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Growth Performance, Blood Serum Vitamins and Minerals of Broiler Chickens on Supplemental Moringa Leaf (*Moringa oleifera*) and Pumpkin Leaf (*Telferia occidentalis*) Extracts

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Abstract

Extracts of fresh leaves of Moringa leaf (*Moringa oleifera*) and Pumpkin (*Telferia occidentalis*) were administered to broiler chickens in a study that lasted for 8 weeks to evaluate the growth performance, blood serum vitamins and minerals of the birds. A total of 210 day-old broiler chicks were randomly allocated into various pens which consisted of 7 different groups (treatments) with each one having 30 birds. Treatment 1 birds served as the control and were offered commercial synthetic multi-vitamins (vitalyte) in their drinking water. Treatment 2 birds had 50ml moringa leaf extract (MLE) per liter of water while Treatments 3 was 50ml pumpkin leaf extract (PLE) per liter of water. Treatment 4 was 100ml MLE and 5, 100ml PLE. Treatment 6 birds had a mixture or a combination of MLE and PLE (50ml MLE+50ml PLE), while treatment 7 was also a mixture of MLE and PLE (100ml MLE+100ml PLE). Commercial broiler starter and finisher feeds were offered throughout the duration of the experiment. Data were collected on feed intake, weight gain, feed conversion ratio and water intake. On the last day, blood samples were collected for serum vitamins and minerals analysis. The results showed that the extracts significantly ($P<0.05$) affected all the parameters assessed. Growth parameters per chicken; final live weight gain (3044.65g), daily feed intake (97.06g) and feed conversion ratio (1.84) were best in chickens given 100ml/L MLE while other leaf extracts treated birds compared favorably with the vitalyte chickens. Chickens offered moringa and pumpkin leaves extracts had higher concentrations of the assayed vitamins and minerals; vitamins A, C, D and E; potassium, calcium, magnesium and iron except for sodium. It was therefore concluded that extracts of *M. oleifera* and pumpkin leaves could serve as organic substitutes to the synthetic commercial multivitamins (vitalyte) in broiler chicken nutrition. Also the residual effects of the use of synthetic vitamins will be reduced.

Keywords: Broiler Chickens, *Moringa oleifera*, *Telferia occidentalis*, Growth Performance, Blood Serum Vitamins and Minerals.

INTRODUCTION

The poultry industry in the developing countries like Nigeria is facing some challenges, of which is the increase in the cost of feeds because of high prices of protein and energy sources (Abbas, 2013) as well as the micro nutrients. The use of leguminous multipurpose trees and shrubs has been suggested to be a viable alternative source of proteins, vitamins and minerals for poultry feeding. Plant leaves are commonly processed into leaf meals for use as poultry feed.

The utilization of plant and leaf extracts in animal production has found widespread scientific and commercial acceptance as a strategy to improve the health status and performance of the animals. Leaf extracts also have appetizing and digestion stimulating properties and antimicrobial effects. Leaf meal supplementation has been included in the diet of poultry as a means of reducing high cost of conventional protein sources and to improve profit margin (Odunsi *et al*., 1999; Nworgu *et al*., 2007; Onyimonyi *et al*., 2009). Leaves can also be used as feed additives for the biological function of birds such as vitamins and trace elements as growth promoters, absorption enhancers, antimicrobial agents and metabolic modifiers (Abaza 2001; Hassan *et al*., 2004).

Examples of the leaf meals which have been widely used in feeding non-ruminant animals include *Telferia occidentalis*, *Leucaena leucocephala, Gliricidia sepium, Sesbania sesban and Manihot esculenta* (Gadzirayi *et al.,* 2012). However, Moringa *(Moringa oleifera)* is now presently being focused globally as another promising leaf meal in livestock feeding. Moringa is drought-tolerant and grows at a rainfall of 250-1500mm per year (Martin, 2004). Rich in nutrients such as protein and minerals, Moringa is one of those plants that have not been fully studied for many years but now is being investigated for its fast growth, higher nutritional value, and increasing utilization as a livestock fodder crop (Nouman *et al*., 2013). The feeding value of Moringa has been reported to be analogous to that of soybeans and rapeseed meal (Soliva *et al.,* 2004). With the leaves of Moringa being rich in nutrients, pregnant women and lactating mothers use the powdered leaves to enhance their children's nourishment, principally in under-developed countries where malnutrition is common (Stephen *et al.,* 2008, Sudha *et al.,* 2010).

Telferia occidentalis (pumpkin leaf) is a leaf vegetable that is widely cultivated in the tropics and subtropics. Chemically *T. occidentalis* leaf extract contains 21.31% crude protein, 6.41% crude fibre, 5.50 ether extract, 10.92% ash, and 3121ME (kcal/kg) (Nworgu, 2007). The authors noted that the leaves had low level of tannic acid (4.75+0.50mg/100g DM) and oxalate (0.45+2.10mg/100g DM), but high level of phytic acid (20.5+2.10mg/100g DM).

Haematology is the study of blood and it forms an important part of clinical pathology as well as diagnostic processes. Haematology includes not only the examination of the cellular and fluid portions of blood, but also the study of the tissues that form, store and circulate blood cells. However, the serum is the component that is neither a blood cell nor a clotting factor. It is the part of blood that is like water that contains substances (called antibodies) that fight diseases. Serum includes all proteins not used in blood clotting and all the electrolytes, antibodies, antigens, hormones and any exogenous substances.

The results of haematology and serum analysis are usually used to assess the health status of an animal. Haematological and serum parameters have been observed as good indicators of the physiological status of animal and their changes are important in assessing the response of such animal to various physiological situations (Khan *et al*., 2006).

This study assessed the growth performance indices and blood vitamins and minerals compositions of broiler chickens on dietary supplements of moringa leaf and pumpkin leaf extracts.

MATERILAS AND METHODS

Preparation of Moringa and Pumpkin Leaves Extracts

Fresh leaves of *Moringa oleifa* (moringa leaf) and *Telferia occidentalis* (Pumpkin leaf) were harvested and thereafter handpicked and rinsed in clean water. They were drained and sieved. One (1) litre of water was added separately per kg of the pumpkin and moringa leaves to facilitate the extraction of the aqueous during grinding using a standard kitchen grinder. The extracts were collected and seived using 0.5mm sieve to remove particles and debris and placed separately in clean containers. The supernatants were thereafter stored in the refrigerator and maintained at 5^{o}c, then removed and allowed to melt when needed before being added to drinking water of broiler chickens in proportions as designed in the experiment.

Experimental Design and Experimental Birds

The completely randomized design (CRD) was used for the experiment. A total of 210 day-old broiler chicks were randomly allocated into various pens which consisted of 7 treatments with each one having 30 birds. Each treatment had three replicates of 20 broiler chicks. Treatment 1 consisted of birds given a commercial synthetic multivitamins (vitalyte) in water following manufacturer's recommendation of 1g/L of water and it served as the control birds. Treatment 2 birds were offered 50ml moringa leaf extract (MLE) per litre of drinking water while in Treatments 3, 50ml pumpkin leaf extract (PLE) per liter of drinking water was given. Treatments 4 and 5 were 100ml MLE and 100ml PLE respectively. Treatment 6 birds had a mixture or combination of 50ml MLE and 50ml PLE (50ml MLE+50ml PLE), while treatment 7 was a mixture of 100ml MLE and 100ml PLE(100ml MLE+100ml PLE). Commercial broiler starter and finisher feeds were offered throughout the duration of the experiment. The birds had access to feed and water *ad-libitum* with daily consumption rates measured accurately. Medications and vaccinations were based on veterinary prescriptions.

The birds were weighed at the beginning of the experiment and subsequently on a weekly basis. The growth parameters that were examined included feed intake, water intake, weight gain, and feed conversion ratio (FCR). Feed intake was measured by using a 5kg measuring scale to take the weight of feed given and the feed leftover. The feed intake was calculated from the relationship using the formula below:

Feed intake = Feed given (previous day) – Feed leftover (g).

The birds were weighed on weekly basis using a measuring scale, the weight gain was calculated from the relationship using the formula below:

Weight gain = final weight – initial weight (g).

Feed conversion ratio was calculated using the formula below:

$$\text{Feed conversion ratio: } = \frac{\text{Feed intake (g)}}{\text{Weight gain (g)}}$$

Blood Collection and Analysis

On the last day of the experiment, blood samples (2ml /bird) were randomly collected from the wing veins of two chickens per replicate into anticoagulant bottles for vitamins and minerals analysis. The vitamins assessed included A, D, E, and K while minerals included sodium (Na), potassium (K) calcium (Ca), magnesium (Mg) and iron (Fe) for serum biochemical studies.

Statistical Analysis

Results obtained were subjected to one-way Analysis of variance (ANOVA) and Duncan Multiple Range Tests were used as suitable means separation techniques SASS, 1999 statistical package.

RESULTS AND DISCUSSION

Results on growth of the broiler chickens as shown in Table 1, revealed that all assessed parameters were significantly affected (P<0.05) by dietary treatments. The vitalyte control broilers were not superior to the *Moringa oleifera* and pumpkin leaves treated birds. In fact, statistically, the 100 MLE birds had higher final live weight gain of 3044.65g/bird as against the 2944.05g/bird recorded for vitalyte. Amongst the test extracts treated birds, the 100 PLE chickens were the least (2882.75g/bird). Feed intake and feed conversion were also best in the 100ml/L MLE. The chickens consumed less feed (97.06g/bird/day) with the least feed conversion ratio of 1.84. The vitalyte treated birds were again poorest in the two parameters, 109.25g/bird/day for feed intake and 2.09 for feed conversion ratio.

The findings of this research disagree with the earlier report of Gakuya *et al*., (2014) that the final live weight of broilers fed with moringa and pumpkin leaves were not significantly affected. Contrary to above, this study agrees with the report of Alabi *et al*., (2017) that aqueous extract (120ml/L) of *Moringa oleifera* supplemented broiler chickens had higher daily and final body weight gain compared with the unsupplemented control chickens. The superior performance of these birds is an indication that the concentration was within the tolerable limits of the birds and as such did not suppress the growth of the chickens. *Moringa oleifera* and *T. occidentalis* contain low levels of saponins, tannic acid, phytate and oxalate which are nutritional factors that depress animal growth. However, in the present study they did not exert any negative influence on the growth of the chickens indicating that the concentration levels of the leaf extracts were not toxic to the animals. Makkar *et al*., (1997) have since proved that *Moringa oleifera* leaves are rich in minerals, vitamins and protein with eight essential amino acids. Thus, the improvement of chicken growth may be attributed to those essential nutrients contained in Moringa leaves. Sanchez *et al.*, (2006) and Teteh *et al*., (2013) reported that *Moringa oleifera* and pumpkin leaves did not contain any factors that could limit feed consumption. Similarly, as shown in this study, higher inclusion levels of Moringa oleifera and pumpkin leaves demonstrated in treatments 5 and 6 did not reduced the intake of feeds. This may, however be attributed to the improvement in the energy and protein consumption of birds resulting from the enhanced nutrient availability of the birds offered the extracts. The fact that the feed conversion ratio of the leaf extract treated birds, were generally better than the vitalyte gives an indication that the birds had better ability to utilize the available nutrients in the feed and extracts. This observation is also in agreement with the reports of Machebe (2010) that birds fed *Gongronema latifolia* extracts had better feed conversion ratio than the control. Inclusion of both moringa and pumpkin leaves extracts in the broiler chickens' water did not significantly reduce daily water intake compared to the vitalyte treated birds. In fact daily water intake was significantly (P<0.5) higher amongst the 50ml/L MLE and 50ml/L PLE (204.20 and 207.57ml/bird/day respectively) compared with the vitalyte (194.73ml/bird/day). Higher levels of both MLE and PLE significantly reduced the water intake as shown in treatments 4, 5, 6 and 7. This finding is in agreement with Onu (2012), that at low concentration, the water intake of *T. occidentalis* administered chickens was not significantly different from control birds. As observed, the two leaf extracts at low concentrations in this study did not impact any significant change in the odour and taste of the water since the sense of taste and smell are important factors in determining what birds consume or drink like other monogastric animals. Despite that higher concentrations reduced water intake, the impact was not enough to in any way affect the growth of the chickens.

The role of vitamins and minerals in the body of an animal cannot be over emphasized, this is because deficiency of one or more of vitamins and minerals in the body is often associated with an observed condition. The extracts significantly (P<0.05) affected the blood vitamins and minerals of birds as shown in Table 2. Generally, except for sodium, birds administered the control vitalyte multivitamins were significantly low in assessed vitamins and minerals. High blood sodium is an indication of poor nutrition which could be detrimental to the health of the animals. The Na ranged from 126.80mol/L in treatment 7 (100ml/L MLE+100ml/L PLE) to 148.00mol/L in the vitalyte. Among the test moringa and pumpkin administered birds, no definite pattern was followed in the levels of values. For example, vitamin C was highest (73.16Umol/L) in the 50ml/L PLE while vitamins D

and E, Ca and Mg were 31.79ug/L, 12.41mg/L, 13.91mg/dl and 5.11ug/dl respectively.

Table 1: Growth Performance of Broiler Chickens on Moringa and Pumpkin Leaves Extracts

Growth Parameters	T_1 (Vitalyte)	T_2 (50ml MLE	T_3 (50ml PLE)	T_4(100ml MLE)	T_5(100ml PLE)	T_6(50ml MLE+50ml PLE)	T_7(100ml MLE+100ml PLE)
Ave. initial weight (g)	44.86	45.25	44.95	45.13	45.10	44.88	44.96
Av. Final live wt.(g)	2944.05^{ab}	2860.73^{bc}	2938.7^{ab}	3044.65^{a}	2882.75^{bc}	2961.3^{ab}	2943.45^{ab}
Ave. daily feed intake (g)	$I09.25^{a}$	98.25^{b}	99.92^{b}	97.06^{b}	103.94^{a}	97.79^{b}	103.43^{a}
Ave. daily weight. gain (g)	51.77^{b}	50.27^{c}	51.69^{b}	53.55^{a}	50.66^{c}	52.10^{b}	51.765^{b}
Feed conversion Ratio	2.09^{a}	1.96^{b}	1.98^{d}	1.84^{c}	2.04^{a}	1.85^{bc}	2.01^{a}
Ave. daily water Intake (ml)	194.73^{b}	204.20^{a}	207.57^{a}	192.02^{b}	189.56^{c}	180.63^{d}	172.46^{e}

Means in the same row with different superscripts (a-d) are significantly different (P<0.05)

Table 2: Blood serum vitamins and minerals of broiler chickens on MLE and PLE

Parameters	T 1 (Vitalyte)	T 2 (50ml MLE)	T 3 (50ml PLE))	T 4 (100ml MLE))	T 5 (100ml PLE))	T 6 (mix 50ml MLE + 50ml PLE)	T 7 (100ml MLE + 100ml PLE)
VIT. A (mg/L)	0.26^{d}	0.29^{cd}	0.32^{ab}	0.31^{bc}	0.34^{a}	0.30^{bc}	0.31^{bc}
VIT. C (Umol/L)	62.84^{e}	69.91^{b}	73.16^{a}	71.86^{a}	63.59^{e}	67.48^{c}	65.56^{d}
VIT. D (Ug/L)	26.97^{c}	29.13^{bc}	27.13^{d}	30.33^{ab}	28.41^{bc}	29.71^{ab}	31.79^{a}
VIT. E (mg/L)	8.71^{d}	9.65^{cd}	10.43^{bc}	12.14^{a}	11.24^{ab}	10.48^{bc}	12.41^{a}
Na (m mol/L)	148.00^{a}	103.90^{e}	130.60^{c}	131.00^{c}	132.00^{c}	138.00^{b}	126.80^{d}
K (m mol/L)	4.40^{d}	2.80^{f}	4.65^{c}	4.90^{b}	4.60^{c}	5.20^{a}	3.80^{e}
Ca (mg/dl)	$11.41^{b\,c}$	10.52^{c}	12.96^{ab}	11.86^{bc}	13.64^{a}	12.89^{ab}	13.91^{a}
Mg (mg/dl)	3.51^{b}	3.45^{b}	3.24^{b}	4.40^{a}	4.56^{a}	4.47^{a}	5.11^{a}
Fe (ug/dl)	25.97^{c}	38.06^{a}	37.91^{a}	29.98^{b}	20.45^{d}	27.71^{c}	19.57^{d}

Means in the same row with different superscripts (a-d) are significantly different (P<0.05)

The higher values of vitamins and minerals of the birds offered moringa and pumpkin leaves extracts in this study confirmed the potency of the plants leaves to be able to successfully replace the synthetic multi vitamins in broiler production. Therefore the cost due to the use of synthetic vitamins in broiler production can be reduced by using moringa and pumpkin leave extracts. Also the residual effect of synthetic vitamins will be eliminated.

Moreover the value obtained for blood minerals of the chickens fall within the ranges reported by earlier researchers; calcium, potassium and sodium (Nworgu *et al.*, 2007). The higher values of blood minerals recorded in moringa and pumpkin leaves extract especially at 100ml/litre of water show that, they can supply the macro-minerals at the rate required for optimum growth of the chickens.

CONCLUSION

Growth parameters per chicken; final live weight gain, daily feed intake and feed conversion ratio were best in chickens given 100ml/L MLE while other leaf extracts treated birds compared favorably with the vitalyte chickens. Chickens offered moringa and pumpkin leaves extracts had higher concentrations of the assayed vitamins and minerals; vitamins A, C, D and E, potassium, calcium, magnesium and iron except for sodium. It was therefore concluded that *M. oleifera* and pumpkin leaves could serve as organic substitutes to the synthetic commercial multivitamins (vitalyte). Also the residual effects of the use of synthetic vitamins will be reduced.

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