UTILIZATION OF BITTER LEAF (*Vernonia amygdalina*) MEAL AS FEED FOR WEST AFRICAN DWARF (WAD) GOATS

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This is to certify that this research project titled "Utilization of bitter leaf (*Vernonia amygdalina*) meal as feed for West African Dwarf (WAD) Goats" was carried out by Mr. Olosunde Abiodun Oluwasesan under my supervision in accordance with the partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy (Ph.D.) in Animal Science, Obafemi Awolowo University, Ile-Ife, Nigeria.

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DEDICATION

I dedicate this project to the God Almighty who has always been my helper and provider and to my family.

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ABSTRACT

This study investigated the nutritive value of bitter leaf meal, optimum level of offer of bitter leaf (*Vernonia amygdalina*) meal (BLM) to West African Dwarf (WAD) goats, the haematological characteristics, blood chemistry and carcass characteristics of WAD goats fed graded levels of bitter leaf meal. This was with a view to assess the nutritive value of bitter leaf meal as a feedstuff for West African Dwarf goats.

In a 20-week trial, twenty four West African Dwarf (WAD) goats of both sexes, 5-7 months old, were randomly allotted to four treatments of graded levels of BLM (0% BLM (Control diet/CD), 15% BLM, 30% BLM and 45% BLM diets) in a completely randomized design to determine the utilization of bitter leaf meal as feed for West African Dwarf goats. The diets served as supplements to a basal ration of guinea grass (*Panicum maximum*). Growth and digestibility trials lasted for 20 weeks. Two digestibility trials were carried out. Feed and faeces collected were subjected to chemical analysis to determine proximate components. Data obtained were statistically analyzed with the General Linear Model and significant means were separated using the Duncan's Multiple Range Test.

Processing methods had significant ($P<0.05$) effect on the proximate, antinutritional and mineral composition of the bitter leaf meal. Comparison of the chemical composition of bitter leaf meal (BLM) and *Panicum maximum* (PM) revealed higher dry matter, crude protein, ether extract and ash content in bitter leaf meal. However, PM had higher crude fibre, nitrogen free extract and organic matter content. The mean daily dry matter intake (DMI g/day) was not significant but higher ($P>0.05$, F_{cal} (0.55) < F_{tab} (3.10)) in goats fed 30% BLM than goats on 45% BLM, CD and 15% BLM. The apparent digestibility coefficient of the crude protein, crude fibre, ether extract, nitrogen free extract and ash were significantly ($P<0.05$) affected by the

inclusion levels of bitter leaf meal. The digestible ether extract intake and digestible organic matter of goats fed CD were significantly ($P<0.05$, F_{cal} (20.14) > F_{tab} (3.10)), ($P<0.05$, F_{cal} (7.88) > F_{tab} (3.10)) higher than the values obtained for goats fed 45% BLM, 15% BLM and 30% BLM diets. The average daily weight gain (g/day) for goats on CD was significantly ($P<0.05$, F_{cal} (8.61) > F_{tab} (3.41)) higher than that of others. The analysis of blood components, red blood cell (RBC), white blood cell (WBC) and packed cell volume (PCV) counts showed that there were no significant differences ($P>0.05$) in each of these parameters among the goats fed experimental diets. The result of the serum glucose of goats fed 30% BLM and 45% BLM was significantly ($P<0.05$, F_{cal} (3.84) > F_{tab} (2.92)) lower than that of CD. There were no significant differences ($P>0.05$) in the parameters used in determining the carcass characteristics except in the lung %. The lung weight (%) of animals fed CD diet was significantly ($P<0.05$, F_{cal} (8.69) > F_{tab} (6.59)) higher than that of 15% BLM and 30% BLM.

It was concluded that bitter leaf meal could be included in the diets of WAD goats up to 15% without any deleterious effect.

CHAPTER ONE
INTRODUCTION

One of the major problems confronting the small ruminant production is the non availability of feed all year round to meet the maintenance and productive requirements of the animals. Solomon *et al.*, (2007) reported that the major problems confronting the development and expansion of livestock industries in developing countries are the reduced supply, high demand, and prohibitive cost of feeds and feed stuffs especially protein source. Although, grasses abound in the tropics, seasonal changes which affect their palatability and nutritive value had been a major problem in ruminant animal production (Alokan, 1998). This seems to be a great concern to researchers (Huston *et al*., 1993) in the tropics because the availability of good quality grasses during the dry season is difficult (Onwuka, 1986). Babayemi (2007) stated that in the tropics, ruminants are raised mainly on grasses, which are poor in nutrients and digestibility coupled with scarcity during the dry season (Odeyinka, 2014).

Poor productivity and high mortality of stock, which characterize this industry is largely explained by the inadequacy of feeding the right quantity and quality of feeds to the various livestock species (Odeyinka *et al*., 2003; Ayandiran *et al*., 2013). Rearing of small ruminant animals in urban areas further compounded the problems and makes the use of concentrate diets more reasonable where lots of agro industrial by products and agricultural residues are generated. In Nigeria, utilization of crop residues, agro-industrial by-products and non-conventional feed resources are still at infancy process because of great competition between human and livestock for the resources, and these have greatly reduced the animal protein intake (Odeyinka *et al*., 2003). The unprecedented increase in the cost of conventional ingredients (e.g. maize) used in compounding livestock feeds has necessitated intensive investigations into the use of agricultural and agro-industrial

by-products, leguminous fodder trees and shrubs which are regarded as non-conventional feed sources (Hamzat and Babatunde, 2001; Mousa, 2011). Asaolu and Odeyinka (2006) suggested that the nutritive value of these feedstuffs should be computed for use in local feed ration formulation since their cost is low enough for local farmers to afford.

Ruminants play an important role in the livelihood of farmers in the developing world, it provides sustenance as milk and meat, animal traction, manure for crop production and energy, cash income from sales of their products and readily available asset to face risks and misfortune in harsh environments (Ørskov and Vigilizzo, 1994). Ruminants have been shown to be able to make contributions to waste management both as consumers and producers. The goat's digestive tract allows it to process many products which would otherwise be considered wastes, and turn those materials into high quality food and/or fiber. The utilization of crop residues and processing by-products is an accepted practice and has been well documented in the literature (Sempeho, 1987; Abdelhamid and El-Ayoty, 1988; Gasa *et al.*, 1989; Serrano, 1989; Smith, 1989; Guessous *et al.*, 1991; Snyman, 1991).

The feeding of selected waste materials to goat has the potential of reducing the burden placed on landfills while converting the waste materials into added value products such as meat, milk, fiber and manure. The use of maize dietary fibre source in most parts of animal producing areas of Nigeria has pushed up its price, thereby necessitating a search for a cheaper and locally available alternative such as leaf from trees and shrubs. This challenge has become more imperative since the developed countries are now diverting their abundant grain reserves, hitherto used for feeding livestock to the production of biofuels to propel their huge industrial sector (Chauynarong *et al.*, 2009). The rising trend in tree planting can be mutually beneficial to both small ruminants and

the environment at large. Leaf of the trees can be used to feed goats and sheep as protein supplements all year round while the wastes accruing from the animals can as well be used as organic manure for the trees. Tropical trees are highly nutritive and rich sources of protein and minerals (Teferedegne, 2000; Babayemi *et al*., 2004). Many leguminous fodder trees and shrubs have high protein levels and are potentially promising supplements to overcome nutrient deficiencies provided anti-nutritional factors as tannins and other secondary compounds can be controlled (Mousa, 2011).

Bitter leaf (*Vernonia amygdalina*) is a drought tolerant shrub with petiole leaf of about 6mm diameter. It has a characteristic odour and bitter taste and grows under a range of ecological zones in Africa with large mass of forage for both human and animal nutrition (Bonsi *et al.*, 1995). The leaves are used for human consumption, suggesting that the excess may be utilized as feed (Daodu and Babayemi, 2009). Ekeocha (2011) reported that on average the chemical composition of bitter leaf appeared to be suitable as a protein concentrate for ruminants, a suitable replacement for *Gliricidia* and *Leuceana* species. El Hassan *et al*. (2000) concluded that some of the multipurpose leguminous trees (MPT) such as bitter leaf, may prove to be useful dietary supplements for ruminants feeding considering their chemical composition. A special attention should be given to efficient integration of multipurpose fodder shrubs and trees as fodder bank in feeding calendars of sheep and goats under harsh climates (Ben Salem *et al*., 2004). Kabirizi and Ejobi (2005) reported that goats have developed a mechanism of feeding on indigenous fodder trees and shrubs (IFTS) forage like bitter leaf without treatment and the feeding of it in mixtures helps to overcome possible side effects that could result from feeding species, known to be poisonous in large quantities

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