, in the original corn. Indeed Akinrele and Edwards, (1971) concluded that the protein content of ogi or pap (corn gruel) was too low even to support the growth of rats. Another report noted that corn gruel can provide some energy, but not other nutrients needed for the growth of the baby (Ketiku & Ayoku, 1984). These observations were confirmed by recent work done in Port Harcourt, Rivers State (Okoronkwo, 2005; Uzoma, 2005, and Aduba (2005).

A baby girl aged 4-6 months would need 920g of corn gruel to meet daily needs of energy (740 kcal) and protein (13g) (Eka & Edijala, 1972). This is an impossible task, considering the size of an infant's stomach. The family diets to which some infants are weaned are also low in nutritional value. Thus protein energy malnutrition is a common problem among infants and children in the poor socio-economic groups of developing countries, Nigeria inclusive. Little wonder



that WHO *advocated that developing countries should embark on the local manufacture of cheap weaning foods based on local foodstuff as part of the national health and nutritional programme.*

## **COWPEA IS A SOLUTION**

Cowpea represents a good source of proteins, calories, and vitamins. These qualities were harnessed to solve the incidence of malnutrition and infection. The strategy adopted was to combine locally available food that complement each other. Maize and cowpea are known to complement each other. We obtained an amino acid pattern that was similar to that recommended for infants (Uwaegbute & Nnayelugo, 1989). Cereals are deficient in lysine but have sufficient sulfur containing amino acids that are limiting in legumes. The formulations have been found to produce amino acid patterns that adequately promote growth. Let us examine some of our products.

## **PRODUCT 1**

Abbey and Nkanga (1988) formulated a maize based diet containing about 16% cowpeas 5% cray-fish and 48% maize that compared favourably with a commercial weaning food cerelac-maize, which is cow milk based and fortified with purified vitamins and minerals when fed to rats (Table 9). Pancreas and liver weights were not affected. This confirmed that the processing method was adequate in destroying the trypsin inhibitors in cowpeas. Trypsin inhibitors have been found to cause pancreatic hypertrophy when legume seeds are fed to rats (Abbey, 1976; Leiner, 1969). However, digestibility of the diets decreased with increase in cowpea supplementation.

**Table 9****Biological evaluation of maize-cowpea-crayfish diet**

<b>Diet</b>	<b>Weight Gain (g/d)</b>	<b>Protein Efficiency Ratio</b>	<b>Biological Value</b>
Cerelac-maize	3.80c	2.30c	88.00b
16% Cowpea	3.50c	2.17c	85.40b
36% Cowpea	2.30b	1.71b	73.60a
49% Cowpea	1.50a	1.01a	66.50a

a-c Mean of triplicate determinations. Means with different letters in the same column are significantly different at the 5% level.

In developing countries, there seems to be no problem of lack of protein in the diet of adults and those older children who receive enough of their normal diet to meet their calorie requirement. However, the problem seems to be with pre-school children who suffer from chronic protein energy malnutrition with diminished resistance to gastro-intestinal infections that results in high mortality. Furthermore, mothers also believe that their infants do not digest or tolerate beans except in very limited amount. This might be due to the large stool bulk excreted after the consumption of beans.

The results of our study has shown that supplementing maize starch with 16% beans and 5% crayfish can serve the same purpose as the milk substituted commercial food. Children have been reported to need a smaller proportion of their protein in the form of methionine than rats and that humans generally have a lower ratio of essential to total amino acid requirements than rats. The methionine/ cystine ratio provided in this diet by cowpea and crayfish would thus be sufficient for the pre-school child.

When our diet was costed, taking all parameters into consideration it was established that the commercial diet was three times more expensive.

We further subjected our product to physico-chemical organoleptic, storage and microbial tests (Abbey et al, 1988). Since we have the rural dwellers and low income person as our target simple packaging and storage conditions were investigated, such as using polyethylene bags, plastic containers and tin cans. We found that the product could be stored in polyethylene bags for 6 weeks, plastic containers for 12 weeks and tin can for minimum of 18 weeks at 30+10C. Where refrigeration facilities are available the products could be stored in polyethylene bags for 12 weeks, plastic containers and tin cans for minimum of 18 weeks

## **Products 2**

Rural dwellers in developing countries cannot afford to enrich their infant weaning food with purified vitamins and minerals. We therefore, sought alternative means of improving the quality of the diet by germinating the cowpea. Abbey and Mark-balm (1988) developing maize based diet containing about 20% to 60% germinated and un-germinated cowpeas and fed to rats. We found that trypsin inhibitor activity was destroyed. Pancreas and liver weights of the animals were not affected. Another commercial diet Nutrend, comprising of maize flour, soybean flour and fortified with vitamins and minerals also milk based was used as standard. The food intake and growth of rats on Nutrend was superior to the cowpea substituted diets (Table 10). Germination increased the crude protein content of the diet but did not significantly improved the weight gain of the rats (Table 11). The inability of the germinated cowpea flour to cause significant

improvement could be as a result of the deficiency of sulfur containing amino acids. There was a progressive decrease in performance with increase in the cowpea content.

**Table 10**

<b>Biological evaluation of the diets containing germinated cowpea flour</b>			
Diet	Weight Gain g/d	Protein Efficiency Ratio	Biological Value
Nutrend	4.30b	2.75b	88.30b
20% cowpea	2.20a	1.69a	76.50a
40% cowpea	1.95a	1.57a	73.70a
60% cowpea	1.70a	1.38a	70.60a

a-b Mean of triplicate determinations. Values with same letter in the same column are significantly different at the letters in the same column are significantly different at the 5% level.

We advocate a maximum of 20% substitution of cowpeas for weaning small children.

**Table 11**

**Comparative evaluation of the experimental diets containing germinated and un-germinated cowpea flour**

Diets	Weight gain/d		Protein efficiency ratio		Biological value	
	UGC	GC	UGC	GC	UGC	GC
20% cowpea	1.85a	2.20a	1.59a	1.69a	68.5a	76.5a
40% cowpea	1.63a	1.95a	1.31a	1.57a	66.5a	73.7a
60% cowpea	1.30a	1.70a	1.09a	1.38a	62.0a	70.6a

Mean of triplicate determinations. Values with same letter in the same column are not significantly different at the 5% value.

The success of these products depends on the processing method and the level of legume supplementation. Fashakun and Ogunshola (1982), formulated nut-ogi, a mixture of corn and peanut. Akunrele and Edwards (1971), formulated soyi-ogi (corn gruel and soya bean).

## **GENERAL COMPLAINTS AND THEIR SOLUTION**

In a survey carried out on cowpea utilization (Abbey and Ibeh, 1988) three general complaints were made namely;

1. The seeds took long to cook,
2. The commercial flour had poor quality.
3. They could not digest the beans resulting in flatulence

## **ELIMINATING THE HARD-TO-COOK PHENOMENON**

Legume seeds take long to cook (Phillip et al, 1988). This phenomenon in cowpeas has been reported to be due to the presence of calcium pectate, an insoluble complex formed in the middle lamella of the cowpeas and which delays the destruction of the middle lamella thereby prolonging cooking time (Phillips and McWaters, 1991). As the storage period of legumes increases, there is a tendency for the grains to develop hard to cool phenomenon. Cooking cowpeas with 0.1% sodium bicarbonate (w/v) enhanced the cooking quality and shortened cooking time (Uzogara et al, 1988).

## **ELIMINATING FLATULENCE FACTORS IN COWPEAS**

Hydrogen is a major component of flatus and has been shown to relate to total flatus production (Phillips and Abbey 1989). The flatus producing potential of a cross section of legume seeds which are commonly consumed in West Africa

and USA is presented in table 12 and the poor digestibility of the carbohydrates, a-galactosides, raffinose, stachyose, and verbascose is shown in tale 13

**Table12**

**Hydrogen production following ingestion of cooked legume.**

Legume Genus, species	variety	hydrogen produced (ml/g)
Phaseolus vulgaris	kidney bean	1.61
Phaseolus lunatus	baby Lima	3.04
Pisum sativum	green split pea	1.60
<b>Vigna unguiculata</b>	<b>African black eyed bean</b>	<b>1.67</b>
Cajanus cajan	pigeon pea	1.97
Lens esculenta	lentil	1.00
Sphenostylis sternocarpa	yam bean	1.86
Voandzeia subterranean	bambara groundnut	0.29
	Control diet	0.15

**Source: Adapted from Philip & Abbey, (1989)**

**Table 13**

**Carbohydrate composition of legume seeds**

Legume variety	oligosaccharides			starch	
	Raffinose (Mg/g)	Stachyose (Mg/g)	Verbascose (Mg/g)	Content (%)	Digestibility (%)
<b>African blackeyed</b>					
<b>Beans</b>	<b>4.68</b>	<b>22.39</b>	<b>6.03</b>	<b>40.0</b>	<b>22.6</b>
Blackeyed pea	2.88	16.54	3.76	39.0	58.8
Lentil	2.81	13.64	6.05	42.2	40.5
Yam bean	4.60	24.11	2.56	40.7	54.9

**Source: Adapted from Philip and Abbey, (1989)**

The methods used to eliminate flatus gas partially or totally include soaking in sodium bicarbonate for 6 hrs or 12hrs and cooking for 30mins. or 45mins. respectively. Although, the method is very effective, the alkaline medium destroys the B-complex vitamins. An alternative method is to soak in plain water for 6hrs or 12hrs and cook for 30mins. or 45mins respectively. (Nwinuka et al, 1997). Furthermore, controlled germination for 24hrs in the dark at 30oC reduced the flatulence potential (Nnanna & Phillips, 1990).

## **COMMERCIAL PREPARATION OF THE FLOUR**

The commercially available cowpea flour has low market acceptability. Therefore, the production of flour with optimal functional properties which can easily be converted into paste by the addition of water will be of considerable advantage. As a result, studies have been carried out to determine optimal processing variables for tempering, drying and dehulling the cowpea seeds. (Onoja, 1982, Uchendu 1982, McWaters et al, 1988). It was observed that flour for making both akara and moi-moi can be manufactured provided the drying temperature did not exceed 60oC (Enwere & Ngoddy 1986; McWaters et al, 1988).

## **MAJOR CONSTRAINTS TO COWPEA UTILIZATION.**

The utilization of cowpea is affected by poor crop yield due to erratic weather and soil conditions and insect infestation. The cowpea weevil female can reproduce herself 20 fold every 3-4 weeks resulting in poor quality seeds.

Other factors that affect cowpea utilization are the low acceptability of cowpea new formulation, low adoption of improved post harvest technologies,

change in taste and neglect of indigenous food crops and the negative attitude to the development of post-harvest system by governments (Gomez, 2004).

## RECOMMENDATION

1. Nigeria is the largest producer of cowpeas in the world and should not allow Malaysia or any other nation to take over this position from her as was the case with the oil palm.
2. Cowpea is a cash crop, and has potential for export to earn foreign exchange for the country. The Federal Government should accord this crop the same opportunity given to cassava and increase production.
3. The new technologies and novel products from cowpeas should be advertised for consumer awareness. It is only when cowpea utilization is increased and expanded that farmer will have the motivation to grow more as the demand will be high.
4. Introduce and disseminate among farmers improved cowpea varieties which show greater resistance to diseases, Insects, drought, heat and parasitic weed and adaptable to poor fertility soils.
5. Breeders should know the characteristics the consumers want and integrate into their system.
6. Government should define the policy frame work of development and public services which should include the creation of infrastructures, fair markets and legal guarantee etc.
7. Cowpea provides a source of cash income for women farmers who make and sell snack foods from this nutritious legume. Government should give both male and female farmers incentive to cultivates more.



8. Collaborative studies should be encourage as it is in a number of Research institutes (IITA, IAR) and University (ABU,OAU, UNN etc) both locally and internationally-(the Bean Cowpea Collaborative Research Support Program, USAID, going on in many American Universities). Government should take the central stage in harnessing the result of their findings for maximum productivity and utilization.
9. No primary processed ingredients based on cowpea are easily available, so food companies are forced to invest in primary processing which could have been avoided to save on cost.
10. There are clear opportunities to develop industrial products using cowpea as a source of protein, but strong support from government is necessary to promote and to organize the supply chain and the primary processing.

## **CONCLUSION**

I want to remind you that both infants and adults need cowpea based on the following:

1. Cowpeas have an average of 24% protein with lots of vitamins and mineral needed for metabolic function of the body.
2. Cowpeas are good sources of iron with its content being higher than those of meat, fish or eggs. Cowpea contains more thiamin, riboflavin and niacin than whole milk and cereals, with the levels of these vitamins being comparable to those available from fish, beef and eggs (Elegbede, 1988), yet cheaper.

3. Toxic factors, anti-nutrients and bulkiness due to fiber and starch can be destroyed during processing.
4. Cowpeas have very good functional properties, so mix well with other food ingredients.
5. Cowpeas have good protein quality that can meet the requirement of infants particularly when incorporated into foods such as maize to serve as weaning food.
6. Cowpeas can be served as school snacks for infants in the form of moi-moi, akara, doughnut, biscuit, cowpea-meat-pie, milk etc.
7. Cowpeas have dietary fiber which aids in the evacuation of the gastrointestinal tract.
8. The presence of fiber slows down the rate of sugar going into the blood stream, so cowpea is recommended for people suffering from diabetes. (High blood sugar).
9. Cowpea does not contain cholesterol and so reduces the cholesterol level of the blood and prevent coronary heart disease and hypertension.
10. Cowpeas also contain saponins which also plays a role in lowering blood cholesterol.
11. Cowpea contains protease inhibitors, a phyto-chemical, tannis and saponins which are themselves anti-carcinogens.

We desperately need proper education in order to eradicate malnutrition and poverty. When people are eating beans and rice, they look as if they are suffering. Little do they know they are having an adequate diet that will prolong their life? Little wonder that Hosea said in the Bible that my people perish for lack of knowledge.

Vice Chancellor Sir, my advice is that we must be careful about what we eat. We should eat healthy nourishing foods to maintain a healthy body. It is up to each one of us to choose a healthy lifestyle. Our bodies are our business.

*Bridging the protein gap with what we have will confer both health and wealth to everyone.*

Will you still wait for your doctor to recommend cowpeas to you before developing interest in its consumption? I am referring to those who say, "I don't like beans". You are most likely to like beans because the disease of old age will catch up with you, so why not now?

Vice Chancellor Sir, revered guests, distinguished ladies and gentlemen. There are more than 50 ways of preparing cowpea, as snacks (akara, biscuits, moi-moi), as soup (gbegiri, cowpea flour soup) as main meal (boiled cowpea with gari, rice or corn) you are invited to pick your choice. Bon appetite and thank you for your attention.

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