*Nig. J. Anim. Prod. 2021, 48(5):213-222. https://doi.org/10.51791/njap.v48i5.3205* *Nigerian Journal of Animal Production*


# Performance and Nutrient Digestibility of Broiler Chicks (0 – 4 weeks) Fed Diets Containing Spurge Weed (*Euphorbia heterophylla) Leaf Meal*

[1]Upah, S. O., [1]Okwori, A. I. and [2]Orayaga, K. T.

[1]*Department of Animal Production, College of Animal Science, Federal University of Agriculture, Makurdi, Benue State, Nigeria.*

[2]*Department of Animal Nutrition, College of Animal Science, Federal University of Agriculture, Makurdi, Benue State, Nigeria.*

**Corresponding author:** samsonupah64@gmail.com

**Abstract**

*Soya bean, a conventional plant protein source in poultry feeding has become so costly and occasionally scarce resulting in high cost of poultry feed. The replacement of soya bean is therefore necessary to improve production. This study evaluated the effects of Euphorbia heterophylla (Spurge weed) leaf meal (EHLM) on the growth performance and nutrient digestibility of One Hundred and Eighty (180) Ross 308 strain of broiler chicks. They were randomly allotted to six (6) experimental diets with three replications of ten bird each and fed for 28 days. Diets were formulated such that EHLM was included as 0, 5, 10, 15, 20 and 25% levels for T1, T2, T3, T4, T5 and T6 which replaces soya bean meal in the basal diets. Data collected were subjected to analysis of variance in a completely randomized design. Results indicated that the average daily feed intake, average daily weight gain, average daily protein intake, protein efficiency ratio and average final live weight, were significantly different (P<0.05) among treatment groups while average feed conversion ratio and mortality were not affected. Digestibility coefficient of CP, CF, EE, NFE and Ash showed significant different(P<0.05) among treatment groups. However, bird fed T2, T3 and T4 digest nutrient efficiently compared with the control than T5 and T6. It was therefore concluded that upto 15% EHLM levels could be adopted for optimum growth performance and nutrient digestibility in broiler chicks aged 0-4 weeks.*

**Keywords:** Broiler chicks, growth performance, nutrient digestibility, *EHLM*

# Performance et digestibilité des nutriments des poulets à griller (0 à 4 semaines) Aliments nourris contenant de l'euphorbe ésule (Euphorbiaheterophylla) Farine de feuilles

**Résumé**

*Le soja, une source conventionnelle de protéines végétales dans l'alimentation de la volaille, est devenu si coûteux et parfois rare, ce qui entraîne un coût élevé de l'alimentation de la volaille. Le remplacement du soja est donc nécessaire pour améliorer la production. Cette étude a évalué les effets de la farine de feuilles (EHLM) d'Euphorbia heterophylla (euphorbe ésule) sur les performances de croissance et la digestibilité des nutriments de la souche cent quatre-vingt (180) Ross 308 de poulets de chair. Ils ont été répartis au hasard dans six (6) régimes expérimentaux avec trois répétitions de dix oiseaux chacun et nourris pendant 28 jours. Les régimes ont été formulés de telle sorte que l'EHLM a été inclus en tant que niveaux de 0, 5, 10, 15, 20 et 25 % pour T1, T2, T3, T4, T5 et T6 qui remplace le tourteau de soja dans les régimes de base. Les données recueillies ont été soumises à une analyse de variance dans un plan complètement randomisé. Les résultats ont indiqué que l'apport alimentaire quotidien moyen, le gain de poids quotidien moyen, l'apport protéique quotidien moyen, le ratio d'efficacité protéique et le poids vif final moyen étaient significativement différents (P < 0,05) entre les groupes de traitement, tandis que le taux de conversion alimentaire moyen et*

*la mortalité n'étaient pas affectés. Le coefficient de digestibilité de CP, CF, EE, NFE et Ash a montré une différence significative (P<0,05) parmi les groupes de traitement. Cependant, les oiseaux nourris avec T2, T3 et T4 digèrent efficacement les nutriments par rapport au témoin que T5 et T6. Il a donc été conclu que jusqu'à 15 % de niveaux d'EHLM pouvaient être adoptés pour des performances de croissance optimales et une digestibilité des nutriments chez les poulets de chair âgés de 0 à 4 semaines.*

**Mots clés** : Poussins de chair, performances de croissance, digestibilité des nutriments, EHLM

**Introduction**

The poultry industry in developing countries like Nigeria is facing some challenges one of which is increase in the cost of feed because of high prices of protein and energy sources (Abbas, 2013). This high cost of feed component has forced many poultry producers out of production or cut down production level. This results in low output of animal products such as meat and egg which made them unaffordable to most Nigerians. The inability of average Nigerians to afford this product in a required quantity and quality to meet their daily needs results in malnutrition (low protein intake) Ikeokwu (2012) In Nigeria it is estimated that an average of about 20 g per caput per day of animal protein is consumed (FAO, 2008) compared to a recommended daily intake of 36 g for adult which represent 40% of 65 – 70 g of total daily protein requirement (Women in Agriculture, 2011). Livestock feed cost in developing countries are a continuing challenge. These high and increasing prices for animal feeds which account for 60 – 70% (Tion and Wuanor, 2009) have compelled researcher to direct their attention to non-conventional feed sources with particular emphases on protein substitute so as to produce quality feed at affordable prices, improve net profit and provide animal product to meet the daily protein requirement of average Nigerian. Therefore, reducing feed cost per unit of weight gain will always be a main objective for livestock farmers. The use of non-conventional feedstuff such as *Euphorbia heterophylla leave* to reduce the competition for soya bean has great potential for bringing down feed cost and increase net profit. *Euphorbia heterophylla leave* can be explored because of its high nutrition values for monogastric animals. It is a common herb abundantly available and freely accessible in tropical and sub-tropical regions of the world especially Nigeria in West Africa. It is a common weed of most crops (soya bean, cowpea, groundnut and cotton) which are often thrown away. About 10.5 tons of*Euphorbia heterophyllaleaf* can be harvested annually in Nigeria (Okeniyi*et al.* 2012). It has a short life span of about 45 – 50 days with many reproductive cycles in a year (N'Goran*et al.,* 2013). *Euphorbia heterophylla leaf meal (EHLM)* is high in crude protein (17-27.1%), crude fibre (22% of DM), Ether Extract (7.7% DM), alpha-linolenic acid (55.4%) which is used to improve significantly the n-3 polyunsaturated fatty acid (PUFA) content of poultry meat, egg and carcass (Bindelle*et al.,2007;*Kouakou*et al.,* 2013; N'Goran*et al.,* 2013). It is rich in n-3 PUFA (56.0%) such as eicosapentaenoic acid (EPA, C20:5n-3) and docosahexaenoic acid (C22:6n-3). It's anti-artherogenic, anti-thrombotic and anti-inflammatory effect and overall increase intake leads to reduce risk of coronary heart disease (CHD) in humans (ANSES, 2011). The increase in PUFA/SFA ratio (3.0%) and decrease in C18:2 n-6 / C18:n-3 (0.63%) and n-6/n-3 (0.3%) ratios which result in reduction of cholesterol in *Euphorbiaheterophylla* diet (Edeoga*et al.,* 2005; Wood *et al.,* 2008;

N'Goran*et al.,* 2013; N'Goran*et al.,* 2016) is of great interest in poultry nutrition. Feedstuff of this type are of special interest to livestock nutritionists because they are not human food items and are therefore free or very cheap in comparism with ingredient such as soya bean. This study was therefore carried out to access the effect of graded level of *Euphorbia heterophylla*leave *meal* on the performance on nutrient digestibility of starter broiler.

## Materials and methods

### *Experimental site*

This study was conducted at Nogga Farms, Secretariat Road, Oju Local Government Area of Benue State Nigeria. Oju Local Government Area lies between Latitude $6^{0}51^{1}$ north and Longitude $8^{0}25^{1}$ east in the Southern Guinea Savannah Zone of Nigeria, with a climate that has two distinct seasons: wet and dry seasons. The wet season covers mid march to mid-November, while the dry season starts in late November to early March. High temperatures are experienced between February and April (Oju Physical Setting Online Nigeria.com, 2003). Oju Local Government Area has an annual rainfall which ranges from 1200 mm to 1500 mm with an average minimum and maximum daily temperature of about $21^{0}$c and $35^{0}$c in the dry season and $16^{0}$c and $37^{0}$c in the wet season respectively. The relative humidity ranges from 60% to 80% (Akpen, 2019).

### *Preparation of experimental materials*

*Euphorbia heterophylla*plants were sourced from Oju metropolis and nearby communities. The plants were harvested by pulling them from the soil and the leaves detached from the stems. The leaves were air dried under a shade by spreading them evenly on a mat with regular turning by spreading them evenly on a mat to avoid mould growth; they were milled in a hammer mill fitted with 2 mm sieve before use to produce *Euphorbia heterophylla leaf meal (EHLM)*. Prior to inclusion in the diet, the *EHLM* was sub-sampled and analyzed for proximate composition to guide in feed formulation.

### *Experimental diets and experimental design*

The feeding trial conducted for broiler starter consisted of six (6) experimental diets tagged: T1, T2, T3, T4, T5 and T6 containing *EHLM* which replaced soya bean meal at 0% (control), 5%, 10%, 15%, 20% and 25% respectively in starter diet as contained in Tables 1. Each treatment was replicated three times.

The feeding trial which lasted for 28 days (4 weeks) commenced from 0 – 28 day in a completely randomized design.

### *Experimental animal, housing and management*

One hundred and eighty (180) day-old broiler chicks of Ross 308 strain were used for the study. They were randomly allotted to six (6) treatment diets and raised in a conventional deep litter poultry house with concrete floor, dwarf walls and zinc coated metal roofing with wire nettings, to enhance adequate ventilation and protection.Birds were given the experimental diets and water *ad-libitum*. The birds were given Newcastle disease vaccine (Lasota) at the $4^{th}$ day and $24^{th}$ day, while Gumboro vaccine was administered at the $10^{th}$ and $16^{th}$ day. Multivitamin, mineral and glucose were administered in drinking water on arrival. Anti-coccidial drug (Pantacox®) and antibiotic (Ciprofloxacilin) were given to the birds in drinking water in alternate week while anti-stress was administered when necessary.

### *Performance parameters measured*

The feed intake (FI), body weight gain (BWG), feed conversion ratio (FCR), Daily Protein Intake (DPI), and Protein Efficiency Ratio (PER) were determined. Feed intake was estimated as the difference between the amount of feed served and feed leftover. The body weight gain was determined by

**Table 1: Ingredients composition (%) of broiler starter diets**

| Ingredients | T1(0%) | T2(5%) | T3(10%) | T4(15%) | T5(20%) | T6(25%) |
|---|---|---|---|---|---|---|
| Maize | 52.45 | 52.45 | 52.45 | 52.45 | 52.45 | 52.45 |
| SBM(48%) | 35.00 | 33.25 | 31.50 | 29.75 | 28.00 | 26.25 |
| EHLM | - | 1.75 | 3.50 | 5.25 | 7.00 | 8.75 |
| Blood Meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Fish Meal | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Brewers Dried Grain (BDG) | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 |
| Bone Meal | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 |
| Common Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Palm oil | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | 100 | 100 | 100 | 100 | 100 | 100 |
| Calculated Analysis | | | | | | |
| ME(Kcal/kg) | 2911.94 | 2910.53 | 2909.14 | 2907.74 | 2906.84 | 2904.44 |
| Crude Protein(%) | 23.82 | 23.72 | 23.61 | 23.50 | 23.40 | 23.31 |
| Crude Fibre(%) | 4.23 | 4.61 | 4.99 | 5.42 | 5.81 | 6.19 |
| Ether Extract(%) | 4.65 | 4.66 | 4.67 | 4.68 | 4.68 | 4.69 |
| Calcium (%) | 1.33 | 1.33 | 1.32 | 1.32 | 1.32 | 1.31 |
| Available | | | | | | |
| Phosphorus (%) | 0.58 | 0.58 | 0.57 | 0.57 | 0.57 | 0.56 |
| Lysine(%) | 1.46 | 1.44 | 1.41 | 1.39 | 1.34 | 1.29 |
| Methionine(%) | 0.61 | 0.62 | 0.63 | 0.65 | 0.66 | 0.67 |

[1]Vitamin / mineral premix (Bio-mix brand) supplied per kilogramme:
Vitamin A 450000 IU, Vitamin D3 9000 IU, Vitamin E 900 IU, Vitamin K 75 mg, Vitamin B12 0.6 mg, Thiamine (B1) 60 mg, Riboflavin (B2) 180 mg, Pyridoxine (B6) 120mg, Niacin 1200 mg, pantothenic acid 300 mg, folic acid 30 mg, Biotin 2.4 mg, Choline chloride 15 g, Antioxidant 3.75 g, Manganese 2.88 g, Zinc 1.8 g, Iron 0.72 g,Copper 0.18 g, Iodine 0.042 g, Selenium 7.2 mg, Cobalt 7.2 mg.

the difference between the initial weight and the final weight. The mean body weight was calculated as the average weight of the chickens for a week. The feed efficiency ratio was calculated as the ratio of feed intake to the corresponding live weight gain of birds. The protein efficiency ratio was calculated as the ratio of live body weight gain to the amount of protein consumed in the diet. Daily protein intake was determined by multiplying the amount of feed consumed by a bird per day by the amount of protein in the diet divided by 100.

***Nutrient digestibility trial***

One bird per replicate was randomly selected and moved to the metabolic cages at the end of 4$^{th}$ weeks. They were allowed 3 days of acclimatization and four (4) days of feacal collection. The birds were given a known weight of feed daily. The faeces voided each day per treatment per replicate were weighed fresh and oven dried to constant weight, ground and subjected to chemical analysis. The apparent nutrients digestibility was calculated.

$$\text{Apparent digestibility coefficient} = \frac{\text{Nutrient intake in feed} - \text{Nutrient in voided faeces} \times 100}{\text{Nutrient intake in feed}}$$

**Statistical analysis**

The data obtained were subjected to one way analysis of variance (ANOVA) in a completely randomized design using the procedure outlined in Minitab (2014). Where significant difference between treatment means occurred, they were separated using the Fisher's method

described in Minitab (2014).

**Results and discussion**

The growth performance parameters of starter broiler chicks fed graded levels of *EHLM* diet is presented in table 2. The average final body weight, average daily feed intake, average daily weight gain, average daily protein intake and average daily protein efficiency ratio were significantly (P<0.05) different among the dietary treatments. The best live weight was obtained in birds fed 10% *EHLM*(996.67 g) diet which was similar to 0% (control) diet (993.33 g). The two diets (10% and 0%) have similar live weight with 15%, 20% and 25% *EHLM*diets. The least live weight(940.00 g)was obtained in 5% *EHLM*. The feed intake was significantly (P<0.05) different among dietary treatments and the highest value (51.77 g) was observed in 25%*EHLM* (T6)which is similar with the control (51.59 g) and the least (50.56 g) in 15%*EHLM* (T4).The highest average weight gain was obtained in 10% *EHLM* (34.06 g) and 0% *EHLM* (33.54 g) *EHLM* and the least in 5%*EHLM* (32.04 g). The values obtained for 15%, 20% and 25% were similar.The highest average protein intake was obtained in 0% *EHLM* (12.43 g) and decreased with increasing levels of *EHLM* though with no definite pattern. The least value was obtained in 15% *EHLM* (11.89). The feed conversion values were best at 10% *EHLM* (1.51) which compared with the control (1.52) but showed no significant (P>0.05) difference among dietary treatment groups. The protein efficiency ratio has best value from 10% (2.78)*EHLM*. All the values of APER in this study are higher than the control (2.73) except T2 (2.62). The mortality was observed in birds fed 5% and 15% *EHLM* diet.

**Table2: Growth performance of starter broiler chick (0 – 4 weeks) fed graded levels of spurge weed (*Euphorbia heterophylla)* leaf meal**

| PARAMETERS AVERAGE | EXPERIMENTAL DIET | | | | | | |
|---|---|---|---|---|---|---|---|
| | T1(0%) | T2(5%) | T3(10%) | T4(15%) | T5(20%) | T6(25%) | S.E.M |
| Average Initial live weight (g) | 43.03 | 43.03 | 43.03 | 43.03 | 43.03 | 43.03 | 0.00 ns |
| Average final live weight (g) | $993.33^{a}$ | $940.00^{b}$ | $996.67^{a}$ | $960.00^{ab}$ | $963.33^{ab}$ | $970.00^{ab}$ | 28.00* |
| Average daily feed intake (g) | $51.59^{ab}$ | $51.13^{b}$ | $51.59^{ab}$ | $50.56^{c}$ | $51.48^{ab}$ | $51.77^{a}$ | 0.29* |
| Average daily weight gain(g) | $33.94^{a}$ | $32.04^{b}$ | $34.06^{a}$ | $32.75^{ab}$ | $32.87^{ab}$ | $33.11^{ab}$ | 0.99* |
| Average daily protein intake(g) | $12.43^{a}$ | $12.22^{b}$ | $12.23^{b}$ | $11.89^{c}$ | $12.01^{c}$ | $11.99^{c}$ | 0.07* |
| Average feed conversion ratio | 1.52 | 1.60 | 1.51 | 1.54 | 1.57 | 1.56 | 0.05 ns |
| Average daily protein Efficiency ratio | $2.73^{ab}$ | $2.62^{b}$ | $2.78^{a}$ | $2.75^{ab}$ | $2.73^{ab}$ | $2.76^{ab}$ | 0.09* |
| Mortality(%) | 0.00 | 1.85 | 0.00 | 1.85 | 0.00 | 0.00 | 1.85 ns |

*** Means that do not share a common letter are significantly different.**

**EHLM = *Euphorbiaheterophylla* leaf meal; SEM = Standard error of the mean, NS = Not significant.**

The significant (P<0.05) improvement in AFW, AFI and AWG in treatments 3, 6, 5 and 4 which compared with the control may be due to individual animal variation in feed consumption as each bird eats to meet its energy requirement and to get essential nutrients available for growth and development. The broiler in this study were managed by straight run rearing or mixed sex population so there was tendency to be variation in male and female number among the treatment groups. Many studies have showed that male broiler are more active and consume more feeds than female to meet their nutrient requirements and therefore grow faster with a heavier live weight and daily weight gain than female broiler. This could be the reason for the variation in FLW, AFI and AWG observed in this study. This agreed with (Ojedapo*et*

*al.,*2008; Olawumi*et al.,2012)*who reported that male broiler grow faster and has higher live weigh*t;* Lopez *et al.,*(2011; Benyr*et al.*, 2015; Olusegun *et al.* 2020) who observed that male broiler had heavier live weight and higher feed intake than female. This result corroborate with Sanghamitra*et al.* (2020) who reported that since the beginning of hatching, broiler male have 1% body weight higher than the females but along the age the different becomes 17% harvest. Though the AFI was highest in T6, the AFW, AWG and AFCR were superior in T3 and T1 (control) compared to other dietary treatments which infers that the birds in T3 and T1 have better ability to utilize feeds more efficiently. This result agreed with the report of Odeh, (2012). The significant (P<0.05) improvement in AFI among dietary treatments may be due to high protein and amino acid content, improved flavour, odour and test due to radical scavenging properties of flavonoids. This agreed with Okeniyi*et al.* (2012) and Okwori and Attah (2016) who reported that high protein content in forages has significant effect on intake, digestibility, absorption and performance of animals. It was previously reported that broiler chickens that provide higher potentials for weight gain will consume more feeds than other due to their higher nutritional requirements to express their genetic potentials (Cruz *et al., 2018)*. The lower weight in T6 and T5 which has the highest AFI compared to the value in T3 and T1 may be due to the laxative effect of saponins, terpenes and alkaloids which may result in excretion of nutrient thus low absorption, utilization of nutrients and low growth performance. This agreed with Falodun and Agbakwuru (2004) who reported laxative effect of the leave extract of *Euphorbia heterophylla.* The improved APER in T3, T4, T5 and T6 compared to the control may be due to longer small intestine suggesting better nutrient absorption and utilization. This agreed with the report of Henn *et al.* (2014) who observed longer gegenum and elium enhanced nutrient absorption and utilization. The AFW, AWG, AFCR and APER of starter broiler in this study were superior to the values of 839.91 g, 28.64 g, 1.96 and 2.16 respectively at 3000 Kcal/kg ME reported by Salami and Odunsi, (2017). However, AFI was lower than the value of 56.19 g reported by Salemi and Odunsi, (2017) which may be attributed to differences in diet form as the researchers fed their birds with pelleted feed while marsh was used in the present study. Fasuyi and Arire (2015); Salami and Odunsi (2017) found that pelleted diet increased feed intake in broiler chickens than marsh diet.

**Nutrient digestibility**

The Apparent Digestibility Coefficient (ADC) of starter broiler fed graded levels of *EHLM* diets is presented in Table 3. The ADC of Crude protein, crude fibre, ether extract, nitrogen free extract and ash were significantly (P<0.05) different among dietary treatment groups. The highest CP digestibility was obtained in 0% *EHLM*, while the least value is in 20% *EHLM*.The CP digestibility values observed in 10%, 15%, 5% and 25% *EHLM*were similar with the values in the control (0%)*EHLM,* while the values for T2 and T6 were also similar but differs significantly (P<0.05) from the control (0%). The crude fibre digestibility was highest in 5% and 10% which was followed by 15% *EHLM* while the least CF digestibility was obtained in 25%. The best ether extract digestibility was obtained in 5% and 10% *EHLM* which were significantly (P<0.05) different from the values of 0%*EHLM*, 15%*EHLM*, 20% *EHLM*and 25% *EHLM* that were similar. The highest NFE digestibility was obtained in 0% *EHLM*and the least in 20%*EHLM* while the second highest value was obtained in 15% *EHLM*. The ash digestibility has the highest value in 0%*EHLM*which was

followed by the values in the order of 15%, 10% and 5% *EHLM* inclusion levels. On the overall assessment, the nutrient digestibility of the five nutrients investigated in this study exceeded 50% in all treatment groups which indicate good efficiency of the biological value of the experimental diet.

**Table 3: Apparent nutrients digestibility of starter broiler ch ickens fed graded levels of spurge weed (*Euphorbiaheterophylla*) Leaf Meal**

| PARAMETERS | EXPERIMENTAL DIETS | | | | | | |
|---|---|---|---|---|---|---|---|
| | T1 (0%EHLM) | T2 (5% EHLM) | T3 (10% EHLM) | T4 (15% EHLM | T5 (20% EHLM) | T6 (25% EHLM) | S.E.M |
| Crude Protein (%) | 90.16$^{a}$ | 81.71$^{bc}$ | 84.98$^{ab}$ | 86.45$^{ab}$ | 77.85$^{c}$ | 81.68$^{bc}$ | 3.39* |
| Crude Fibre (%) | 61.53$^{abc}$ | 69.21$^{a}$ | 69.21$^{a}$ | 67.15$^{ab}$ | 61.06$^{abc}$ | 55.34$^{bc}$ | 7.59* |
| Ether Extract (%) | 87.81$^{ab}$ | 89.19$^{a}$ | 89.19$^{a}$ | 87.89$^{ab}$ | 88.60$^{ab}$ | 84.80$^{ab}$ | 2.99* |
| NFE (%) | 94.73$^{a}$ | 89.23$^{cd}$ | 91.67$^{bc}$ | 92.37$^{ab}$ | 88.30$^{d}$ | 89,28$^{cd}$ | 1.63* |
| ASH(%) | 73.11$^{a}$ | 63.66$^{ab}$ | 64.63$^{ab}$ | 66.18$^{ab}$ | 57.86$^{b}$ | 60.55$^{b}$ | 6.25* |

* Means that do not share a letter are significantly different

EHLM = E*uphorbia heterophylla* Leave Meal; SEM = Standard Error of the Mean; NFE Nitrogen Free Extract.

The high digestibility of crude protein, ether extract and nitrogen free extracts among all dietary treatments by the broiler chicks probably may be due to improved morphological and physiological development of the intestine which result in better intestinal absorption and utilizationof nutrients in diets containing polyunsaturated fatty acids. This agreed with the findings of Hashemi*et al*. (2008a) and Biasata*et al*. (2018) who reported that high concentration of polyunsaturated fatty acid and anti-microbia, anti-oxidative and anti-inflammatory properties of phytochemicals in *Euphorbia heterophylla*which enhanced a balance between the host, intestinal microbiota, intestinal microscopic features and diets results in improved gut health, intestinal morphology, improve digestive process, increased digestibility, absorption and retention of protein in amino acid. The higher digestibility of fat in birds fed 5%, 10%, 15%, and 20% *EHLM* inclusion compared with the control (0%) might be due to the higher content of PUFA which enhance higher lipase activity and bile secretion. This agreed with the findings of Noyand Sklan (1996) and Baiao and Lara (2005) who reported that fats containing higher unsaturated fatty acids or mixed with Saturated Fatty Acid (SFA) enhance bile secretion and lipase activity, which promote digestibility of young chickens by increasing the ability to form micelles, which enhance digestibility and absorption of fats.The higher digestibility of nutrients in this study may probably be due to modulation of intestinal morphology by the phytochemical effects of *EHL* in intestinal length which might result in increased intestinal lengths of birds fed the test diets. The increase in intestinal length is positively correlated to an increase in the length of villi and increased absorptive surface area available for digestion and absorption of nutrients. The findings of the present study agreed with the earlier observations that villi greatly expand the surface area of the intestinal lining in the avian gut (Hoerr 2001). Long villiwas positively correlated with improved gut health, and increased in duodenal and jejuna height (Baurho*et al.,*2000). The digestibility of crude fibre and ash is low compare to other parameters measured but the digestibility exceeds 50% in all treatment groups which indicates good efficiency of the biological value of the experimental diets. For all the parameters

measured, digestibility was superior in birds fed 10% and 15% *EHLM* diets.

**Conclusion**

The study demonstrated that *EHLM* could replace soya bean meal at 10% and 15% levels of inclusion in broiler chicks without any adverse effect on growth performance and nutrient digestibility.

**References**

**Abbas, A. K., Linchtnan, A. H. and Pillai, S. 2007.** Cellular and molecular immunology, 6th Ed. Elsevier, Philadelphia, Pp. 32 – 34.

**AgenceNationale de SecuriteSanitare de I' Alimentation, de I'Environment et du Travail (ANSES) 2011**. Actualization des apportsnutritionnelsconseilles pour les acidesgras. Repportd'expertise collective.

**Akpen, G. D, 2019**. Aquifer Characteristics of some Local Government Areas of Benue State. http://www.ajol.info;viewfile.

**Baiao, N. C. and Lara, L. 2005.** Oil and Fat in Broiler Nutrition RevistnBrasilCienAvic 7: PP 129-141.

**Baurhoo, B., Ferket, P. R., Zhao, X. 2009.** Effects of Diets containing different concentrations of mannoligosacharides or Antibiotics in growth performance, intestinal development, cecal and litter microbial population and carcass parameters of broilers. Poult. Sci., 88: Pp. 2262 -2272.

**Benyr, K., Thendo, S. T., Avhafunami, J. M. 2015.** Effect of Genotype and Sex on the Growth Performance and Carcass Characteristics of Broiler Chicken. Trop Anim Health Prod. 1225 – 1231.

**Biasata, I., Ferrocino, I., Teresa, M. C. 2018**. Modulation of Intestinal Microbiota, Morphology and Mucin Composition by Dietary Insect meal Inclusion in Free-range Chickens, BMC Veterinary Research 14. No. 383 (2018).

**Cruz, F. L., Saraiva, L. K. V., Silva, G. E., Nogueira, T. M., Silva, A. P. and Faria, P. B. 2018.** Growth and Carcass Characteristics of Different Crosses of Broiler Chickens Reared under an Alternative System. SeminaSiencias Agrarians. 39.. 317 – 328.

**Falodun, A. and Agbakwuru, E. O. P., 2004.** Phytochemical Analysis and Laxative Activities of the Leaf Extract of *Euphorbia heterophylla (Euphorbiacae)*. Pakistan Journal of Scientific and Industrial Research 47(5). 345-348.

**F.A.O 2008.** Statistical Data for 2008. Retrieved on 2011-01-16, FAO (2010). Food and Agricultural Organization of the United Nation, Rome, Italy.

**Fasuyi, A.O. and Arire, E. O. 2015.**Particulating Broiler Finisher Feeds into Forms and Diameters for Nutritional and Economic Benefits (Part 2). Academic Journals No. 3 E980 AA50016, Vol. 9(2).. 76-83.

**Hashemi, S.R; Zulkifli, I; Hair, B.M; Karam, M. and Soleimanii, A.R. 2008a**. Acute toxicity study and phytochemical Screening of selected herbal aqueous extract in broiler chickens Int. J. Pharmacol. 4, Pp. 352-360.

**Henn, J. D, Bockorl, Ribeiroaml, Coldebella, A. and Kessieradm, 2014.** Growth and the Position of Body Components of Intermediate and High Performance Broilers. Brazilian Journal of Poultry Science, ISSN – 1516 – 635X, Vol. 16, No. 3,

http://doi.org/10.1590/1516.635X 1603319-328..1-5

**Hoerr, E.J. 2001**. Intestinal Integrity and the impact of losing it. Elanco Poultry Health Conference, Atlanta, January 21st.

**Ikeokwu, N. 2012.** Global Food Crisis and Challenges in Nigeria. www.ganji.com/articule8000/NEW8004.htm.

**Lopez, K. P. M., Schilling, W., Corzo, A. 2011.** Broiler Genetic Strain and Sex Effect on Meat Characteristics. PoultSci, 90.. 1105-1111.

**MINITAB 2014**. Statistical Analysis. MINITAB Student version 14 for windows, 1st Edition, Duxbur Press, Belmont, N. Y.

**N'Goran, D.V.K., Jean-Francois, G., Nogbou, E.A., Eric, T., Pierre-Guy, M., Daniel, C., Legend, P. and kouba, M. 2013.** Effect of Supplementation of *Euphorbia heterophylla*on nutritional meat quality of Guinea pig (*Caviaporcellus* L.) Meat Science Vol. 93, Issue 4, Pp. 821-826.

**N'Goran, D.V.K., Gnantro, C.M.T., Cho, E.M.A., Jean-Francois, G. and Marryline, K. 2016.** Effect of Feeding *Euphorbia heterophylla* seeds on egg production, egg quality, lipid composition and sensory evaluation of eggs. Journal of Animal and Plant Science, 2016. Vol. 31 Issue 2: Pp. 4889-4900. Publication date 11/10/2017. http://www.m.elewa.org/JAPS,ISSN 2071- 7024.

**Noy, Y. and Sklan, D. 1996.** Uptake Capacity in Vitro for Glucose and Methionine and in Situ for Oliec acid in Proximal small intestine of post hatch chicks, Poult. Sci., 75: Pp. 998-1002.

**Odeh, M. O., Igwebuike, J. U., Ubosi, C. O. and Akukwaegbu, S. E. 2012.** Performance, Digestibility and Carcass Characteristics of Broiler Chickens Fed with Graded Levels of Rice Milling Wastes. Katsina-Ala Multi-Disciplinary Journal 1 (2).. 38-50

**Ojedopo, L. O., Akinokun, O., Adedeji, T. A., Olayeni, T. B., Ameen, S. A. and Amao, S. R. 2008.** Effect of Strain and Sex on Carcass Characteristics of Three Commercial Broilers Reared in Deep Litter System in the Derived Savannah Area of Nigeria. Classic Anim Breed Genet. 4..847-491

**Oju2003.**Oju Physical online; Oju LGA, Benue State SA3. Last edited on September, 2015, at 20:41, Time zone WAT (CTC + 1), Oju Physical setting online.com 29th January.

**Okeniyi, S.O., Adedoyin, B.J. and Garba, S. 2012**. Phytochemical Screening, Cytotoxicity, Antioxidant and Antimicrobial Activities of Stem and Leaves Extracts of *Euphorbia heterophylla*. Bulletin of Environmental Pharmacology and Life Sciences. Online ISSN 2277-1808, Vol. 1(8) Pp. 87-91.

**Okwori, A.I. and Attah, S. 2016.** Essentials of Forage Crop Production, Management and Utilization in the Tropic, ISSN: 978-978-978-961-682-4. Jalim Publishers Nig. Ltd. Highlevel, Makurdi, Benue State, First Edition Pp. 106.

**Olawumi, S.O., Fajemilehin, S. O., Fagbuaro, S. S. 2012.** Genotype and Sex Interaction Effect on Carcass Trait of Three Strains of Commercial Broiler Chickens. J.World'sPoult Res. 2.. 21-24

**Olusegun, O. I., Falowo, A. B., Mpendulo, T. C., Zindove, T. J. and Okoh, A. J. 2020.** Effect of Strain, Sex and Slaughter Weight

on Growth Performance, Carcass Yield and Quality of Broiler Meat. https//doi.org/10.1515/opag.2020. 0056.607-616.

**Salami, R. I. and Odunsi, A. A. (2017.** Growth Performance of broiler Starter Chickens Fed Varying Levels of Fibre and Energy in Multi-Fibre Source-Based Diets. Nigerian Journal of Animals Science, 19(2)..83-93.

**Sanghamitra, K.**, **Kula, p. K., Niranjan, K. and Joga, D. M. 2020.** Performance of Commercial Broiler Chickens Under Sex Separate Rearing in Deep Lither System. International Journal of Livestock Research, eISSN..2277 – 1964. Vol. 8 (5), 129-135. http..//ds.doi.org/10.5455/ijlr.2017 0605044468.

**Tion, M.A. and Wuanor, A.A. 2009.** The Effects of Pelleted and Unpelleted All Mash Broiler Diets on Performance, Carcass Quality and Internal Organ Developments of Broiler Chickens Nig. J. Anim. Prod. 2009, 36(2): Pp. 264-274. Nigeria Society of Animal Production.

**Women in Agriculture, 2011**. Table Egg Production in Lagos State, Nigeria, West Africa by Mrs. Grace Evbuomwan. http://www.infmannline.org /pdf/congress/09. Women-Panel-Grace Evbuoman. Pdf.

***Received: 10th June, 2021***
***Accepted: 27th September, 2021***