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# Analysis and Evaluation of *Moringa oleifera* Leaves Extract on Performance and Carcass Characteristics of Broilers Chicks

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***Abstract:*** *Eight weeks feeding trial involving 100 day-old broiler chicks was carried out in a completely randomized experimental designed(CRD) to analyze and evaluate Moringa oleifera Leaves Extract (MLE) for the performance indices and carcass characteristics of broilers. The birds were randomly assigned to five treatment groups containing 0, 40, 80, 120 and 160ml MLE/liter of water. Water intake was recorded daily while initial weight of the birds was taken at the beginning of the experiment and weekly thereafter. Body weight gain was calculated as the difference between the final and initial body weight. Feed conversion ratio was determined by dividing feed intake by the body weight gain. Mortality was recorded as it occurred. The effect of Moringa oleifera extract on carcass characteristics was also evaluated. Results showed significant (P<0.05) effect for all the parameters evaluated. Birds served 40ml MLE/liter of water had the highest feed intake and body weight gain than any other treatments (P<0.05). It was concluded that Moringa oleifera leaves extract at 40ml MLE/liter of water improves growth performance of broiler chickens without adverse effect on carcass.*

***Keywords:*** *Chicks, Carcass, Broilers, Moringa, Organs, Weight*

## INTRODUCTION

Antibiotics have been extensively used as feed additives and growth promoters in animal feed industry. In Nigeria, antibiotics are administered in poultry drinking water for prevention or control of bacterial contamination and as growth promoters. The benefits of such practice is to maintain good health, suppress mortality of birds, support optimum growth and feed utilization and increased profit (Murwani and Murtini, 2009). The use of antibiotics is limited due to their residual effect in poultry products, drug toxicity and development of bacteria resistance (Schwarz et al., 2001). The negative impact on consumers of meat or poultry products due to residual effects has led to the ban on the use of antibiotics as growth promoters since 2006 by the European Union. In recent years, Animal scientists and veterinarians are now turning attention to safe and natural alternatives such as plants extract to replace antibiotics. Meanwhile, the use of organic supplements such as probiotics, prebiotics, enzymes and plant or herbal extracts, are generally believed to be safer, healthier, and less subject to hazards.

Plant extracts have been used in the diets of poultry as a means of reducing high cost of conventional protein sources (Nworgu, 2007; Machebe et al., 2010) as well as growth promoter (Nidaullah *et al*., 2010). According to the authors, extracts also have appetizing and digestion stimulating properties. Machebe et al. (2010) and Onu (2012) indicated that the plant leaf extracts do not only serves as protein but also provides some necessary vitamins

and minerals which could complement the inadequacies in most feedstuffs. Plant antimicrobial effect has also been repoted.

Plant extracts contain phytonutrients and phytochemicals (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides), which are referred to as secondary metabolites (Machebe et al., 2010).

Secondary metabolites are applied in nutrition as pharmacologically active ingredients. Proximate and phytochemical analysis showed that plant extract contained essential nutrients and bioactive compounds (or phytochemicals) that play a role in nutrition as feed supplement and as medicines for the treatment of certain diseases (Durrani et al., 2008; Ogbe et al., 2011).

*Moringa oleifera* is one of the herbs containing bioceutical agents that could substitute synthetic growth enhancers in broiler and other livestock production. Scientific studies pertaining to its potential involved the study of Lannaon (2007). The author reported that performance of broilers given *M. oleifera* leaf decoction, improved feed consumption, daily weight gain, final weight and reduced cost of production. Furthermore, Du et al. (2007) evaluated the effects of dietary supplementation of *Moringa oleifera* on growth performance, blood characteristics and immune response of Arbor acre broiler strain. It was found out that increasing supplementation of *Moringa oleifera* decreases contents of uric acid, triglycerides and albumin/globulin ratio in the serum improving the immune response of the animals significantly. Yang et al. (2007) evaluated the effect of *Moringa oleifera* on the growth performance, immune function, and ileum microflora in broilers. Significant enhancement of immune system, duodenum traits, increased Lactobacillus counts in ileum. This study evaluated *Moringa oleifera* leave extract on the performance and carcass characteristics of Anak broilers.

## MATERIALS AND METHODS

The experiment was conducted at the poultry farm of College of Agriculture Umaru Ali Shinkafi Polytechnic Sokoto, Sokoto State of Nigeria. The State, which consists of 23 Local Government Areas (LGAs), has its capital and seat of government located in Sokoto. The State is located in the North-west geographical zone of Nigeria lying between latitudes $4^0$-$6^0 40'$ N and longitudes $11^0 30'$-$13^0 50'$ E. It covers a land area of 28,232.37 square kilometers (SOSGD, 2011).

### EXPERIMENTAL DESIGN AND PROCEDURES

A total of one hundred (100) 3day-old broiler chicks were randomly assigned to five treatments containing 0 ml, 40 ml, 80 ml, 120 ml and 160 ml of *Moringa oleifera* leaf extract (MLE) per one liter of water in a completely randomized design (CRD). Birds in each treatment groups were further subdivided into four (4) subgroups of five birds to serve as replicate. The experimental diets fed to the animals at the starter and finisher phases are shown in Table1.

**Table 1: Composition of the experimental diet for both starter and finisher stages**

| Ingredient (S) | Starter (%) | Finisher (%) |
|---|---|---|
| Maize | 55 | 54 |
| Groundnut cake | 30 | 24 |
| Wheat offal | 5.0 | 12 |
| Blood meal | 5.0 | 4.0 |
| Bone meal | 2.0 | 2.5 |
| Limestone | 2.0 | 2.5 |
| Premix | 0.3 | 0.3 |

| | | |
|---|---|---|
| Methionine | 0.2 | 0.2 |
| Lysine | 0.2 | 0.2 |
| Salt | 0.3 | 0.3 |
| Total | 100 | 100 |

| Calculated analysis | | |
|---|---|---|
| CP (%) | 24.65 | 22.07 |
| ME (kcal/kg) | 2950 | 2840 |
| Ca (%) | 1.3 | 1.59 |
| P (%) | 0.37 | 0.35 |
| CF (%) | 0.37 | 0.35 |
| EE (%) | 5.4 | 5.1 |

The broiler starter and finisher diets were formulated to meet the NRC (1994) nutrient requirements for broilers. During the experiment, feed and water were provided *ad-libitum* to the birds and the birds were fed once daily.

**COLLECTION AND PREPARATION OF EXTRACT**

Fresh leaves of *Moringa oleifera* were collected from the orchard of the College of Agriculture's livestock farm of the polytechnic. Two kilogramme of freshly cut *Moringa oleifera* leaves with stalks were washed, drained, chopped and pounded in a mortar with pestle. This was then squeezed and filtered with sieve to obtain the homogenous extract of the Moringa leaves extract (MLE). The MLE was prepared at three days interval.

**ADMINISTRATION OF THE EXTRACT**

*Moringa oleifera* leaf extract (MLE) was administered through drinking water at three days intervals for 27 days each for starter and finisher. The birds in group 1, 2, 3 and 4 were served 40 ml, 80 ml, 120 ml, and 160 ml MLE/litre of water. After consumption, fresh water was offered for the remaining of the day. Similarly birds in group 0 (control) were given fresh water without MLE.

**PREPARATION OF THE BROODING HOUSE**

According to Oluyemi and Roberts (2000), brooding is the care of chick from day old to six or eight weeks of age. It consists primarily of the provision of heat, air, water and feed. Similarly, all necessary repairs were carried out. A 60 watt electric bulb was fixed in each pen. The pens were thoroughly cleaned and disinfected using Izal solution and fresh wood shaving were used as litter material. Prior to the allocation of the chick to the pens, the bulbs were switched on for 24hours to warm the room. Routine management practices including feeding, supply of water; medication and vaccination were carried out as described by Oluyemi and Roberts (2000).

**SOURCE OF INGREDIENTS FOR EXPERIMENTAL DIETS**

All the major ingredients for the experimental diet formulation such as maize, wheat offal, groundnut cake, Bone meal, limestone and Blood meal were sourced from Sokoto central market. Other ingredients such as Methionine, Lysine and Premix were sourced from vendors within Sokoto metropolis.

**DATA COLLECTION**

Feed intake was recorded daily while initial weight of the birds was taken at the beginning of the experiment and weekly thereafter. Body weight gain was calculated as the difference between the final and initial body weights. Feed conversion ratio was determined by dividing feed intake by the body weight gain. Mortality was recorded as it occurred.

## CARCASS ANALYSIS

At the end of the experiment (8 weeks) one bird per replicate were randomly selected and slaughtered to obtain the relative weight of the carcass and organs. The birds were defeathered and eviscerated manually after slaughter. The eviscerated birds were dissected and all internal organs (lungs, heart, intestine, spleen, and gizzard) and external offals (head, shank and neck) were carefully removed. Dressing percentage will be calculated using the formula.

$$\text{Dressing percentage (\%)} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

## STATISTICAL ANALYSIS

All the data collected from the study were subjected to analysis of variance (ANOVA) using SPSS computer software package and Means separation were carried out using Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

The results of the effect of *Moringa oleifera* leaves extract on carcass and organs characteristics of broiler chickens 1 – 8 weeks are shown in Table 2, 3, 4 and 5.

**Body weight gain (g/bird)**

Table 2: Body weight gain of broilers fed with *Moringa oleifera* leaves extract

| | **TREATMENTS** | | | | | |
|---|---|---|---|---|---|---|
| Age of birds (weeks) | 0(0ml) | 1(40ml) | 2(80ml) | 3(120m) | 4(160ml) | SEM |
| 1 | 357.50$^{b}$ | 500.00$^{a}$ | 475.00$^{a}$ | 427.50$^{ab}$ | 457.50$^{ab}$ | 61.22 |
| 2 | 740.00$^{a}$ | 870.00$^{a}$ | 665.25$^{a}$ | 725.00$^{a}$ | 695.00$^{a}$ | 64.28 |
| 3 | 1170.00$^{c}$ | 1450.00$^{b}$ | 4500$^{a}$ | 900$^{d}$ | 1235$^{c}$ | 61.15 |
| 4 | 2137.50$^{b}$ | 2327.50$^{a}$ | 1890.00$^{cd}$ | 2025.00$^{bc}$ | 1755.00$^{c}$ | 57.70 |
| 5 | 3150.00$^{b}$ | 3750.00$^{a}$ | 2327.50$^{d}$ | 2175.00$^{e}$ | 2977.50$^{c}$ | 44.52 |
| 6 | 4300$^{b}$ | 5000$^{a}$ | 3550$^{c}$ | 3500$^{c}$ | 3750$^{d}$ | 110.11 |
| 7 | 6250$^{a}$ | 6250$^{a}$ | 6250$^{a}$ | 6250$^{a}$ | 6250$^{a}$ | 32.11 |
| 8 | 7800$^{b}$ | 8175$^{a}$ | 6262.5$^{d}$ | 5800$^{d}$ | 7148$^{c}$ | 77.40 |
| **TOTAL** | **25905** | **34930.24** | **28322.50** | **21832.50** | **24268.00** | |

**a**bc- means values on the same row with different superscript are significant (P<0.05)

There were significant difference (P<0.05) in all the performance parameters indices evaluated. The best weights gain of1838g/bird was observed on the birds served 40 ml compared to 80 ml, 120 ml, 160 ml and control (1565g/bird, 1450g/bird, 1787g/bird and 1560g/bird) respectively. The higher weight gain of birds served 40 ml of MLE/litre of water could be as a result of higher digestion of the nutrient consumption by the birds and greater efficiency in the utilization of feed which resulted in enhanced growth. Nuhu (2010) noticed that a diet containing *Moringa* leaves extract significantly (P<0.05) increased dry matter, protein digestibility and daily weight gain. The decreased of body weight gain observed in birds served MLE at 80 ml, 120 ml and 160 ml could be attributed to the presence of anti-nutritional factors (ANFs) in the extract. These findings coincided with report of Muhammad et al. (2011) that the leaves of *Moringa oleifera* contains tannin and saponnins which known to reduce feed efficiency and consequently body weight gain.

**FEED INTAKE**

Table 3: Average Feed intake (g/bird)

| | TREATMENTS | | | | | |
|---|---|---|---|---|---|---|
| Age of birds (weeks) | 0(0ml) | 1(40ml) | 2(80ml) | 3(120m) | 4(160ml) | SEM |
| 1 | 105.27[b] | 104.27[b] | 103.06[b] | 116.94[a] | 190.88[a] | 1.25 |
| 2 | 178.82[a] | 178.27[a] | 162.08[c] | 176.96[a] | 166.35[b] | 1.282 |
| 3 | 232.40[a] | 229.86[a] | 223.61[b] | 207.86[c] | 215.65[c] | 1.282 |
| 4 | 260.72[b] | 266.07[a] | 252.15[c] | 225.08[d] | 258.40[b] | 1.92 |
| 5 | 310.71[a] | 310.71[a] | 307.14[b] | 298.57[c] | 310.71[a] | 1.61 |
| 6 | 335.72[b] | 342.86[a] | 328.57[c] | 325.00[d] | 335.72[b] | 1.38 |
| 7 | 385.71[a] | 385.71[a] | 369.21[c] | 374.28[b] | 382.85[a] | 1.56 |
| 8 | 417.86[a] | 417.86[b] | 416.08[b] | 414.29[c] | 417.86[a] | 1.71 |
| **TOTAL** | **2227.21** | **2235.61** | **2161.90** | **2138.98** | **2278.42** | |

abc: means values on the same row with different superscript are significantly different (P<0.05)

There is significant difference (P<0.05) in feed consumption among the treatments (Table 3) The group served 120 ml consumed significantly lower amount of feed (2138g/bird) respectively. The results however showed that birds offered 160 ml and 40 ml from 1 – 8 weeks consumed more feed compared to the groups containing 80 ml, 120 ml and control. This could be as a result of the availability of minerals and vitamins in the extract which enhanced the palatability of feed and consequently improved feed intake. Oluyemi and Roberts (2000) reported that the incorporation of both micro and macro nutrients in poultry diets enhances feed intake and utilization. The total feed intake of (2208.42g/bird/day) recorded across the treatments was higher than the 1251.61b/bird/day reported by Suleiman et a*l*. (2013) when fed *Carica papaya* leaves extracts to finisher broilers. However, Nworgu et al. (2007) reported higher values of 3175.05g/bird/day when they fed *Telfaria occidentalis* leaves extract. Kakenzi et al. (2007) declared that addition of 20% and 35%of *Moringa oleifera* leaves extract to the broiler diet, significantly (P<0.05) increased feed intake and dry matter intake. Olugbemi et al. (2010) reported that levels above 45% of *Moringa oliefera* leaves extract decreased broiler performance. High level of saponins and tannin in feed can also affect feed intake and growth rate.

**WATER INTAKE**

Table 4: Water intake (bird/day)

| | TREATMENTS | | | | | |
|---|---|---|---|---|---|---|
| Age of birds (weeks) | 0(0ml) | 1(40ml) | 2(80ml) | 3(120m) | 4(160ml) | SEM |
| 1 | 155.43[a] | 146.75[a] | 143.25[a] | 147.78[a] | 143.54[a] | 14.26 |
| 2 | 229.08[a] | 227.57[a] | 213.22[b] | 194.00[d] | 202.51[c] | 17.87 |
| 3 | 350.00[a] | 349.82[a] | 339.82[c] | 318.04[d] | 345.00[b] | 18.86 |
| 4 | 610.71[c] | 628.57[a] | 610.00[c] | 576.96[d] | 619.89[b] | 1.58 |
| 5 | 892.89[a] | 892.89[a] | 869.89[b] | 858.25[c] | 892.89[a] | 2.29 |
| 6 | 100.93[b] | 1017.86[a] | 983.93[c] | 980.36[d] | 1017.86[a] | 2.27 |
| 7 | 1000[a] | 1000[a] | 994.64[c] | 998.22[b] | 1000[a] | 2.90 |
| 8 | 1000[a] | 1000[a] | 1000[a] | 1000[a] | 1000[a] | 3.00 |

| | | | | | |
|---|---|---|---|---|---|
| **TOTAL** | **4439.04** | **5263.46** | **5154.75** | **5073.61** | **5221.69** |

abc- means values on the same row with different superscript are significantly different (P<0.05)

There were significant (P<0.05) differences in the water intake among the treatments. The total water intake was highest at 40ml level concentration of *Moringa* leaves extract. The total water intake here agrees with the report of Oluyemi and Roberts (2000). The decreased of water intake observed in birds served MLE could be attributed to the presence of anti-nutritional factors (ANFs) in the extract. The total water intake here agrees with the report of Oluyemi and Roberts (2000)

**FEED CONVERSION RATIO**

Table 5: Average Feed conversion ratio (g feed $^{1-}$gain)

| | **TREATMENTS** | | | | | |
|---|---|---|---|---|---|---|
| Age of birds (weeks) | 0(0ml) | 1(40ml) | 2(80ml) | 3(120m) | 4(160ml) | SEM |
| 1 | $2.47^{a}$ | $1.51^{b}$ | $1.93^{a}$ | $1.55^{b}$ | $1.14^{c}$ | 14.26 |
| 2 | $3.51^{c}$ | $3.74^{d}$ | $8.68^{b}$ | $16.20^{a}$ | $5.03^{b}$ | 2.40 |
| 3 | $3.79^{b}$ | $2.89^{b}$ | $3.65^{b}$ | $15.96^{a}$ | $3.10^{b}$ | 1.89 |
| 4 | $1.89^{b}$ | $1.57^{b}$ | $2.45^{b}$ | $1.40^{b}$ | $3.64^{a}$ | 1.35 |
| 5 | $2.21^{b}$ | $1.64^{b}$ | $12.19^{a}$ | $8.40^{a}$ | $1.97^{b}$ | 2.03 |
| 6 | $2.04^{b}$ | $1.92^{b}$ | $1.92^{b}$ | $1.91^{b}$ | $3.08^{a}$ | 2.17 |
| 7 | $1.38^{b}$ | $2.25^{a}$ | $1.37^{b}$ | $1.09^{c}$ | $0.98^{c}$ | 1.94 |
| 8 | $2.05^{c}$ | $1.54^{c}$ | $3.33^{b}$ | $3.64^{a}$ | $3.66^{a}$ | 1.22 |
| **TOTAL** | **19.34** | **17.06** | **35.52** | **50.15** | **22.60** | |

abc- means values on the same row with different superscript are significantly different (P<0.05)

The lower body weight gain was recorded in the birds served 80ml, 120ml, 160ml MLE/litre of water and control groups. This could be associated with the poor feed conversion ratio. The better FCR observed in birds served 40ml MLE/litre of water suggests the ability of the birds to utilize available nutrients in the feed and the extract. This could be due to lower level of *Moringa oleifera* leaves extract concentration as observed, thereby allowing for regular absorption of nutrients. These findings are in line with the reports of Nworgu et al. (2007) and Machebe et al. (2010) who reported that birds fed with leaf extracts had better feed conversion ratio than control. It could be seen from Table 4.4 that FCR improved for bird offered MLE. These findings are in line with the report of (*Guo et al.*, 2002) that the use of some additives with medicinal properties helps to eliminate pathogenic organism and improved utilization of feeds by the birds.

Table 6: Carcass characteristics of experimental birds

| | **TREATMENTS** | | | | |
|---|---|---|---|---|---|
| **Parameters** | **0 (0ml)** | **1(40ml)** | **2 (80ml)** | **3(120ml)** | **4(160ml)** |
| **SEM** | | | | | |
| Live weight (g/b) | $1650^{a}$ | $1725^{a}$ | $1625^{a}$ | $1450^{b}$ | $1625^{a}$ |
| 48.73 | | | | | |
| Dressing weight (g/b) | $1500^{ab}$ | $1575^{a}$ | $1550^{a}$ | $1387^{b}$ | $1550^{a}$ |
| 45.52 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Dressing % 1.19 | 91[b] | 91[b] | 95[a] | 95[a] | 95[a] |
| Breast muscle (g) 5.27 | 269.3[b] | 326.33[a] | 275.700[b] | 292.85[a] | 299.67[a] |
| Back (g) 1.45 | 176.87 | 143.92 | 148.55 | 136.03 | 166.97 |
| Chest (g) 1.04 | 91.88 | 95.97 | 113.00 | 93.20 | 96.00 |
| Wing (g) 1.47 | 74.98[b] | 78.29[a] | 70.91[c] | 61.00[d] | 58.83[e] |
| Drumstick (g) 1.27 | 192.66[b] | 190.77[b] | 200[a] | 195.00[a] | 190.00[b] |
| Shank (g) 1.27 | 46.01[a] | 36.200[c] | 44.19[a] | 42.100[b] | 47.53[a] |
| Head (g) 2.00 | 70.83[a] | 74.44[a] | 60.30[b] | 58.71[b] | 55.00[c] |
| Neck (g) 2.21 | 82.05[a] | 78.25[b] | 79.38[b] | 78.95[b] | 84.60[a] |

abc- means values on the same row with different superscript are significantly different (P<0.05)

Table 7: Weights of organs

| | **TREATMENTS** | | | | |
|---|---|---|---|---|---|
| **Parameters (g) SEM** | **0 (0ml)** | **1(40ml)** | **2 (80ml)** | **3(120ml)** | **4(160ml)** |
| Liver 1.52 | 35.60[b] | 34.60[b] | 40.78[a] | 36.20[b] | 39.05[a] |
| Lungs 1.37 | 12.03[b] | 11.850[b] | 11.45[b] | 9.95[c] | 15.20[a] |
| Heart 1.14 | 7.97[b] | 7.87[b] | 6.27[c] | 7.07[b] | 9.40[a] |
| Pancreas 1.09 | 3.02[b] | 4.38[a] | 2.50[c] | 4.47[a] | 3.56[b] |
| Abdominal fat 5.55 | 50.33[a] | 33.93[a] | 31.65[ab] | 13.90[b] | 34.95[a] |
| Crop 2.22 | 16.25[a] | 17.95[a] | 7.28[b] | 7.00[b] | 6.25[c] |
| Small intestine 2.2 | 42.18[b] | 37.90[c] | 71.33[a] | 44.73[b] | 38.88[c] |
| Large intestine 1.98 | 29.05[d] | 32.75[c] | 52.38[a] | 37.80[c] | 43.53[b] |
| Ceacum 5.62 | 15.08[a] | 12.13[c] | 10.85[c] | 11.68[b] | 11.78[b] |
| Gizzard 4.22 | 46.93[b] | 39.71[c] | 50.20[a] | 38.9[c] | 40.20[c] |
| Spleen 3.11 | 2.00[a] | 1.80[b] | 2.30[a] | 1.98[b] | 2.00[a] |

| | | | | | |
|---|---|---|---|---|---|
| Proventriculus 1.28 | 7.50[a] | 7.50[a] | 7.10[a] | 6.20[b] | 6.30[b] |

abc- means values on the same row with different superscript are significantly different (P<0.05)

The results of the carcass characteristics and organ weight (Table 4.5 and 4.6) showed that were there is significant differences (P<0.05) between the treatments for the weight of various parts of the birds measured. Birds served 40ml MLE/litre of water has the highest live weight of 1725g .

Compare to other groups. The improvement in the live weight of the birds served 40ml MLE/litre of water could be attributed to the fact that *Moringa oleifera* contains some medicinal properties. These coincided with reports of Doyle (2001) who reported that application of medicinal plants allowed chicken to grow strong and healthy. The dressing percentage recorded were fall within the range of 91.13 – 95.24 obtained by Akintunde *et al*., (2012).In the same vein prime cuts of shank, breast muscle, wing, drumstick and other internal organs are statistically similar. The significant differences observed could be due to tissue synthesis for these parts. Abbas and Ahmed (2012) reported that an addition of 20% - 45% of Moringa leaves extract increased carcass weight. However, the increase in the size of liver and gizzard could be related to increased activity to overcome the effect of toxic anti-nutritive compounds in the extract. Contrary to the lants extracts on liver, gizzard, kidney and lung weight

Table 8: Proximate composition of Moringa leaves extract

| **Parameters** | **Moringa extract** |
|---|---|
| Moisture content (%) | 64 |
| Ash content (%) | 0.2 |
| Crude fiber content (%) | 3.1 |
| Crude protein content (%) | 3.4 |
| Carbohydrate content (%) | 4.2 |

The results of the proximate composition of Moringa extract are shown in Table 8. The moisture contents are higher than the values reported for baobab seed flour (4.20%) Adubiaro *et al.* (2011). The protein content of these extract samples give an indication of their usefulness in human diet and as livestock feed.

## CONCLUSION

It could be concluded from the results of this study that giving *Moringa oleifera* leaves extract at 40 ml MLE/litre water to chicks in drinking water improves the growth performance of broiler chickens without adverse effect on carcass.

## RECOMMENDATIONS

- Since the test ingredients (*Moringa oleifera*) are abundant in the study area, there is need to utilize them as an alternative antibiotic growth promoter. This will reduce the risk of side effect occasioned by the routine use of convectional antibiotics on broiler chickens to maximize the production of safe meat for consumption.
- *Moringa oleifera* leaves extract at 40 ml MLE/litre of water is recommended at 3-days interval for improved feed intake and weight gain.

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