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Original Research Article

Bitterleaf (*Venonia amygdalina*) and Water leaf (*Talinum triangulare*) in Pullets Nutrition: Effects on Blood Vitamins and Minerals

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Abstract

The effect of bitter leaf (*Venonia amygdalina)* and water leaf (*Talinum triangulare)* extracts on blood vitamins and minerals composition of pullet birds were investigated. A total of 456 day-old Isa brown pullet chicks were allotted to four dietary treatments in six replicates in a completely randomized design experiment. Aqueous extracts of bitter leaf and water leaf were used as test dietary treatments for the birds. In treatment 1, a commercial multivitamin (vitalyte) was given in water (1g/L) to the birds to serve as the control. In treatments 2 and 3 aqueous extracts of bitter leaf and waterleaf were given at 100ml/L of water, while in treatment 4 mixed bitter leaf and water leaf aqueous extract (50% each in composition) was given. On the last day of the feeding trial, blood samples were collected from the birds for vitamins and minerals analysis. The observed results showed that dietary treatments significantly affected the blood serum parameters. Vitamin A was significantly higher ($P < 0.05$) in the vitalyte birds. The values ranged from 0.27iu in the bitter leaf birds to 0.37iu in the vitalyte. Vitamin C was more abundant (1.84iu) in the bitter leaf treated pullets and was significantly reduced (1.21iu) in the vitalyte. Vitamin D was significantly ($P < 0.05$) higher (0.35 iu) in the water leaf as well as vitamin E (10.14iu) while they were highly reduced considerably in the vitalyte administered birds, 0.16 and 4.83iu respectively. On mineral composition, while bitter leaf was the highest Ca (14.24mg/dl) source, K (5.46 mmol/L) and Mg (2.78mg/dl) were highly increased in the water leaf administered birds. Pullets on the control vitalyte had higher Na (132.75 mmol/L) and Fe (1.42g/dl). It can however be concluded that bitter leaf and water leaf as used in this study are potential sources of some vitamins and minerals in pullet chick nutrition.

Keywords: Bitterleaf, Waterleaf, Pullets, Vitamins, Minerals.

INTRODUCTION

Poultry production is an important economic activity in Nigeria [1]. The human population in Nigeria is projected to grow at an annual rate of 2-5% to the year 2025, thus the need to produce more animal protein in the country has become increasingly urgent in view of the ever rising population [2]. Population growth has surpassed food production and the nation is already facing chronic food insecurity. Poultry meat and eggs have been recommended among the livestock products to bridge the protein gab because of their short generation interval, high rate of productivity, quick turnover rate, higher feed efficiency and low labour and land requirement [1].

In recent years, the use of herbal growth promoters (HGP) as natural alternative to antibiotic growth promoters (AGP) has taken a very important place in livestock and poultry nutrition [3]. After the feeding ban of antibiotic growth promoters in European Union (EU) countries in 2006 [4], the search for safe and healthy alternatives has become a very high research topic. Therefore, utilized parts of medical plants and spices, or their extracts, also known as phytogenic feed additives, found their place in promotion of production performance and improvement of the quality of food of animal origin [5]. Likewise, numerous studies reported positive effects regarding the improvement of animal health and wellbeing after the administration of medicinal plants or spices in animal nutrition [3, Ghasemi *et al*., [6]; Kostadinović *et al*. [7]. Phytogenic additives may show antimicrobial activity, stimulating effects on animal digestive systems, antioxidative and anticoccidial activity, may increase production of digestive enzymes and improve utilization of digestive products by enhancing liver

functions [8]. Chemical compounds synthesised by medical plants, also known as phytochemicals, are responsible for the influences prescribed to these plants. 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 [9, 10]. Leaf extracts also have appetizing and digestion-stimulating properties and antimicrobial effect [11]. According to Ifon and Basir [12] leaf vegetables supply minerals, proteins, and vitamins which could complement the inadequacies of most feedstuffs.

Waterleaf (*Talinum triangulare* (Jacq.) belongs to the plant family *portulaceae.* It is a short-lived perennial herb growing to 30-60 cm in height. The leaf is greenish in colour with succulent stem and alternate leaf arrangement. Amongst its other names are *Talinum fruticosum, Portulacafruticosa L., Portulaca triangularis* (Jacq.) and *Talinum crassifolium* (Jacq.) Willd. The plant is mostly found in Southeast Asia, South America and Africa [13, 14]. According to Aja *et al*. [15], waterleaf which is fast growing and easily reseeding itself contains appreciable amounts of protein, carbohydrates, steroids, carotenoids, among others and low level of oil content. In addition, Leung *et al*. [16] reported that waterleaf contains per 100g edible portion: water 90.0g, energy 105kJ (25kcal), protein 2.4g, fat 0.4g, carbohydrates 4.4g, fibre 1.0g, calcium 121 mg, phosphorus 67mg, iron 5.0mg, thiamin 0.08mg, riboflavin 0.18mg, niacin 0.3mg and ascorbic acid 31mg. Ezekwe *et al*. [17] reported that nutritionally, waterleaf has been shown to possess the essential nutrients like β – carotene, minerals (such as calcium, potassium and magnesium) pectin, protein and vitamins. The vitamin A content (900*u*g) is comparable to other medium green leafy vegetables. Since it contains substantial amount of nutrients, there is a high indication that *Talinum triangulare* leaves can contribute significantly to the nutrient requirements and health management of poultry.

Vernonia amygdalina is a shrub or small tree that grows throughout tropical Africa. It is popularly called bitter leaf because of its abundant bitter principles [18]. The leaves contain a considerable amount of anti-nutritive factors like high level of tannic acid and saponin [18]. The findings by Akwaowo *et al.*, [17] reported that the young leaves often preferred for human consumption, contain high cyanide (60.1mg 100^{-1}g DM) and tannin content (40.6mg 100^{-1}g DM) than older ones. Proximate composition of *Vernonia amygdalina* leaf meal (VALM) shows a chemical composition of 527.83 ME kcal/ kg, 86.40% DM, 21.50% CP, 13.10% CF, 6.80% EE, 11.05% Ash, and the results on mineral composition indicate that *Vernonia amygdalina* has 3.85% Calcium, 0.40% Magnesium, 0.03% Phosphorus, 0.006% Iron, 0.33% Potassium and 0.05% Sodium [19]. Furthermore, *Vernonia amygdalina* has also been fed to broilers, where it was able to replace 300g kg-1 of maize-based diet without negative effect on feed intake, body weight gain and feed efficiency [20]. Extracts of *Vernonia amygdalina* has been shown to reduce serum low-density lipoprotein cholesterol and total cholesterol [21, 22]. Some studies have reported that plants which lower serum lipid values are rich in flavonoids and tannins [21-23]. These compounds play a significant role in the mobilization and metabolism of lipids. Phytochemical analysis of *Vernonia amygdalina* revealed high levels of flavonoids, saponin, tannins, and alkaloids [23]. Specifically, this study focused on the use of bitter leaf and waterleaf extracts as sources of vitamins and minerals for pullet birds

MATERIALS AND METHODS

Experimental Materials and Experimental Design

Fresh waterleaf and bitter leaf were collected in batches as required at the University Teaching and Research Farm. The leaves were air-dried for about 30mins after which the freshly cut *Talinum triangulare* and *Vernonia amygdalina* leaves were separated from the stem and washed with clean deionised water to remove contaminants like dust, dung, dirt and sand. They were separately drained and blended using a kitchen blender. Little quantity of water was added to facilitate blending and seiving. The aqueous extracts were collected separately in clean containers and stored in the refrigerator until needed for use.

Experimental Design and Management of Birds

A total of five hundred (500) day-old Isa brown pullets were purchased from a reputable hatchery in Ibadan, Nigeria. Prior to the arrival of the birds, the house was cleaned, washed and disinfected with vinkokill and izal. The brooder house was allowed to dry for a period of one week. Litter materials and wood shavings were spread evenly on the floor in the deep litter pen. Drinkers and feeders of plastic material were placed in the brooding house. To ensure appropriate visibility and warmth within the brooder house, heaters were placed at designated locations. The heaters were gradually withdrawn or reduced to avoid heat stress. The surroundings were thoroughly cleaned to ward off dangerous predators and rodents. The birds had free access to feed and dietary water *ad-libitum*.

The birds were brooded for four weeks and thereafter four hundred and fifty-six (456) of them were randomly selected and allotted based on their average initial weight to each of four experimental water treatments ($T_1 – T_4$) that were required. Each treatment group contained one hundred and fourteen (114) birds in six replicates of nineteen (19) birds each. The birds were housed in a deep litter management system with wood shavings as litter materials.

A commercial multivitamin source (vitalyte), *Talinum triangulare* and *Vernonia amygdalina* aqueous leaves extracts were supplied as; treatment 1(vitalyte),

treatment 2 (bitter leaf aqueous extract), treatment 3 (waterleaf aqueous extract) and treatment 4 (a mixture of waterleaf and bitter leaf aqueous extracts of 50% each in composition). The vitalyte was given in water according to the manufacture's recommendation of 1g per litre of water while birds in treatments 2, 3, and 4, were given 100mls of the supernatant per litre of water respectively.

Blood Vitamins and Minerals Study

At the end of the six weeks feeding study, blood samples were taken from the wing vein of 2 birds per replicate. Glass vials were used for blood collection. Blood serums were separated by centrifugation of samples and were analyzed for minerals (Na, K, Ca, P, Mg) and vitamins A, C, D and E) content.

STATISTICAL ANALYSIS

All the data collected were subjected to one way analysis of variance (ANOVA) and differences between means and treatments were determined using Duncan's multiple range test (DMRT) at 5 percent level of probability. All statistical procedures were in accordance to Steel and Torrie [24] with the aid of SAS 2009 package.

RESULTS

The effects of waterleaf and bitter leaf on blood vitamins of pullet birds are shown in Table 1 and 2. Table 1 revealed that the dietary treatments (waterleaf and bitter leaf extracts) significantly ($P < 0.05$) affected vitamins A, C, D and E. Vitamin A was significantly ($P < 0.05$) higher (0.37 IU) in birds on vitalyte control treatment and decreased highly in Bitter leaf birds (0.27 IU). Waterleaf was 0.36 IU while Bitter leaf and Water leaf mix had 0.33 IU. The values for vitamin C was significantly higher in birds on T_2 Bitter leaf (1.84 IU) than those on T_3 (1.63 IU), T_4 (1.44 IU) and T_1 (1.21 IU). Birds on T_4 had significantly ($P < 0.05$) higher vitamin D value (0.35 IU). Others were; T_3 (0.30 IU), T_2 (0.32 IU) and the vitalyte control birds (0.16 IU in a decreasing order). The values for vitamin E followed the same trend as observed in vitamin D with birds on T_4 being significantly ($P < 0.05$) higher.

Table 2 showed that the treatments (waterleaf and bitter leaf extracts) significantly ($P < 0.05$) influenced the calcium, potassium and magnesium composition of birds while minerals like sodium and iron of pullet birds were highly reduced by the treatments. Calcium values showed that birds on Bitter leaf T_2 (14.24 mg/dl) was significantly higher than others as follows; Bitter leaf and Water leaf mix T_4 (13.14 mg/dl), vitalye T_1 (10.84 mg/dl) and water leaf T_3 (10.04 mg/dl). Potassium was significantly ($P < 0.05$) higher in T_3 (5.46 mmol/L) than those of T_1 (4.86 mmol/L), T_4 (4.16 mmol/L) and T_2 (3.06 mmol/L). Serum sodium of pullet birds placed on control (132.75 mmol/L) was significantly ($P < 0.05$) higher than the values (127.75, 125.75 and 118.75 mmol/L) obtained in T_4, T_2 and T_3 respectively. Iron content in the blood serum of pullet birds followed the same trend observed in sodium. However, birds on T_2 (1.36 g/dl) and T_4 (1.34 g/dl) were not statistically ($P > 0.05$) different from each other, while birds on T_3 (1.25 g/dl) recorded the least. Magnesium content of pullet birds showed that T_3 (2.78 mg/dl) was significantly ($P < 0.05$) higher than birds on T_2 (2.28 mg/dl), T_4 (1.88 mg/dl) and T_1 (0.68 mg/dl) in a decreasing order.

Table-1: Effect of *Vernonia amygdalina* and *Talinum triangulare* extracts on blood vitamins of pullet birds

Parameters	T_1	T_2	T_3	T_4	SEM ±
Vitamin A (IU)	0.37^a	0.27^d	0.36^b	0.33^c	0.01
Vitamin C (IU)	1.21^d	1.84^a	1.63^b	1.44^c	0.01
Vitamin D (IU)	0.16^d	0.32^b	0.30^c	0.35^a	0.01
Vitamin E (IU)	4.83^d	8.20^b	7.55^c	10.14^a	0.02

Means in the same row with different superscripts (a,b,c & d) are significantly different ($P < 0.05$), SEM = Standard error mean

Table-2: Effect of *Vernonia amygdalina* and *Talinum triangulare* extracts on minerals composition of pullet birds

Parameters	T_1	T_2	T_3	T_4	SEM ±
Calcium (Ca) (mg/dl)	10.84^c	14.24^a	10.04^d	13.14^b	0.02.
Potassium (K) (mmol/L)	4.86^b	3.06^d	5.46^a	4.16^c	0.01
Sodium (Na) (mmol/L)	132.75^a	125.75^c	118.75^d	127.75^b	0.03
Iron (Fe) (g/dl)	1.42^a	1.36^b	1.25^c	1.34^b	0.01
Magnesium (Mg) (mg/dl)	0.68^d	2.28^b	2.78^a	1.88^c	0.01

Means in the same row with different superscripts (a, b, c & d) are significantly different ($P < 0.05$) SEM = Standard error mean

DISCUSSION

One of the common issues with regard to backyard flocks relates to poor or inadequate feeding programmes that can lead to vitamin and mineral deficiencies for the birds. Vitamins and minerals are very important components of a chicken's diet and unless a formulated ration is fixed, it is likely that deficiencies will occur. Vitamin A is required for normal growth and development of epithelial tissue (skin and the linings of the digestive, reproductive, and respiratory tracts) and reproduction. Vitamin A can also act as an effective radical-tapping antioxidant and quencher of singlet oxygen [25]. It was observed in this study that waterleaf and bitter leaf extracts decreased vitamin A content of the blood serum of pullets when compared to the commercial vitalyte administered birds, but the levels were not critical to be detrimental to the health of the birds which implies that Vitamin A requirements of pullets can also be met by giving waterleaf and bitter leaf extracts in their water. Vitamins D and E are fat soluble vitamins which aid the normal growth, bone development, eggshell formation and help fights free radicals in the early stage as well as line defense against lipid peroxidation caused by heat stress. The results of the current study show that bitter leaf and waterleaf have potential of supplying the required vitamin D and E for optimum performance of pullets. Although chickens are known to synthesize ascorbic acid, increased supplementation of vitamin C has proved to have beneficial effects in pullet birds.

Minerals play a role in bone formation, but are also needed for several other important functions, including the formation of blood cells, blood clotting, enzyme activation, energy metabolism and for proper muscle function. Calcium represents the third most expensive nutrients after energy and protein. Calcium is required by poultry birds in greater amount than any other minerals. The values of calcium ranging from 10.04 – 14.24mg/dl were higher than the values reported by Nworgu *et al.* [26] when birds were fed with waterleaf meal. However, the values ranging 3.06 – 5.46mmol/L for potassium were similar to values (4.40 – 5.30mmol/L) reported by Nworgu *et al.* [27]. Sodium values (118.75 – 132.75mmol/L) were also similar to the values (103.10 – 131.00mm/L) reported by Nworgu *et al.* [27]. The higher significant ($P < 0.05$) values of calcium, potassium and magnesium reported in birds served the bitter leaf and waterleaf extracts implies that the birds could be more favoured in terms of growth. The fact that the vitalyte birds had higher iron and magnesium suggests that for both bitter leaf and waterleaf aqueous extracts to be successfully utilized partial supplementation with synthetic mineral source for these minerals might be necessary.

From the foregoing it can be concluded that bitter leaf and water leaf are rich sources of vitamins and minerals and their aqueous extracts can serve as alternative to the commercial multivitamin/mineral premix (vitalyte) in pullet chick nutrition especially in times of scarcity.

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