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Full Length Research Paper

Antilipemic effect of *Moringa oleifera* leaf powder on blood serum cholesterol fractions in broiler finishers

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The effects of plant growth promoting Rhizobacteria (PGPR) on the growth, plant nutrient content and crop yield of groundnut (*Arachis Hypogaea L.*) cv. *Golden* were investigated under rainfed conditions in degraded lands within 2011 and 2014. The experiment was planned with a randomized complete block design having three replication. The two PGPR treatments alone or in combination with FYM were tested and compared with gypsum (alone), farm yard manure (FYM) (alone) and control. The data of4 years showed that the use of PGPR and other amendments significantly increased plant growth, plant nutrient content, crop yield and soil fertility compared with the control. The (Gypsum, PGPR, FYM, and PGPR+FYM) applications increased cumulative grain yield by 3.94, 1.35, 7.08 and 10.34%, respectively. The straw yield increased by (1.29, 0.40, 2.17 and 4.15%) by the applications of gypsum, PGPR, FYM, and PGPR+FYM respectively compared with the control. In addition, organic matter content of soil with PGPR and other amendments significantly increased from 0.73 to 1.00%. Soil moisture content was enhanced from 23.40 to 28.20%. These amendments reduced soil pH from 8.14 to7.80 and soil electrical conductivity (ECe) from 1.73 to 1.37 dS m^{-1}. Overall, the results of this study indicated that the PGPR alone or in combination with FYM had the potential to increase growth and yield of groundnut and improve soil healthof degraded soils.

Keywords: Plant growth promoting Rhizobacteria (PGPR), farm yard manure (FYM), gypsum, groundnut, degraded soils.

INTRODUCTION

It has been clinically proven that human requires a balanced diet in order to survive (Stadelman, 1994). One of the essential requirements for this balanced diet is protein, which is supplied by meat (Oyewole et al., 2003). Broilers are white meat producing chickens that grow and ready for table after forty- two days of rearing with good management (Adesehinwa and Iyayi, 2010). Their feed is concentrated with energy and protein content (Nworgu et al., 1999). Their growth pattern can be divided into two phases namely broiler starter which is between the first to fourth week, while the finisher is from fifth week to harvest (Oluyemi, 2010). Broiler starter requires high metabolic energy of about 3240 kcalkg^{-1} and 24% of protein while finisher requires between 21 and 24% protein and energy content of 2900 to 3000 kcalkg^{-1} (Low, 2004).

Fatty broilers meat has been linked to prolonged consumption of high energy diets by broiler chickens

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(Ayssiwede et al., 2011) and this makes such meat to be undesirable for the fear of high dietary cholesterol levels on the part of the consumers to avoid escalated blood cholesterol levels which can predispose them to heart related diseases (Grundy, 1990). The desire of meat consumers is highly geared towards healthier products with very low level of cholesterol (Basmacioglu and Ergul, 2005).

Broiler chicken has a good feed conversion ratio ranging from 1:1.5 to 1:2.5 kg. This implies that for every 1.5 to 2.5 kg of feed consumed, broilers will gain 1 kg of meat. This efficiency is often affected by environmental, temperature, disease, nature of the feed, nutrient supplements and availability of water (Adeyemi, 2002). An animal needs sufficient levels of some vitamins, minerals, proteins and other nutrients for its physical development and well-being. Vitamins are usually given to the non-ruminant either as feed base premix or as oral therapy against vitamins deficiency or as immune suppressors during stressful conditions such as vaccination, transportation, weighing and so on (Portugaliza and Fernandez, 2012).

Several vegetables and plant species abound in Nigeria as condiments or spices in human diets or as supplementary feeds to livestock such as rabbits, poultry, swine and cattle (Adeogun, 1994). Feed additives are non-nutritive materials which when added to the feed improves the performance of birds, but while absent from the feed does not constitute a deficiency situation (Atteh, 2004). Additives used in poultry feeding includes enzymes, antibiotics and grit, those that are used to produce more desirable consumer product like marigold petal, algae meal, ripe pawpaw, those that alter metabolism like growth promoters. Other additives include antifungal agents, coccidiostats, antihelmintic drugs and at times tranquiling drug (Klasing and Leshchinsky, 2000).

As a result of high costs of these commercial additives (Adeleke, 2000), animal nutritionists are exploring locally available plants; shrubs and herbs are used as feed additives to reduce the cost of production. Among of these plants is *Moringa oleifera*, which is a fast growing drought resistant tree of the family Moringaceae and contain wealth of essential disease preventing nutrients. *M. oleifera,* or the horseradish tree, is a pan-tropical species (Anderson et al., 2004). Over the past two decades, many reports have appeared in mainstream scientific journals describing its nutritional and medicinal properties. Its utility as a non-food product has also been extensively described (e.g. lumber, charcoal, fencing, water clarification, lubricating oil). As with many reports of the nutritional or medicinal value of a natural product, there are an alarming number of purveyors of “healthful” food who are now promoting *M. oleifera* as a panacea (Foidl et al., 2001).

M. oleifera is a native of Indian sub-continent and naturalize in tropical and sub-tropical area around the world. *M. oleifera* among other twelve varieties of *Moringa* species have been found to contain all essential amino acids, which is unusual for a plant source. It has also proven to be good cure for diseases like skin infection, intestinal worms, glandular swelling in countries like Malaysia, Guatemala, Pueto Rico, Philippines (Fuglie, 2001).

Moringa dried leaf powder has been found to be rich in calories (205.0%), protein (27.1%), carbohydrates (38.2%), fiber (19.2%), calcium (20.3%), phosphorous (204.0%), potassium (13.24.%), copper (0.6%), iron (28.2%), sulphur (87.0%), vitamin A-B carotene ((16.35%), vitamin B1-Thiamine (2.6%), vitamin B2-riboflavin (20.5%), and vitamin B3-nicotinic acid (8.2%). Many of the listed vitamins, minerals and amino acids are very important for healthy diet and in regulation of blood cholesterol level (Anderson et al., 2004).

The fear of fatty meat and high dietary cholesterol which may be dangerous to human health is of great concern to broilers meat consumers. In order to reduce this fat intake and alleviate the fear of heart and other related diseases, many commercial products reported to be liver enhancers have been introduced to the poultry feed industry with good results in respect of detoxification and hypocholesteromic effects. However, these products are not always available to the poultry farmers at affordable prices hence the need to investigate ways of reducing cholesterol level in meats with the use of organic materials that are locally available. Therefore, integration of *M. oleifera* as feed additive in broiler nutrition is a new dimension worth investigating. The objective of this work is to establish the effect of inclusion of *M. oleifera* leaf powder on serum lipid component concentrations of broiler chickens at finisher phase of production.

MATERIALS AND METHODS

M. oleifera leaves were harvested fresh from matured trees. The fresh leaves were sundried for about five days until complete dryness. Dried leaves were thoroughly pounded with wooden mortar. The resulting powder was stored in an airtight bottle and preserved under room temperature for subsequent usage as feed additive for the experimental birds.

One hundred and twenty day old Abor Acre broiler chicks purchased from a reputable farm in Ibadan, Oyo State, Nigeria was used for this investigation. At four weeks of age with an average live weight of 425 g, they were randomly allotted into treatment groups with three (3) replicates each. Thirty birds were allotted to each treatment group (10 birds per replicate) in a completely randomized design. The treatment groups (T1-T4) are the control group, T1 without MLP inclusion, T2 with 0.40% (of the total diet on dry matter basis) MLP inclusion, T3 with 0.80% MLP inclusion and T4 with 0.40% liver fit powder (LVP-commercial product).

The birds were reared on a closed deep litter system. Routine management practices in term of medication and vaccination were strictly observed while feed and water were given to them *ad libitum.* At the end of the eighth week, blood samples were taken from the wing web veins of twelve birds from each treatment group to determine the serum concentrations for total cholesterol, high-

Table 1. Gross composition of the experimental diets.

Ingredient (%)	Treatments			
	T1	T2	T3	T4
Maize	58.00	58.00	58.00	58.00
Wheat offal	11.00	11.00	11.00	11.00
Palm kernel cake	7.50	7.50	7.50	7.50
Full fat soya	10.00	10.00	10.00	10.00
Groundnut cake	8.50	8.50	8.50	8.50
Fish meal	0.50	0.50	0.50	0.50
Oyster shell	1.00	1.00	1.00	1.00
Bone meal	3.00	3.00	3.00	3.00
Broilers premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Lysine	0.05	0.05	0.05	0.05
Methionine	0.05	0.05	0.05	0.05
Moringa leaf powder	0.00	0.04	0.08	0.00
Liver fit powder	0.00	0.00	0.00	0.04
Calculated values				
Metabolizable Energy (Kcalkg^{-1})	2800.50	2800.50	2800.50	2800.50
Crude protein (%)	22.50	22.50	22.50	22.50
Crude fiber (%)	3.62	3.62	3.62	3.62
Ether extract (%)	5.80	5.80	5.80	5.80

*Premix to provide the following per kg of meal: Vitamin A 500 mg; Vitamin D3 1200 mg; Vitamin E 11 mg; Vitamin k3 2 mg, Riboflavin 20 mg; Nicotinic acid 10 mg; Panthothenic acid 7 mg; Cobalamin 0.80 mg; Manganese 80 mg; Chlorine 900 mg; Folic acid 1.5 mg; Biotin 1.5 mg; Copper – 2 mg; Zinc 5 mg; Cobalt 1.2 mg and Selenium 0.1 mg.

Table 2. Effect of *Moringa* leaf powder as feed additive on differential serum lipid of Broiler chickens at finisher phase.

Parameter (mg/dl)	Treatments				
	T1	T2	T3	T4	SEM
Total Cholesterol	153.53^{a}	148.65^{a}	125.42^{b}	120.05^{b}	8.00
Triglycerides	143.63^{a}	142.15^{a}	130.05^{b}	128.65^{b}	7.50
Low density lipoprotein	72.51^{a}	70.38^{a}	58.50^{b}	49.50^{c}	5.50
High density lipoprotein	38.75^{b}	40.42^{b}	67.50^{a}	68.40^{a}	5.00
Very low density lipoprotein	90.55^{a}	90.00^{a}	86.40^{b}	70.45^{c}	6.50

abcd: Means with different superscript are significantly different (p<0.05).SEM: Standard Error of Mean.

density lipoproteins (HDL), low-density lipoproteins (LDL), very low-density lipoproteins (VLDL) and triglyceride using the procedures earlier described by Julian (2001) and Kwiterovich (2005).

Data collected were subjected to statistical analysis using the Statistical Package for Social Science (SPSS 17 Evolution) and treatments were separated with Duncan's option of the same software.

RESULTS AND DISCUSSION

Table 1 shows the gross compositions of broiler finisher mash fed the experimental birds.

The calculated values for the nutrients conformed to the recommendations for broilers at both phases (Onifade, 1997). The diets were isocaloric and isonitrogeneous. The metabolizable energy was 2800.50 and crude protein content was 22.50% across board.

Table 2 shows the effects of *Moringa* leaf meal inclusion on serum total cholesterol and differential lipids of the broilers.

Some levels of significant differences were observed among the cholesterol fractions investigated. Although, no significant (p>0.05) difference was observed for TC between birds on T1 and T2, and also between T3 and

T4, the pairs significantly ($p<0.05$) differed with the latter having the lower values. The same trend was observed for TG and LDL. Also, birds on T3 and T4 had higher values of HDL significantly ($p<0.05$) than those on T1 and T2. However, the VLDL of T1 and T2 were not significantly ($p>0.05$) different but it significantly differed from others ($p<0.05$) with the least value of 70.45 mg/dl for T4 group. Meanwhile, birds on 0.80% MLP and LVP additives had significantly higher values of HDL as compared to the birds in T2 and T1 group.

The results of the TC and other lipid fractions in this experiment agree with the findings of Booth and Wickens (1998), Fahey et al. (2001) and Bennett et al. (2003) that *Moringa* leaves have antioxidant properties which is useful for the proper functioning of the liver in blood lipid regulations. Ghasi et al. (2000) established the fact that blood cholesterol got reduced significantly with the inclusion of crude extract of leaf of *M. oleifera* in high fat fed Wistar rats. Also, Olugbemi et al. (2010) earlier reported that *Moringa* leaf meal is hypocholesterolemic in its actions on egg yolk and albumen when added to laying hens diets.

Conclusion

High fat deposition among broiler chickens is not desirable and the antilipemic activities of *Moringa* leaf powder have been validated by the results of this investigation. Inclusion of MLP at 800 g/ton (0.80%) as additive in the diets of broiler chickens at finisher phase will reduce the TC, LDL and VLDL which is a good indication of fat reduction for safe consumption.

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