Effects of *Moringa Stenopetala* Bac. Leaf Supplement on Growth Performance of Broiler Chicken

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Abstract

Poultry keeping is the most widespread of all livestock enterprises, it plays a great role in food security improvement, socio-cultural and economic development in most countries. While broiler production is a source of income, it is a good source of protein and a profitable investment. In developing world, high feed to gain ratio and high feed costs are among the challenges in poultry keeping. Current attempts to mitigate these challenges involve the use of antibiotics in feed as growth promoters, prophylaxis and disease treatment. It is notable that the use of conventional antibiotics for promoting growth and performance has been effective. However, undesirable residual effects and antibiotic resistant pathogens due to antibiotics in conventional poultry feeds is of global health concern. Therefore, there is continuous need to evaluate natural alternatives to antibiotics to mitigate the problems encountered with conventional antibiotics. Many medicinal plants have been associated with growth performance enhancement, Moringa stenopetala Bac leaves are used as food for humans. Seeds, bark, roots, and flowers are widely used in traditional medicine. Leaf extracts are reported to have the greatest antioxidant activity. The extracts of *Moringa stenopetala* leaves have antioxidant potential, β-carotene, protein, vitamin C, calcium, potassium and natural antioxidants including flavonoids, phenolic, ascorbic acid and carotenoids and are thought to be responsible for their effectiveness The current study evaluated the effect of broiler chicken feed supplemented with *M. stenopetala* on feed conversion ratio. The study was prompted because the available data is limited and contradictory. Experimental study design was used. Cobb 500 broiler of one-day-old (165) chicks were obtained from Kenchic Ltd, Kenya and randomly selected. Feed meals were prepared by Unga feed Ltd, Kenya by replacing antibiotics with powders of *M. stenopetala*. Concentrations of 0.0 to 0.65 w/w % for powders were supplemented. Five treatments were used in the experiments and results were analyzed using Minitab Version 19.1. A one-way analysis of variance (ANOVA) followed by Fisher's Least Significant Difference was used at 0.05 Level of significance. Results indicated increases in the chicken weight gains in all the treatment groups at the end of treatment week five but with no significant difference except for the negative control group ($p<0.05$). Also, at the end of 5^{th} week, the results obtained showed that all the chicken in all the experimental groups had a significantly lower feed conversion ratios except for the chicken on the negative control experimental group ($p<0.05$).

Key words: *Antibiotics, food security, medicinal plants, poultry, Moringa stenopetala*
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1.0 Introduction

Poultry production is the fastest growing component of global meat production, with developing economies taking a leading role. In addition to providing opportunities to increased poultry exports, increasing poultry production stimulates growth in global import demand for feeds and other inputs and generates investment opportunities. Poultry industry continues to make important contributions to the global food supply despite the fact that feeds have become increasingly costly. The need to speed up the growth of chicken and thereby improve the animals' performance in terms of body size and weights has called for food supplements which include antibiotics and growth hormone (Mohammed & Yusuf., 2011). Plants are the richest bio-source of natural compounds having antioxidant, antimicrobial (Shahidi & Zhong, 2010) and antiviral activity (Pang et al., 2014). With increase in consumer consciousness about safety of food additives, there is a growing need to search for safer alternatives (Tavasalkar et al., 2012).

Most tropical plants have beneficial values in substances present in their various tissues. It has been reported that about two-third of the global plant species (including M. stenopetala) contain medicinal properties. The medicinal value of these plants is thought to be due to the presence of a variety of phytochemical components. Many of the plant species have been studied for their possible medicinal applications (Talreja, 2010). About 80% of the world's population rely on traditional medicine for their primary health care needs, and most of this involves the use of plant extracts and their bioactive components (Batugal et al., 2004). The role of medicinal plants in preventing or controlling disease has been attributed to the antioxidant properties of their constituents, sometime associated with polyphenolic compounds (Mathew & Abraham, 2006). Moringa stenopetala leaves are reported to have antioxidant potential, β-carotene, protein, vitamin C, calcium, potassium, and natural antioxidants including flavonoids, phenolic, ascorbic acid, and carotenoids (Teixeira et al., 2014). The objective of the current study was to evaluate the effects of M. stenopetala leaf powder supplementation in chicken feed on growth performance (feed conversion ratio) of broilers.

2.0 Materials and Methods

Preparation of powders and extracts

Moringa stenopetala leaves were collected from Isiolo County, Kenya. The leaves were shade dried at room temperature and pressure. A hammer mill was used to grind the dry leaves to obtain coarse texture powder. The powders were subsequently used to prepare the experimental feed at concentrations that ranged from 0.0 to 0.65 w/w % of the leaves.

Feed preparation

Moringa stenopetala leaf powder feed supplement was prepared at Unga Ltd Nairobi. The feed was based on corn/soya diet and was formulated to meet the nutrient requirements for broiler starters and finishers (National Research Council, 1994). The formula for experimental feed was as indicated in Table 1. Treatment 1 (T1) feed constituted base diet with 250 g tetracycline in 100 kg of feed. Moringa stenopetala Bac. leaf powder 250, 450 and 650 g were incorporated into 100 kg of feed to replace tetracycline for treatments 2 (T2), 3 (T3) and 4 (T4), respectively. Basal diet, with neither antibiotic nor Moringa stenopetala leaf powder supplement was used as negative control (T5).

Table 1

Composition of chicken feed diet

	Starter					**Finisher**				
Ingredients (%)	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Maize	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Soya beans cake	23.00	23.00	23.00	23.00	23.00	18.00	18.00	18.00	18.00	18.00
Wheat offal	7.20	7.20	7.20	7.20	7.45	12.20	12.20	12.20	12.20	12.45
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	1.50	1.50	1.50	1.50	1.50	1.00	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Broiler premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Tetracycline®	0.25	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
MSP	-	0.25	0.45	0.65	0.00	-	0.25	0.45	0.65	0.00
Total	100	100	100	100	100	100	100	100	100	100

MSP (Moringa stenopetala)

Experimental design

Cobb 500, one day old broiler chicks were purchased from Kenchic Ltd, Kenya. The floor system was used to keep the chicks. Open sided clean and disinfected poultry house with fifteen units (0.5 x 0.5 m), used to hold 5 chicks per unit was used. The chicks were fed a standard commercial broiler starter diet at the preliminary stage as they acclimatized for one week. At the beginning of experiments, the chicks were weighed individually and randomly allotted into Fifteen units (n=15) in a completely randomized design (CRD). The experimental chicks were fed on M. stenopetala leave powder supplemented feed. The chicks were weighed weekly to calculate live weight gains throughout the period of the experiment. The chicks were brood at 35°C in the first week of age which was gradually reduced by 2°C per week to 23°C using infra-red bulbs. Gumboro vaccines was given at the 7^{th} day while Lasota vaccine was given on the 14^{th} day. The chicks were fed and given water at libitum. Lighting schedules were continuous throughout the experiment period using electric bulbs and daylight as sources of light at night and day,

respectively. Chick's performance (feed intake, weight gains and mortality) were recorded throughout the experimental period of five weeks. The feed conversion ratio was calculated as:

$$\text{FCR} = \frac{\text{average feed intake (g)}}{\text{average body weight gain (g)}}$$

3.0 Results

Effects of leaf powder of M. stenopetala on broiler chicks' body weight gain

Upon supplementation of M. stenopetala leaf powders on broiler feeds, significant body weight gains were observed ($p<0.05$). It was observed that at the end of week 1, the average weight gains of the experimental chicks that were supplemented with M. stenopetala leaf powder at all the studied concentrations and negative control group chicks were not significantly different ($p>0.05$; Table 2).

The experimental chicks supplemented with the studied plant powders in feeds gained significantly more body weight ($p<0.05$) which peaked at the end of the fourth week (Table 2). A similar trend was observed in the control groups. However, the body weight gains in all the experimental chicks were significantly lower by the end of the 5th week as compared with the weights gained in each of the previous treatment groups ($p<0.05$).

Nevertheless, by the end of the 5th treatment week, there were no significant differences in body weight gains in all the experimental group chicks ($p>0.05$) except for the positive control group

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Table 2

Effects of M. stenopetala leaf powder supplementation on broiler chick body weight

Powder concentration	Average body weight per treatment week (Weeks 1-5)				
	1	**2**	**3**	**4**	**5**
MSP (250)	294.7 ± 31.7^{ab}	416.8 ± 15.5^{ab}	551.8 ± 35.4^{abc}	372.2 ± 31.4^{bc}	174.2 ± 12.9^{bcd}
MSP (450)	251.7 ± 68.1^{b}	357.4 ± 33.5^{abc}	575.7 ± 48.0^{ab}	395.6 ± 89.3^{bc}	183.3 ± 23.6^{bcd}
MSP (650)	286.7 ± 54.6^{ab}	410.0 ± 44.4^{ab}	495.1 ± 14.0^{abc}	294.4 ± 68.7^{c}	194.6 ± 56.7^{bcd}
Positive Control	267.8 ± 45.7^{ab}	374.9 ± 24.5^{abc}	564.6 ± 17.0^{abc}	363.2 ± 81.7^{bc}	177.2 ± 19.8^{bcd}
Negative control	387.7 ± 32.5^{a}	435.5 ± 11.2^{a}	600.0 ± 1.8^{a}	585.7 ± 32.9^{a}	650.7 ± 15.8^{a}

Values are expressed as $\tilde{x}\pm$SEM; Means with same superscript letter within the column are not significantly different (one-way ANOVA followed by Fisher's LSD) ($p>0.05$), MSP (Moringa stenopetala)

Effects of leaf powder of M. stenopetala supplementation on Feed conversion ratio

The results obtained revealed that, by the end of the first and the second week, the FCR values of the experimental chicks supplemented with the leaf powder of M. stenopetala at all the studied concentrations were not significantly different ($p>0.05$) in the third week, the FCR values recorded for the chicks whose feed was supplemented with 650 g of M. stenopetala leaf powder was significantly higher than the FCR values recorded for other treatment groups of chicks that received feed fortified by the studied plant leaf powders ($p<0.05$; Table 3). But the FCR values obtained for chicks whose feed was supplemented with 250 g and 450 g of M. stenopetala leaf powders were not significantly different among them ($p>0.05$). However, the FCR values of the chicks in the negative control were significantly higher than all the treatment groups ($p<0.05$ (Table 4).

The FCR values obtained for chicks that were supplemented with the leaf powder of M. stenopetala at a concentration of 250 g and450 g was not significantly different from that obtained in the positive control group of chicks ($p>0.05$; Table 3.). Notably, the chicks in the negative control group recorded a significantly higher FCR compared with the FCRs of all the other groups of chicks ($p<0.05$; Table 3). In the fifth week the chicks whose feed was supplemented with M. stenopetala at all concentrations recorded a significantly lower FCR value compared to the negative control group ($p<0.05$; Table 3). However, the positive control group of chicks and all the experimental groups of chicks recorded no significant difference in the FCR values ($p>0.05$).

Table 3

Effects of leaf powders of M. stenopetala on Feed Conversion Ratio (FCR)

Powder concentration	**FCR (Treatment weeks 1-5)**				
	1	**2**	**3**	**4**	**5**
MSP (250)	0.8835 ± 0.08^{c}	1.0669 ± 0.07^{b}	1.1683 ± 0.07^{b}	1.559 ± 0.22^{bc}	3.713 ± 0.49^{bcd}
MSP (450)	1.122 ± 0.26^{b}	1.197 ± 0.10^{b}	1.197 ± 0.14^{b}	1.680 ± 0.45^{bc}	3.188 ± 0.52^{d}
MSP (650)	1.043 ± 0.22^{b}	1.055 ± 0.15^{b}	1.2355 ± 0.03^{b}	2.266 ± 0.57^{b}	3.880 ± 0.85^{bc}
Positive Control	1.082 ± 0.258^{b}	1.179 ± 0.11^{b}	0.9957 ± 0.06^{c}	1.736 ± 0.54^{bc}	3.174 ± 0.39^{d}
Negative control	2.012 ± 0.18^{a}	2.9595 ± 0.04^{a}	2.99347 ± 0.00^{a}	3.6859 ± 0.02^{a}	5.43307 ± 0.00^{a}

Values are expressed as $\tilde{x}\pm$SEM; Means with same superscript letter within the column are not significantly different (one-way ANOVA followed by Fisher's LSD) ($p>0.05$), MSP (Moringa stenopetala)

4.0 Discussion

The increase in body weight of the studied chicks is attributable to the presence of pharmacologically active compounds which have demonstrated body weight enhancing effects. Some of these chemicals include carbohydrates, terpenes, saponins, steroids alkaloids, cardiac glycosides, and flavonoids (Ambali & Furo, 2012).

The findings of this study corroborate well with a previous study conducted by Zanu et al. (2012) increasing concentration levels of Moringa spp leaf meal increased bird body weight. Furthermore, significant differences in body weights of experimental chicks administered with supplemented powders of Moringa spp have been documented by Ashong & Brown (2011), Moreki & Gabanakgosi (2014), among other scholars. However, in this study, no significant differences were observed. This could be attributed to the ecological location and time of harvesting of the plant materials.

Research has shown that phytocompounds derived from plants have antimicrobial (lipid soluble chemicals) and antioxidant (polyphenolics-water soluble), which modulate proper growth and health in the body. Phenolic antioxidant properties have been shown to modulate immunity, restore redox homeostasis and help maintain optimum body health (Luqman et al., 2012). Additionally, the synergistic activities of various phytocompounds, may in part have played a key role in modulating key aspects of nutrient

utilization, thereby ensuring good health and ultimate weight gain (Mbikay, 2012).

Feed conversion ratio (FCR), has been used as an indicator of growth performance and as a predictor of capital value (Alabi et al., 2017). The FCR results presented herein suggest that indeed the studied plant powders promoted growth of the broiler chicks comparatively with the positive control. This can in part be explained by the presence of bioactive and bioceutical phytoconstituents in the studied Moringa species which act as antibiotics and immunomodulators (Ghazalah & Ali, 2008). These findings are supported by earlier studies by Ebenebe et al. (2012) and David et al., 2015). These FCRs are indicators of better economic returns and that the studied plant can be used as alternative to raise broiler chicken.

5.0 Conclusion and recommendations

The findings from this study revealed remarkable effects of the M. stenopetala leaf supplemented in feed on growth performance of the experimental broiler chicks as witnessed by the body weights gain and FCR. Therefore, based on the study findings reported herein, M. stenopetala leaf powder should be supplemented in meals to enhance growth of broiler chicken. Also, based on the findings, M. stenopetala can be used as an alternative to commercially formulated feeds in raising broiler chicks. Further studies aimed at identifying and characterizing the phytoactive chemicals responsible for growth performance in broiler chicken is recommended.

Conflict of interests

The Researchers declare no conflict of interes

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