**A**

**RESEARCH PROJECT**

**ON THE TOPIC:**

**NUTRITIVE EVALUATION OF RUMEN CONTENT OF BUCKS FED LEGUMES AND CONCENTRATES**

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**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of the Study**

Nigeria hosts an estimated 19.5 million cattle, 41.3 million sheep and 72.5 million goats (National Agricultural Sample Survey, 2011). From this estimate, goats represent about 54.4% of total ruminant livestock. The indigenous goat breeds in order of importance are Red Sokoto (50 %), West African Dwarf (45 %) and Sahel (5 %) (Ajala *et al.*, 2008). Goats contribute about 24% of meat supply in Nigeria (Oni, 2002). Goats, like other herbivores in the tropics and sub-tropics, experience marked seasonal fluctuations in feed supply which results in a seasonal pattern of wet season live weight gains and dry season live weight losses until animals reach marketable weight. This is due to the scarcity of good quality feed during the dry season. Feed intake is one of the important factors that influence animals’ lifetime productivity, health and carcass characteristics (Bawa *et al.*, 2003). The increased demand and high cost of conventional animal feed ingredients like soybean or ground nut cake makes it necessary to search for alternative indigenous feed resources which are readily available and cheaper than the conventional feed ingredients (Sodeinde *et al.*, 2007). The search for alternative feed resources has over the past decades rekindled research interest in the use of tropical browses, herbs and medicinal plants as nutrient sources for ruminants (Okoli *et al.*, 2002). *Leucaena leucocephala* is a small fast-growing mimosoid tree native to southern Mexico and northern Central America and is now naturalized throughout the tropics including parts of Asia and Africa (Subabul, 2019). Common names include jumbay, pearl wattle, white leadtree, river tamarind, ipil-ipil, tan-tan and white popinac. *Leucaena leucocephala* is used for a variety of purposes, such as fencing, soil fertility, firewood, a fiber, and livestock fodder. The legume provides an excellent source of high-protein cattle fodder (Subabul, 2019). However, the fodder contains mimosine, a toxic amino acid (Hammond, 1995). In many cases this acid is metabolized by ruminants to goitrogenic DHP [3-hydroxy-4(1H) pyridone] in the rumen, but in some geographical areas, ruminants lack the organisms (such as Synergistes jonesii) that can degrade DHP. In such cases, toxicity problems from ingestion of *Leucaena* have sometimes been overcome by infusing susceptible animals with rumen fluid from ruminants that possess such organisms (Graham *et al.,* 2013). *Jatropha tanjorensis* is a perennial herb that belongs to the family *Euphorbiaceae* whose common name includes: catholic vegetables, *Jatropha*, ‘*Hospital too fa*r’, *lapalapa* and *Iyana ipaja* in Yoruba language (Uroko *et al.,* 2015). The leaves are employed traditionally in the treatment of anaemia, diabetes and cardiovascular diseases. It is a traditionally used medicinal plant in South-Eastern Nigeria with many claims from local consumers that it possesses blood replenishing properties (Oyewole *et al.,* 2012). It has been reported that Jatropha leaves are rich in beta blockers, anti-cancer agents, anti-anaemic, anti-microbial activities, anti-plasmodial and anti-oxidant effects against oxidative stress induced by malaria parasite (Omoregie *et al*., 2011). Although, studies have been carried out on *J. tanjorensis,* none of such researches have addressed the antioxidant potentials of lyophilized aqueous extract of *Jatropha tanjorensis* leaves. Most local consumers consume the aqueous extract of *J. tanjorensis* for its health benefits while researchers have provided scientific data from either methanol or ethanol extracts to support or counter claims from local consumers (Uroko *et al.,* 2015). A number of studies have shown that the plant extracts having antioxidant activities protect against induced oxidative stress and hepatotoxicity by inhibiting lipid peroxidation and enhancing antioxidant enzymes activities (Oyewole *et al.,* 2012). Alfalfa (*Medicago sativa* L.) represent an excellent alternative for the production of ruminant animals since they have a greater nutritional value, are diffused worldwide and have a satisfactory cost-benefit relation. Their chemical properties are higher crude protein and lower effective fiber, which promotes a reduction in the use of concentrated protein for ruminant feed, consequently reducing production costs. Increased digestion and passage rates, common characteristics in legumes, determine a lower rumen filling with a direct impact on the increase in consumption due to the less space occupied by the fiber fraction (Agudelo, 2007). Digestion rates of structural carbohydrates are often faster for feed based on legume than grasses. The higher rate of passage may, however, decrease the digestibility of some nutrients (Vieira *et al.,* 2008; Cannon *et al.,* 2010) and therefore affect performance. Differences between feeds, especially a physical dissimilarity regarding fibrous contents, determine alterations in feeding behavior, with a lower total intake time and an animal resting for longer as the amount of fiber decreases. Teferedegne (2010), pointed to the role being played by ruminants in the livelihood of farmers in the developing world, including milk, meat, animal traction and manure for improved crop production. He further reported that local trees (legumes) have been investigated as potential supplements for ruminants because of their beneficial effect of increasing metabolizable energy, N intake and feed efficiency and thereby improving animal production. He reported that foliage of some tree plants, however, has been shown to be selectively toxic to rumen protozoa with chemical compound acting as anti –protozoa or natural defaunating agent. Khanal and Subba (2011) also evaluated nutritional composition of some fodder trees with result further revealing that they could be relevant to animal nutrition. Rumen Residuals also called Rumen Contents which contains undigested feed which are fairly rich in crude protein and other micro-flora such as fungi, protozoa and bacteria (microbial protein) (Esonu *et al*., 2006; Dairo *et al*., 2005). Microbial protein is a major source of amino acids; the amino acids composition of microbial true protein is similar to that of protein in the main animal products, such as milk, chevon and beef. Microbial protein contains a higher proportion of methionine and lysine. Rumen contents is an important source of vitamins specially vitamins B complex, and other nutritional groups specially carbohydrates to the animals and any alterations in it balance consequently affect the Animals performance (Esonu *et al*., 2006). Hence, this work aims at evaluating the nutritive value rumen content of male goats fed these legumes and concentrates.

**1.2 Problem Statement**

The production of goats in Nigeria is a growing enterprise among smallholder livestock farmers, widely adopted in the rural, urban and semi urban areas, kept in small numbers and managed on whatever feed resources are available at village level. These animals are exposed to numerous constraints, characterized by poor housing and poor nutrition, high incidence of diseases, poor breeding methods, among others (Sanusi *et al.,* 2010). The direct competition with man and industries for feed resources as well as the inadequacy of year round feed availability, mainly because of the seasonal fluctuation leading to wide fluctuations in the quantity and quality of forage available to animals has being a major limiting factor in sheep production (Bamigboye *et al.,* 2013). Moreover, over the years, attempts have been made to alleviate the problem of feed shortage in ruminant production systems through the use of crop residues as alternative and strategic cheap source of feed for ruminants. Studies have shown that feed intake contributes to animal’s productivity but milk yield and growth of ruminant animals are largely affected by the quality of forage (Bamigboye *et al.,* 2013). Many of these browse species that may be relished by ruminants require further evaluation to determine their nutritive values for livestock. Furthermore, the utilization of most of these crop residues is often limited by low nutrient levels and low digestibility, there is the need for the introduction of low-cost supplementary legumes in the diets of ruminants to stimulate rumen microbes to obtain maximal rate of digestion of carbohydrate diet as well as high microbial protein synthesis and nutritive value.

**1.3 Justification of the Study**

The majority of ruminant production systems in Nigerial uses grass-based feed. However, grasses, mainly tropical grasses, even though they have higher growth rates, generally have a restricted nutritional value especially regarding the amount and availability of protein. On the other hand, legumes such as alfalfa (*Medicago sativa* L.), *Leucena lucocephela* and *Jatropha tanjorensi* represent an excellent alternative for the production of ruminant animals since they have a greater nutritional value, are diffused worldwide and have a satisfactory cost-benefit relation. Some of the existing physical differences between these feedstuffs are higher density of particles, higher rate of digestion and lower particle size for legumes. Their chemical properties are higher crude protein and lower effective fiber, which promotes a reduction in the use of concentrated protein for ruminant feeding, consequently reducing production costs. Increased digestion and passage rates which determines a lower rumen filling with a direct impact on the increase in consumption due to the less space occupied by the fiber fraction. Digestion rates of structural carbohydrates are often faster for feed based on legume than grasses. The higher rate of passage may, however, decrease the digestibility of some nutrients in the rumen and therefore affect performance. The rumen holds the most nutritive value which is to be ingested by the animals and any alteration could lead to reduced performance of the rumen and it microbes, hence this work seeks to evaluate the nutritive content of the rumen fed with abovementioned legumes for increased ruminant production.

**1.4 Objectives of the Study**

The objective of this study will be to;

* evaluate the nutritive value of rumen contents from bucks (male goats) fed the legumes; Jumbay (*Leucena lucocephela),* Nettlepurge *(Jatropha tanjorensi)* and Alfafa (*Medicago sativa).*

**CHAPTER THREE**

**MATERIALS AND METHODS**

**3.1 Experimental Site**

The experiment will be conducted at the Goatry Research unit of the Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus, Oruk Anam Local Government Area, Akwa Ibom State. The area lies between latitude 4030’N and 50 00’N and longitudes 700 30’E and 800 00’E. The climate of the experimental site is a tropical rain forest characterized with high temperature (average of 300C), high rainfall (about 1500mm) and relative humidity of 70% on average.

**3.2 Animal Management**

Four (4) West African Dwarf buts goats of average initial weight be used for the study which will be purchased from local producers around the vicinity. The animals will be subjected to prophylactic treatment against internal and external parasites on arrival. All animals will receive 0.1ml/10Kg body weight of ivermectin (10ml) injection and 0.1mg/Kg body weight of Tetranor (Oxytetracycline Dehydrate, 20% weight/volume injectable solution). Albendazole 10% solutions will be administered in drinking water for the control of intestinal parasites. Amitics solutions will be spread on the animals using bottle sprayer against external parasites prior to the commencement of the study. The animals will be allowed 14 days to adjust to the feed and confinement before the commencement of the experiment.

**3.3 Experimental Diet and Design**

The study will be laid in a Complete Randomize Design (CRD) using four buck goats will be randomly allotted to 4 treatment diets containing the concentrate, Jumbay (*Leucena lucocephela),* Nettlepurge *(Jatropha tanjorensi)* and Alfafa (*Medicago sativa)* respectively which will be fed to the animals for 3 months. The supplemented concentrate will consist of other ingredients such as rice bran, palm kernel cake, bone meal, brewers spent grain, cassava peel meal and salt which will be fed to the control animal without any basal diet in a for the experimental period. Each buck will serve as a treatment. Water will be provided ad*-libitum.* Each buck will receive the treatment diet in the morning and the evening respectively. All animals will be weighed at the beginning and at the end of the experiment.

**3.4 Collection of Forages**

The legumes (Jumbay (*Leucena lucocephela),* Nettlepurge *(Jatropha tanjorensi)* and Alfafa (*Medicago sativa*) browse trees and shrubs will be collected around Obio Akpa, Oruk Anam Local Government Area.

**3.5 Sample Collection**

Samples of the Buck Rumen Contents will be collected from 1 each of the 4 goats to be slaughtered after the experimental phase. They will be collected from the slaughtered animals and sundried for 3 days. The sundried materials will be milled and then analyzed.

**3.6 Proximate Analysis**

Dry matter (DM), Crude Protein (CP), Ether Extract (EE) and Ash, will be determined according to the method described by AOAC (1980). The Nitrogen Free Extract (NFE) will be calculated as follow: NFE% = {DM – (EE% + CP% + CF% + ASH %)}.

***3.6.1 Metabolizable Energy***

Metabolizable energy (ME) values of the dried rumen contents from the bucks will be calculated according to the following equation:

ME for Ruminants (MJ/Kg) = 0.12 CP + 0.31 EE + 0.05 CF + 0.14 NFE (MAFF, 1975).

ME for Poultry (MJ/Kg) = 1.549 + 0.0102 CP + 0.0275 EE + 0.0148 NFE – 0.0034 CF (Lodhi *et al*., 1976).

***3.6.2 Mineral Determination***

Mineral of samples will be extracted according to the method described by Pearson (1981). Each sample will be burnt in muffle furnace at 550°C. Then addition 10ml of NHCL, then the solution will be carefully filtered in a 100ml volumetric flask and finally distilled water will be added to make up to the mark. Potassium (K) and Sodium (Na) will be determined by AOAC (1980) using flame photometer. Calcium (Ca) and Magnesium (Mg) levels will be carried out according to Chapman and Pratt (1982) by titration method. Phosphorus (P) level will be carried out according to the method described by Champ and Pratt (1968) by atomic absorption spectrophotometer.

***3.6.3 Digestibility***

*In-Vitro* dry matter digestibility will be determined according to Tilley and Terry (1963), by incubating in a thermostatically controlled circulating water bath by tow stage digestibility.

*In vitro* dry matter digestibility (IVDMD) % = {Sample (DM) weight – residues (DM) weight**/** Sample (DM) weight} × 100

Digestible CP, Digestible CF, Digestible NFE and Digestible EE will be calculated as follow:

Digestible Nutrient = (Nutrient Percentage × Nutrient Digestibility).

Total Digestible Nutrient (TDN) will be determined by a calculation follow:

TDN= [Digestible CP + Digestible CF + Digestible NFE + (Digestible EE×2.25)].

***3.6.4 Fiber Composition***

Analysis of crude fiber (CF) of rumen contents will be carried out according to AOAC (1980). Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) and Acid Detergent Lignin (ADL) will be determined according to Goering and Van Soest (1970). Cellulose and Hemi cellulose will be calculated as follow:

[Cellulose = NDF – ADF]. [Hemi cellulose = ADF –ADL].

**Table 3.1: Feed formulation table**

|  |  |  |  |
| --- | --- | --- | --- |
| **T1** | **T2** | **T3** | **T4** |
| **Panicum**  **80** | **Panicum**  40 | **Panicum**  **40** | **Panicum**  **40** |
| **Concentrate**  **20** | **Gliricidia**  **40** | **Moringa oliefera**  **40** | **Jathropha**  **40** |
|  | **Concentrate**  **20** | **Concentrate**  **20** | **Concentrate**  **20** |

This is a formulation that has control 80 panicum grass and conc. 20. T1 (Pm80 + 2x)

T2 Panicum 40, Gli.40, C20 T2(Pm 40 + Gliri.40 + C20)

T3 Panicum 40, Mo 40, C 20 T3 (Pm 40 + Mo 40 + C 20)

T4 panicum 40, J40, conc. 20 T4 (Pm 40 + J40 + C20)

**Expected Results**

This research work is expected to show significantly S differences in each of the treatment with respect to their nutrient composition. Therefore, experimental bucks under each treatment will also shows differences in their proximate composition, digestibility and fiber composition depending on the diet in their respective treatment and replicates. The significant differences in T1, T2 will be observed and recorded in their mineral composition and feed conversion with comparison to the control. The body weight of the animal compared to the control is expected to be higher than the that of the control

According to the current finding total dry matter intake based up on percent body weight (%BW) and dry matter intake based on metabolic body weight (g/kgW0.75) will be expected to indicate significance difference in the treatments groups.

**3.7 Data Analysis**

All the data obtain will be expressed as mean ± standard error and analyzed using One Way Analysis of Variance (ANOVA). Significant means will be separated by applying Duncan multiple range as outlined by Duncan (1955).

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