# EFFECTS OF FEEDING GRADED LEVELS OF ACKEE LEAF MEAL ON NUTRIENTS DIGESTIBILITY, GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS

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**ABSTRACT**

***A study was carried out to determine nutrients digestibility, growth performance and carcass characteristics of weaner rabbits fed graded levels of Ackee Leaf Meal (ALM). Twenty weaner rabbits were randomly assigned to four treatments (T0 – 0 % ALM, which served as the control, T1 – 7.5 % ALM, T2 – 15 % ALM and T3 – 22.5 % ALM) in a Completely Randomized Design (CRD) and fed the assigned diets for ten weeks after one week adjustment period. Parameters measured included average daily feed intake, average daily body weight gain, feed conversion ratio and mortality. The digestibility study was carried out during the 8th week of the feeding trial. At the end of the feeding trial, two rabbits per treatment were randomly selected, starved of feed for 24 hours and slaughtered. Carcass measurements and weights of internal organs were taken. The results revealed significant differences in final body weight, total weight gain and average daily weight gain with T1 recording the highest values. Feed conversion ratio (FCR) increased when ALM was increased to 22.5 %. Digestibility values for DM and EE were significantly ($p<0.05$) higher for T2. Dressed weight and dressing percentage declined significantly ($p<0.05$) when ALM was increased to 22.5 % of the diet. It was concluded that ALM could be used to improve average daily weight gain and FCR up to 15 % inclusion level without increasing the unit cost of feed. The inclusion of ALM up to 15 % of the diet could also improve digestibility of DM and EE.***

**Keywords:** Digestibility, Growth, Carcass, Ackee leaf meal, Weaner rabbits

## INTRODUCTION

The increase in human population especially in developing countries coupled with inadequate supply of animal protein from the principal livestock species (cattle, sheep, goats, pigs and poultry) has made it imperative that attention be shifted to other micro-livestock such as rabbit (Biobaku and Dosumu, 2003; Fayeye and Ayorinde, 2003). Rabbit meat is composed of 18.8 – 19.4 % crude protein, 9.9 – 10.9 % fat and 68.5 – 72.0 % moisture (Rao *et al.,* 1978). Karikari and Asare (2009) have reported that in many developing countries, the production of rabbits lies in the hands of micro-scale producers and children because it is reared purposely to achieve protein sufficiency for the home. Rabbit production, when given the needed rightful attention and reared on a large scale could solve the problem of low animal protein intake in the developing world because they are fast growing and very prolific.

Soya bean meal and fish meal have been widely and successfully used as conventional protein sources for livestock. Since the prices of these protein sources continue to rise, there is the need for the search for alternate protein feed sources that have the capacity to yield the same output as conventional feeds and perhaps at a cheaper cost since according to Vidjannagni *et al.* (2018), the profitability of rabbit production is highly dependent on the quality and cost of feed. Leaf meals are one of the sources of cheap proteins available in the tropical regions. They are good sources of proteins, vitamins, minerals and oxycarotenoids (Jiwuba *et al.,* 2016; Jiwuba *et al.,* 2017). Leaf meals have also been reported to contain a wide range of anti-nutritional factors like tannins, haemagglutinins, saponins and prosopine (Belewu and Ojo-Alokomaro, 2007).

Ackee (*Blighia sapida* KDE König) is a plant widely cultivated throughout the tropical and subtropical regions and readily available in Ghana. Different parts of Ackee have been used for many purposes such as food, fodder, furniture, charcoal, construction and cosmetics in Benin, West Africa (Ekué *et al.,* 2010). Known for its health and nutritional benefits, Ackee leaves have the potential to be used as an alternate source of protein with the view to increasing performance and productivity of animals. The current study sought to evaluate the effects of feeding graded levels of ackee Leaf Meal (ALM) in the diet of weaner rabbits. The specific objectives were to: i) determine the chemical composition of air-dried ALM, II) assess the growth performance of weaner rabbits fed varying levels of ALM as well as the economics of production, iii) determine the apparent nutrients digestibility of DM, CP, CF and EE in weaner rabbits fed diets containing varying levels of ALM and iv) evaluate the carcass characteristics of the weaner rabbits fed the varying levels of the ALM.

## MATERIALS AND METHODS

**Experimental Site:** The study was conducted at the Dairy/Beef Cattle Research Station, Boadi, of the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. The monthly temperatures of the area vary between 26.1°C and 28.9°C. High temperatures occur during the months of November – April with maximum temperatures occurring in February and March while the lowest are experienced in July. Annual rainfall ranges between 1500 – 1600 mm. The rainy season covers April – July and September – November. A short dry season separates the two periods in August. The main dry season lasts from November to February (Tuah *et al.*, 1987).

**Harvesting and Processing of Ackee Leaves:** Fresh mature leaves, harvested from Ackee trees at the Dairy/Beef Cattle Research Station, were air-dried under a shed until they were crispy to touch, while retaining their greenish colouration. Samples of the leaves were identified and authenticated in the herbarium at the Department of Herbal Medicine, KNUST. A voucher specimen was kept at the Department's herbarium with a voucher specimen number KNUST/HM1/2020/L001. The leaves were then milled, using a hammer mill of sieve size 2 mm, to obtain a product herein referred to as Ackee leaf meal (ALM). It is likely that the leaves contain little or none of the toxin in the unripe arils since they are always exposed to light and animals particularly small ruminants are usually seen browsing on the plant (Aderinola *et al.*, 2007). Indeed the authors also concluded that *B. sapida* leaves could be used as a major feed resource for WAD goats even though Antwi *et al.* (2009) have reported the presence of some anti-nutritive factors like saponins, phytosterols, reducing sugars and polyamides in Ackee extracts. Representative samples of the air-dried leaves were taken to the laboratory for chemical analysis to determine crude protein (CP), crude fibre (CF), ether extract (EE), ash, nitrogen free extractives, calcium, and phosphorus, using the standard procedures of the Association of Official Analytical Chemists (AOAC, 1990).

**Feed Ingredients and Experimental Diets:** Millet mash residue was procured from local porridge sellers in Kumasi, while soya bean meal (SBM), wheat bran, dicalcium phosphate and vitamin premix were purchased from a commercial feed supplier in Kumasi. All formulated diets were analysed for their proximate composition (AOAC, 1990) and subsequently fed to rabbits in the different treatment groups. Water and diets were given *ad libitum* for 10 weeks.

**Experimental Animals and Management:** Twenty (20) weaner rabbits of mixed breeds (from the New Zealand White and Californian breeds) and sexes obtained from a private rabbit farmer at Kentinkrono near KNUST in Kumasi were used for the experiment. The rabbits were between 6 – 7 weeks of age and weighed between 450 and 550 g. They were assigned to four groups of five animals per treatment, after balancing for body weight. The animals were housed individually in three-tiered metal cages. Each animal was provided with earthenware feeder and drinker specially designed to minimize spillage. Prior to the commencement of the experiment, each animal was dewormed using Piperazine (Dorpharma B.V. Limited, The Netherlands). Coccidiosis was routinely controlled using Britacox (Special T Products Limited, United Kingdom). The four treatment groups were assigned the four experimental diets in a Completely Randomized Design (CRD). Each treatment was replicated five times so there were five animals per treatment. Each rabbit was fed the assigned diet for 10 weeks after one week adjustment period.

**Animal Care and Welfare:** All necessary standard operating procedures outlined by the Animal Research Ethics Committee (AREC, 2018) of the Quality Assurance and Planning Unit of the Kwame Nkrumah University of Science and Technology were followed.

**Experimental Diet:** Four experimental diets were formulated. Diet 1, which was designated as T0 served as the control diet and contained soya bean meal as the main protein source with no ALM. Diet 2 designated as T1; Diet 3 designated as T2; Diet 4 designated as T3 contained ALM at the rate of 7.5, 15 and 22.5 %, respectively (Table 1).

**Table 1: Percentage inclusion of dietary ingredients in Ackee leaf meal (ALM) based diets and analysed chemical contents of experimental diets fed to rabbits**

| Ingredients (%) | Dietary Treatments | | | |
|---|---|---|---|---|
| | T0 (0 % ALM) | T1 (7.5 % ALM) | T2 (15 % ALM) | T3 (22.5 % ALM) |
| **Millet mash residue** | 59 | 53 | 47 | 41 |
| **Soya bean meal** | 19 | 17.5 | 16 | 14.5 |
| **Wheat bran** | 20 | 20 | 20 | 20 |
| **Ackee leaf meal** | 0 | 7.5 | 15 | 22.5 |
| **Dicalcium phosphate** | 1 | 1 | 1 | 1 |
| **Vitamin-mineral premix[1]** | 0.5 | 0.5 | 0.5 | 0.5 |
| **Salt** | 0.5 | 0.5 | 0.5 | 0.5 |
| **Total** | 100 | 100 | 100 | 100 |
| ***Analysed composition(%)*** | | | | |
| **Moisture** | 9.5 | 9.0 | 9.5 | 9.0 |
| **Dry matter (DM)** | 90.5 | 91 | 90.5 | 91 |
| **Crude protein (CP)** | 19.2 | 18.7 | 18.6 | 18.0 |
| **Crude fibre (CF)** | 7.3 | 8.6 | 9.8 | 10.9 |
| **Crude Fat** | 14.3 | 15.3 | 14.3 | 14.5 |
| **Ash** | 2.5 | 2.8 | 3.0 | 3.3 |
| **Carbohydrate** | 47.2 | 45.6 | 44.8 | 44.3 |
| **Metabolisable energy (Kcal/kg)*** | 3517.3 | 3524.8 | 3411.1 | 3388.8 |

*[1]Vitamin-mineral premix: contains the following/kg diet: vitamin A - 8000 IU; vitamin D – 3000 IU; vitamin E – 8 IU; vitamin K- 2 mg; vitamin B1- 1 mg; vitamin B 2 – 2.5 mg; vitamin B 12 – 15 mcg; niacin – 10 mg; panthothenic – 5 mg; antioxidant – 6 mg; folic acid – 0.5 mg; choline –150 mg; iron -20 mg; manganese – 80 mg; copper – 8 mg; zinc – 50 mg; cobalt – 0.225 mg; iodine – 2 mg; selenium – 0.1 mg. *Estimated according to Pauzenga (1985): ME (kcal/kg) = (35 x percentage crude protein) + (81.8 x per cent ether extract) + (35.5 x percentage nitrogen free extract)*

**Growth Study:** The experimental diets and water were offered in separate earthenware feeders in the morning (08.00 hour). The rabbits daily feed intake was determined. The daily supply was 10 % the body weight of the rabbit concerned. The diets were offered daily and the feed leftover and/or wastage were weighed daily before feeding. 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, feed cost per kilogramme weight gain and mortality.

**Digestibility Study:** Digestibility study was carried out during the 8$^{th}$ week of the feeding trial. It involved feeding the rabbit with known quantity of feed which lasted for seven days. Total faeces voided were collected daily and oven dried to determine moisture content. Representative samples of dried faeces were taken for proximate analysis using AOAC (1990) methods. The digestibility values for dry matter (DM), CP, EE and CF were calculated as nutrient intake minus nutrient excreted divided by nutrient intake multiplied by hundred.

**Carcass Yield Evaluation:** At the end of the 10 weeks feeding period, two rabbits per treatment were randomly selected, starved of feed for 24 hours and humanely slaughtered. Determination of blood weight was by the difference between slaughter weight and hot carcass weight. The slaughtered rabbits were defurred using flame and eviscerated to evaluate their carcasses. Dressing percentage was determined by dividing the hot dressed carcass weight by the slaughter weight and multiplied by hundred. The weights of the following internal organs were also taken: gastrointestinal tract (full and empty), liver, kidney, lung, heart and caecum (full and empty).

**Chemical Analyses:** Samples of the Ackee leaves as well as all experimental diets were taken for proximate analysis at the Nutrition Laboratory of the Department of Animal Science, KNUST. The leaves were also analysed for calcium and phosphorus at the Crop and Soil Sciences Laboratory of the Faculty of Agriculture, KNUST.

**Economics of Production:** Existing market prices for the ingredients used during the period of the study were used for the economic appraisal of the feeds. Economics of production was based on the feed cost per kg diet and feed cost per kg weight gain. Feed cost per kg live weight gain was calculated as a product of the feed cost per kg diet and feed conversion ratio for individual dietary treatments. Table 2 showed the feed ingredients and their prices per kilogram.

**Table 2: Feed ingredients and their prices per kilogram used in the formulation of Ackee leaf meal (ALM) based diets fed to rabbits**

| Ingredients | Price per kilogram (GH¢/) |
|---|---|
| Millet mash residue | 0.60 |
| Soya bean meal | 2.86 |
| Wheat bran | 0.74 |
| Ackee leaf meal | 1.00 |
| Vitamin premix | 10.00 |
| Dicalcium phosphate | 5.00 |
| Salt | 5.00 |

**Statistical Analysis:** The data collected from the feeding trial were subjected to analysis of variance (ANOVA) using GenStat Version 12.1. The probability level for declaration of significance was set at 5 %.

## RESULTS AND DISCUSSION

**Percentage Inclusion Levels of ALM and Chemical Compositions of Experimental Diets:** The percentage inclusion levels, and analysed nutrient compositions of the four experimental diets fed to the rabbits during the period of the experiment are shown in Table 1.

The DM contents of the analysed diets were similar but the CP content of the control diet was slightly higher than those of the ALM diets which could be attributable to relatively high levels of millet mash residue and soya bean meal. The analysed CF contents of the diets showed relative increase as the inclusion level of ALM increased from 0 % ALM to 22.5 % ALM. This may be as a result of the high level of CF in the ALM (Table 1). The nutrients met the minimum nutrient requirements for rabbits (Maertens, 1992).

**Chemical Composition of Air-Dried Ackee Leaf Meal (ALM):** ALM was rich in CF (34.7 %), ash (6.5 %) and phosphorus (0.30 %) (Table 3).

**Table 3: Chemical composition of air-dried Ackee leaf meal**

| Parameter | Percentage composition |
|---|---|
| **Moisture** | 4.0 |
| **Crude protein (CP)** | 17.0 |
| **Crude fibre (CF)** | 34.7 |
| **Crude fat** | 2.0 |
| **Ash** | 6.5 |
| **Carbohydrate** | 40.3 |
| **Phosphorus** | 0.30 |
| **Calcium** | 0.98 |

Crude protein and calcium contents were however not very high (17.0 and 0.98 % respectively). The 17 % CP content was lower than the 18.59 % reported by Aderinola *et al.* (2007) for Ackee leaves but the CF content of 34.7 % obtained in the current study was much higher than the 16.45 % reported by the same authors. The disparities in the nutrients content may be attributed to the age of plant at harvesting, climatic conditions, edaphic factors, agronomic practices as well as methods of processing and analysis of leave samples (Fuglie, 1999).

Compared to other leaf meals, it was observed that ALM has higher CP, CF and EE than *Gliricidia* leaf meal with CP - 15.6 %, CF - 13.77 % and EE - 1.41 % (Amata and Bratte, 2008). The ash content of *Gliricidia* leaf meal (11.58 %) was however higher than the 6.5 % for ALM in the current study. The contents of CP, EE and ash for ALM in the current study were all lower than the 28.2 , 6.6 and 11.9 % respectively reported for *Moringa* leaf meal (Tesfaye *et al*., 2013) and the 20.26, 4.61 and 7.96 % reported for *Leucaena leucocephala* leaf meal (Safwat *et al.,* 2015). The phosphorus content was comparable to the 0.33 % DM reported for *Moringa* leaf meal, and the calcium content was much lower than the 8.64 % DM reported for *Moringa* leaf meal (Nuhu, 2010).

**Productive Performance of Rabbits Fed the Experimental Diets:** The initial body weights of the rabbits were similar ($p>0.05$) (Table 4). Final body weight and the total weight gain were significantly higher ($p<0.001$) for rabbits fed T1 (7.5 % ALM) diets. This result was in agreement with the finding of Bamikole *et al.* (2005) that reported increase in daily weight gain of rabbits fed mulberry leaf meal-based diets. Average daily weight gain increased with the addition of ALM up to 15 %, but decreased when ALM was increased to 22.5 % even though daily feed intake across the treatments were similar ($p>0.05$). This observation is at variance with the report of Ravindran *et al.* (1986) where the authors did no find significant differences ($p>0.05$) in gain, feed intake and feed efficiency between the control and diets containing cassava leaf meal but agrees with the report of Jiwuba and Ogbuewu (2019) who reported significant differences ($p<0.05$) in average daily gain with *Moringa oleifera* leaf meal over the control.

High weight gain of animals normally results from increased feed intake, but in the case of rabbits in T3 fed 22.5 % ALM, feed intake did not translate proportionally into weight gain and a better feed conversion ratio perhaps due to the high fibre content of ALM (34.7 %) and the presence of some anti-nutritive factors like saponins, phytosterols, reducing sugars and polyamides in ackee extracts as reported by Antwi *et al*. (2009). This explained why final weight, total weight gain, average daily gain and feed conversion ratio were all poorer when ALM was increased to 22.5 %. The slight decrease in feed intake when ALM was increased to 22.5 % was in agreement with the finding of Nworgu *et al*. (1999) who reported a reduction in feed intake by rabbits on increased forage meal in the diet. The current trend however contradicted the findings of Spreadbury and Davidson (1978) and Aduku *et al*. (1988) who reported higher feed intake with increasing level of CF in the diets of rabbits. The slight decrease in feed intake observed with increase in ALM may also mean that higher levels of ALM affected the palatability of the diets.

The present average daily weight gain (ADWG) values of 8.93 – 10.57 g/d were lower than the 15.16 – 39.70 g/d reported by Omole and Onwudike (1982), Ayers *et al*. (1996) and Okorie (2003).

**Table 4: Productive performance of rabbits fed Ackee leaf meal (ALM) based experimental diets**

| Parameter | Dietary Treatment | | | |
|---|---|---|---|---|
| | T0 (0% ALM) | T1 (7.5% ALM) | T2 (15% ALM) | T3 (22.5% ALM) |
| Initial weight (g) | 496.40 ± 0.55$^{a}$ | 495.40 ± 1.14$^{a}$ | 495.20 ± 0.91$^{a}$ | 496.20 ± 0.94$^{a}$ |
| Final weight (g) | 1230.1 ± 6.97$^{bc}$ | 1235.2 ± 4.39$^{c}$ | 1218.2 ± 4.39$^{b}$ | 1121.2 ± 0.94$^{a}$ |
| Total weight gain (g) | 733.7 ± 7.28$^{bc}$ | 739.8 ± 4.33$^{c}$ | 723.0 ± 6.89$^{b}$ | 625.0 ± 6.45$^{a}$ |
| Average daily weight gain (g) | 10.48 ± 0.10$^{bc}$ | 10.57 ± 0.06$^{c}$ | 10.33 ± 0.10$^{b}$ | 8.93 ± 0.09$^{a}$ |
| Daily feed intake (g) | 47.06 ± 3.07$^{a}$ | 47.14 ± 2.38$^{a}$ | 46.86 ± 2.31$^{a}$ | 44.66 ± 3.02$^{a}$ |
| Feed conversion ratio | 4.49 ± 0.26$^{a}$ | 4.46 ± 0.21$^{a}$ | 4.54 ± 0.23$^{a}$ | 5.00 ± 0.35$^{b}$ |
| Feed cost /kg (Gh¢) | 1.17 | 1.17 | 1.16 | 1.16 |
| Feed cost/kg gain (Gh¢) | 5.25 ± 0.31$^{a}$ | 5.22 ± 0.24$^{a}$ | 5.26 ± 0.26$^{a}$ | 5.80 0.41$^{b}$ |
| Mortality | 2 | 1 | 2 | 0 |

$^{a,b,c,}$ *Mean values with different superscripts on the same row differ significantly (p<0.05)*

The generally low growth rates observed in this study could be due to the fact that the rabbits did not consume much to ensure higher growth. The metabolisable energy of all the diets met the requirements for maintenance and production reported by Aduku and Olukosi (1990) and was higher than the range of 2400 – 2800 kcal/kg reported by Pond *et al.* (1995) for growing rabbits. It is also possible that the coccidiosis case observed may have adversely affected their growth rate as the disease has been associated with failure of young animals to gain weight, poor feed conversion, diarrhoea, anaemia and growth retardation by Bhat *et al.* (1996).

Feed conversion ratio decreased significantly (p>0.05) when ALM was increased to 22.5 %. The feed conversion ratio values of 4.46 - 5.00 (Table 4) obtained in this study were higher than the 2.63 - 4.00 reported earlier by Ayers *et al*. (1996) and the 4.00 – 4.74 reported by Jiwuba and Ogbuewu (2019) in the tropics but were generally lower than the range of 5.32 – 5.63 reported by Iyayi and Odueso (2003) The generally low FCRs obtained were undoubtedly due to the relatively low growth rates.

The addition of ALM did not increase the unit cost of the concentrate feed used. This was due to the low cost of the ALM. However, feed cost per gain was higher for the highest inclusion rate of 22.5 %.

**Apparent Nutrient Digestibility of Rabbits Fed ALM Diets:** Digestibility values for DM increased significantly (p<0.05) when ALM was increased to 15 % but declined with increase up to 22.5 % as shown in Table 5. The present DM values (59.89 – 66.33 %) were lower than the 67.55 – 74.94 % and the 75.67 – 82.0 % reported by Iyayi and Odueso (2003) and Bamikole *et al.* (2005) respectively, but were higher than the reported range of 55.72 – 64.35 % by Ayers *et al.* (1996). Digestibility values for CP were similar (p>0.05) which was indicative of the same efficiency in CP utilization. The present values (66.5 – 68.47 %) were comparable to the 59 – 74 % and 65.1 – 87.8 % reported by Iyeghe-Erakpotobor *et al.* (2005) and Nuhu (2010) respectively, but lower than the 69 – 79 % stated by Iyeghe-Erakpotobor *et al.* (2006). Compared to the reported values of 57.66 – 66.26 % by Iyayi and Odueso (2003), the values in the current study were higher.

Also CF digestibility increased linearly with increase in ALM from 7.5 % for rabbits in T1 to 22.5 % for rabbits in T3, but the increases were not significant (p>0.05). Perhaps the increased CF portions of the diets were well acted upon within the GIT of the rabbits. The trend was similar to what was observed by Safwat *et al.* (2015) where increasing levels of leaf meal in the diet of rabbits resulted in an increment of dietary fibre digestibility. The present values of 63.85 – 70.23 % were higher than 33.37 – 48.53 reported by Iyayi and Odueso (2003), 43 – 55 % reported by Iyeghe-Erakpotobor *et al.* (2005) and 50.01 – 55.0 % reported by Nuhu (2010) in that order but lower than the 79.67 – 88.67 % reported by Bamikole *et al*. (2005).

**Table 5: Apparent nutrient digestibility of rabbits fed Ackee leaf meal (ALM) based experimental diets**

| Parameters | Treatments | | | |
|---|---|---|---|---|
| | T0 (0 % ALM) | T1 (7.5 % AlM) | T2 (15 % ALM) | T3 (22.5 % ALM) |
| **Dry matter** | 59.94 ± *1.48* $^{a}$ | 59.89 ± 0.90$^{a}$ | 66.33 ± 2.67$^{b}$ | 61.58 ± 0.58$^{a}$ |
| **Crude protein** | 68.34 ± 2.66$^{a}$ | 66.50 ± 2.65$^{a}$ | 68.47 ± 0.58$^{a}$ | 66.66 ± 0.60$^{a}$ |
| **Crude fibre** | 63.85 ± 3.37$^{a}$ | 65.74 ± 2.06$^{a}$ | 68.88 ± 0.88$^{a}$ | 70.23 ± 1.77$^{a}$ |
| **Ether extract** | 61.81 ± 1.40$^{a}$ | 77.71 ± 3.11$^{b}$ | 83.28 ± 1.32$^{c}$ | 61.03 ± 1.73$^{a}$ |

$^{a,b,c,}$ *Mean values with different superscripts on the same row differ significantly (p<0.05)*

**Table 6: Carcass characteristics of rabbits fed Ackee leaf meal (ALM) based experimental diets**

| Parameters | Treatments | | | |
|---|---|---|---|---|
| | T0 (0 % ALM) | T1 (7.5 % ALM) | T2 (15 % ALM) | T3 (22.5 % ALM) |
| **Slaughter weight (g)** | 1235.00 ± 7.04$^{b}$ | 1233.60 ± 2.02$^{b}$ | 1221.80 ± 5.23$^{b}$ | 1128.00 ± 9.83$^{a}$ |
| **Hot carcass weight (g)** | 1197.10 ± 3.98$^{b}$ | 1197.10 ± 3.29$^{b}$ | 1179.80 ± 6.68$^{b}$ | 1088.30 ± 8.87$^{a}$ |
| **Blood weight (g)** | 37.85 ± 3.10$^{a}$ | 35.80 ± 1.27$^{a}$ | 41.59 ± 0.84$^{a}$ | 40.25 ± 0.21$^{a}$ |
| **Dressed weight (g)** | 753.90 ± 3.59$^{b}$ | 771.30 ± 10.39$^{b}$ | 754.80 ± 1.52$^{b}$ | 676.50 ± 4.79$^{a}$ |
| **Dressing percentage** | 61.04 ± 0.06$^{ab}$ | 62.52 ± 0.74$^{b}$ | 61.78 ± 0.40$^{b}$ | 59.97 ± 0.10$^{a}$ |
| **Full GIT weight (g)** | 269.40 ± 1.02$^{ab}$ | 260.30 ± 14.36$^{ab}$ | 285.90 ± 0.18$^{b}$ | 233.70 ± 8.97$^{a}$ |
| **Empty GIT weight (g)** | 120.80 ± 2.96$^{a}$ | 118.70 ± 4.00$^{a}$ | 125.60 ± 0.54$^{a}$ | 122.80 ± 3.20$^{a}$ |
| **Liver weight (g)** | 35.70 ± 0.48$^{a}$ | 36.60 ± 0.66$^{a}$ | 35.00 ± 0.03$^{a}$ | 34.50 ± 6.40$^{a}$ |
| **Kidney weight (g)** | 7.67 ± 0.73$^{a}$ | 7.00 ± 0.91$^{a}$ | 6.78 ± 0.31$^{a}$ | 5.68 ± 0.45$^{a}$ |
| **Heart weight (g)** | 3.98 ± 0.03$^{a}$ | 3.92 ± 0.12$^{a}$ | 3.98 ± 0.04$^{a}$ | 3.30 ± 0.31$^{a}$ |
| **Lung weight (g)** | 11.28 ± 0.86$^{a}$ | 9.51 ± 0.70$^{a}$ | 10.93 ± 0.11$^{a}$ | 9.23 ± 0.81$^{a}$ |
| **Caecum + content (g)** | 88.15 ± 3.50$^{b}$ | 70.17 ± 0.45$^{a}$ | 80.26 ± 0.93$^{b}$ | 65.48 ± 1.16$^{a}$ |
| **Weight of empty caecum (g)** | 27.89 ± 1.97$^{a}$ | 21.01 ± 1.40$^{a}$ | 25.16 ± 0.66$^{a}$ | 23.51 ± 0.69$^{a}$ |

$^{a,b,c,}$ *Mean values with different superscripts on the same row differ significantly (p<0.05); GIT = gastro intestinal track*

Table 5 further showed that the digestibility values for EE increased (p<0.05) linearly as ALM increased from 0 – 15 % but declined at 22.5 % inclusion of the ALM. The values for the current study were lower than the 83.07 – 90.66 % reported by Iyayi and Odueso (2003), but were comparable to the range of 55.65 – 86.0 % reported by Bamikole *et al.* (2005). The slight increases in the digestibility values for DM and CF and the significant (p<0.05) increase in EE due to the addition of ALM contrasted the report of Safwat *et al.* (2015) who reported higher apparent digestibility values for the control group than those on *M. oleifera* and *L. leucocephala* based diets.

**Carcass Measurements of Rabbits Fed ALM Diets:** The dietary treatments imposed did not produce significant differences (p>0.05) in most of the carcass parameters measured (Table 6). Blood weights were similar despite the differences in slaughter weight, hot carcass weight and dressed weight. The values for dressing percentage which was highest in T1 and T2 rabbits, and were comparable to 60.38 – 66.63 % and the 52.69 – 62.16 % reported by Nuhu (2010) and Jiwuba and Ogbuewu (2019) respectively for *M. oleifera* leaf meal but higher than the 45.31 – 52.27 % reported by Biya *et al.* (2008). Compared to the 72.6 – 76.2 % reported by Okorie (2003), the present values were much lower. Liver, kidney, heart and lung weights were all similar (p>0.05) across the various treatments.

According to Parkhurst and Mountney (2012), under-processing of soya bean meal may lead to the synthesis of harmful levels of anti-nutritional factors, which may impact negatively on the growth and performance of young animals. The soya bean meal used for the study might have been slightly under-processed thereby retaining some anti-nutritional factors which could have accounted for the slightly higher weights of the kidney and to some extent the liver in an attempt to detoxify them in T0 and T1 that received high amounts of soya bean meal relative to the other treatments. The present weights of liver (29.96

– 37.03 g) and kidney (5.36 – 8.18 g) were lower than 32.24 – 42.84 g for liver and 6.52 – 10.95 g for kidney reported by Amata and Bratte (2008) when fed graded levels of Gliricidia leaf meal to weaner rabbits. The values were also lower than the 40.40 – 48.35 g for liver and 9.40 – 9.80 g for kidney reported by Iyayi and Odueso (2003) when they assessed the response of growing rabbits to varying levels of dietary cyanide. The values were however higher than the 2.79 – 3.28 g for liver and the 0.70 – 0.80 g for kidney reported by Okorie (2003). The weight of full caecum was higher in T0 and T2 but the empty weights of the caeca were similar (p>0.05).

**Conclusions:** The current study has shown that: i) Ackee leaf meal could be used at the inclusion level of 7.5 % without negatively affecting daily weight gain and feed conversion ratio, ii) ALM could be used to partially replace soya bean meal in the diet of weaner rabbits as a non-conventional protein source without increasing the unit cost of feed, iii) ALM could be used to improve DM and EE digestibility in weaner rabbits when included up to 15 % in the diet, and iv) finally the inclusion of 7.5 % ALM in the diet of weaner rabbits could improve the dressed weight and dressing percentage of rabbits. Further study should be conducted to determine anti-nutritional factors, if any, in ALM as well as the effects of ALM on blood biochemical and haematological indices.

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