# EFFECTS OF INCLUSION LEVEL OF LEUCAENA LEUCOCEPHALA LEAF MEAL ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS

**BY**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF ANIMAL PRODUCTION AND HEALTH, FACULTY OF AGRICULTURE, FEDERAL UNIVERSITY OYE-EKITI, IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE BACHELOR DEGREE OF AGRICULTURE IN ANIMAL PRODUCTION AND HEALTH.**

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# DECLARATION

I, **BODUNDE TAYO BENJAMIN,** hereby declare to the senate that the project titled **"EFFECT OF INCLUSION LEVEL OF LEUCAENA LEUCOCEPHALA LEAF MEAL ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS"** is my own original work done has been carried out by me in the Department of Animal Science, Fedral University OyeEkiti, Ekiti, under the supervision of Prof (Mrs.) A.A Aganga and Dr. A.H. Ekeocha. All citations and information derived from the literature has been duly acknowledged in the text and the list of references and this work has not been submitted before nor currently in any other institution

14/03/2019

**BODUNDE TAYO BENJAMIN** **Date**

## CERTIFICATION

I, BodundeTayo Benjamin, hereby certify that the work herein submitted as a thesis for the Bachelor degree in Animal Production and Health has neither in whole nor in part been presented nor is being concurrently submitted for any other degree elsewhere. However, works of other researchers and authors which served as sources of information were duly acknowledged by references of the authors.

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# DEDICATION

This report is dedicated to the lord almighty, author and finisher of this programme. It is also dedicated to my beloved parents Mr.&Mrs.Bamisaye for their financial support throughout my 5years of this programme.

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# ABSTRACT

Thirty-two (32) zealand breed rabbits of both sexes, made up of sixteen (16) males and females were used for the experiment to investigate, the growth and carcass characteristics of weaner rabbits fed four(4) dietary levels of Leucaena leucocephala leaf meal (LLLM). Treatments 1, 2, 3, and 4 received 0, 10, 20, and 30% LLLM, respectively. They were randomly divided into 4 groups blocked by sex of 2 animals per replicate, in a Randomized Completely Blocked Design (RCBD). Means was separated using Turkey's test. Feed and water were provided *ad libitum*.

Only the average daily feed intake did not differ between dietary treatments ($p>0.05$), however, the average daily weight gain was least ($p<0.05$) in rabbits fed 30% LLLM (8.003 g/d) compared to the other LLLM based-diets (13.829, 11.204, 8.911 g/d) in T1, T2, T3 respectively. There was significant difference ($P<0.05$) in the final body weight (1152.25g, 1025.0g, 913.0g, 868.38g respectively) in rabbits fed the diets T1-T4. There was significant difference ($P<0.05$) in the feed conversion rate (5.15, 6.079, 7.252 and 7.702 respectively) in rabbits fed the diets T1-T4. There was also significant difference ($P< 0.05$) on the feed cost per kg (₦) as Treatment 4 feeds was cheaper (₦59.83), than T3, T2 and T1 whose feed costs were ₦68.23, ₦76.43 and ₦82.58, respectively. Feed cost per gained was highest in rabbits fed based diet 30% LLLM (₦156.467) and 20% LLLM (₦153.015) compared with rabbits fed 0% and 10% LLLM (₦122.359 and ₦142.984 respectively). The effect of sex on body weight gained, feed conversion ratio, daily feed intake, feed cost per Kg feed depict no significant ($P>0.05$) difference. However results of feed cost per gained indicated that bucks performed better than the does. Results of interaction between sexes and the various growth performances were not significantly ($P>0.05$) influenced by treatment.

Results of carcass evaluation showed a significant difference ($P < 0.05$) on the; live weight ranging from T1-T4 respectively (1127.5g, 1056.5g, 942.3g, 919.5g), dressing % (55.92, 51.90, 49.47, 48.25), %bled weight ranging from T1-T4 respectively (87.71, 89.20, 85.85, 86.93), % slaughtered weight ranging from T1-T4 respectively (82.31, 80.93, 80.25, 82.58). % head weight ranging from T1-T4 respectively (15.067, 17.053, 18.739, 16.73), % loin weight ranging from T1-T4 respectively (22.094, 25.901, 20.982, 20.33), % neck weight ranging from T1-T4 respectively (3.316, 2.2679, 4.3134, 2.33). The % kidney weight ranging from T1-T4 respectively (1.34267, 1.3669, 1.14943, 1.2267), %liver weight ranging from T1-T4 respectively (5.2933, 6.8503, 4.3851, 5.9076), % heart weight ranging from T1-T4 respectively (0.473, 0.367, 0.649, 0.4603) and % GIT weight ranging from T1-T4 respectively (24.246, 29.94, 31.08, 31.345). However, there was no significant difference ($P > 0.05$) on the other parameters such as, % fore limb weight, % hind limb weight, % lung weight, % full stomach weight. This investigation therefore suggests that, rabbits tolerate *Leucaena leucocephala* leaf meal (LLLM) up to 20% level, for optimal growth and quality carcass performance.

**Keywords:** Rabbit, *Leucaena leucocephala* leaf meal, growth, cost benefit and carcasses.

**Words count:** 476

TABLE OF CONTENTS

**CHAPTER SIX**

## LIST OF TABLES

## ABBREVIATIONS

B/M : Bone meal

C.P : Crude Protein

E.E : Ether Extract

FC : Feed cost

FCR : Feed conversion ratio

FC/G : Feed cost per body weight gained

F : Female

F-L : Fore limb

LLLM : Leucaena leucocephala leaf meal

M : Male

PKC : Palm kernel cake

SBM : Soybean meal

SLAUG WT : Slaughtered weight

T1 : Treatment 1 (0%LLLM)

T2 : Treatment 2 (10% LLLM)

T3 : Treatment 3 (20% LLLM)

T4 : Treatment 4 (30% LLLM)

W/O : Wheat offal

# CHAPTER ONE

## 1.0. INTRODUCTION

Protein intake among the ever increasing human population of the third world countries has long been recognized and remains one of the greatest issues of concern today (Omoikhoje *et al.*, 2008). The daily per capita meat consumption in Nigeria is 5.3g while the per capital daily consumption in developed countries is over 35g (Ojo, 2003). One of the reasons for the low per capita consumption of meat in Nigeria is the inability of local production to meet the demand for animal proteins. Agboola *et al.*, 2015 stated that the increasing world human population averaging seven billons (UN, 2012) resulted into concomitant increase in demand and competition for conventional food/feedstuff used both by man and livestock. This high demand of these feed stuffs especially the staple food sources has led to the competition between man and animal thereby increasing the price of these conventional feedstuffs.

To meet the increasing demand for animal protein, emphasis needs to be given to non-conventional sources such as easily managed rabbits as against the conventional sources such as, pig and poultry that would require more capital, space and time (Yusuf *et al.*, 2009). One of the ways to tackle the high demand of animal protein is to diversify into micro-livestock species production. Esonu (2000) observed that the inadequate production of cereal grains for livestock production has led to a high cost of feeds in the tropical countries. Due to high demand of these staple feed, there is need for conservation of some of our nutritive valued leguminous and forages to meet the demand for protein and energy in livestock among which is the *Leucaena leucocephala* plant which can be utilized into micro-livestock feeds. The contribution of *Leucaena leucocephala* into rabbit nutrition has been identified to reduce the total dependent on conventional protein sources (Adama and Adekojo, 2002).

The foliage of *Leucaena leucocephala* contains both nutrients and roughages which is essential for rabbits growth (roughages). The leaves contains (25.2% crude protein, ash content of about 17.6% and the levels of lysine, histidine, arginine, isoleucine, and leucine were 5.6%, 2.3%, 5.9%, 5.4%, and 11% on a dry matter basis, respectively (Feedipedia, 2013) . It contains two major anti-nutritional factors which are Tannin and Mimosine with level varying with stage of plant growth at harvesting. Leucaena may not be a major portion of the diet in non-ruminant animals unless well processed. Although most of these animals eat the plants with relish, they are less able to tolerate mimosine than are ruminants. Research has shown that Non-ruminants generally do not tolerate rations that contain more than 5% to 10% leucaena (dry weight). The presence of mimosine causes weight loss and ill health in non-ruminants when leucaena is fed at level of above 7.5% (dry mass) of the diet.

Animal proteins are very important to human beings. This is because they are better utilized than plant protein and has a better amino acids profile. Certain essential amino acids such as tryptophan, cysteine and lysine are usually deficient in plant protein sources. The level of animal protein consumption has direct influence on the general well-being and health of the ever increasing population. The wide gap between demand and supply of animal protein has caused a declination of protein intake in Nigeria. (FAO, 2002).

Rabbit is known to be a micro-livestock animal falling under hindgut fermenters monogastric herbivorous animals. Being herbivore they have the ability to feed on grasses, forages, pastures and able to utilize it into the body system, digesting the fibrous plants with the help of the microbes in their GIT(caecum). The ability of these animals to utilize these feed stuffs has helped to reduce cost of production, feeding in particular of which has the highest production cost in livestock (accounts for 60-70% of the rabbitry expenses).

The capital investment needed to begin raising rabbits is not large when compared to that needed by most other livestock industries. The amount of land, equipment and other items required is relatively small. Since the space requirement is not much, it is often possible to raise rabbits near the home on rather small acreages.

Rabbits are known to be environmental friendly most especially when raised on the intensive cage system whereby they do not have contact with their droppings. The faeces are usually of low moisture i.e. does not splash on the floor unlike in poultry. Due to this the routine cleaning of the hutch is less tedious. They are also environmental friendly as they do not constitute noise nuisance to the environment. Rabbits rarely make sounds unless when they are not comfortable with the environment.

Most domestic rabbits are slaughtered for food. Rabbit meats are known as a white meat, appealing and tasty, juicy and tender with low cholesterol which is best recommended and suitable for hypertensive or high blood pressure, obese patients. The dressing ranges from 55-65%. Rabbits has the same physiology as human(except to an extent in their digestive system) as a result of this they are used in research, testing drug effects before introducing to human, effect of nutrition etc.

Rabbits are well known to be induced ovulators as they can return to pregnancy as early as 6hrs after parturition when being mated. They are also characterized with their prolificacy with low gestation period of 30-35 days depending on the breed. They also have a short generation interval of 6-7 months. Due to their low gestation period; theoretically they can kindle as much as 10 times in a year but practically 6-8 times in a year. Due to the prolificacy and breeding interval this has made it more advantageous than other monogastric and ruminant animals like Grass-cutter, pig, goat, sheep, cattle etc.

Feed cost is estimated to account for over 70% of the total cost of production for poultry (Ogunfowora, 2006). This is caused by the inability and the steep rise in the price of conventional feed ingredients especially energy and protein sources. The ability to thrive on forage by-products therefore makes their production cheap. Generally, the price of conventional feeds in Nigeria has been rising steadily in recent years. This has resulted in unreliable supply and relatively high prices of locally produced micro-livestock animals. This has led to the shutting down of these micro-livestock practices. Reducing and regulating feed costs are therefore critical to the sustainability and profitability of the rabbit production. This can be done more extensively by replacing some of these conventional feeds with readily available legume forage or crop residues especially when the price of protein cakes become unbearable to farmers.

The present study aimed at assessing the possibility of including LLLM at different varying level for weaner rabbits

## 1.1 The objectives of the study were to:

- Evaluate the chemical content of diets containing varying levels soaked and sundried *Leucaena leucocephala* leaf meal.
- Assess the performance of weaner rabbits fed on diets containing varying inclusion level of *Leucaena leucocephala* leaf meal.
- Determine the carcass quality of the weaner rabbits fed the varying level of *Leucaena leucocephala* leaf meal.
- To determine the effect of the different inclusion levels of LLLM on final live weight, daily weight gained, feed intake and feed conversion ratio and to determine the optimum inclusion level of LLLM in rations of the weaner rabbits optimum growth based on these growth parameters mentioned above.
- Assess the performance of interaction between sex and diets on weaner rabbits fed on diets containing varying inclusion level of *Leucaena leucocephala* leaf meal.

- Assess the economics of rabbit production using LLLM i.e. to calculate the cost/kg feed intake and feed costs/kg weight gain of the rabbits fed varying levels of LLLM in rations.

### 1.2 Justification of the Study

The high cost of protein feedstuff for livestock feeding, resulting from the scarcity of feedstuffs such as fishmeal, groundnut cake and soya bean meal and the high competition that exists between man and animals for the conventional feed stuffs, has necessitated the need for maximizing the effective utilization of non-conventional feedstuffs.

This can be achieved by reducing the quantity of these expensive feedstuffs and supplementing them with cheaper price non-conventional protein feedstuffs like *Leucaena leucocephala.* In this way the cost of production of rabbit feeds will be greatly reduced, thereby making cost of feeding affordable to rabbit farmers.

## CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1 Taxonomy Of Rabbit

| | |
|---|---|
| Kingdom: | Animalia |
| Phylum: | Chordata |
| Subphylum: | Vertebrate |
| Class: | Mammalia |
| Subclass: | Euthera |
| Order: | Lagomorpha |
| Family: | Leporidae |
| Subfamily : | Leporinae |
| Genus: | Oryctolagus |
| Specie: | cunniculus |

## 2.2 Importance of rabbit production

The optimum performance of the livestock depends solely on the quality of the feed to meet the requirement of the animal for effective growth. One of the major nutrients required for optimum growth is protein. Protein is responsible for the building up of muscles in the body system. Protein is an important component of the cells, tissues, organs and the body system. According to Adejimi *et al.* (1999) stated that "high cost, scarcity and occasional adulteration by feeds ingredient suppliers are the major challenges facing the use of soybean meal, groundnut cake, fish meal etc into livestock protein sources.

Rabbits are able to efficiently convert feed to high quality protein. They can utilize local forages and food wastes that are of no direct value to humans. Rabbit meats are referred to as white meat as it is of low fat and cholesterol. Based on the organoleptic characteristics of rabbit meat, it is more palatable as it is tender, juicy with attractive flavor compared to other livestock meat. Damron (2006) showed that a cooked piece of rabbit meat is high in protein (56%), low in fat (9%), low in cholesterol, sodium and calories (8%) and contain 28% phosphorus, 13% iron, 16% zinc, 14% riboflavin, 6% thiamin, 35% B12 and 48% niacin.

Rabbit is a good source of useful by-product like the fur which is useful for making fabrics. They have fairly small body size which makes it relatively possible to be raised in a confinement. There is a low cost of production in other words starting requires modest production compared to other farm animals. Rabbits are attractive animal for handicapped children who enjoy being involved in its care and management. Rabbit is a suitable animal for learning basic skills in animal husbandry; it responds to careful handling but can withstand the sometimes rough handling of the beginner. It also lend itself to simple recordkeeping e.g. of weekly live weight gain and reproduction and so can introduce the idea of management recording to new students of animal production. Scientists use this pet for testing if there is an adverse effect of nutrition, drugs, chemicals in human. This experiment will first be done on rabbits before introducing such drug to man.

Rabbits have the potentials of high rate of multiplication due to their short generation interval and fast growth rate (Ezekwe, *et al.*, 2002). They are highly prolific reaching its table size at 5-6 months with a short gestation period of 32 days, gives birth to an average of 5-6 kittens per litter. Kitchen waste, garden wastes, vegetable waste can be collected and fed to the rabbits as these rabbits in return produces faeces that can be recycle back into the garden or farm. According to Mikled (2005), the wastes from products grading before selling to the market, such as vegetable wastes, are well utilized as feed resources for rabbits, and the manure from the animals could be used as an organic fertilizer for crops. There is excellent product acceptance with respect to social and religious traditions in other words it is not restricted by any strong taboos or particular beliefs that prevent the eating of rabbit meat or its promotion as food.

## 2.3 Constraints to Rabbit production

Enu (2009) stated that inadequate nutrition, poor management, and low reproductive efficiency, diseases, shortage of pure breeding stock and marketing problem are the major constraints to successful commercial rabbit production in the tropics. The nutrition should be able to meet with the energy, protein, fibre requirement of the animal. The optimum energy requirement of a rabbit ranges from 2390-2500 kcal/kg with protein requirement of 15-18% depending on the stage of growth and fibre ranging from 10-15%. The energy and protein is required for good growth performance of the rabbit. Energy and vitamins are important for the reproductive performance, growth performance of rabbits. Calcium is also responsible for the skeletal formation of animals. The fibre is also required to fill their gut most especially the enlarged caecum in order to prevent enteritis. This is the very reason why some farmers supplement their feed with forages. It is important that all these nutrients must be present in the compounded or feed offered to the rabbits as it must meet up the requirement for their daily function.

- Most people are not ready for rabbit production that demand daily care and attention and many don't see the reasons for keeping the rabbits anyway.
- Most people are not aware of the skills needed in rabbit production.
- Unavailability of improved parent stock that are adaptable to our local conditions

## 2.4. Description of *Leucaena leucocephala* plant

*Leucaena leucocephala* (Family: Fabaceae) is a small, fast-growing tree, and has multiple common names by which it is known such as White Lead tree, White Popinac, Jumbay, and Wild Tamarind (Devi *et al.*, 2013). According to Zayed *et al.* (2017), Leucaena originated from the Greek words "leuc," which means "white," and "caen,"which means "new," referring to the whitish flowers. According to Pandey & Kumar, (2013) there are three recognized subspecies of *L. leucocephala* namely *L. leucocephala* ssp. leucocephala, *L. leucocephala* ssp. glabrata (Rose) Zarate, and *L. leucocephala* ssp. ixtahuacana .Hughes.

It is a neglected and underutilized; medium to small sized tree of multiple values. It has fast growing nature, easy adaptability to various ecological conditions but suitable for tropical conditions, high biomass productivity and re–sprouts capacity (more than 50 t/ha/year) (Feria *et al.*, 2011). Leucaena (*Leucaena leucocephala* (Lam.) de Wilt) is a fast growing, evergreen, thornless shrub, reaching a height of 5m (FAO, 2009). Leucaena is a long-lived perennial legume.

Leaves are bipinnate, bearing numerous leaflets 8mm to 16mm long (Cook et al., 2005). The inflorescence is a cream colored globular sharp producing clusters of flat brown pods, 13 to 18mm long containing 15-30 seeds (Feedipedia, 2015). Seeds are dark brown with a hard, shining testa, 6.7–9.6 mm long, 4–6.3 mm wide, aligned transversely in pod (Pandey and Kumar, 2013).

Leucaena is valuable for its wood, which is used to make good quality charcoal, small furniture and paper pulp. Its young shoots, young leaves and sees may be used as a vegetable in human nutrition (Feedipedia, 2015). The seeds of L. leucocephala can also be used as a substitute of coffee or as pieces of jewellery (Cook *et al.*, 2005). Leucaena is one of the highest quality and most palatable fodder trees of the tropics (Ecoport, 2009).

## 2.5. Distribution of *Leucaena leucocephala* plant

Leucaena is native to Guatemala and Mexico. It was introduced to the Philippines and South-East Asia in the $16^{th}$ century, spread throughout the Asian Pacific region and reached Australia in the late $19^{th}$ century. It is widespread within $30^{0}$N and $30^{0}$S and grows well in areas where annual rainfall ranges from 650-3000mm and where day-temperature is within $25^{0}$c and $30^{0}$c. It prefers neutral to mildly acid, well drained soils. Leucaena is tolerant of dryer climates (300mm) and drought periods (up to 6-7 months). It may withstand light frost (though with lower yields), moderate salinity and short periods of waterlogging (less than three weeks). Heavy frost, acid soils, low P, low Ca and high Al are detrimental to leucaena

## 2.6. Germination requirements for *Leucaena leucocephala* plant

*Leucaena leucocephala* fruits are harvested from branches when it changes their color to dark brown before dehiscence (Zayed *et al.*, 2017). *L. leucocephala* seeds can then be stored as un-scarified or scarified seeds. Unscarified seeds can be stored for more than one year under dry conditions at ambient temperature and up to 5 y when stored at 2 °C to 6 °C, dried.

Due to the texture of the seeds(hardness) there is need to break dormancy which can be done by soaking in hot water or soaking in sulfuric acid. Soaking *L. leucocephala* seeds in 100 °C water for 20 s and subsequently in water at room temperature for 48 h had the highest seed germination rate, higher cumulative germination (CGP) and shortened period of complete dormancy (CDP),when compared to the germination rate when seeds were soaked for only 24 h or untreated seeds (Zayed, 2014).

The seeds are then planted very shallow on the soil surface of about 2cm depth. If it is to be done on the nursery, one should collect sets of polythene bags, punctured for ease drainage. Collect dark loamy or sandy-loam soil into the polythene bags and deep seeds to the soil of about 2cm depth. Seed germination is about 7-10 days. While transplanting ensure you transplant during the day with the seedlings moisten. The planting position should be dug to desire depth and well moisten. Collect the seedlings with ball of soils beneath the root.

Direct seeding by planting container seedlings, bare root seedlings and stem cuttings of 2 to 5 cm in diameter can be used as a method of plantation development (Francis, 1993).

## 2.7 Potential use of *Leucaena leucocephala* in rabbit feeds

Ruminant animals are able to tolerate mimosine than non-ruminants and therefore, *L. leucocephala* could not be a major portion of the non-ruminant diet (Zayed *et al.*, 2017).

Fresh or dried *Leucaena leucocephala* or leaf meal improves feed intake, feed efficiency and animal performance in rabbits. The recommended inclusion rate ranges from 24%-40% for growing or fattening rabbits fed on fresh *Leucaena leucocephala* leaves (Adejumo, 2006). *Leucaena leucocephala* can also be used to replace alfalfa (Scapinello *et al.*, 2000). Leucaena leaf meal may be included at 25% when supplementing a diet based on cassava peels and *Gliricidia sepium* and at 30-40% when rabbits are fed with Arachis pintoi.

Not all rabbit trials with leucaena have been positive (FAO, 2005). The inclusion of fresh leucaena leaves at 20-25% had deleterious effects on the survival of female and young rabbits (up to 55% mortality) (Sugur *et al.*, 2001).

## 2.8 Other economic important uses of *Leucaena leucocephala* plant

*Leucaena leucocephala* is used as a source of edible pods, forage for domestic animals, poles for construction, firewood and shade in permanent plantations is well documented (Prasad *et al.*, 2011). The wood has medium density, medium textured, close grained and easily workable for a wide variety of carpentry purposes like sawn timber, mine props, furniture and parquet flooring (Alabi and Alausa, 2006).

The species is also used for pulp and paper production (Lopez *et al.*, 2008) wood production ( Prasad *et al.*, 2011), green manuring (Sharma and Behera, 2010), phytoremediation and re-vegetation of fly ash basins and other contaminated areas (Lins *et al.*, 2006), for prevention of slope failure (Normaniza *et al.*, 2008), for energy and chemicals from auto-hydrolysis (Feria *et al.*, 2011). *L. leucocephala* can also be used for soil erosion, for reclamation of marginal and degraded waste land (due to high nitrogen-fixing potential), as ornamental and to control air pollution along roadside, as live fence along cultivated fields and for shade and support for shade loving plants and vines such as pepper, vanilla, and yam etc. (Pandey and Kumar, 2013).

*L. leucocephala* wood is pale yellow sapwood and light reddish-brown heartwood. The wood has medium density, medium textured, close grained and easily workable for a wide variety of carpentry purposes like sawn timber, mine props, furniture and parquet flooring (Alabi and Alausa, 2006). *Leucaena leucocephala* pulp is used in paper and rayon industries (Dutt *et al.*, 2007) Red, brown and black dyes are extracted from the pods, leaves and bark of *L.leucocephala*.

Seeds also yield about 25 percent gum and is highly viscous solutions at low solute concentrations (Shrivastava, 2012).

## 2.9 Nutrient composition of *Leucaena leucocephala* plant

**Table 1: The chemical constituents of *L. leucocephala* leaves and seeds (Ojo and Fagade, 2002)**

| S/N | Chemical constituents | Leaves | Seeds |
|---|---|---|---|
| 1 | Crude Protein (%) | 25.9 | 46 |
| 2 | Carbohydrate (%) | 40 | 45 |
| 3 | Tannin (%) | 4 | 1.2 |
| 4 | Mimosin (%) | 7.19 | 10 |
| 5 | Total ash (%) | 11 | 3.79 |
| 6 | Total N (%) | 4.2 | - |
| 7 | Calcium (%) | 2.36 | 4.4 |
| 8 | Phosphorus (%) | 0.23 | 0.189 |
| 9 | b-carotene (mg/kg) | 536.0 | - |
| 10 | Gross energy (kJ/g) | 20.1 | - |

***Source of data: Ojo and Fagade (2002).***

**Table 2: The chemical constituents of *L. leucocephala* seeds (Alabi and Alausa, 2006).**

| S/N | Chemical constituents | Seeds |
|---|---|---|
| 1 | K | 137.3 |
| 2 | N | 338.0 |
| 3 | Mg | 44.6 |
| 4 | Ca | 44.4 |
| 5 | Na | 12.6 |
| 6 | Mn | 52.6 |
| 7 | Fe | 642.4 |
| 8 | Cu | 55.0 |
| 9 | Zn | 125.1 |
| 10 | Fatty acid (%) | 15 |
| 11 | Saponification value | 108.74 |
| 12 | Iodine | 4.9 |
| 13 | Acid value | 1.08 |

***Source of data: Alabi and Alausa (2006).***

## 2.10 Phytochemical compounds in *Leucaeana leucocephala* plant

*Leucaena leucocephala* leaf and seed extracts have antioxidant activity (Chowtivannakul and Talubmook, 2012). An application of this extract should be considered as it can affect renal function by reducing the levels of albumin, ALP and total protein (Joshi and Mahajan, 2003). The anti-inflammatory and anti-tumor property of chloroform, ethyl acetate and methanol extracts of leaves of *L. leucocephala* was reported (Zayed and Benedict, 2016). *L. leucocephala* seed oil extract had a concentration-dependent activity against both Gram-positive (Staphylococcus aureus, Bacillus subtilis) and Gram-negative (Pseudomonas aeruginosa, Esherichia coli) bacteria and the lotion formulation with an emulsifying agent had good pharmaceutical properties (Aderibigbe *et al.*, 2011).

**Table 3: Phytochemical compounds identified from the *L. leucocephala* leaf extracts and their therapeutic Activity (Zayed and Benedict , 2016).**

| No | Compound | Secondary metabolite | Therapeutic activity |
|---|---|---|---|
| 1 | Phytol | Diterpene | Antimicrobial, anticancer, cancer preve diuretic, antioxidant, antitumor, cancer-preve chemopreventive, pesticide, immunostimulant |
| 2 | Squalene | Triterpene | Antioxidant, hypocholesterolemic nemat pesticide, antiandrogenic, flavor, hemolytic |
| 3 | n-Hexadecanoic acid | Palmitic acid | Antioxidant |
| 4 | Pentadecanoic acid, 14-methyl-esther | Palmitic acid me thyl ester | Antioxidant, nematicide, pesticide, flavor, antiandrogenic |
| 5 | Hexadecanoic ancid, 15-methyl-, methyl ester | Fatty acid ester | Antioxidant, nematicide, pesticide, flavor, antiandrogenic |
| 6 | 3,7,11,15-Tetramethyl-2-hexadecen-1-ol | Terpene alcohol | antimicrobial |
| 7 | 9,12,15-octadecatrienoic acid methyl ester | Linolenic acid ester | Anti-inflammatory, insectifuge, antiacne, nematicide, hypocholesterolemic, cancer preventive, hepatoprotective, antihistaminic, antiarthritic, antiacne. |
| 8 | 9,12,15-octadecadienoic | Linolenic acid | Anti-inflammatory, insectifuge, antiacne, |

| | | | |
|---|---|---|---|
| | methyl ester | ester | nematicide, hypocholesterolemic, cancer preventive, hepatoprotective, antihistaminic, antiarthritic, antiacne. |
| 9 | Oxalic acid, ally hexadecyl Ester | Dicarboxylic Acid | Acaricide, antiseptic, CNS-paralytic, hemostatic, irritant, pesticide, renotoxic |

***Source of data: (Zayed and Benedict, 2016).***

### 2.11. Toxicity of Leucaena

Reports of toxicity in rabbits due to mimosine in Leucaena suggested reduction in hair growth and in ruminants causes goiter; growth depression; retardation of functional organs such as ovaries and testes; necrosis or degeneration of the liver, kidneys and reduced fertility and reproductive failure; short lifespan and mortality. The mimosine causes alopecia (loss of hair). Plant breeders in Australia and Hawaii are developing low mimosine varieties of leucaena, which should improve the feeding value of this high protein plant (McNitt *et al*., 2013). Mimosine toxicity symptoms disappear after a short time and leave no residual effects when the plants are removed from the diet.

Another toxic in leucaena leucocephala is the tannin. Tannin is found both in the leaves and seeds of leucaena plant. Tannin reduces the release of protein in leucaena by binding with the protein thereby preventing some part of the protein readily absorb into the body system.

## 2.12. Controlling effects of the toxicity in ANF for the *Leucaena leucocephala* leaf meal.

**Table 4: Effects of processing methods of *Leucaena leucocephala* leaf meal by Adekojo *et al.* (2014)**

| Parameter(mg/100g) | RLL | ADLL | FWLL | HWLL | FLL | LS |
|---|---|---|---|---|---|---|
| Mimosin | $0.42^{a}$ | $0.26^{ab}$ | $0.09^{ab}$ | $0.00^{b}$ | $0.14^{ab}$ | * |
| Tannin | 322.00 | 311.40 | 120.50 | 120.50 | 163.10 | ns |
| Cyanogenic glycoside | 3.97 | 3.89 | 1.50 | 1.50 | 1.12 | ns |
| Phytic acid | 10.02 | 9.22 | 4.98 | 4.98 | 5.57 | ns |
| Oxalate | 1961.40 | 1909.70 | 904.5 | 763.80 | 730.50 | ns |

*RLL – Raw Leucaena leucocephala leaf*

*ADLL – Air dried Leucaena leucocephala leaf*

*FWLL – Fresh water processed Leucocephala leucocephala*

*HWLL – Hot water processed Leucaena leucocephala leaf*

*FLL – Fermented Leucaena leucocephala leaf.*

From the table above; it can be deduced that fresh water is one of the most suitable processing method for leucaena leaf meal with respect to Mimosin content in the leaf though other processing method is also reliable for removing other Anti-nutritional factor. Fresh water processing reduces by 79%, 62.5%, 62%, 50%, 54% in Mimosin, Tannin, Cyanogenic glycoside, Phytic acid, Oxalate respectively in the Leucaena leucocephala leaf.

Adekojo *et al.* (2014) found that in order to achieve 40% inclusion level of LLLM in feeds of rabbit the mimosin present in it have to be destroyed, the three most suitable methods employed for mimosine degradation includes: soaking fresh leaves with water at room temperature for 36 hours, soaking leaves at $60^{0}$C in hot water for 24 hours and fermentation for 5 days of the

Leucaenal leucocephala leaf. In employing soaking-drying technique, it was affirmed that there is 94% reduction of mimosin and 99.3% reduction of tannin in Leucaena leucocephala leaf. Nuttaporn and Naiyatat (2009) indicated that the soaked leaf meal processing of leucaena plant leads to the diminishing of protein quality in the leaf which could be as a result of reduction in methionine and histidine.

Fayemi *et al.* (2011) reported that crude protein of the experimental diet containing 40% of different processing methods of LLLM ranged from 17.49% to 21.45%. Adekojo *et al.* (2014) analysed the protein content of LLLM containing 29.17%, 25.23%, 24.69% and 22.67% CP of airdried, fresh water, fermented and hot water processing techniques respectively.

### *2.13. Review of findings of Rabbits under Tropical conditions*

Adedeji *et al.* (2013) asserted that Leucaena leucocephala leaf meal had adverse effects on the feed intake, body weight gain and growth performance when it is included in the ratio beyond 10% level of rabbit diet. Inclusion of 10% white lead tree or 10% Siratro leaves in rabbits' diet had no adverse effects on the performance and carcass yield of growing rabbits (Makinde, 2016). Mänika *et al.*, 2016 recommended the adding of 10% level of Leucaena leucocephala leaf meal of the diet for economic rabbit meat production. Chisowa and Mwenya (2013) concluded that rabbits would prefer *Leucaena leucocephala* when offered with Gliricidia sepium, Caliandra calothyrsus and Sesbania sesban in a cafeteria type of feeding. Fasae *et-al.* (2016) concluded that 30% of cassava and 10% *Leucaena leucocephala* leaf meals can be best incorporated in the diet of rabbits to achieved optimum production without any adverse effects on the animals.

There is also need to feed rabbits with concentrates which are easily prepared and readily available with a higher dry matter intake usually at 90% DM. This high dry matter content has helped the body to easily utilize the nutrients as the nutrients are available at a higher concentration and animals are also fed with smaller quantity releasing a very large amount of nutrient to the body unlike feeding solely on grasses, hay etc. with very low nutrients in them due to their moisture.

# CHAPTER THREE

## 3.0 MATERIALS AND METHODS

### 3.1 Experimental site

The research was conducted at the rabbitry unit of the teaching and research farm of the Department of Animal Production and Health, Federal University of Oye-Ekiti, Ikole campus, Ekiti-State. Ikole lies within longitude $5.5145^0$E and latitude $7.7983^0$N and at an elevation of 570 m above sea level. The climate of the study area is typically tropical with relative humidity ranging from 57-92% and mean average daily temperature of 68-$90^0$F. The rainy season is between April – October and dry season between November – March, with annual rainfall range of 500 – 3000mm.

### 3.2 Experimental Materials and Duration of Study

Thirty-two (32) cross-bred rabbits of both sexes were used for this study. Some of the rabbits were bought from the farm of the Federal College of Agriculture, Akure, Ondo-State while others were purchased from Azeez Rabbit farm, Iworoko road, Ado-Ekiti. Some rabbits were equally sourced from the stock of the Teaching and Research farm of federal university of Oye-Ekiti.

The rabbits were sixteen (16) males and sixteen (16) females. Eight rabbits were randomly assigned to each treatment in the ratio of four (4) males and four (4) females per treatment. There were four treatments in all. In addition, the experiment lasted for six (6) weeks after a one week of pre-feeding trial. The *Leucaena leucocephala* leaves were harvested from the University premises where there is abundant of the vegetation.

### 3.3 Processing of *Leucaena leucocephala*

The harvested *Leucaena leucocephala* leaves were soaked in water for 48 hours, sun dried for 72 hours period of sunlight until they were crispy to touch, while still retaining their greenish colouration. The leaves were then milled using a grinding machine, to obtain a product herein referred to as *Leucaena leucocephala* leaf meal (LLLM) which was stored in sacs until needed.

### 3.4. Experimental Animals and Management

Thirty-two (32) mixed bred rabbits of both sexes with ages ranging from 4-6 weeks old and their weights ranging from 300g-550g were randomly divided into four treatment groups of eight (8) rabbits each. Two animals constituted a replicate and each replicate was housed in a separate hutch raised from the ground. The treatments were balanced for the sexes, (i.e. same number of males and females in each treatment). They were randomly divided into four groups of eight animals per treatment, after balancing for body weight. They were also separated into males and females. The animals were provided with a feeder and a drinker in each hutch. Prior to the experiment, each animal was treated for both endo and ecto-parasites using ivomec injection administered subcutaneously (0.1ml/rabbit). Coccidiosis was routinely controlled using Coccifor and Embazin-forte.

### 3.5. Experimental diet

Four experimental diets were formulated. Diet 1, which was designated as T1 served as the control diet and contained soyabean meal as the main protein source with no *Leucaena leucocephala* leaf meal. Diet 2 designated as T2; Diet 3 as T3 and Diet 4 as T4 and each containing 0%, 10%, 20% and 30% Leucaena leucocephala leaf meal (LLLM) respectively. A known quantity of feed was fed daily to each rabbit. Water was given ad libitum.

**Table 5a: Feed composition and calculated nutritional composition of the experimental diets**

**Table 5a: Feed composition and calculated nutritional composition of the experimental diets**

| INGREDIENTS | TRT1 | TRT2 | TRT3 | TRT4 |
|---|---|---|---|---|
| MAIZE | 25 | 22 | 15 | 8 |
| LLLM | 0 | 10 | 20 | 30 |
| SBM | 12 | 10 | 7 | 4 |
| W/O | 15.5 | 13.5 | 17.5 | 20.5 |
| PKC | 45 | 42 | 38 | 35 |
| B/M | 2 | 2 | 2 | 2 |
| SALT | 0.25 | 0.25 | 0.25 | 0.25 |
| PREMIX | 0.25 | 0.25 | 0.25 | 0.25 |
| | 100 | 100 | 100 | 100 |
| ENERGY(KCAL/KG) | 2643.4 | 2715.7 | 2762.8 | 2809.9 |
| PROTEIN (%) | 16.97 | 16.96 | 16.97 | 16.90 |
| FIBRE (%) | 11.975 | 11.7676 | 11.792 | 11.9164 |
| COST(#)/kg feed | 82.575 | 76.425 | 68.625 | 59.825 |

**Table 5b: Chemical composition of the experimental diets**

| | 0% LLLM | 10% LLLM | 20% LLLM | 30% LLLM |
|---|---|---|---|---|
| % C.P | 16.70 | 18.17 | 18.20 | 18.61 |
| % E.E | 11.45 | 12.11 | 12.23 | 10.78 |
| % ASH | 4.25 | 5.22 | 6.37 | 5.02 |
| % FIBRE | 16.67 | 19.23 | 24.75 | 27.84 |

**Table 5c: Tannin content of soaked-dried Leucaena leucocephala leaf meal (LLLM)**

| S/N | Tannin (mg/100g) |
|---|---|
| Leucaena leucocephala leaf | 1.62 |

**Supplementary feed:** Each rabbit were offered an average of 35g of *Panicum maximum* or *Tithonia diversifolia* leaves on daily bases.

### 3.6. Experimental design and duration of experiment

The four treatment groups were assigned the four experimental diets in a completely randomized design (CRD). Each treatment was replicated twice per sex and there were two rabbits per replicate. Each rabbit was fed an assigned diet which lasted for six (6) weeks after a one week of adjustment period.

### 3.7. Growth study

The experimental diets were offered ad libitum in separate wooden feeders in the morning (08.00am), so the rabbits determined their intake of the feed. The diets were offered daily and the feed leftover and/or wastage were weighed daily before feeding. Water was also provided ad libitum in a concrete drinker. All animals were weighed at the start of the experiment before allocating them to the treatments. Parameters determined included average feed intake, average body weight gain, feed conversion ratio, feed cost and feed cost per kg gain.

### 3.8. Data Collection

The following parameters were evaluated:

i. Average daily feed intake

Feed given and the left over were weighed, the difference between the quantity of feed given and the left over, gave the daily feed intake for the previous day.

ii. Average body weight

Initial body weights of each rabbit were taken before assigning them to the various treatments. Weekly measurement of body weight was also taken using a weighing balance.

iii. Average weight gain:

This was taken as the difference between the initial body weights and the final body weights of the rabbits. This measurement was carried out on weekly basis.

iv. Feed conversion ratio:

The quantity of feed consumed per unit increase in live weight. It is then reciprocal of feed efficiency and is estimated as:

$$FCR = \frac{\text{Feed consumed (g)}}{\text{Weight gain (g)}}$$

v. Feed cost per Kg gain: The ratio of cost in naira of the total feed consumed and the total weight gain in Kg per treatment ie. FCR X cost of feed.

$$\text{Feed cost per Kg gain} = \frac{\text{Total feed consumed in Kg X cost}}{\text{Total weight gain (Kg)}}$$

### 3.9a. Carcass yield evaluation

At the end of the experimental period, only the male animals were considered for the carcass analysis. Due to the mortality during the experiment, two animals were slaughtered from T1 and T2, while three animals were slaughtered from T2 and T3, with a total of 10 rabbits for carcass evaluation. The rabbits were starved of feed for 18 hours prior to slaughtering and then slaughtered by cutting the jugular vein to allow proper bleeding. Determination of blood weight was by the difference between slaughter weight and hot carcass weight. The slaughtered rabbits were defurred using hot water and eviscerated to evaluate their carcasses. Dressing percentage was determined by dividing the hot carcass weight by the slaughter weight and multiplied by hundred.

### 3.9b. Carcass characteristics

Parameters measured were:

Live weight (g): This was done after 24hrs of starving the animal using a sensitive scale.

Slaughter weight (g): This was carried out after taking the bled weight and de-hairing the rabbit with hot water and scraping the hair with knife.

Slaughter weight (%): $\frac{\text{Slaughtered weight(g)}}{\text{Live weight (g)}} * 100\%$

Bled weight (g): This was done after making an incision beneath the neck to drain the blood and using a sensitive scale to weigh the bled rabbits.

Bled weight (%): $\frac{\text{Bled weight(g)}}{\text{Live weight (g)}} * 100\%$

Dressed weight (g): This was done by weighing the carcasses which excludes the viscerals.

Dressed percentage (%): $\frac{\text{Dressed weight (g)}}{\text{Slaughtered weight (g)}} * 100\%$

Head weight (g): The head of the slaughtered rabbit was placed on the sensitive scale to weigh

Head weight (%): $\frac{\text{Head weight(g)}}{\text{Dress weight (g)}} * 100\%$

Loin weight (g): The portion of the loin was cut-off and weighed on the sensitive scale

Loin weight (%): $\frac{\text{Loin weight(g)}}{\text{Dress weight (g)}} * 100\%$

Fore limb weight (g): The fore limbs were collected and weighed

Fore limb weight (%): $\frac{\text{Fore-limb weight(g)}}{\text{Dress weight (g)}} * 100\%$

Hind limb weight (g): The back legs were collected and weighed

Hind limb weight (%): $\frac{\text{Hind-limb weight(g)}}{\text{Dress weight (g)}} * 100\%$

Internal organs: The animals were made a long incision beneath the chest to open up the internal organs.

Liver weight (g): The animal liver was collected and weighted on the sensitive scale.

Liver weight (%): $\frac{\text{Liver weight(g)}}{\text{Dress weight (g)}} * 100\%$

Heart weight (g): Individual heart was collected and weighed on the scale

Heart weight (%): $\frac{\text{Heart weight(g)}}{\text{Dress weight (g)}} * 100\%$

Kidney weight (g): Individual kidney was collected and weighed

Kidney weight (%): $\frac{\text{Kidney weight(g)}}{\text{Dress weight (g)}} * 100\%$

Lungs weight (g): Individual lungs were collected and weighed with sensitive scale

Lungs weight (%): $\frac{\text{Lungs weight(g)}}{\text{Dress weight (g)}} * 100\%$

GIT weight (g): The caecum, large intestine, stomach were collected and weighed

GIT weight (%): $\frac{\text{GIT weight(g)}}{\text{Dress weight (g)}} * 100\%$

Stomach weight (g): Internal part of the stomach was cleaned and weighed.

Stomach weight (%): $\frac{\text{Stomach weight(g)}}{\text{Dress weight (g)}} * 100\%$

### 3.10. Statistical model

The statistical model that will be applied for the variance analysis is

**Yijk=μ+Li+Sj+LSij+eijk**

where μ=overall mean;

- Li=effect of the level of inclusion of LLLM (i=0, 10, 20 and 30%);
- Sj=effect of sex (j=male or female);
- LSij=interaction between the level of LLLM inclusion I and sex j; and
- eijk=effect of the random error.

Tukey test at 5% was used to compare the results that will be obtained with each of the inclusion levels in relation to the diet without inclusion of the LLLM (0% of inclusion).

### 3.11. Stating of hypothesis

$H_0$ : There is no significant difference between the mean of the diets.

$H_A$ : There is significant differences between the mean of the diets.

### 3.12. Statistical analysis

The data on live weight gain, the mean values of data for feed intake for each pair of animals, feed efficiency ratio, and the data on carcasses, costs and returns was analyzed using the general linear model (GLM) procedure in the SAS program (SAS 2006) to test significant effects of diet, sex and their interactions. Contrast comparison was applied (SAS 2006) to test the significant effects of inclusion of the tested diets. The Tukey Honesty Significance Differences was used to rank means of treatments.

CHAPTER FOUR

# 4.0 RESULTS

## 4.1 EFFECT OF LEUCAENA LEUCOCEPHALA LEAF MEAL (LLLM) ON GROWTH PERFORMANCE OF RABBITS.

**Table 6: Growth performance of rabbits fed *Leucaena leucocephala* leaf meal (LLLM).**

**(BETWEEN TREATMENT)**

| | T1 | T2 | T3 | T4 | SEM | SIGNIFICANCE |
|---|---|---|---|---|---|---|
| AVERAGE INITIAL BODY WEIGH | 474.63 | 476.13 | 475.88 | 476.25 | 12.4954 | ns |
| AVERAGE FINAL BODY WEIGHT | $1152.25^{a}$ | $1025.00^{b}$ | $913.00^{c}$ | $868.38^{c}$ | 31.6929 | * |
| AVERAGE BODY WEIGHT GAIN | $677.63^{a}$ | $549.00^{a}$ | $437.75^{ab}$ | $392.13^{b}$ | 31.8388 | * |
| TOTAL FEED INTAKE | 3449.60 | 3250.17 | 3168.34 | 3040.94 | 76.3883 | ns |
| AVERAGE DAILY FEED INTAKE | 70.40 | 66.33 | 64.66 | 62.06 | 0.9029 | ns |
| AVERAGE DAILY BODY WEIGHT GAIN | $13.829^{a}$ | $11.204^{a}$ | $8.911^{ab}$ | $8.003^{b}$ | 0.647 | * |
| FCR | $5.15^{b}$ | $6.079^{b}$ | $7.252^{ab}$ | $7.886^{a}$ | 0.3437 | * |
| FC/G | $122.359^{b}$ | $142.984^{b}$ | $156.467^{ab}$ | $153.015^{a}$ | 5.5700 | * |
| FC | $82.58^{a}$ | $76.43^{b}$ | $68.23^{c}$ | $59.83^{d}$ | 2.2123 | * |

$(P < 0.05)$;

### 4.1.0. Average Initial body weight (g)

The effect of varying levels of LLLM is presented in Table 6 & 7. There was no significant difference ($p > 0.05$) on the average initial body weight of rabbits fed LLLM at different levels.

### 4.1.1. Average Final body weight (g)

The effect of dietary levels of LLLM on the final average body weight of rabbits is presented in Table 6 & 7. There was a significant effect of the dietary treatment ($p < 0.05$) on the final body weight of rabbits during the experimental period. Rabbits on controlled diet T1 (0%) performs better than T2 (10%), T3(20%) and T4(30%). Rabbits fed with T2 (10%) tends to perform better than T3 (20%). There was no significant differences between rabbits fed T3 (20%) and T4 (30%).

From Table 7, growth performance of rabbits fed different level of LLLM was not affected by sex and interaction between sex and diets.

### 4.1.2. Average daily weight gain (g)

Average daily weight gain of rabbits fed LLLM is presented in Table 6 & 7. There was significant ($p < 0.05$) effect of LLLM on the average daily weight gain of rabbits. Rabbits fed with controlled diet T1(0%) was not significantly different from rabbits fed with T2(10%) and T3(20%) but rabbits fed with T1(0%) T2(10%) was significantly different from rabbits fed with T4(30%). The effect of LLLM was not significant on average daily weight gain ($p < 0.05$) within rabbits of different sex and interaction between sex and diet i.e. sex and interaction between sex and diets does not affect the daily weight gained of rabbits.

### 4.1.3. Average daily feed intake (g)

The effect of varying levels of LLLM is presented in Table 6 & 7. There was no significant difference ($p > 0.05$) on the average daily feed intake of rabbits fed LLLM at different levels.

The effect of LLLM was not significant on average daily feed intake ($p > 0.05$) within rabbits of different sex and interaction between sex and diets.

### 4.1.4. Feed conversion ratio (g)

The effect of varying dietary levels of LLLM on feed conversion ratio is presented in Table 6 & 7. There was significant difference ($p < 0.05$) on the feed conversion ratio of rabbits fed LLLM at different levels. Rabbits fed with T4 (30%) was not significantly different from rabbits fed with T3(20%) but T4 tends to perform better than rabbits fed with T1(0%) and T2(10%). Rabbits fed with T1(0%), T2(10%) and T3(20%) were not significantly different from each other. It is also deduced that sex and interaction between sex and diets does not affect the rate at which feed is converted to meat with Leucaena leucocephala leaf meal on the rabbits.

### 4.1.5. Feed cost (₦)

Feed cost of rabbits fed LLLM is presented in Table 6 & 7. There was significant differences ($p < 0.05$) in the feed cost of rabbits fed LLLM across the group at different inclusion levels. feed cost increases from left to the right across the treatments respectively i.e. T1>T2>T3>T4. Also, sex and interaction between sex and diets does not affect the feed costs of rabbits fed with diets containing varying level of *Leucaena leucocephala.*

### 4.1.6. Feed cost per gained weight.

The effect of varying levels of LLLM is presented in Table 6 & 7. There was significant difference ($p < 0.05$) on feed cost per body weight gained of rabbits fed LLLM at different levels. There was no significan different between T3(20%) and T4(30%) but T4(30%) tends to perform better than T1(0%) and T2(10%) Feed cost per gained weight of rabbits fed with T1(0%), T2(10%), T3(20%) were not significantly differen from each other. Furthermore, feed cost per gained weight of rabbits fed with the diets containing varying level of Leucaena leucocephala leaf meal were affected by sex but not affected by interaction between sex and diets.

## 4.2.0. EFFECT OF LEUCAENA LEUCOCEPHALA LEAF MEAL (LLLM) ON THE CARCASS EVALUATION OF RABBITS.

The results for the carcass evaluation of rabbits fed Leucaena leucocephala leaf meal (LLLM) is presented in Table 8 below:

**Table 8: Carcass Evaluation of Rabbits fed Leucaena leucocephala Leaf Meal (LLLM)**

**Dietary Treatments**

| parameter | T1 | T2 | T3 | T4 | SEM | SIGNIFICANCE |
|---|---|---|---|---|---|---|
| Live weight | 1127.50[a] | 1056.50[ab] | 942.30[a] | 919.50[b] | 43.826 | * |
| DRESSED WEIGHT | 630.52.00[a] | 548.29[ab] | 464.27[b] | 434.47[b] | 24.809 | * |
| DRESS % | 55.92[a] | 51.90[a] | 49.47[ab] | 48.25[b] | 1.138 | * |
| BLED WT | 989.00[a] | 942.50[ab] | 809.00[b] | 799.33[b] | 43.935 | * |
| BLED% | 87.71[a] | 89.20[a] | 85.85[b] | 86.93[a] | 0.559 | * |
| SLAUG WT | 928 | 855 | 756.0 | 759.3 | 31.814 | ns |
| SLAGT % | 82.31[a] | 80.93[a] | 80.25[b] | 82.58[a] | 1.326 | * |
| HEAD WT | 95.500[a] | 93.500[a] | 87.000[ab] | 72.667[b] | 3.578 | * |
| HEAD % | 15.067[ab] | 17.053[ab] | 18.739[a] | 16.73[b] | 0.733 | * |
| LOIN WT | 140[a] | 143[a] | 97.33[b] | 88.33[c] | 7.638 | * |
| LOIN % | 22.094[a] | 25.901[a] | 20.982[b] | 20.33[c] | 0.950 | * |
| F- LIMB | 74.500[a] | 60.000[ab] | 53.333[b] | 51.333[b] | 2.898 | * |
| F-L % | 11.7505 | 10.9357 | 11.4866 | 11.814 | 0.205 | ns |
| H-LIMB | 177.00[a] | 157.00[ab] | 128.33[b] | 117.00[c] | 6.912 | * |

| | | | | | | |
|---|---|---|---|---|---|---|
| H-L% | 27.904 | 28.653 | 27.651 | 26.929 | 0.368 | ns |
| NECK WT | 21.000[a] | 16.667[b] | 12.500[c] | 10.000[c] | 1.116 | * |
| NECK % | 3.3165[b] | 2.2679[c] | 4.3134[a] | 2.33[c] | 0.245 | * |
| KIDNEY WT | 8.5000[a] | 7.5000[a] | 5.3333[b] | 5.3333[b] | 0.476 | * |
| KID % | 1.34267[a] | 1.36697[a] | 1.14943[c] | 1.2267[b] | 0.050 | * |
| LIVER WT | 33.500[ab] | 37.500[a] | 20.333[c] | 25.667[b] | 2.436 | * |
| LIVER % | 5.2933[b] | 6.8503[a] | 4.3851[b] | 5.9076[a] | 0.351 | * |
| HEART WT | 3[a] | 2[b] | 3[a] | 2[a] | 0.167 | * |
| HEART % | 0.47336[b] | 0.36659[c] | 0.64884[a] | 0.4603[b] | 0.040 | * |
| LUNG WT | 8.000 | 8.000 | 5.333 | 4.667 | 0.490 | ns |
| LUNG % | 1.2623 | 1.4353 | 1.1575 | 1.074 | 0.073 | ns |
| FUL STO | 85 | 66.5 | 74 | 65.3 | 3.704 | ns |
| STOM % | 13.394 | 12.073 | 15.915 | 15.0298 | 0.715 | ns |
| GIT WT | 277.5[a] | 256.5[a] | 235.0[b] | 238.0[b] | 11.384 | * |
| GIT % | 24.246[b] | 29.94[a] | 31.08[a] | 31.345[a] | 0.938 | * |

(P< 0.05) levels of significant.
NS: Not significant.

#### 4.2.1. Dressing percentage (%)

The effect of dietary levels of LLLM on dressing % is presented in Table 8. There was a significant ($p > 0.05$) effect of LLLM on the dressed % of rabbits across treatments. There was no significant difference between T1, T2 and T3 but T1 and T2 were significantly different from T4.

#### 4.2.2. Bled %

The effect of dietary levels of LLLM on Bled % is presented in Table 8. There was a significant ($p<0.05$) effect of LLLM on the bled % of rabbits across treatments. There was no significant difference between T1, T2 and T4 but T3 was significantly different from other treatments.

#### 4.2.3. Slaughter %

The effect of dietary levels of LLLM on slaughter % is presented in Table 8. There was a significant ($p<0.05$) effect of LLLM on the slaughtered weight % of rabbits. There was no significant difference between T1, T2 and T4; T3 is significantly different from the other treatments.

#### 4.2.4. Head %

The effect of dietary levels of LLLM on head % is presented in Table 8. There was a significant ($p<0.05$) effect of LLLM on the head % of rabbits across treatments. There was no significant difference between T1, T2 and T3 but there was significant difference between T4 and T3 only.

#### 4.2.5. Loin %

The effect of dietary levels of LLLM on the loin % is presented in Table 8. The effect of LLLM on loin% was significant ($p < 0.05$) from each other. Loin % of T1 and T2 is performs better than T3 and T4.

#### 4.2.6. Fore-limb %

The effect of dietary levels of LLLM on the fore-limb % is presented in the table 8. There was no significant difference ($p > 0.05$) in the fore-limb of rabbits fed with LLLM.

#### 4.2.7. Hind limb %

The effect of dietary levels of LLLM on the hind-limb % is presented in the table 8.

Rabbits fed varying level of LLLM were not significantly different ($p > 0.05$) from each other in hind-limb.

#### 4.2.8. Neck weight %

The effect of dietary levels of LLLM on the % neck weight is presented in the table 8.

There was significant difference ($p < 0.05$) in the % neck weight across the treatments except in T3 and T4 which were not significantly different from each other.

#### 4.2.9 Kidney %

The effect of dietary levels of LLLM on the % kidney is presented in the table 8. The effect of LLLM on % kidney weight was significantly ($p < 0.05$) different from each other. Rabbits fed with T1 and T2 were not significantly different from each other, T1 and T3 are not significantly different but T1 has higher % kidney weight than T4 and T2 has higher %kidney weight than T3 and T4.

### 4.3.0. % liver weight

The effect of dietary levels of LLLM on the hind-limb % is presented in the table 8. The effect of LLLM on % liver weight was significantly ($p<0.05$) different from each other. Rabbits fed with T2 and T4 tends to perform better than those fed with T1 and T3.

### 4.3.1. % heart weight

The effect of dietary levels of LLLM on the % heart weight is presented in the table 8. The effect of LLLM on % heart weight was significantly ($p<0.05$) different from each other. There was no significant different between rabbits fed T1 and T4 but both are significantly different from T2 and T3 as T3 has the highest weight while T2 has the least weight.

### 4.3.2. % lungs weight

The effect of dietary levels of LLLM on the % lung weight is presented in the table 8. The effect of LLLM on % lung weight was not significantly ($p> 0.05$) different from each other.

### 4.3.3 % full stomach weight

The effect of dietary levels of LLLM on the % full stomach weight is presented in the table 8. The effect of LLLM on % full stomach weight was not significantly ($p>0.05$) different from each other.

### 4.3.4. % GIT weight

The effect of dietary levels of LLLM on the % GIT weight is presented in the table 8. The effect of LLLM on % GIT weight was significantly ($p<0.05$) different from each other. Rabbits fed with diet T1 are significantly different from rabbits fed T2, T3 and T4.

## CHAPTER FIVE

## 5.0 DISCUSSION

The results of this experiment are shown in Table 6, 7 and 8. From Table 6, there were no significant differences in all the growth parameters such as average weight gained, feed conversion ratio, feed cost per body weight gained of rabbits fed 0%, 10%, 20% LLLM except in feed intake which is only significant at 10% LLLM. This shows that the growth performance of rabbits fed varying level of LLLM up to 30% inclusion level is not influenced by sex.

The result of the growth study is shown in Table 7.0. Significant difference ($p<0.05$) were noticed in final average body weight and average daily weight gain across treatments. Growth performance was highest in T1 (control diet), but rabbits in treatment T4 (30%inclusion) had the least performance on all parameters. This could be as a result of increasing level of fibre (16.67, 19.25, 24.75, 27.84) from T1-T4 across the treatment in which is a type of carbohydrate that cannot be digested thereby coming out of the body as undigested waste materials.

It can also be deduced from Table 7 that sex does not affect the final body weight of the rabbits fed with LLLM.

Average daily feed intake decrease numerically as 70.40g, 66.33g, 64.66g and 62.06g from T1 to T4 respectively. The numerical decrease in average daily intake could be as a result of the slight differences in energy, crude protein, Ether extract (EE) and fibre intake which increased across the treatment. This has shown that feed intake and weight gain in animal are influenced by Energy, crude protein (CP), and crude fibre (CF) contents of the diet (Makkar and Becker, 1997). The decrease in average daily intake could also be traced to the acceptability of LLLM due to its bitter taste and offensive odor. Statistically there was no significant difference across the treatment which means that differ value of feed intake does not affect the performance of rabbits. This result is in conflict with Adedeji *et al.* (2013) who stated that Leucaena leucocephala leaf meal had adverse effects on the feed intake, body weight gain and growth performance when it is included in the ratio beyond 10% level of rabbit diet.

It can also be deduced from Table 7 that sex does not affect the daily feed intake of the rabbits fed with LLLM.

Daily weight gain was observed to be highest in rabbits on T1 (controlled diet) diet with a daily weight gain of 13.829g compared with 11.204g, 8.991g and 8.003g for T2(10% LLLM), T3 (20% LLLM) and T4 (30% LLLM) respectively. Statistically there was significant differences in the diets across the group with T1 (controlled diet) having the best performance which is significantly not different from T2 and T3(10% and 20% inclusion level of LLLM). The decreasing manner of daily weight gained of the rabbits could be traced to the numerical decrease in feeds intake. This result is in line with Makinde, (2016) who stated that body weight gain and feed conversion ratio were significantly ($P<0.05$) better in rabbits fed on 10% leucaena leaf and 10% Siratro inclusion than those fed on the 20% white lead tree and 20% Siratro inclusion levels. Similar results have also been reported by Adedeji *et al.* (2013).

It can also be deduced from Table 7 that sex does not affect the daily weight gained of the rabbits fed with LLLM.

There was significant difference in FCR across the group but increases numerically with T1, T2, T3, T4 as 5.15, 6.079, 7.252 and 7.886 respectively. The results in table 6 and 7 also show that rabbits are not affected with below 20% inclusion level of LLLM. This is in line with Manika *et al.* (2016) that Leucaena leucocephala leaf meal may be used as an alternative source of protein in the diet of rabbit at 10% inclusion level as there was no adverse effect (toxicity) on feed consumption and feed conversion ratio.

It can also be deduced from Table 7 that sex does not affect the feed conversion ratio of the rabbits fed with LLLM.

Although there was no significant difference (p> 0.05) in feed cost among the treatments, the feed cost per kg gain showed significant ($p < 0.05$) differences among treatments The costs of these three concentrate mixture were ₦82.58, ₦76.43, ₦68.23 and ₦59.83 for diet T1, T2, T3 and T4, respectively. The feed cost of producing 1 kg live weight are ₦122.35, ₦142.984, ₦156.467, ₦153.015 for diet T1, T2, T3 and T4, respectively. This is more feasible than Manika *et al.* (2016) that adding 10% level of Leucaena leucocephala leaf meal of the diet improve the economic rabbit meat production. Based on this research, it will be more economical and better to use Leucaena leucocephala up to 30% inclusion level into the diet for better body weight and daily weight gain of rabbit.

It can also be deduced from Table 7 that sex does not affect the cost/kg feed of the rabbits fed with LLLM but the cost/kg weight gained was affected. The cost/kg weight gain affected could be as a result of the numerical differences in the body weight gained of male and female rabbits.

From Table 8.0 it was observed that rabbits fed 0%, 10%, 30% LLLM had higher dressing weight than rabbits on 20% dietary treatments. This was also similar to Bled weight but slightly different from bled% at 30%LLLM. This was against Dressing% whereby rabbits fed 30%LLLM had better carcasses than the controlled diet, 10% and 20%LLLM respectively. This result also show that carcasses performance decreases with increasing % of LLLM as rabbits assimilated the LLLM diet in diet T1 better than rabbits on the other treatment diets except at T4 and deposited more proteins as flesh or muscle tissues than the rabbit on 10% and 20% LLLM diets. This result was similar to Makinde (2016) who concluded that that inclusion of 10% white lead tree or 10% Siratro leaves in rabbits' diet had no adverse effects on the performance and carcass yield of growing rabbits. Increased carcass yield at T4 could be as a result of the lower gut filled which adversely affected the live-weight.

Most carcass characteristics evaluated were significantly different in all treatments except %fore-limb weight, %hind-limb weight, %lungs weight, weight and % full stomach weight which were not significantly different ($p < 0.05$) between the treatments. The instability or oscillatory condition of the internal organs across the treatment (i.e % weight in the lungs has 1.2623, 1.4353, 1.1575 and 1.3319 for T1, T2 T3 and T4 respectively) could be traced to the interaction between the increasing physiological metabolism of Anti-nutritional factor in Leucaena leucocephala leaf meal and the decreasing physiological metabolism of Anti-nutritional factor in soybean. This result is in line with Ahamefule *et al.* (2006) who indicated that increased metabolic rate of the organs in attempts to reduce these toxic elements or anti-nutritional factors to non-toxic metabolites could result to these abnormalities that arises in the weights of liver and kidney. The treatment of the LLLM (using soaking and drying method) and SBM (by roasting) has reduced the mortality effects of the feeds on rabbits. This was further collaborated by Jubb *et al. (*1995) who stated that the increase in weight of the liver is as a result of the detoxification and excretion of toxic substances in the liver.

# CHAPTER SIX

## 6.1 CONCLUSION

The results of this experiment have shown that Leucaena leucocephala leaf meal (LLLM) can be incorporated up to 20% level in the diets of growing rabbits since it met both the growth performance and quality carcass performance.

And more economical at 30% without any deleterious effects provided that the soaking and drying technique of removing ANF is adopted. The greatest advantage of this plant to other non-conventional feed stuffs is its affordability since it is widely distributed in the tropical and adaptable to a wide range of climatic change.

## 6.2 RECOMMENDATION

Research to support improved production techniques of the leucaena leucocephala plant, improved harvesting and processing tools or machine is however needed to enable farmers produce the meal at lower cost for economic use in animal feeding.

Research should be done on combination of various non-conventional feedstuffs in the formulating feeds for micro-livestock production for more economic improvement in diets.

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