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GOAT (*Capra hircus*): A MISUNDERSTOOD ANIMAL

By

Professor Ayobami Bukola Joseph Aina
(Professor of Ruminant Production)

*Department of Animal Production and Health (COLANIM)
Federal University of Agriculture, Abeokuta, Nigeria*



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Professor A.B.J. Aina, Ph.D, M.Sc.(Ibadan), **PGDE (Ilorin)**, B.sc. (Ibadan)
(Professor of Ruminant Production)

GOAT (*Capra hircus*): A MISUNDERSTOOD ANIMAL

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Other Heads of Department
Highly esteemed Academic and non-teaching Colleagues
My Lord Bishop of Egba Diocese (Anglican Communion) and Mama Egba
Other Clergy Dignitaries here present
My core and extended family members
Eminent invited Guests

Gentlemen of the press
Distinguished Ladies and Gentlemen
Reputable FUNAABITES

1.0 PRELIMINARY

First and foremost, I want to thank God Almighty for his enduring mercies over my life, who kindly saw me through the storms of life right from the moment He started forming me in the womb of my mother till this day which He has made to glorify His Holy Name. This is God who has lavished all that He has upon my life including the ONE and the only SON He has –Jesus Christ, the Saviour of the World. Blessed be His Name for ever. Amen.

I am rather humbled for seeing this day come true in my life. My mind flowed back to thirty six years ago, when I first gained admission into that Great Premier University, University of Ibadan, to pursue a B.Sc. degree programme in Animal Science, I did not know that on this 28th March, 2012, a rural boy like me, first generation academic among my siblings and my family, most of whom were peasant farmers, will mount this podium to deliver an Inaugural Lecture. There was no mentor, I was just acting on intuition. “What is destined, to succeed however, knows no failure”. By God’s grace, I am what I am today (I Cor. 15: 10^a). Besides, King David writes

“Behold God is mine helper: the Lord is with them that uphold my soul” (Psalm 54:4). In another situation he also writes “If it had not been the Lord, Who was on our side when men rose up against us” (Psalm 124: 1-2). One of my referees who was my mathematics teacher in secondary school, Mr J.S Ajayi, sometimes wrote in his concluding referee’s report on me ‘he is a self-made man’. He knows my background very well. It is by the grace of God upon my life beyond measure that I would this day be professing Animal Science to this august audience who had assembled this afternoon to listen to make this day a reality.

I would like to posit here that, Education is more than the bricks and mortar of our academic institutions, and the style of delivery. Above all The Educators are our parents, teachers and lecturers. It is they who encourage and inspired us, and ‘lead out our soul’ in the words of Muriel Spark’s character, Jean Brodie. I am sure that everyone here in this assembly would have memories of a teacher who has touched your life, and had an enduring impact.

I am fortunate because there have been several individuals who have played key roles in shaping my academic career. Some of them are here today and I would like to take this opportunity to express my utmost gratitude to them all. Thank you Sirs and Mas.

Mr Chairman, distinguished audience, my lecture is dedicated to God and all my academic moulders and builders of my life.

2.0 INTRODUCTION

Mr Chairman, with your permission, I wish to start this lecture by quoting a famous philosopher- W.C Stone (1976) who **motivated my academic ambition in life: “The road to success starts when you are inspired to make the effort. Inspiration starts when you are motivated to dissatisfaction with things as they are. Therefore inspirational dissatisfaction is the strongest single force in your success system that never fails”**.

Distinguished ladies and gentlemen, in my academic career (1976 to date), my research interest has been on goat and sheep focussing on three major areas that relate to their production:

- (i) Mineral requirements
- (ii) Development of all year round feed for small ruminants
- (iii) Browse plants utilization by goat and sheep

I will delve more on these in the course of this lecture.

Small ruminants consist primarily of sheep and goat which are produced with the objective of supplying meat, milk, wool

and skin. These products assume varying degree of importance in different countries depending on existing agro-ecological conditions, production system and or rational choice or speciality of the producers. There are just two products of importance in small ruminant production in Nigeria. These are meat and skin. In Nigeria, small ruminant production forms part of nearly all known farming systems. They have long association with nomadic pastoralism, mixed farming, shifting cultivation and fallow, small holder farms, and even among non-farming communities where they are tethered and fed in backyards. Among small farmers, they play an important role as an investment that can easily be converted to cash, while among mixed farms and larger farmers, they form part of the array in a diversified enterprise.

3.0 GOAT FACTS AROUND THE WORLD

Goat meat is the most widely consumed meat in the world. There are few, if any, religious taboos limiting goat meat consumption. In fact, goat meat is an important component of the traditions of Hindu and Muslim faiths (File:IIA:1 GOAT % 20 FACTS % 20 AROUND % 20 THE % 20 WORLD.htm).

The largest producers of goat meat are the largest consumers, but not the largest importers or exporters.

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Table 1: Top 10 Goat Inventories

China (About 180 million goats)
India
Pakistan
Sudan
Bangladesh
Nigeria
Iran
Indonesia
Tanzania
Mali

Table 2: Top 10 Goat Producers

China
India
Pakistan
Nigeria
Bangladesh
Sudan
Iran
Indonesia
Mali
Greece

Table 3: Top 10 Goat meat Importers

United States
China
United Arab Emirate
Hong Kong
Saudi Arabia
Italy
France
Canada
Trinidad & Tobago
Portugal

Table 4: Top 10 Goat meat Exporters

Australia
China
France
Pakistan
Ethiopia
New Zealand
Bulgaria
Spain
Sudan
India

Source: <http://theikga.org/goatfactsaroundtheworld.html>

From above tables, it would be noticed that Nigeria is the 6th among the top 10 goat inventories and 4th top 10 goat meat producers in the world, but not among top 10 goat meat importers and top 10 goat meat exporters. These observations suggest that Nigeria consumes all her goat meat produced. With the high level of inventories, Nigeria has potential to increase goat meat production. These inventories should be properly harnessed and put into use to increase production so that Nigeria can also be among the goat meat exporters in the nearest future to increase foreign exchange earnings, in addition to petroleum products.

The world population of goats was estimated at 746 million (FAOSTAT, 2003), with 96% of these being kept in developing countries.

The population of goats in sub-Saharan Africa (SSA) is estimated at 147 million. The arid and semi-arid zones together hold the majority (64%) of the goat populations of SSA. However, the arid zone holds 12% more goats than the semi-arid, which contains 26% of the goats. The humid and the high land zones account for about equal proportions of the population of goats (9 and 10%, respectively) (Lebbie, 2004). The sub-humid zone accounts for 17% of the SSA goat population (Harris, 1962, Epstein, 1971). Thus, goats are an important livestock component in all agro-ecological zones. The

majority of these goats are kept in the rural households where they serve multiple purposes (Jahnke *et al.*, 1988).

Goat is a multipurpose animal, providing meat, milk, clothing, fertilizer, offering loyalty and companionship; alert, intelligent and socially inclined. This animal forms an important economic and ecological niche in agricultural systems throughout the developing countries. Goat is also one of the first animals to be domesticated by man. Goats are among the cleanest of all farm animals. They will not lay in filth, nor will they eat contaminated foods, unless they are forced to by poor management. Goats are the preferred dairy choice in many countries. The Nigerian Dwarf goat has been internationally recognized as dairy and companion animal since 1854 (William, 1854). They can be raised easily in all climates and do not need elaborate housing. The does and kids are odourless, but **the mature bucks do have a "musk-like" odour, especially during the breeding season;** but with proper management the scent is not overly offensive.

Interest in goat production all over the world is increasing (van Niekerk and Pimented, 2004), and during the last decade worldwide, goat production experienced the most rapid and exceptional growth (Fonseca *et al.*, 2006). High ethnic demand for goat meat and milk products and the relative low cost of production have called for increased goat production in

Southern USA (Terrill *et al.*, 2008) as a new option for on-farm income (Browning Jr. *et al.*, 2007).

There exist about 570 breeds of goat and 1,314 breeds of sheep all over the world out of which three breeds of goat and four breeds of sheep are found in Nigeria.



Plate 1: West African Dwarf Goat



Plate 2:Maradi Goat



Plate 3:Sahel (Desert) Goat



Plate 4: Red Kalahari Goat of South Africa



Plate 5: West African Dwarf Sheep

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Plate 6:Uda Sheep



Plate 7:Balami Sheep



Plate 8: Yankassa Sheep

Goat and sheep population in relation to other livestock in Nigeria as at 1992 actual count, through traditional sector survey and services of commercial livestock enterprises is as presented below. These figures would have increased substantially by **now but for the 2006 ‘Bird Flu’ outbreak which resulted into** loss of thousands of chickens. Livestock census is yet to be addressed in Nigeria. Available figures are projections. Even the census figures for Nigeria is accepted by consensus. We hope to move closer to reality with time.

Table 5: Nigerian Livestock Population Estimate

Species	Number (millions)
Chicken	82,400.00
Goats	34,500.00
Sheep	22,100.00
Cattle	13,900.00
Horses	0.200
Camels	0.090
Other poultry*	31,900.00
Pigs	3,500.00
Rabbits	1,700.00
Guinea pigs	0.50

* includes pigeons, ducks, Guinea fowls, and Turkeys

Source: Bourn *et al.* (2007)

4.0 ORIGIN OF GOAT AND GOAT DOMESTICATION

Different animals were domesticated in different parts of the world at different times.

The domestic goat (*Capra negragus hircus*) is a sub-specie of goat domesticated roughly 10,000 years ago from the wild goat of Southwest Asia and Eastern Europe (Hirst, 1997). The goat is a member of the Bovidae family and is closely related to the sheep both being in the goat antelope sub-family Caprinae. Domestic goats are one of the oldest domesticated species. For thousands of years, goats have been used for their milk, meat, hair and skins in the world (Coffey *et al*, 2008). In the last century, they have also gained some popularity as pets (Mclead, 2008). Hirst (1997) reported that goat was domesticated in Western Asia 8000 BC. Goats seem to have been first domesticated roughly 10,000 years ago in the Zagros Mountains of Iran. Ancient cultures began to keep them for easy access to milk, hair, meat and skins. Female goats are referred to as does or nannies, intact (uncastrated) males as bucks or billies and their offsprings are kids. Castrated males are wethers, goat meat from younger animals is called kid; and from older animals is called ‘Chevon’.

5.0 SPECIAL ATTRIBUTES OF GOATS

A goat is useful to humans both alive and dead, first as a re-

newable provider of milk and wool and then as meat and hide. Some charities provide goat to impoverished people in poor countries, because goats are easier and cheaper to manage than cattle, and have multiple uses. The intestine of goat is used to make "Catgut", which is still in use as a material for internal human sutures. The horn of the goat, which signifies well-being is also used to make spoons (Anonymous, 2009).

Goats are highly adaptable to a broad range of environments. Of all ruminant livestock, goats are the most effective browsers, very selective, and often select feeds which have anti-parasitic properties e.g trees and bushes containing tannins.

5.1 The special attributes of goats that make them particularly important in rural resource poor communities compared to other domestic ruminants include:-

- ability to graze and utilize a wide range of poor quality forages and browse;
- well adapted to almost all ecological zones of Nigeria, particularly the West African Dwarf breeds;
- ability to walk long distance;
- the cheapest in term of feed requirement compared with cattle and other domestic animals;
- attract the least risk;
- the easiest to manage;

- no religious taboo against their consumption
- short generation intervals (1½ years compared to cattle of 4-5 years) and high reproductive rates (kids at least 3 times in two years under extensive management system and twice a year under strict intensive management system).
- high turnover rates on investment and hence low risk on investment;
- high energetic efficiency of milk production;
- efficient utilization of marginal lands;
- resistant to most diseases affecting most farm animals
- smaller carcasses which are conveniently marketed or consumed over a short time period – an important factor in rural areas without cold storage; and
- Flocking instinct which makes herding by younger and older members of the family possible.

5.2 Food Products

Available statistics indicate that goats produce about 17 and 12% of **tropical Africa's meat and milk, respectively (Lebbie, 1996)**. In sub-Saharan Africa, goats account for about 11% of the total meat output (Rege and Lebby, 2000). There are currently no accurate estimates of the contribution of goats to human food security and general livelihoods. This is, to a large extent, due to the fact that the use of goat products at the rural household levels is not recorded and at the national

level more goat products flow through the informal markets than the formal markets.

Moreover, in the African context, as is true in most developing countries, the conventional concept of dressing percentage is inappropriate because almost all parts of the animal are consumed. What is important however is the fact that goats provide food for poor households where it is most needed. It has been established that goat meat is lower than mutton in

5.2.1 Goat meat



Plate 9:A Goat Buck

fat and cholesterol, and comparable to chicken. It also has more minerals than chicken, and lower in total and saturated fats than many other meats (<http://en.wikipedia.org/wiki/Goat>”).

One reason for the leanness is that goats do not accumulate fat deposits or ”marbling” in their muscles (Coffey *et al.*, 2008). Goat meat, sometimes called chevon, is often cooked slowly and at low temperatures. It is popular in the middle East, South Asia, Africa, Northeastern Brazil, the West Indies and Belize.

Other parts of goat including organs are also edible including the brain and liver. The head and legs of the goat may be smoked and used to prepare spicy dishes and soup.

5.2.2 Goat milk, butter and cheese

Some goats are bred for milk, which can be drunk fresh, although pasteurization is recommended to reduce, naturally occurring bacteria such as *Staphylococcus aureus* and *Escherichia coli* (Ekici, 2008). If the strong-smelling buck is not separated from does, his scent will affect the milk. Goat milk is commonly processed into cheese, goat butter, ice cream, cajeta and other products. Goat milk can replace cow’s milk in diets of those who are allergic to cow’s milk (Wikipedia, 2008). However, like cow’s milk, goat’s milk has lactose (sugar) and may

cause gastrointestinal problems for individuals with lactose intolerance.

Goat's milk is naturally homogenized which means the cream



Plate 10:Goat Doe being hand-milked

remains suspended in the milk, instead of rising to the top as in raw cow's milk. Goat butter is white because goats produce milk with the yellow beta-carotene converted to a colourless form of vitamin A.

Goat cheese is known as “chevre” in France, after the French word for “goat“. Some varieties include Rocamadour and Montrachet (Encyclopedia, 2008).

5.3. Contribution to employment and economic stability
The average share of livestock in agricultural Gross Domestic Product (GDP) in sub-sahara Africa has been estimated at 25%, but this increases to 35% when traction and manure are considered (Winrock International, 1992).

In general, goats do not contribute much to direct income earnings in rural households. As tangible financial assets, however, goat product consumption and sales enhance economic stability of households in times of crop failures and currency fluctuations. Goat keeping provides employment for the rural poor women and their children, whose responsibility is to take care of the goats. This role is expected to be more important with the increased intensification of crop-livestock production system.

In several countries, including Nigeria, Kenya, Rwanda and

Ghana, there is an increase in the consumption of goat meat in the growing urban areas. By assisting to meet local demand for animal products, goat keepers indirectly enhance national economic stability through the reduction of foreign currency expenditure on importation of these products to meet domestic demands. Some countries notably Kenya, Somalia and Ethiopia, trade in hides and skins thus bringing in much needed foreign exchange.

5.4 Goats as assets, banking system and security

Goat owners in rural areas do not usually have access to banking facilities, especially the women, they have therefore come to rely on investment in their stock, with goats serving as "current accounts" and cattle and camels serving as "savings accounts". It is popularly believed that goat keepers prefer to hold on to their animals as a sign of wealth or status. The fact of the matter however, is that goats provide security against crop failure and currency fluctuations. They are used or sold only when necessary to meet family needs, especially in the case of emergencies (Wilson and Light, 1986). Goats are also used in form of diversification, helping to cushion changing prices in the cattle market.

If the final destiny of the goat is meat production in Asia and Africa, then the goat is essentially a banking system. If you ask Indonesian and Vietnamese small farmers when they will

sell their goats, it is never when the goat is at certain age or weight, but it is always when they need money to buy medicines or school uniforms for children etc. It is their bank and a secure bank, generally better than cattle. For the price of one cattle beast you can have six goats. If one goat dies there are five left. If the cattle beast dies nothing is left. Hence goat is better for risk management. On the other hand, in Ethiopia small ruminants such as sheep and goats often serve as current account whilst cattle serve as the savings account (Orskov, 2011).

5.5 Goat in human health

5.5.1 Goat Serum Extract (GSE) has been reported to prevent the HIV virus from entering a human cell (Davis, 2004, 2005). The antiserum also drastically reduced the viral load of infected persons to undetectable levels and eliminated the symptoms of the disease such as weight loss, depression, weakness, insomania and loss of appetite. The author further added that the unique feature of the GSE, named BB:7075, was that it had no side-effects, unlike the anti-retroviral drugs now in use. Besides, the efficacy of BB:7075 has been proved to suppress and neutralise HIV-2 in goats. It is concluded that neutralising antibodies to HIV-2 can be produced in the goat.

5.5.2 Superiority of goat milk to cow milk

Goat milk is superior to cow milk in that tuberculosis (TB)

bacteria are absent or rare in goat milk. Goat milk protein resembles that of humans. Goat milk is used in the treatment of gastro-intestinal disorders, liver diseases as well as infantile pyloric stenosis.

Goat milk has been recommended for the relief of ulcers since goat milk is alkaline in nature.

The milk casein and fat are more digestible than cow milk. Goat milk is valued for the elderly, the sick, babies, children with new milk allergies, patients with ulcers and even preferred for raising orphan foals or puppies. Fat globules in goat milk are smaller than those of cow milk, and remain dispersed longer. Goat milk is higher in vitamin A, niacin, choline and inositol than cow milk, but it is lower in vitamins B6, B12, C and carotenoids. The shorter chain fatty acids (C6, C8, C10, C12) are characteristically higher in goat milk than in cow milk.

6.0 GOATS IN FOLKLORE AND MYTHOLOGY

Since her inception, Christianity has associated Satan with imagery of goat. A common superstition in the middle ages was that goats whispered lewd sentences in the ears of the Saints. The origin of this belief was probably the behaviour of the buck in rut, the very epitome of lust. The common medieval depiction of the Devil was that of a goat-like face with horns

and small beard. The Black Mass, a probably – mythological “Satanic Mass”, was said to involve a black goat, the form in which Satan supposedly manifested himself for worship.

The goat has had a lingering connection with Satanism and pagan religions, even in modern times. The Pentagon, a symbol used by Satanism, is said to be shaped like a goat’s head. The Baphomet of Mends refers to a satanic goat-like figure from 19th century occultism. This is reflected as a popular theme in the satanic genre Black Metal.

According to Norse Mythology, the god of thunder, Thor, has a chariot that is pulled by several goats. At night when he sets up Camp, Thor will eat the meat of the goats, but take care that all bones remain whole. Then he wraps the remains up, and in the morning, the goats will always come back to life to pull the chariot. When a mortal, who is invited to share the meal, breaks one of the goat’s legs to suck the marrow, however, the animals leg remains broken in the morning, and the mortal is forced to serve Thor as a servant to compensate for the damage (William, 1854).

The goat is one of the twelve-year cycle of animals which appear in the *Chinese Zodiac* related to the Chinese calendar. Each animal is associated with certain personality traits; those born in a year of the goat are predicted to be shy, introverted,

creative, and perfectionist.

Several mythological hybrid creatures are believed to consist of parts of the goat, including the Chimera. The Capricorn sign in the Western Zodiac is usually depicted as a goat with a fish tail. Fauns and Satyrs are mythological creatures that are part goat and part human.

The mineral bromine is named from the Greek word "bromos", which means "stench of he-goat".

6.1 Livestock and the environment

Livestock, including goats, interact with the environment in a number of ways (Bourn, 2005).

The way some people discuss about the effects of livestock on the environment sounds as if livestock themselves decided whether or not to destroy our environment. But the fact is, livestock do not degrade the environment – people do. The misperception of livestock as degraders of the environment originates largely in the developed world, where intensive specialised livestock production is the norm. Livestock are also blamed for a wide range of human ills, from heart diseases through to global warming. Studies in developing countries have shown that children who do not get enough meat and milk in their diets may end up physically and mentally com-

promised. Animal manure and urine that people in the developed world would see as pollutants are vital fertilizers to small holder farmers in the developing world.

In some cases, the misperceptions have led to policies that have exacerbated the negative effects of livestock rather than alleviating them. For example, the misperceptions regarding overgrazing in the arid areas have led to measures to control livestock movement and stocking rates, thereby causing more, rather than less, land degradation. A better understanding of the complementarity of domesticated and wild animals would have led to greater species wealth and improved well-being of local human population.

The report “Livestock’s Long Shadow”, published by FAO (2006) brought together a large weight of evidence showing the damaging environmental effect of livestock and livestock-related anthropogenic activities (Steinfeld *et al.*, 2006). The report rightly highlighted the environmental damage of poorly-managed high-input/high-output systems. The report, being used by environmentalist across the world to mount a campaign against all livestock, is gaining dangerous currency amongst policymakers. A close reading of the report shows that the livestock systems with by far the greatest environmental impact are intensive systems in the developed world, namely, the expansion of beef production in South America and

the growth of intensive swine and poultry production systems in Asia. As the livestock, environment and development (LEAD) team (FAO, 2006) noted:

“Livestock are often blamed for degradation of the environment that is caused by other users. For example, a general pattern in the exploitation of new land is that “waste land” or forests are first burned and grazed. Successive grazing and burning will change the tree-bush vegetation into tree-grass vegetation. This opens way for the harvesting of (fire) wood (charcoal burning) followed by clearing the land for crop cultivation. After a number of years of cultivation, the land is left fallow or abandoned because soil fertility has dropped and land has become vulnerable to erosion and degradation. When livestock are grazing this fallow they can easily be blamed for all the degradation, while in fact intensive wood harvesting, the clearing of land and repeated crop cultivation in earlier phases have contributed more to the degradation”.

Land degradation and environmental damages that are associated with livestock production are mainly due to population pressure coupled with inappropriate livestock management practices and policies. Livestock-related environmental problems differ markedly between the developed and developing worlds. In developing countries, most environmental problems are related to poverty and policies. Any attempt to mini-

mize the impact of livestock on the environment is bound to fail if farmers do not have better economic alternatives. Solutions need to try not only to protect the environment but also to encourage more lucrative ways of managing livestock. In contrast, livestock related environmental problems in developed countries can be solved by tougher enforceable legislation that makes livestock producers pay for any harm their activities do to the environment.

There is need for holistic research to better quantify the bio-physical and socio-economic interactions of livestock, the environment and human needs. As demand for livestock products continues to increase in developing countries, finding the appropriate balance is still an issue. In particular, research is needed to quantify the effects of system intensification in developing countries and system extensification or area-wide integration of crop-livestock system in developed countries.

Moreover, there are several constraints to addressing issues of livestock, the environment and human needs, these include:

- (a) Paucity of information on livestock, agriculture and the environment;
- (b) Lack of holistic approach in most of the research dealing with livestock-environment interactions and lack of appropriate indicators of these interactions;

- (c) Lack of involvement of scientists in the development of policies relating to livestock and the environment;
- (d) Inconsistent goals of farmers, scientists and policy makers
- (e) Lack of use of quantitative data for policy formulation (ILRI, 1997)

6.2 Goat-environment interaction

Goats are found all over the world. They are numerous animals. In Nigeria, the majority of the indigenous goats are the Red Sokoto (Maradi) and Sahel breeds in the North, and West African Dwarf breed in the South. They constitute a good source of meat supply to the Nigerian diet. By population it ranks only next to poultry. By demand for its meat, goat ranks 3rd to beef and poultry. They are usually reared in relatively large herds in Northern Nigeria, whereas in the South large goat herds are not common. In the South farmers are known to keep goat semi-intensively or in free range system. Feeding is still done by way of consuming food debris and kitchen wastes as supplement to what the animals obtained around as scavengers. Given this situation, productivity is low, disease incidence is high, parasite burden is heavy and the contribution of goat to household earning is small (Ademosun, 1987). Also in the North, goats are kept either intensively or semi-intensively. Their stubborn and destructive nature has limited pastoralistic method of rearing.

The environment (i.e atmospheric, availability of natural fodders, human and natural influences) has dictated the distribution of this animal across the globe and has also affected their productivity. Majority of the goats in the temperate climate are more productive than those in the Tropics. Likewise the adaptability of the goat to an area is under the influence of the environment. Therefore, if goat husbandry is to be sustainable, it is necessary that there should be proper understanding of the interactions of goats with the environment so as to allow for the development of practices that are productive. The vast majority of goats are kept in extensive/semi-extensive low-input systems with, in most cases, a comparatively light environment touch.

An important constraint to the development of goats has been the question of damage to the environment. The issue has involved emotional discussions, and in some countries, such as Pakistan, laws were passed to eliminate goats. The laws were withdrawn in 1964, but the remarkable result of it all was that goat production actually increased over this period. There are two schools of thought on goat. On one hand, it is contended that the goat is the major cause of deforestation and soil erosion (Maher, 1945), while on the other, it is claimed that goats are of considerable value, not only in providing valuable meat and milk in the rural parts of the tropics, but also in controlling bush encroachment (Knight,

1965). This is especially the case in those parts of Africa where cattle production is impossible or hampered by tsetse-transmitted trypanosomiasis (Lowe, 1943).

Campbell *et al.* (1962) have reviewed this situation with regard to this controversy, and have suggested that the goat could be an important animal in the major regions of tree and shrub savannah.

There are two types of interaction between goats and their environment. First, goats affect the environment largely because they eat vegetation, secondly, the environment (i.e. natural ability conferred on the animal due to external condition) affects the productivity of the goats. Goats dietary preferences can be used to provide biological weed control. Conventional control of weeds by various chemical options is becoming less acceptable due to cost, environmental safety and social acceptability. Goats provide a realistic option to manage plant communities. Goats can be utilized to control undesirable plant species and provide biological weed control in pasture and range land. When properly managed goat can have a beneficial effect on environment. Goats are best able to cope with degraded environments and are frequently and ignorantly blamed for causing it when, in fact, they are the only species that can continue to survive.

In the 1965-80 development plan in Nigeria, a substantial increase in the goat population was recommended, partly to supply more meat, but also for use in keeping bush free from rapid regeneration and regrowth. Thus, goats do make a significant contribution, especially to the landless peasants and small farmers in the tropics and subtropics.

In Turkey, there is evidence that goats have positively contributed to the intensification of sedentary Agriculture in those places where soil and water resources are sufficient (Kolars, 1966). Following browsing by day, goats are often kept in paddocks and corrals at night, and their dung is carefully gathered and sold in bags to local farmers. In this way, goats have been responsible for promoting agricultural development of sub-marginal areas, particularly since the use of artificial fertilizer was limited. Agricultural utilization of alluvial soils has even been intensified, which would not have happened had the goat not been used as a source of fertilizer.

The goat's bad reputation arises more from its mismanagement than from any inherent fault. When land which had been over grazed by cattle and sheep shows signs of soil exposure, it should not be grazed again by goats, or serious erosion will occur. Specialists in the economic development of land resources are often far too prone to exaggerate the destructive habits of goats, even though other contributing caus-

es, such as overpopulation, forest fires and insect damage, are recognised. A case in point is the Alanya-Antalya area in Turkey. Here, goat populations were found to be largest in the upland areas where forests remain best preserved (Kolars, 1966). Furthermore, these same areas have been the summer pasture of the Yurk (Turkmen) nomads with their herds and flocks for at least 500 years. As Kolars (1966) pointed out, it was therefore, not the absence of goats that preserved the high groves, but rather the availability of forests (now destroyed) at low elevates that saved the remaining trees from **the woodman's axe and shipwright's adze** (Devendra and Burns, 1983). David (1980) reported that much popular prejudice against goats, and many real problems of goat farming, arise out of the special difficulty involved in keeping goats **under control**. **In cultivated areas, the goat's contempt for the normal stock fences, and its destructiveness to trees, gardens and crops are notorious, on wasteland-mountain, heath and cliff – the tendency of the goat to return to the wild (turn-feral) is a significant nuisance.** Even when narrowly confined to the yard or loose box, the goat contrives to trespass on the privacy and liberty of her owner by refusing to thrive or be **silent out of her owner's company.** **For all these sins the penalty and solution may be found in the collar and tethering chain – the most laborious method of controlling farm stock, and one to which the goat is naturally ill adjusted.** However, if the value of goats is to be fully exploited, then there must

be appreciation of their ecological significance, and of those management practices which allow full use of their special feeding habits, while maintaining control over the goats. In particular, there is a need for adequate fencing, tethering or other measures of grazing control, which are not at present applied to all countries (Hill, 1959).

Goats are very inquisitive animals and they can walk long distance in search of food, and they have the ability to feed on a wide variety of feedstuffs. While goats will accept a wide variety of feeds, they are, contrary to popular opinion, fastidious in their feeding habits. Feed that is acceptable to one goat is sometimes not acceptable to another, and goats usually refuse anything which has been soiled by other animals. Goats can distinguish among bitter, sweet, salty and sour tastes. They relish variety in their feed and do not thrive well when kept on a single type of feed for any length of time. They prefer to select from many varieties of feeds, such as a combination of grasses and shrubs plants or tree leaves.

It cannot be conclusively stated that goats will or will not eat some particular plants, but some species are highly proffered, some are moderately proffered while some are proffered to a lesser degree by goats.

The feeding habits of grazing goats vary not only with the ecology but also with the season of the year in the same locality. Seasonal variations and intensity of stocking influence the nature and magnitude of the intake. In Spain, goats eat brush in the dry season, and grasses, legumes and forbs (herbaceous plants other than grass) in the wet season. Similarly, in Texas, goat have been found to show a distinct preference for grass even though browse was available and, in winter and early spring, changed their preference to browse. The actual choice of forage for goats in a particular environment will be determined by soil type, rainfall, availability of planting material and seed. In general, goats tend to prefer the less coarse grass like Guinea grass or Pangola grass than the coarser types such as Elephant grass. Legumes should also be included to increase the nutritive value of the forage. They provide variety in the diet of goats and most importantly, they fix atmospheric nitrogen. However, insufficient dietary energy and protein are often the main limiting factors of efficient goat production in tropical environment. It is essential for the goat farmer to make sure that rations provide adequate supply of both energy and protein (Devendra, 1982).

7.0 IMPACT OF CLIMATE CHANGE ON GOAT DISEASES

There is increasing awareness that global warming, associated changes in precipitation patterns, and the frequency and the severity of dramatic weather events such as droughts, hurricanes and floods are having direct and indirect effects on human and animal health. The relationship of climate change to disease has received more attention with regard to human health (Khasnis and Nettleman, 2005), but there is growing awareness and documentation that animal health is also affected (Sherman, 2002; Baylis and Githko, 2006). Specific information on the relationship of climate change to goat disease is rare, but concrete examples are beginning to emerge.

In both human and animal health, vector-borne diseases are linked with climate change. In a number of cases, arthropod vectors such as ticks, midges and mosquitoes that can transmit various viral and protozoal diseases to animals and humans are expanding their ranges into new geographic areas. Furthermore, in temperate regions, warmer winters are allowing these vectors to survive year round thus increasing the likelihood that cycles of infection will be continuous rather than be interrupted by winter freeze. The incursion of bluetongue virus (BTV) infection into Europe in the last 10 years has been quite convincingly linked to global warming.

Increases in nighttime temperature and winter temperature along with increases in precipitation in summer and autumn have led to an increased geographical and seasonal incidence of BTV transmission by increasing the range, abundance and seasonal activity of vectors, by increasing the proportion of the vector species that are competent and by increasing the development rates of the virus within vectors, thereby extending transmission ability to other *Culicoides* species (Purse *et al.*, 2005). The bluetongue incursion into Europe has directly affected goats, and in the epizootic in Northern Europe which began in 2006, clinical cases in goats due to BTV-8 were seen in the Netherlands (Dercksen *et al.*, 2007).

Other climatic events besides global warming can adversely affect livestock health, including goat health. For example, the Rift Valley Fever (RVF) epizootics in the Horn of Africa is associated with the El Nino-Southern Oscillation (ENSO) phenomenon (Baylis and Githko, 2006). These warm ENSO events are known to increase precipitation in portions of East Africa. Epizootics often follow periods of heavy rainfall as rain facilitates the hatching of previously laid, dormant, infected *Aedes* mosquito eggs resulting in sudden increases in infected *Aedes* mosquito population. These initiate infection which is then amplified markedly by *Culex* and other species of mosquitoes whose population increases lag somewhat behind those of the *Aedes* mosquitoes. Heavy winds that blow infected

insects into previously uninfected areas and the transport of infected livestock into such areas, both also contribute to epizootics (Purse *et al.*, 2005).

Rift Valley Fever in goats has been reviewed (Smith and Sherman, 2009). A RVF epizootic which affected the contiguous areas of the Northerneastern province of Kenya, the south of Somalia and southern Ethiopia from 1997 to 1998 is estimated to have affected over a half million goats and sheep and sickened 89,000 people leading to possibly 450 human deaths in Kenya alone. A similar, severe RVF outbreak occurred in Kenya and Tanzania in late 2006 through early 2007 and spread later in the year into Sudan (Smith and Sherman, 2009).

Bluetongue in Europe and RVF in East Africa are two documented examples of increased vector-borne disease risk in goats associated with climate change. Parasitism is another category of goat disease that is likely to increase in association with climate change, though currently it is less well documented. Haemonchosis, a serious disease of goats, is likely to increase in places where warmer winters and moister summers allow overwintering and survival of infective larvae, while liver fluke disease is likely to increase in places where flooding and resultant standing water create habitat for intermediate snail hosts. (Peacock and Sherman, 2010).

8.0 GOAT AND FOOD SECURITY

Throughout the developing countries, small ruminants make a very valuable contribution, especially to the poor in the rural areas. These contributions range from precious animal proteins (meat and milk) to wool and skins, as well as food security and stable households.

From the early 1970s to the mid-1990s, the increase in meat consumption in the developing countries was almost three times that in the developed countries. While people in developed countries continued to obtain an average of 27% of their calories and 56% of their protein requirement from animal food products the respective averages in developing countries were 11 and 26% (Mirrad, 2011). Production of animal food products increased most rapidly in those countries where consumption was also increasing and the total meat production in developing countries grew by 5.4% per year between the early 1980s and mid-1990s (Mirrad, 2011). This is more than five times the rate seen in the developed world and, without any doubt, we are heading for a Livestock Revolution as reported by FAO (2011). With the exception of a few countries, per capital production kept up with population increase in most developing regions.

The combined effect of the reduction in available poultry meat (due to recent Avian Influenza etc) and the increased demand for red meats (in developed countries) leads to a further

increase in both the legal and illegal trade of live animals and animal products among countries. This in turn increases the threat of transboundary animal disease spreading or being introduced (Murad, 2011).

The versatility of the goat as an animal which can survive on poor pastures and provide a source of meat, milk and cheese should be a natural choice in our endeavours to meet the nation's protein requirements. The goat, the animal which we have ignored in this nation for a long time unimproved and considered to be of lesser economic value than cattle may now play a major role in Food Security of this nation.

9.0 CHALLENGES AND CONSTRAINTS TO SUSTAINABLE GOAT KEEPING AT THE HOUSEHOLD LEVEL IN AFRICA

The potential contribution of goats to the food security needs, economic growth and environmental sustainability is great. Unfortunately, this potential is not usually fully realized. A number of issues will be discussed to try to explain the underlying factors attributed to this problem:

9.1 Rural Households are Generally Poor

Over 90% of the goats in the world is owned by rural households. These rural households are characterized by poverty

and therefore adopt low-input agricultural practices. They also lack modern management skills that are essential to improve the productivity of their livestock.

9.2 Poor Animal Management

This poverty combined with lack of modern agricultural skills and low-input agricultural practices are responsible for poor animal management including poor feeding and housing practices, inappropriate breeding practices and inadequate adoption of proper animal health practices. These in turn account for poor overall productivity due to poor animal nutrition, prevalence of diseases and parasites, and poor animal production performance.

9.3 Inadequate or Lack of Investment into Goat Farming and Production

It is common knowledge that national investments in livestock in most developing and even developed countries is on cattle, sheep, poultry and pigs in terms of infrastructure, marketing inputs and services, research and advocacy. Similarly, rural households keepers of goats do not invest in their goats. They rely on the animals and the forces of nature for driving performance.

This marginalization of the goat at the household and national levels has limited the development of the goat industry through the lack of appropriate technologies, and skills by

technical staff including extension service providers. Inadequate marketing and marketing information services, required to meet the needs of the rural households that are the custodians of the majority of goats in the world are also limiting.

9.4 Unfounded Prejudices limit Goat Development

The erroneous stigmatization of goats as the major culprits for environmental degradation is unfortunate. Available evidence shows that when properly managed, especially in mixed species grazing, goats contribute to sustainable natural resource management (Schwartz, 1983; Roge and Agyemang, 1992). The reality is that poverty and demographic pressures on the land drive environmental degradation through deforestation, overgrazing, overstocking and indiscriminate exploitation of fragile marginal ecosystems.

9.5 The way Forward

The potential of goats as contributor to the attainment of food security, economic development and environmental sustainability is tremendous. The broad genetic variability of African goat breeds enables them to survive under stressful environmental conditions, including high disease incidence, poor nutrition and harsh environmental temperature. Environmental pressure also maintains a wide range of genotypes, each adapted to a specific set of circumstances. Under on-station management, indigenous African goat breeds have shown

good growth and reproductive performance, indicating their potential and ability to respond to improvements in management, particularly nutrition and disease control. This should in turn provide opportunity for effective selection for improved performance. However, African livestock producers are not yet in a position to organize breed improvement programs. National governments should therefore take responsibility for the development of infrastructure to facilitate the development and implementation of appropriate genetic improvement schemes. One of the highest ranking priority activities should be the development of breeding objectives and strategies, including simple recording systems, which can be implemented at village level.

National governments of developing countries and the developed world must therefore increase their investment in goat development at various levels – infrastructure (facilitating access through good roads and transportation), marketing and marketing services, animal health services, research to develop **technologies appropriate to the farmers' circumstances**, appropriate training of change agents and provision of production inputs.

Farmers must also be trained and retrained to develop their management skills for proper feeding including fodder development and conservation, proper breeding skills, disease control and prevention, basic on-farm processing methods to add

value to their goat farming, simple record-keeping and the exploitation of synergies between livestock and crops (Lebbie, 2004).

10.0 MY CONTRIBUTIONS TO KNOWLEDGE

Mr Chairman, you will recall earlier in this lecture, I stated three areas of my research focus on goat and sheep production as:

1. Mineral requirements of goat;
2. Development of year round feed for West African Dwarf (WAD) goat and sheep, and
3. Browse utilization in small ruminant feeding.

Sir, perhaps one of the most difficult things to do in pure and applied sciences generally is to amass considerable evidence(s) to debunk a widely held view.

My research studies on goat production started 24 years ago when I enrolled for my Doctoral degree under a renowned connoisseur in Ruminant Nutrition, in person of Professor A.O. Akinsoyinu, in the Department of Animal Science, of the one and only Premier University in Nigeria till today, University of Ibadan. I want to seize the opportunity of this gathering to express my deep appreciation to all my academic moulders and builders in that great University.

One of the critical areas in the nutrition of WAD goats is the inorganic element or mineral nutrition. An in-depth study on Magnesium (Mg) and Copper (Cu) requirements of WAD goat for maintenance and growth took me four solid academic years. The knowledge of WAD goat nutrition, particularly that of mineral requirements, metabolism and utilization is highly limited compared with numerous studies on cattle and sheep. There are more nutritional studies conducted on cattle and sheep than goats. The convention is that information on cattle and sheep can be imposed on goats (Kearl, 1982, Georgievsk et al., 1982). This is more complicated by the fact that there are very many divergent farming systems and breeds of goat in the world. There are, however, enough evidences on the unique metabolic differences between goats and other domestic ruminants (Haelein 1980; Owen and Waheed, 1985; Morand-Fehr *et al.*, 1985)

Publications on my research studies have shown that Copper (Aina and Akinsoyinu, 1996; Aina *et al.*, 2000; Aina, 2001, Sowande *et al.*, 2007); Magnesium (Aina, 1997, Sowande *et al.*, 2000; Sowande and Aina, 2001, Adeleye *et al.*, 2004, Sowande *et al.*, 2008, Aina and Mensah, 2008, Aina and Oppong, 2011); and Sodium (Aina, 1999, Aina, 2002) compounds can be used as dietary supplements to overcome deficiencies caused by naturally low concentrations of these minerals in feeds and

forages; or deficiencies induced by elevated dietary levels of the minerals. The implications of these studies include the fact that we do not need to impose values determined for either indigenous or exotic sheep and cattle on WAD goats henceforth.

I have also made immense contributions at developing cheap and affordable year round feed packages for WAD goat and sheep production (Oladotun, Aina and Oguntona, 2003). Evidences are also documented of my research studies on Browse utilization in small ruminant feeding (Aina, 1996; Aina, 1998; Lamidi and Aina, 2009; Aina *et al.*, 2011).

10.1 Mineral requirements of goat

Church (1988) stated that until more definite information is available, the use of recommended mineral allowance for maintenance and growth of sheep should be applied to goats. Most mineral requirements of goats in general have always been based on either cattle or sheep requirements. Mineral metabolism has been reviewed for numerous livestock including cattle, sheep, swine and poultry (Bunch *et al.* 1965; Miller, 1975, Little, 1981) but specific comments on goats in general and WAD goat in particular are highly limited.

Magnesium is one of the critical mineral elements for ruminants (Maham, 1990). Ruminants are susceptible to a disturbance accompanied by low blood serum Mg level (called 'Grass

'Tetany' or 'Hypomagnesaemia') below 10mg/L of serum caused by a metabolic deficiency of Mg. This metabolic deficiency may be due to low levels of Mg in the feed or from an impairment in the utilization including defective absorption of dietary Mg by the animal (Fontenote *et al.*, 1989).

Copper has been recognized as dietary essential in ruminant nutrition and is indispensable in the formation of haemoglobin (Underwood, 1971). Copper is involved in numerous body physiological functions in animals including haemoglobin formation, Fe absorption and mobilization, connective tissue metabolism usually through its involvement in enzyme function where it alters reproductive performance and various immune-suppression processes (Corah, 1996).

In my 4-year doctoral pursuit of Cu and Mg requirements of WAD goat for body maintenance and growth, hydrated Copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) and hydrated Magnesium sulphate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) were used as dietary supplement.

10.1.1 Studies on copper requirements of West African Dwarf goat

Blood cells contain Cu, but the content of the red blood cell is constant while that of the serum is highly variable, about 90u/

dl (Harper, 1975). Experimental animals on a Cu- deficient diet could lose weight and die (Poole, 1970). A significant elevation has been observed in blood Cu from 0.26 to 0.91 mg/dl in sheep and goats fed 50mg dietary Cu using EDTA salt as source of the Cu over a 5-month period (Maro and Kategile, 1980).

My Ph.D research on Cu and Mg requirements of WAD goat (7 to 9 months old) for body maintenance and growth performance involved depletion – repletion approach using dried ground maize cobs as depleting material. The results obtained indicate significantly lower but traces of serum Cu after 42 day -depletion period (1.70 to 1.90Ug/dl serum) and after 42 days of dietary repletion (1.28 to 2.50 Ug/dl serum). The best responses in terms of growth rate (0.114kg/d), highest dry matter intake (0.046kg/W^{0.75} kg), and dietary Cu intake (1.13 Ug/g feed DM) were induced by 240.68 UgCu/g DM of feed. The maintenance requirement for Cu was 5.033UgCu/W^{0.75} kg while the dietary Cu supplementation requirement was 240.68 UgCu/g DM of feed for optimum weight gain, growth rate and voluntary dry matter intake.

Prior to this study, a number of copper sources had been used to determine requirements in goats while the use of hydrated CuSO₄.5H₂O had not been reported in literature. However, recent work on sheep shows that copper compounds have

been used as dietary supplements to overcome deficiencies caused by naturally low Cu concentrations in feeds or forages or deficiencies induced by elevated dietary molybdenum (Ledoux *et al.*, 1995).

In an experiment which monitored the effects of different dietary copper salts on the performance of WAD goat (Aina, Edafe and Oyebisi, 2000), copper acetate significantly promoted the fastest growth rate (67.35g/d) and copper balance (8.83ppm) but the least serum Cu concentration (0.01mmol/d), followed by copper sulphate (57.14g/d) while the control group (zero dietary Cu salt) exhibited the least growth rate (20.41g/d). Water intake and serum Cu concentration were not affected by the type of copper salt in the diet.

In another study, (Aina, 2001) to estimate Cu requirements of WAD goats incorporating different levels of hydrated copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in the diet, results indicated an increasing weight gain with increasing levels of dietary copper. The diet containing 0.10% $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ encouraged significantly higher growth rate (0.105kg/d), optimum DMI ($0.32\text{kg}/\text{kgW}^{0.75}$), dietary copper intake (0.040gCu/g diet) and copper balance ($3.082\text{gCu}/\text{kgW}^{0.75}$) than other levels. Results further suggested that the goats required $0.45\text{gCu}/\text{kgW}^{0.75}$ for maintenance and 0.10% dietary Cu (in form of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in the concentrate ration for maximum growth rate.

10.1.2 Studies on Mg Requirements by West African Dwarf goats

As part of my Ph.D research study on Mg requirements for maintenance and growth, using depletion – repletion approach, it was established that WAD goat requires higher dietary Mg supplementation for maximum serum Mg concentration and growth rate than either temperate sheep or cattle. Besides, growth rate and feed conversion ratio also increased with increasing dietary Mg supplementation while Mg requirement for maintenance is low ($0.00183\text{kg}/\text{kgW}^{0.75}$). The optimum growth rate ($0.094\text{kg}/\text{d}$), DMI ($0.045\text{kg}/\text{kgW}^{0.75}$) and serum Mg concentration ($4\text{ mgMg}/100\text{ml serum}$) were significantly induced at $0.50\text{kg Mg}/100\text{kg diet (DM)}$.

However, Mg deficiency in WAD goats that could cause loss of weight, appetite and serum Mg deficiency below $1.03\text{mg Mg}/100\text{ml serum}$ was rectified through a 42-day dietary Mg repletion period.

10.1.3 Other studies on Mg requirements of West African Dwarf goats

In a related study (Sowande, Aina, Oduguwa, Biobaku and Abiola 2000) designed to assess the performance of WAD

goat fed dietary magnesium sulphate at different varying levels of inclusion (0.0,0.5,1.0,1.5%) in concentrate diets. Results showed that, addition of magnesium sulphate significantly increased mean daily gain from 34.00 to 46.00g. The DMI, however, declined with increased level of dietary magnesium sulphate (3.21 – 2.34kg/KgW^{0.75}). Goats fed 1.5% MgSO₄ inclusion in the concentrate diet depicted optimum feed conversion ratio (10.50) while the poorest (14.50) was recorded for goats fed control diet (zero MgSO₄).

The study further showed that Mg requirement for body maintenance was 0.003g/KgW^{0.75}/d while the requirement for maximum growth rate was 1.5% of the concentrate diet.

We have also examined (Sowande and Aina 2001) magnesium nitrate as dietary additive at four inclusion levels in the nutrition of WAD goat. With the objective of estimating DMI, average daily gain, feed conversion ratio, serum Mg and Mg retention. Results suggested that 0.45% magnesium nitrate inclusion level supported the lowest DMI (0.282KgDM/d) best mean daily gain (39.00g/d), feed conversion ratio (8.28), serum Mg (3.10mg/100ml) and Mg retention (0.160g/kgBW). The performance and Mg retention of goats on other diets were significantly lower. We have thus established that Magnesium nitrate can therefore be used up to 1.5% of diets to increase Mg intake without any adverse effect, for a better per-

formance in WAD goats.

10.1.4 Studies involving sodium (Na) requirement of West African Dwarf goat

In a developing country like Nigeria, goats are seldom given sodium (Na) in their diets. The most likely reasons include the fact that range management system is the norm where the animals have access to different sources of salt from browsing. However, with the increase in demographic growth and the consequent introduction of intensive paddock management system, animals may no longer have access to such benefit. Animals obtain Na in the form of NaCl. Cattle or sheep deprived of NaCl for short periods consume lethal quantities when confronted with large amounts (West *et al.*, 1966). Deficiency of Na has been reported to precipitate retardation of growth, impaired digestion, lack of appetite and reduced efficiency of feed utilization in growing animals (Steele, 1996). It has been recommended (Van Horn and Haenlein, 1983) that the concentrate diet of goats should contain 1% common salt. There is however, some paucity of information on Na requirements for maintenance and growth of WAD goats.

Loose salt is a common and cheap household item while salt lick which is about 90% common salt (NaCl) is very expensive and not easy to come by, hence the use of salt lick in the developing countries is highly limited. Dietary salt shortages re-

duced feed intake and induced dirt chewing, poor hair coat, and heat stress, all of which indirectly affect their reproductive efficiency (Church and Pond, 1988). Cattle and sheep are **known to travel a great distance to find 'salt lick' if they are** otherwise deprived of such (Boumgardt, 1969). Dietary salt requirements in WAD goats for optimum performance have not been sufficiently studied in Nigeria, yet WAD goats occupy an important place in the socio-economic life of the people. The general convention is to impose recommendations determined for temperate breeds of cattle and sheep on goats in general and the WAD goats in particular (Kearl, 1982). There is thus an urgent need for a meaningful and realistic recommendation on salt requirements in WAD goat production in the humid tropics, particularly in Nigeria.

In a 70-day feeding trial (Aina, 1999) on sodium requirements of WAD goats for maintenance and growth using common table salt (NaCl) as Na source at 4 dietary levels (0,5,10,15g) in the concentrate diets (sun-cured cassava peels (1kg), Gmelina leaves (1.5kg), and water (2 litres), it was found that increasing dietary NaCl levels increased total DMI, average daily weight gain and water intake. Animals offered 5g salt/day recorded the fastest growth rate (58.6g/d), optimum DMI (2.90% BW) and highest serum Na concentration (200mmol/L). Goats on higher dietary NaCl however, depicted a decline in growth rate. The data suggested that WAD goats would require 5g/

animal/day common salt in the concentrate diet for maximum growth rate and 0.52 ppmNa/KgW^{0.75}/day for maintenance.

When the effects of dietary salt levels on the performance of WAD goats were estimated (Aina, 2002) it was established that increasing common salt level also increased average daily gain and feed conversion ratio in both dry and fresh cassava peels-based diet. Goats fed dry cassava peels based diets significantly consumed more water as the salt level increased in the diet. It was concluded that application of 5g common salt/kg dry cassava peels promoted highest daily gain, optimum DMI and FCR in WAD goat production.

10.1.5 Study involving the use of ‘Kan-un’ (local potash) as a mineral source in WAD goat Nutrition

The advantage of mineral supplementation in enhancing the performance of grazing animals has been established (Van Hourtert and Leng, 1991). However, in the traditional ruminant production systems, mineral premix is not normally included in the diets of the animals. This could be due to ignorance on the part of ruminant livestock owners who may not be aware of the importance of such mineral source, or unavailability and high costs of mineral premix (Adeleye *et al.*, 2004).

Local potash known as (a) Trona in geological sector (b) Saline lake deposit in form of hydrated sodium bicarbonate (c) evaporation product and efflorescent on arid soil (d) a product of salt industry in West and North Africa (RMRDC, 1996) and popularly called (e) 'Kan-un' in most West and North Africa communities (Adeleye *et al.*, 2004) is a common household item and readily available in all local markets. It is traditionally added to vegetable as a tenderizer and enhancer of green colouration of vegetable, used in energizing horses for effective transportation of goods over a considerable distance, used locally to fatten up rams towards festive periods (Gbodi and Ikwuegbu, 1982) and is a repository of various essential mineral elements required by grazing animals (Idowu, 1994; Ranjhan, 1997). There is however, scarcity of information on the effects of 'Kan-un' on the performance of goats in general and West African Dwarf goat in particular.

The WAD goat utilizes 'kan-un' as mineral source better than synthetic mineral premix. In a study (Aina and Oppong, 2011), the chemical composition of 'Kan-un' showed that it contains virtually all the minerals required by small ruminants (Ranjhan, 1997) and it is fairly higher in P ($32.5 \pm 0.03\%$), Na ($20.19 \pm 0.30\%$), Cl ($16.25 \pm 0.11\text{mg/L}$), HCO_3 ($13.55 \pm 2.10\text{mg/L}$), CO_3 ($12.8 \pm 0.02\text{mg/L}$), Mg ($0.63 \pm 0.03\%$), Fe ($0.89 \pm 0.01\%$), Cu ($0.73 \pm 0.11\%$) and Zn ($0.67 \pm 0.30\%$) than the quantities required by small ruminants (Ranjhan, 1997). This suggests

that inclusion of 'Kan-un' in the diet of goat can meet the requirements for most of the minerals without supplementation from other sources. It was also observed that 'Kan-un' is fairly richer in some minerals than the commercial mineral lick like Ca, Mg and P, while some minerals that are contained in 'Kan-un' are completely absent from the mineral lick, like Fe and Cu which are vital in blood formation. And because 'kan-un' is alkaline in nature (pH = 8.8 – 9.03) it can be useful in neutralizing acidity in the digestive system of the animals.

Besides, the results of dietary treatment of the experimental goats suggested an increasing weight gain as 'Kan-un' supply in the concentrate diet increased from 4g 'kan-un'/animal/d up to 8g 'Kan-un'/animal/d and then declined. Average daily gain was significantly accelerated in goat fed 8g/kan-un/d (23.8g/d) beyond which there was a decline in average daily gain (16.79g/d). The control group, offered mineral lick exhibited significantly slower growth rate (8.3g/d). The reason for the poorest performance of the control group could be attributed to the lower Ca, Mg and P contents in mineral lick than in the 'Kan-un' and complete absence of Fe and Cu, which are required in blood formation.

It could, however, be concluded that 'Kan-un' inclusion in the diet of growing goats as a mineral source has beneficial effects since it is readily available in all local markets, encourages faster growth rate and better feed conversion, which are im-

portant economic indices. Our studies have therefore determined that up to 8g kan-un/animal/d may safely be included in the diet of growing WAD goats without any detrimental effects.

This study is significant considering ready availability and cost effectiveness of 'kan-un' as mineral source in the diets of small ruminants.

10.2 Development of year round feed for West African Dwarf goat and sheep

The systems of small ruminant production in West African countries, Nigeria in particular, are usually characterised by limitations posed by non-availability of year round feed resources due to usually prolonged dry season. Certain small ruminant production systems are adopted by livestock owners in Nigeria to cope with problem of feed scarcity. In the extensive management of small ruminant, supplementary feeding in the dry season is not a common feature. However, the range lands for animals to graze only blossom in the rainy season. The situation so presented indicates that those groups of animals will have abundant feed in the wet season and a shortage of feed in the dry season. It is therefore usual to find well fed robust small ruminants in the rainy season and the same animal losing weight in the following dry season. The problem of dry season feeding is particularly a serious one in the

Northern parts of Nigeria where the animals become emaciated. It has been reported (Tarawali *et al.*, 1993) that many animals die of starvation during the dry season. There is also reduction in milk yield of these animals. Thus, the livestock owners cull their animals to reduce costs of feeding. Even the transhuman nomadism could not solve the problems of dry season feeding as the nomads often record losses of their animals as a result of trypanosomiasis attack in the process of searching for green herbage for the animals (Joshua and Kayit, 1982). In the Southern part of Nigeria, however, there is abundant forage materials that can be conserved in form of silage and hay. However, silage and hay production is not yet popular enough in the Southern Nigeria. High relative humidities prevent the storage of hay long enough to meet the needs of the ruminants in the dry season. In ruminant nutrition, agro-industrial by-products, such as cereal bran and oilseed cakes have long been recognized as potential sources of nutrient, especially crude fibre, crude protein and energy (Bamowo, 1992). However, it is a common knowledge that farmers select feeds based on availability, growing season, cost and production potential. The costs of these agro-industrial and agro-allied by-products as component of livestock ration have, however, risen exorbitantly in recent times thus making the search for some by-products imperative.

Sawdust, poultry manure and cassava peels are materials

whose utilizations have not attracted competition by man, live-stock and feed processing industry in Nigeria. Presently, these wastes constitute environmental nuisance in that their disposal become a menace. The sawdust is constantly burnt off in the sawmill industries. If these materials could be harvested and harnessed into a dry season feed for ruminant, feed problems would be alleviated. Various studies have been conducted on sawdust, poultry manure and cassava peels (Bhattacharrya, 1964; Drake *et al.*, 1965; Biely *et al.*, 1980 and Bokanga, 1989) to determine proximate composition, the processing techniques suitable for each material that will make it to be maximally utilized and levels of inclusion in the diet for different animals. Considerable information therefore exist on the nutritive value of these materials which can be in the feed either formulated for maintaining weight during the dry season, for zero grazing or fattening stock.

There was a trial carried out by Oladotun, Aina and Oguntona (2003) designed to evaluate the utilization of inclusions of dry cassava peels, poultry dropping and sawdust ash as supplement in the dry season ration of rams and compared with the animals on free range. Eight rams were fed the test diet while 8 rams were left on free range with supplemented wheat offal. Among other parameters considered, the ram on the test diet grew faster than those on free range (48.6 vs 13.4g/d). There were also significant dietary effects on chestgirth gain (0.71 vs

0.03cm/d), backbone length gain (0.045 vs 0.020 cm/d) and height at withers (0.041 vs 0.029 cm/d) in rams fed experimental diet and those on free range, respectively. The results of this study suggest that when poultry droppings and sawdust ash are contained in forage-based diet for small ruminants, significant fast growth rate, increases in chest girth, backbone length and height at withers could be obtained than by the animals on dry season free range even with supplement.

This study is significant in that the use of poultry droppings and sawdust, which hitherto constitute environmental menace, as component of forage-based diet, reduces small ruminant production cost, alleviate perennial dry season feeding problem and reduces environmental menace constituted by sawmill industry.

10.3 Browse utilization in small ruminant feeding

In a study by Aina (1998) on the use of *Margaritaria discoidea* leaf as basal supplement in the diet of WAD goats, the maximum growth rate (73.3g/d), optimum DMI ($0.39\text{kg}/\text{W}^{0.75}\text{Kg}$) and feed conversion ratio (0.534) were promoted by 50% browse plus 50% concentrate diet. However, feeding *M. discoidea* leaves as sole diet still encouraged satisfactory growth performance (46.1g/d) over time and completely eliminates the cost of concentrate diet in goat production. From the predictive function, there was a significant relationship between the

level of browse fed and growth rate ($r = 0.87$, $P < 0.05$). It appears that *M. discoidea* has good potentials as fodder for dry season feeding in small ruminant production.

A related study (Lamidi and Aina, 2009) in which the utilization of *Panicum maximum* (30%), *Gliricidia sepium* (30%), and *Gmelina arborea*, (30%) supplemented with concentrate diet (dry cassava peels: 30%, wheat offal: 30%; and ruminant mineral premix: 10%) as dry season feed for WAD goat was assessed, the animals fed *G. sepium* supplemented diet exhibited the best performance in terms of feed intake, average daily gain and feed conversion ratio. Considering the nutritional qualities depicted during the 6 months storability study, all the experimental diets can be used for feeding when kept indoor during cropping season or during the dry season when feed is very scarce. However, because *G. sepium*-based diet promoted the best performance in the animals it is therefore recommended for dry season feeding of goats.

In a study involving the comparative performance of male and female WAD goats fed fresh and dry *Margaritaria discoidea* (Boll) *webs* plus concentrate supplement (Aina *et al.*, 2011), the maximum average daily gain (35.89g/d) and best feed conversion ratio (8.69) in males were enhanced at 75% concentrate supplement and 25% fresh browse diet, while in females, 25% concentrate supplement and 75% fresh browse induced maxi-

mum average daily gain (33.75g/d) and best feed conversion ratio (13.01), respectively. In the groups fed dry browse and concentrate supplement, the fastest growth rate (31.07g/d) in males was stimulated by 75% concentrate supplement and 25% dry browse; and 31.08g/d in female. The best feed conversion ratio (12.94) was noticed in males when 75% supplement and 25% dry browse was fed, while in females 10.60 was indicated with 50% supplement and 50% dry browse diet. The overall results of this study suggest that 75% supplement plus 25% fresh or dry *M. discoidea* could be recommended for economically desirable weight gain, best feed conversion ratio as well as year round feed for both male and female WAD goats, while 50% supplement plus 50% dry browse could be fed to female for optimum feed conversion ratio.

In a similar study (Aina, 1996; Aina *et al.*, 1999) when *Spondias mombin* (basal feed) was replaced with concentrate diet at 25, 50, 75 and 100% levels in the feed of West African Dwarf goats (7-9 months old), the males fed 75% *S. mombin* plus 25% concentrate exhibited optimum dry matter intake, (21.1g/KgW^{0.75}), highest average daily weight gain (66.7g/d), and best feed efficiency (3.16).

When the same study was repeated with female WAD goats, the highest dry matter intake was noticed in females fed 25% *S. mombin* plus 75% concentrate. The females on 75% *S. mombin* plus 25% concentrate indicated the best performance

in terms of growth rate (106g/d) and feed conversion ratio (0.391). The highest crude protein intake (86.21g/d) and protein retention (578.18g/KgW^{0.75}) in the females were induced by 50% *S. mombin* and 50% concentrate.

The implications of the results of these studies, if adopted by ruminant animal farmers, include the fact that the perennial **problem of ‘dry season feeding’** of goat and sheep would have been overcome.

11.0 CONCLUSION AND RECOMMENDATION

GOAT: A MISUNDERSTOOD ANIMAL

From the foregoing, it is abundantly clear that goat does not in anyway deserve being called bad name for the reasons of its great contribution to Food Security, human health, promotion of social values (village cohesiveness and recreation), overall for economic development, especially of rural communities. It is the most environmentally friendly of all livestock, adaptable to all ecological zones that exist in the world, tolerant to many of the diseases affecting other livestock, goats can tolerate varied diets, can utilize alternative feedstuff excellently and has less stringent nutrient requirements.

Besides, in the records of the Bible, goats are mentioned many times (II Chronicles 29: 23-24; Psalm 50:13, Mathew 25:32; Hebrews 9: 12-13; Hebrews 10:4).

A goat is considered a “clean” animal by Jewish dietary laws and was slaughtered for an honoured guest. It was also acceptable for some kinds of sacrifices. Goat hair curtains were used in the tent that contained the Tabernacles (Exodus 25:4). Humans, from time immemorial have always sought to improve upon their standard of living, with a propensity to explore all sought of animals and even humans have become guinea pigs to this innate quest. One such animal that was created on the same day with man that has contributed enormously to both the acquisition of knowledge and the improvement of our way of life is “The Goat”. (“And God said, let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so. And God made the beast of the earth after his kind, and cattle after their kind and everything that creepeth upon the earth after his kind; and God saw that it was good. And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. So God created man in his own image, in the image of God created He him; male and female created He them..... And God saw everything that He had made, and, behold, it was very good. And the evening and the morning were the sixth day.”Genesis 1: 24-27, 31). Since goat was created the same day with human being, it

maybe reasonable to suggest that Goat acquired a bit of intellect of man to excel other animals.

Goats are intelligent and curious. Goats are very often not given credit for being the smart and loving creatures they actually are. Goats are goats, and they think and act like goats, and no other animal, but if you are not familiar with goats and how they think, you could think of goats' brain work like dog's except they don't have the "I must please humans" thing that dogs have.

On Yom Kippur, the festival of the 'Day of Atonement', two goats were chosen and lots were drawn for them. One was sacrificed and the other allowed to escape into the wilderness, symbolically carrying with it the sins of the community. From this comes the word 'Scape Goat'.

Goats as an atonement Animal (Leviticus 16: 21-22: "And Aaron shall lay both his hands upon the head of the live goat, and confess over him all the iniquities of the children of Israel, and all their transgressions in all their sins, putting them upon the head of the goat, and shall send him away by the hand of a fit man into the wilderness. And the "goat shall bear upon him all their iniquities unto a land not inhabited; and he shall let go the goat in the wilderness"). Everyone knows what a scapegoat is. If something goes wrong in some sphere

of life, people look for someone to whom they can ascribe the fault, so as to uphold their own innocence. Usually they are not too concerned about the truth, so long as their own veneer **doesn't suffer any scratches.**

Historically, goat hide has been used for water and wine bottles in both travelling and transporting wine for sale. It has also been used to produce parchments (the skin of sheep or goat with the wool or hair removed, and treated till it is clean and soft and smooth: II Timothy 4:13) which was the most common material used for writing in Europe until the invention of the printing press.

In the Old Testament, King Solomon wrote “And thou shalt have goat's milk enough for thy food, for the food of thy household, and for the maintenance for thy maidens” (Proverbs 27: 27).

Over 2000 years ago when the New Testament of the Bible was written, goat already had a bad name. The implication being that sheep are good and goats are bad: **“when the Son of Man comes in His glory ----- He will separate the people from one another as a shepherd separates the sheep from the goats. He will put the sheep on His right and the goats on His left” (Mathew 25: 31-33).**

In the Acts of Apostles 10: 9-15, “Wherein were all manner of four-footed beasts (goat inclusive) of the earth ----- of the air viz, Apostle Peter called goat, among other animals ‘ a common’, or unclean’ animal, but a voice came from heaven telling him ‘What God hath cleansed’, that call not thou ‘common’.

From this moment on, I recommend that goat should be seen with appreciation and compassion and should not be called any bad name.

Therefore goat is now a cleansed animal by God. As such, as from today, this moment in particular, nobody should give goat any bad name again.

12.0 RECOMMENDATION

Mr Chairman Sir, the year-round feed supply and nutrition had been recognized as major constraint to ruminant livestock in Nigeria, coupled with high feed cost. Efforts to alleviate the inadequacy in feed should be directed towards the utilization of readily available and inexpensive agro-industrial and industrial by-products, and other wastes. It is a common phenomenon in Nigeria, particularly in the northern part of the country that the animals become emaciated during the long dry season, while some might even die of starvation as a result of acute scarcity of feed leading to a situation where animal

even pick-up non-edible items. At this period, some livestock owners sell some of their herds at give-away prices. Even the trans-human nomadism could not solve the problems of dry season feeding as the Nomads often record losses of their animals as a result of occurrence of trypanosomiasis. In the Southern part, which is mainly forest region, the abundance of tsetse fly causing trypanosomiasis is a potent factor militating against rearing of cattle on the zone, apart from the presence of interlocking forest which prevents the free movement of cattle, coupled with inadequate availability of grasses for the animals.

Mr. Chairman Sir, more than enough research studies have gone into dry season feeds for ruminant livestock in various Institutions in the country. What is now required is commercialization of the research results. Besides, judging from the research results reported in this lecture, nothing prevents FUNAAB from putting in place, a working committee to start off the business of producing year-round feeds for ruminant livestock. It will be a glorious thing for FUNAAB to be the pioneer Institution in the business of commercial production of ruminant dry season feed. FUNAAB has on ground more than enough human resources needed to handle the venture. Sir, I can almost predict that the business will grow as fast as, if not faster than, the business of Mobile Phones in Nigeria, because it is likely to be a new area of business in the country.

I therefore strongly recommend that FUNAAB should immediately be engaged in the commercial production of year-round feed for ruminant livestock.

13.0 ACKNOWLEDGEMENT

Mr. Vice-Chancellor Sir, somebody says “To be thankful for the benefit received is the nature of all well-groomed persons, but the most detestable crime is ingratitude”.

I want to sincerely express my deepest appreciation to those who had contributed to what this honourable audience is witnessing in me today. They have, at one stage of my life or the other, made a lasting positive impact upon my life.

I am particularly grateful to all my teachers at primary and secondary schools, who did not neglect their roles in moulding and laying my academic foundation. Among many others, I will always be grateful to Mr. E. A. Popoola, my Arithmetic teacher in primary school, and Mr. J. S. Ajayi, one of my mathematics tutors in secondary school, who later became the Faculty Officer of the Faculty of Agriculture and Forestry, University of Ibadan during my undergraduate days (1976-1979) in the Institution. Their teaching methodologies encouraged me in that subject. Although I am not in Mathematics discipline, everybody deals with mathematics in one way or the other in our everyday life. I am also grateful to all my lecturers

at the Polytechnic, Ibadan during my Advanced Level studies. I am happy to have one of them here, in person of Dr. Akintobi, who was one of my Physics Lecturer.

I have earlier on acknowledged all my lecturers during my University Education both at the University of Ibadan and University of Ilorin. I pray that none of them shall go stale in academic ideas and innovations.

I want to appreciate all my colleagues when I was a lecturer in the College of Education, Ila Orangun, particularly some of my closest friends – Messrs Adeyemi and Ajala; Drs Adeleye and Folajin and Prof. F. O. Olasantan. In addition, I want to further appreciate Prof. F. O. Olasantan for his advice that I should start preparing this lecture long before it comes to my turn. That was the second day he presented his own Inaugural Lecture (02/02/2011).

I also want to acknowledge all my academic siblings bound together by a mother called “COLANIM” Mr. Vice-Chancellor inclusive. I am very grateful to my Dean, Prof. C. O. N. Ikeobi as well as my immediate past Dean, Prof (Mrs) D. Eruvbetine. My appreciation also goes to my humble H. O. D. Dr. O. A. Adeyemi and my ex-student, Dr. O. S. Sowande, who was my immediate past H.O.D. now my Chairman, ASUU, FUNAAB Branch and my Deputy Dean COLANIM.

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I am forever grateful to my parents, Paa Timothy Fasikun Aina and Madam Dorcas Motolani Aina both of blessed memory. They instilled in us strict moral discipline, hardwork, honesty and godliness by their life style. They were ardent Christians and lived practical Christian life everyday and whatever we saw them doing that was what we took after. They struggled very hard and suffered an untold financial hardship in the efforts to send the seven of us to school. According to what my mother told me, my father's colleagues were making mockery of him at a stage that why was he sending all of us to school, he should have sent some to school and some to farming, and that he would soon die of over-working himself. Had it not been for the grace of God, if my father, an ordinary crop farmer, had listened to what his colleagues were saying, there was no way I would not have been among the children sent to farming, being the fifth child of the family. My father died at the ripe age of 81 years after an unsuccessful intestinal hernia

operation performed by an Egyptian surgeon. This suggests that there is dignity in hardwork and hardwork does not kill but strengthens one who is hardworking. He was not discouraged by such nauseating statement and to God be the glory, all of us had our education up to first degree level or its equivalent except one who had Grade I Teacher Training Certificate which was equivalent of NCE. May the merciful Lord continue to grant both of them eternal rest.

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Mr. James Bolutife Taiwo Aina
Late Rev'd Emmanuel Akintunde Aina
Late Julius Kikeloluwa Aina

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Pastor Simeon Akinpelu Aina
Late Col. (Engr) Moses Oluwole Gbadebo Aina
Only God understands the mystery surrounding the early death of the four in quick succession.

May their souls rest in peace.

I sincerely thank the retired Bishop of Egba Diocese, Anglican Communion, Rt Rev. Dr. M. O. Owadayo, who ordained me as a Priest on 19th December, 2004 after a vigorous seven months of ministerial training. I will forever be grateful to his immediate successor, Rt Rev. E. O. Adekunle for granting me Preferment of the Canon of the Cathedral of St Peter, Ake. My very humble regards and appreciation to Mama Egba for finding time to come. I am also very grateful to my amiable Provost, Very Rev. I. A. Adeniji, all Venerables, Canons, Priests and all other clergy men here present and many who would have loved to come. I will not forget the church I have been assigned to oversee and I will always be grateful to the members for their holy cooperation: Fountain of Hope Anglican Church, Asero Housing Estate. I sincerely appreciate their prayers for me and my family.

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on of Cathedral granted me by my Lord Bishop of Egba Diocese, Rt Rev. E. O. Adekunle.

My Lord Bishop Sir, God will continue to increase your anointing and prosper your ministry in all its ramifications.

I would be worse than an ingrate, if I forget to appreciate Prof. E. B. Oguntona, who God used for me to accelerate my promotion from Lecturer I to Senior Lecturer. Even though he did not know me from Adam, when I reported in FUNAAB in May 1994, he was the Dean of COLANIM. He saw my CV and called me that with my publications, I was qualified for Senior Lecturer status. He then organised an internal advertisement for Senior Lecturer grade. I was among the shortlisted candidates for interview, and by Divine programme I was found appointable with some others as Senior Lecturer. It may be pertinent to inform this honourable audience that he himself did not ask me any question in the interview. As such I was a Senior Lecturer by appointment. I will always remain grateful to him and Prof. O. A Akinsoyinu, my academic mentor for all the good things they have done for me and my family.

I also appreciate the technical crew handling the audio-visuals today in persons of Drs Sowande, Sogunle and Mr. A. Yusuf. I also thank Mrs. O. R. Oyetunde who patiently typed the

manuscripts of this lecture.

At this juncture, I want to sincerely appreciate the Vice-Chancellor, Prof. O. O. Balogun for giving me an opportunity to present my Inaugural Lecture at this material time, out of so many colleagues that are in the waiting.

I also say well-done to you Sir, for all the physical structures that God is using you to put in place in this University for effective teaching and learning. It is really the first of its kind in the history of this University. I say a very big well-done to you Sir and your team and God bless.

Mr. Vice-Chancellor Sir, I thank Almighty God for giving me the exact woman as a wife, a help-mate for me, who was formed from my ribs when an unusual deep sleep fell on me. God took one of my ribs and made the woman without my knowing it. When I woke up from the deep sleep and opened my eyes, I saw a beautiful woman of the same body complexion with mine beside me, then I asked unconsciously ‘Who is this?’ A voice answered from behind me “This is your help-mate”. Since then we have been embracing each other warmly till today and it shall be so forever and ever. Distinguished audience, I am happy to introduce to you my wife, Mrs (Princess) Victoria Adefunke Adebunmi Aina (Nee Adeyemi).

The merciful God has blessed us with four (4) male and one (1) female children. They are indeed God's heritage and are wonderful children. They have been additional source of joy to us and are of good behaviour in all ramifications.

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Finally Mr. Chairman Sir, I am short of words to express my deep gratitude to God Almighty, who has brought me to this stage of my life. I will continually be grateful to Him all the days of my life. Praise be to His Name for ever.

Thank you all for listening and God bless.

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