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PERFORMANCE, BLOOD BIO-MARKERS, CARCASS CHARACTERISTICS AND COST IMPLICATION OF BROILER CHICKENS FED GOAT DROPPINGS BASED DIETS FORTIFIED WITH PROBIOTICS AND EXO-ENZYMES

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ABSTRACT

An experiment was conducted to evaluate the effect of feeding goat droppings fortified with probiotics and exo-enzyme on performance of broilers, blood bio-markers, carcass characteristics and economics of production. Two hundred and ten (210) day-old broiler chicks were randomly assigned to seven (7) treatment groups of 30 birds each. Each treatment was divided into three replicate groups of 10 broiler chicks per replicate using a completely randomized design (CRD). Seven experimental diets were formulated with goat droppings for starter broilers and finisher broilers respectively. Treatments; T2, T4 and T6 contained 10%, 15% and 20% goat droppings without supplementation of probiotics and exoenzyme while treatments T3, T5 and T7 contained 10%, 15% and 20% goat droppings supplemented with 37.50g of probiotics (Gro-up) and 26.25g of exo-enzyme (natuzyme) per kilogram weight of feed respectively. Control diet, T1 contained 0% goat droppings. Parameters measured were body weight, feed intake, water intake, feed conversion ratio, blood bio-markers, carcass characteristics and feed cost implication, etc. Results of starter broilers experiment showed that daily weight gain, daily feed intake, feed conversion ratio, daily protein intake and protein efficiency ratio were significantly ($P<0.05$) enhanced by the treatments. No significant ($P>0.05$) difference existed in the water intake of the birds. Birds in T3 recorded the highest daily body weight and daily weight gain of 742.02g and 21.20g; best feed conversion ratio of 2.52 and recorded the lowest mortality rate of 3.30% among the treatment groups served the supplements. Similar results were observed among the finisher broilers which showed significant differences in the body weight gain, daily weight gain and feed conversion ratio. Also, the daily feed intake, daily protein intake, and protein efficiency ratio were improved significantly ($P<0.05$). Similarly, no significant ($P>0.05$) differences existed in the daily water intake and blood bio-markers or haematological indices of the birds. Carcass characteristics revealed significant ($P<0.05$) differences in the liveweight, dressed weight and dressing percent. Cost saving percentage was higher in the supplemented diet with T3 recording the lowest cost per kilogram weight gain (N222.94) and (N198.34) than T1(control) with (N270.60) and(N264.32) for broiler starter and finishers respectively. Result of this experiment showed that broilers can be fed with 10% of goat droppings supplemented with probiotics and exo-enzyme in their diets without any detrimental effects on growth performance, haematology, carcass characteristics. Reduced cost of feed was achieved by the use of the dietary treatment which increased the profit margin.

Keywords: Performance, Goat droppings, probiotics, exo-enzyme and broiler chickens.

1. INTRODUCTION

Traditionally, animal wastes including goat droppings have been applied to farmland as fertilizer without any other consideration. Nevertheless, it has been shown however, that animal waste including bedding and associated materials, is more valuable as a feed nutrient than as fertilizer. Adequately processed animal waste in animal feed may not be aesthetically pleasing, but it is safe, nutritionally valid and environmentally sound (Onu, 2015).

Sturn (2003) had stated that goat manure is fibrous and moderately endowed with nitrogen. Goat droppings being a fibrous material contain amounts of non-starch polysaccharides (NSP) and possible pathogens which might reduce nutrients utilization and result in a large scale economic losses when ingested by non-ruminants.

The dietary use of probiotics and enzymes to improve the nutritional health status of Poultry and Counteract the stresses encountered by birds is becoming popular among poultry farmers. Probiotics means "for live" in Greek and previously described as feed supplement of live microbial flora that improve intestinal balance and result in good health of host animals (Shanaz et al., 2010).

FAO/WHO (2010) also described probiotics as Live micro organisms such that, when adequate amount is given confer on the host health benefits. Saminathan (2010) stated that bacteria of the genus lactobacillus are predominantly lactic acid bacteria used as probiotic feed supplements for animals, particularly poultry. The bacteria genera most often used as probiotic are lactobacilli and bifido bacteria although other groups are also represented (El-Banna et al., 2010). The health promoting effect of lactobacilli and bifidobacteria in the colon has been mainly associated with their capacity to stimulate the immune response and discourage the growth of pathogenic bacteria.

Enzymes have been applied in the feed of monogastrics – Pigs and poultry to assist in degrading complex compounds to a size the pigs and birds can use. Many countries had encouraged the application of feed enzymes to enhance the nutritive value of poultry diets (Nwakpu and Onu, 2005; Onu et al., 2006.,and Suma et al., 2007). This is because enzymes are chemical catalyst that accelerate the breakdown and digestion of food but remained unaltered at the end of the reaction.

Feed enzymes enhance access to nutrients previously bound in or by cell wall. For nutrients to be available to the animals, large compounds must be broken into smaller molecules to increase absorption by intestinal walls. Enzymes improves the digestion of fibrous diets and also prevents excreta output of some pollutants such as phosphate nitrogen and ammonia (Gyan, 2015).

This study was designed to evaluate the effects of feeding goat droppings fortified with probiotics and exotic enzymes on growth performance, blood Bio-markers, carcass characteristics and economy of production of broiler birds.

2. MATERIALS AND METHODS

2.1 Ethical Considerations

Ethical principles were taken into consideration during the study to adhere to the National and International standards governing research of this nature with regards to the use of research animals. The permission to use animals was obtained from the Ethical clearance committee of the Directorate of research, innovation and commercialisation of Ebonyi State University, Abakaliki.

2.2 Experimental Site and Duration of Study

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This study was conducted at the Poultry Unit of the Department of Animal Science, of the University. Abakaliki lies between latitudes 06^0 20^1N and longitude 08^0 08^1E at an elevation 51.82m above sea level within the south Eastern Agro-Ecological zone of Nigeria. The climatic feature of Abakaliki Agricultural zone is typical of the humid tropics with pseudo bimodal rainfall pattern. According to Ofomata (1975), the average annual rainfall and relative humidity are 1750mm – 2000mm and 75% respectively, spread from April to October. The area is characterized by high temperature with a mean daily range of 27 – 31^0c throughout the year (FDALR, 1985). The broiler starter and finisher phases lasted for 35 days each respectively.

2.3 Experimental diet

Goat droppings were collected free from some goat farmers across the State including goat section of the main market, Abakaliki, and was sundried to about 80% dry matter. After which, the dried crumbs was broken into homogenous texture and was included in the diet at different levels. The Goat manure was substituted for maize in seven different levels for both starter and finisher diets (Table 1). Treatment one served as control without Goat droppings, while treatment two, four and six contained 10%, (15% and 20% goat droppings without probiotics and enzyme supplementation whereas Treatments three, five and Seven contained 10%, 15% and 20% goat droppings supplemented with 37.60g probiotics (Gro-up) and 26.25g Enzyme (natuzyme) per kilogram.

The ingredients were measured with a scale and mixed properly on the concrete floor. Vigorous mixing of the ingredients was done with a spade to ensure homogeneity. The enzymes were selected as feed enzyme candidate because of their bio-active intrinsic characteristics. The ingredients (%) and proximate (chemical) composition (g/kg DM) of the seven experimental diets (starter and finisher diets) are presented in Tables 1 and 2, respectively.

2.4 Experimental birds and Management

A total of 210 day old non-sexed "Agrited" chicks were used for the study. Thirty birds were assigned randomly to one of the seven experimental diets (T_1 – T_7 diets). Each experimental diet was replicated into three experimental pens (replicates) with ten birds per pen measuring 2.5m length by 3m width by 3m height. The birds were housed in cages with wood shavings as litter. The birds were provided feed and water ad libitum in a six-week feeding trial. General flock prophylactic management and routine vaccinations were administered as follows; day 1 – intra ocular (Newcastle disease), week 2 – Gumboro (Gumbro disease vaccine), week 3 – Lasota (New castle disease vaccine), week 4 – Gumboro (Gumboro disease vaccine), week 5 – fowl pox (fowl pox vaccine).

A stress pack was administered to the birds via drinking water at 100g/50 litres (according to manufacturer's prescription) to boost appetite and energy supply.

2.5 Measurement of growth and Economic parameters

At the beginning of the experiment, birds in each replicate were weighed individually and subsequently on weekly basis. Feed intake was determined daily by the weigh-back technique. Feed conversion ratio was determined as quantity(g) of feed consumed per unit(g) weight gained over the same period.

The protein efficiency ratio (PER): was obtained by first calculating the daily protein intake thereafter making use of value determined to divide the weight gain. PER =

$$\frac{Daily\ weight\ gain}{Daily\ Protein\ intake}$$

The Economics of production as achieved to determine the cost implication (cost of total feed consumed, revenue from a bird produced and income over feed cost) at the end of the study as follows:- Cost of total feed consumed = Feed cost (kg) multiplied by total feed consumed. Revenue from a bird produced was calculated as the cost of Broiler per kilogramme multiplied by the total body weight in (₦), while income over feed cost was calculated as the difference between the Revenue from a bird produced minus the cost of total Feed consumed in (₦).

2.6 Slaughter Procedure

At 42 days of age, all chickens to be slaughtered were gas stunned by exposing them to relatively low concentrations of carbon dioxide (<40% by volume in air) and then, once the birds become unconscious, exposed to a higher concentration (approximately 80% to 90% by volume in air), they were all slaughtered. At the abattoir, all the chickens were hung onto a movable metal rack that holds them upside down by their feet. Chickens were then slaughtered by cutting their jugular vein with a sharp knife and were left hanging until bleeding stopped.

2.7 Carcass Characteristics

Immediately after slaughter, the feathers were plucked and the gastro intestinal tract (GIT) was removed. The carcasses were then weighed to obtain the carcass weight of the birds. Three birds per replicate pen were randomly selected for the determination of carcass characteristics. For the measurement of carcass cuts, head and shanks were removed close to the scull and at hock joint, respectively. Wings were removed by cutting at the humeo-scapular joint, the cuts were made through the rib head to the shoulder girdle and the vertebrae was then removed intact by pulling outwardly (Lutfulkabir,2009). The breast muscle, neck, wings, shank, thighs, drumsticks and vertebrae (back) were each weighed separately.

2.8 Blood Collection and Evaluation

At the end of the feeding trial (42^{nd} day), 21 birds were selected randomly from each of the treatment groups (three birds per replicate). Blood samples (3ml) were collected from the wing veins using sterile needles. The blood samples were collected into a well labeled but sterilized bottle containing anticoagulant EDTA (Ethylene diamine tetra-acetic acid) for haematological study.

Packed cell volume (PCV) and haemoglobin concentration (Hb) were generated using the methods described by Lamb (1991). Red blood cell (RBC) and total white blood cell (WBC) counts were determined using the haemocytometer, while the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC) were estimated through calculations according to Mitruka and Rawnsley (1977).

2.9 Proximate Analysis

The formulated diets (Diets 1 to 7) Tables 1 and 2) as well as goat manure were milled to pass through a 1mm sieve for chemical analysis. Total nitrogen content was determined by the standard macrokjeldahl method (AOAC (1963) method number (984.13) and was converted to crude protein by multiplying the percentage N content by a factor of 6.25. Amino acid determination was conducted by hydrolyzing the samples with 6m HCl (containing phenol) for 24 hours at 110 ± 2^0c in glass tubes sealed under vacuum. Crude fibre was determined using the

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ANKOM^{2000} fibre analyser (ANKOM Technology, New York) with 0.255N crude fibre acid solution and then with 0.313N crude fibre base solution. Crude fat and metabolisable energy (ME) contents were predicted using the near infrared reflectance spectroscopy (NIRs) spectra star XL (Unity Scientific, Australia).

2.10 Statistical Design and Analysis

Data collected during the study were subjected to analysis of variance (ANOVA) for Completely Randomized Design (CRD) as described by Steel and Torrie (1980) using Statistical Package for the Social Sciences (2003), windows version 17.0. Significantly different means were separated using Duncan's New Multiple Range Test (199s)5) as outlined by Obi (2002). The statistical model is shown below:

$$Xij = \mu + ti + \Sigma ij \quad \text{where}$$

Xij = Individual Observations
μ = Population or overall Mean
ti = Effect of treatment
Σij = Experimental error or residual

3. RESULTS

3.1Performance of broiler chicks

The performance of broiler starter (0 – 4) and finisher (5 – 8) birds fed goat droppings-based diets supplemented with probiotics and enzymes is shown in Table 5. The results of the proximate composition of the experimental diets is shown in Table 4. The result shows that the dry matter content ranged from 87.26% ($T_{2)}$ to 89.63% (T_7). The result also showed that ether extract, crude fibre and ash contents of both supplemented and unsupplemented goat droppings – based diets had higher values than the control diet, although were lower in the crude protein and metabolisable energy. The nutrient contents of the unsupplemented diets (T_2, T_4 and T_6) and the supplemented diets T_3, T_5 and T_7) respectively had similar values.

The results of the growth performance parameters (Table 6) showed that significant ($P<0.05$) differences existed in average final body weight, body weight gain, daily weight gain, feed conversion ratio, daily protein intake and protein efficiency ratio. The daily feed intake differed significantly ($P<0.05$) among the treatments. Nevertheless, the water intake of the broiler birds recorded no significant differences – ($P>0.05$) in all the treatments.

Broiler birds fed goat droppings – based diets supplemented with probiotics and enzyme were significantly ($P<0.05$) improved in their final body weight, body weight gain and daily weight gain than the broiler birds fed the unsuppplemented and control diets. In fact, the body weight of broilers in Treatment 3 was statistically similar to that of the control diet.

The economics of production of broiler chickens (Table 7) showed that the cost of feed consumed per day was affected ($P<0.05$) by enzyme and probiotic supplementation. The cost of feed per kg live weight gain was also influenced by effects of treatment ($P<0.05$). However, birds in treatment three (T_3) that received 10% dietary supplementation were superior in the cost of feed consumed (₦222.94) as against the control (T_1) with (₦270.60) and the other treatments respectively. The highest cost saving was recorded by birds in diet (T_3). This yielded 17.61% against the control and other treatments.

3.2Performance of Broiler Finisher birds

The result of the proximate composition of broiler finishers is presented in Table 7. Percentage dry matter (DM) ranged from 87.62% to 89.40% with the control diet recording the highest values while diet 7 was the lowest. The ether extract, crude fibre and the ash of supplemented and unsupplemented goat droppings were numerically higher than the control diet but lower in their crude protein content and metabolisable energy.

The growth performance parameters was affected (P<0.05) in their final body weight, body weight gain and daily weight gain. Similarly, total feed intake, daily feed intake, feed conversion ratio, daily protein intake and protein efficiency ratio were significantly (P<0.05) influenced by the treatments. However, average water intake of the birds was not affected (P>0.05) by both supplemented and the unsupplemented diets.

As was observed in the starter phase, the highest body weight gain (154.5) was recorded by broilers on diet 3 followed by the control diet 1 (140.6) whereas the least body weight gain was observed among birds in treatment 6 (149.30) which was unsupplemented with enzymes.

3.3 Blood bio-Markers

The haematological indices of the finisher broilers fed the experimental diets are presented in table 8. Although the haematological values obtained in the present study fell within the normal ranges, there were no significant differences (P>0.05) in the values and the control diet (ie supplemented and the unsupplemented group) as a result of the dietary treatments. Numerical values recorded however, revealed marginal differences amongst the treatments in favour of the unsupplemented group and the control diet. All the values obtained were within the normal range established for the erythrocyte indices of poultry. This shows that goat droppings as a feed resource does not have any adverse effect on the health status of the birds.

3.4Carcass Characteristics

Table 9 shows the results of the carcass measurements of finisher broilers fed the supplemented and the unsupplemented diets. The head, neck, breast, wing, thigh, shank, heart, liver, kidney and gizzard did not differ (P>0.05) significantly among the treatments. However, live weight, dressed weight, and dressing percentage were significantly (P<0.05) influenced by the effects of the dietary treatments. Dressing percentage of birds ranged from 77.46% to 80.76%. The supplemented groups (T_3 80.76g, T_5 78.43g, and T_7 77.62g were superior in terms of higher values than the unsuppleented groups (T_2 – 79.65g, T_4 – 77.72g, and T_6 – 77.46g) and the control – 80.00g.

4. DISCUSSION

The proximate composition of goat manure showed that it is rich in dry matter, crude protein, nitrogen free extract and metabolisable energy. However, the values obtained in this study were lower than the amounts reported previously for similar samples, Onu, 2009, (for heat treated sheep manure) and Ofoefule (2010) for goat manure. The observed disparity in the proximate composition may have resulted from the variation in the chemical composition and quality of pasture consumed by the animals. Annunputtikul and Rodtong (2004) had earlier on reported that animal wastes often differ in their chemical composition and physical form mainly due to variation in their digestive physiology of the species, composition and form of diet, stages of development of the animal and management method of waste assortment and storage.

The crude protein and ether extract content of the goat droppings based diets were adequate to satisfy the requirements of broiler chickens with the control diet recording slightly higher value

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(Table7). However, the crude fibre enlarged as the level of goat droppings based diets increased, resulting in higher dietary crude fibre content. Similar trend was also observed with the ash content that appreciated also as the amount of goat droppings increased. On the contrary, metabolisable energy decreased as the goat droppings increased. Inclusion levels are in agreement with the nutrient requirements of broiler starter chickens Aduku, (1993). This goes to suggest that goat manure can be used to supplement for the more expensive conventional feed ingredients (maize and soyabeans) to further reduce the cost of production. It is worthy of note that all the diets sufficiently contain nutrients as suggested for birds raised in the tropics (Olomu, 1995).

4.1Performance Characteristics of Broiler Starters

The supplementation of goat droppings based diets with enzymes and probiotics which resulted in superior weight gain of young broiler chicks fed the supplemented diets over the unsupplemented group and the control may be attributed to the effects of dietary supplements which resulted in the maintenance of beneficial microbial population in the gastrointestinal tract of the chicks, improved feed value and digestion. This is in agreement with the account of Farrell and Martin (1993) that young birds generally respond to feed enzymes to greater extent than older birds. Broiler chicks fed the goat droppings based diets supplemented with probiotics and enzymes were significantly improved in their feed intake resulting in efficient feed utilization.

Broiler chicks fed the supplementary diets at 10% inclusion level had improved weight gain (21.20g) than the unsupplemented birds (T_2) 19.35g and control (T_1) 19.49. This may be attributed to the break-down of non-starch polysaccharides (Nsp) in goat manure-based diets by synergetic effects of the supplements (enzymes and probiotics), resulting in enhanced metabolisable energy value of the diets. Awaad et al (2001) and Onu (2009) in previous reports discovered that diets supplemented with probiotics and enzyme had their metabolisable energy enlarged by 10%. They further affirmed that feed intake of birds is reduced by addition of probiotics and exogenous enzyme because birds consume less quantity of feed to meet their requirement.

The reduction in weight gain of broiler chickens fed the unsupplemented diets at 10%, 15% and 20% inclusion levels showed that increased feed intake noticed in this group did not result in increased weight gain.

This could be ascribed to the fact that Poultry lacks the ability to secret enzymes such as cellulase, hemicellulase, xylanase and B-glucanase that digest cell wall components of plant materials. Similar report by El-Bana et al (2010) also pointed to the fact that avian species cannot digest lactose because they lack endogenous enzymes hence lactose present in the food is being digested by intestinal bacteria.

There were significant ($P<0.05$) variations in feed conversion and protein effectiveness ratios of broiler chickens fed the experimental diets. The supplemented group-broilers fed on diets (T_3), (T_5) and (T_7) recorded improvement in feed and protein effectiveness ratios over those unsupplemented diets (T_2, T_4 and T_6). The decrease in the Feed conversion ratio and protein efficiency ratio of the unsupplemented could be due to the effects of high fibre content of feed which contributed to reduce amount of protein and energy available to the birds. The improved feed conversion ratio of chicks fed supplemented diets can be attributed to supplements that enhanced the utilization of nutrients. Awaad et al (2001), Onu (2009) and Egena et al (2009) had earlier observed that enzyme and probiotics supplementation in the feed of chickens improved feed conversion ratio (FCR).

The water intake of the broiler chickens were not affected by the effect of dietary treatment, however, the unsupplemented group recorded marginal increase in their water consumption levels suggesting that without supplements and air temperature, broiler chicks tend to consume more feed and water. This is supported by the National Research Council (NRC, 1994) that water requirements of growing poultry are related to feed consumption and to the air temperature.

The percentage mortality of birds throughout the duration of study ranged from (3.30% - 13.30%) among the treatments. Broiler birds fed 15% unsupplemented diets recorded the highest mortality of 13.30%. This probably could be due to non-inclusion of probiotics and enzymes in their diets which exposed the birds to Pathogenic bacteria and resulted in reduced resistance of the birds to diseases and mortality. Lutfulkabir (2009) had also reported that the major result of using probiotics include upgrading in growth, feed conversion efficiency and decreasing mortality.

4.2 Economics of Production

The aim of any broiler production is to make profit and reduce cost and these largely depend on many factors such as cost of feed, test ingredients and their level of inclusions among others. The result of this study indicated, reduction in feed cost per kilogram, cost of feed consumed daily which recorded significant ($P<0.05$) increase and kilogram liveweight gain. Broilers fed the supplemented diets (T_3), recorded higher cost saving percentage than the unsupplemented T_2; while treatment (T_7) recorded the least cost savings. This observation agrees with the report of Owen et al (2011) which stated that feed cost decreases with addition of alternative sources such as agro by-products like goat droppings.

4.3 Performance Characteristics of Finisher Broilers

The crude protein content of both supplemented and unsupplemented finisher broiler's diets ranged from 18.50% to 19.25% and this ranges were sufficient to address the protein requirement of the birds throughout the duration of the experiment. These values are within the range of 19 – 20% recommended by Olomu (1995) for finisher broiler chickens. The energy levels of the feed met the requirement of the birds and values of 2777.19 Kcal/kg (T_7) to 2851.95kcal/kg (T_1) compared well with the ranges of 3000kcal/kg recommended for the tropics.

Performance characteristics of finisher broilers showed that final body weight, body weight gain, daily weight gain, feed intake, feed conversion ratio, protein intake and protein efficiency ratio were significantly ($P<0.05$) influenced by dietary supplements. This could be attributed to enzyme and probiotic supplementation which significantly favoured nutrient utilization. Result of this study showed that finisher broilers fed the supplemented diets; T_3, T_5, and T_7 recorded superior weight gain (44.14g, 35.40g and 34.24g) over the unsupplemented groups (T_2, 39.11g; T_4, 33.83g and T_6, 32.84g and even the control group T_1, 40.18g) respectively. Shanaz et al, (2010) and Mohnl (2011) agreed to this result and both groups stated that enzyme and probiotics improve body weight gain and prevent gastro-intestinal infections of birds by gut pathogens.

Average daily feed intake, feed conversion ratio, daily protein intake and protein effectiveness ratio of finisher broilers were significantly ($P<0.05$) different among the treatments. Surprisingly, the unsupplemented groups and the control diet (T_1) consumed more feed to satisfy

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their appetite than the broiler birds fed the supplements. Higher consumption of feed of the group on unsupplemented diets did not result into increased weight gains. This could be due to amount of fibre in these diets. Esmail (2012) had earlier on observed that feeding of diets with high fibre could cause enlargement of intestinal villi resemblance to that observed when high fibre diets are fed ruminants. Excess use of fibre sources in the diets of monogastrics could lead to increased viscosity and fecal droppings in the farm environment. This may result in the decreased bioavailability of vitamin A and absorption of dietary fats that manifest in depressed body weight gain and carcass quality. Water intake was not significantly (P>0.05) affected by the treatment and there was no record of mortality throughout the finisher phase. This observation corroborates that of Huff et al (2006) that enzyme and probiotics improved performance and immune competence system of animals, improved the intestinal lumen activities, digestion and re-absorption of nutrients of finisher broilers.

4.4 Carcass Characteristics and Economy of Production

The results of carcass characteristics were significantly (P<0.05) influenced in the liveweight, dressed weight and dressing percentage. However, the head, neck, heart, kidney, gizzard, breast, wing, thigh and shank did not differ significantly. The superior mean values (P<0.05) for liveweight, dressed weight and dressing percentage obtained in this study from birds fed enzymes and probiotics over unsupplemented group and the control diets agreed with the range of 75% - 95% reported by Onu (2009), and met relative values for dressed saleable broiler carcass for net returns on investment. However, the result did not agree with Gyan (2015) that directly fed micro-organisms supplementation did not significantly (P>0.05) affect carcass weight of broiler birds.

The cost of total feed consumed and cost of feed consumed (₦) showed that they were significantly (P>0.05) enhanced by the test ingredient in all treatments, compared with the control (T_1). The outcome of this study showed that there were reduction in favour of feed cost per kilogram, cost of feed consumed (₦) and cost of feed per kilogram liveweight gain than the control. The percentage cost saving was superior in the supplemented diets.

5.CONCLUSION

The reduction in the cost of feed consumed indicated that goat droppings based diets supplemented with probiotics and enzymes can be used to partially replace maize and even soyabeans up to 10% level to reduce the high cost of poultry feed. Enzyme supplementation of goat manure resulted in enhanced income and profitability and can readily be used to replace the expensive conventional feed ingredients (maize and soyabeans) since it is free and readily available, and can be used to enhance nutrient utilization and performance in broiler production.

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Table 1: Ingredient Composition of Starter Broiler Experimental Diets

Ingredients	T_1 0%	T_2 10.00%	T_3 10.00PE	T_4 15.00%	T_5 15.00PE	T_6 20.00%	T_7 20.00PE
Maize	50.00	48.00	48.00	45.00	45.00	42.00	42.00
Soyabean meal	26.00	23.00	23.00	21.00	21.00	19.00	19.00
Goat dropping	0.00	10.00	10.00	15.00	15.00	20.00	20.00
Wheat offal	10.00	5.00	5.00	5.00	5.00	5.00	5.00
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Palm kernel cake	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*Premix per kig feed: Vit. A, 4800000; Vit. D_3 9600001U; Vit. E, 140001U; Niacin (PP), 12000mg; Vit. K_3, 1600mg; Vit. B_1, 800mg; Vit. B_2, 2800mg; Vit. B_6, 2000mg; Cal-Pan 4000mg; Folic acid, 320mg; Vit.B_{12}, 680mg; Biotin, 800mg; Choline Chloride, 200000mg; Copper, 2600mg; Iron, 28080mg; Zinc, 34200mg; Manganese, 30000mg; Iodine, 160mg; Selenium, 32mg; Cobalt, 80mg; Antioxidant, 500mg and Vit. C, 2400mg, T_1 = Control; T_2 = 10% GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15% GD+PE; T_6 = 20% GD; T_7 = 20% GD+PE. PE = Probiotics and Enzyme; GD = Goat Dropping.

Calculated Chemical Composition of Starter Broiler Experimental Diets

Nutrients	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20PE
Crude protein	22.77	21.62	21.62	21.28	21.28	21.15	21.15
Ether extract	3.79	4.21	4.21	4.32	4.32	4.43	4.43

Crude fibre	4.47	5.91	5.91	6.77	6.77	7.63	7.63
ME (kcal/kg)	2845.41	2821.31	2821.31	2800.25	2800.25	2763.67	2763.67
Calcium	0.38	0.52	0.52	0.58	0.58	0.63	0.63
Phosphorus	0.39	0.41	0.1	0.42	0.42	0.44	0.44

T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Table 2: Ingredient Composition of Broiler Finisher Experimental Diets

Ingredients	**T_1 0%**	**T_2 10.00%**	**T_3 10.00PE**	**T_4 15.00%**	**T_5 15.00PE**	**T_6 20.00%**	**T_7 20.00PE**
Maize	52.00	50.00	50.00	48.00	48.00	45.00	45.00
Soyabean meal	24.00	21.00	21.00	18.00	18.00	16.00	16.00
Goat dropping	0.00	10.00	10.00	15.00	15.00	20.00	20.00
Wheat offal	10.00	5.00	5.00	5.00	5.00	5.00	5.00
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Palm kernel cake	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*Premix per kg feed: Vit. A, 200,0001U; Vit. D_3 4000001U; Vit. E, 48001U; Niacin (PP), 4800mg; Vit. K_3, 4800mg; Vit. B_1, 320mg; Vit. B_2, 800mg; Vit. B_6, 640mg; Cal-Pan 80mg; Vit.B_{12}, 18mg; Biotin, 20mg; Choline Chloride, 80000mg; Copper, 480mg; Iron, 3200mg; Zinc, 4800mg; Manganese, 6400mg; Iodine, 160mg; Selenium, 24mg; Cobalt, 32mg and Antioxidant, 48. T_1 = Control; T_2 = 10% GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15% GD+PE; T_6 = 20% GD+PE. PE = Probiotics and Enzyme; GD = Goat Dropping.

Calculated Chemical Composition of Broiler Finisher Experimental Diets

Nutrients	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20PE
Crude protein	20.13	19.96	19.96	19.09	19.09	18.49	18.49
Ether extract	3.80	4.04	4.04	4.15	4.15	4.26	4.26
Crude fibre	4.10	5.54	5.54	6.36	6.36	7.22	7.22
ME (kcal/kg)	2872.43	2854.25	2854.25	2817.07	2817.07	2763.91	2763.91
Calcium	0.39	0.81	0.81	1.04	1.04	1.28	1.28
Phosphorus	0.38	0.37	0.37	0.35	0.35	0.35	0.35

T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Table 3: Proximate Composition of Goat Dropping

Nutrients	%
Dry matter	88.10
Crude protein	16.80
Ether extract	6.00
Crude fibre	12.00
Total ash	23.00
NFE	42.20
ME (kcal/kg)	2576.90
Ca	1.95
P	1.57

A.O.A.C. METHOD

Table 4: Proximate Composition of Broiler starter Experimental Diets

Nutrients	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE

Dry matter	87.73	88.42	87.64	87.26	88.57	87.93	89.63
Crude protein	21.80	20.64	20.70	20.15	20.25	19.48	19.52
Ether extract	7.40	8.00	8.10	8.30	8.46	8.58	8.50
Crude fibre	10.00	12.28	11.00	13.56	13.26	14.85	14.41
Total ash	14.50	15.80	15.38	15.60	15.27	15.63	15.36
ME (kcal/kg)	2976.97	2915.00	2942.69	2889.04	2918.76	2855.49	2876.96

T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Table 5: Proximate Composition of Broiler Finisher Experimental Diets

Nutrients	**T_1 0%**	**T_2 10%**	**T_3 10%PE**	**T_4 15%**	**T_5 15%PE**	**T_6 20%**	**T_7 20%PE**
Dry matter	89.40	89.16	88.51	87.90	87.76	88.56	87.62
Crude protein	19.25	19.00	19.18	18.55	18.66	18.50	18.60
Ether extract	8.21	9.00	9.36	9.28	9.48	9.32	9.80
Crude fibre	10.00	12.18	12.00	12.87	12.73	12.80	12.90
Total ash	20.10	20.23	20.00	20.54	20.39	20.86	20.80
ME (kcal/kg)	2851.95	2806.65	2837.61	2784.33	2803.83	2777.19	2797.99

T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

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Table 6: Performance Characteristics of Starter Broilers fed Experimental Diets

Parameters	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE	SEM
Initial body weight (g)	130.00	130.00	130.00	130.00	131.70	130.70	130.00	
Final body weight (g)	812.00^{ab}	807.00^{b}	872.00^{a}	686.80^{c}	721.80^{bc}	650.00^{c}	659.30^{c}	6.37
Body weight gain(g)	682.00^{ab}	677.02^{b}	742.68^{a}	556.70^{c}	590.80^{bc}	519.30^{c}	529.00^{c}	5.37
Daily weight gain(g)	19.49^{ab}	19.35^{b}	21.20^{a}	15.91^{bc}	16.88^{c}	14.84^{c}	15.04^{c}	0.91
Total feed intake(g)	1871.60^{c}	1965.90^{b}	1866.90^{c}	1968.60^{ab}	1878.60^{a}	1980.60^{a}	1902.90^{bc}	4.10
Daily feed intake(g)	53.48^{c}	56.19^{b}	53.34^{c}	56.25^{ab}	53.68^{c}	56.59^{a}	54.37^{bc}	0.69
Daily water intake	206.17	222.87	203.71	213.00	200.34	201.56	197.47	0.53
Feed conversion ratio	2.76^{c}	2.92^{bc}	2.52^{c}	3.54^{ab}	3.23^{b}	3.83^{a}	3.65^{a}	0.41
Daily protein intake	11.66^{a}	11.60^{a}	11.04^{b}	11.33^{ab}	10.87^{bc}	11.03^{b}	10.61^{c}	0.41
Protein efficiency ratio	1.68^{ab}	1.67^{b}	1.93^{a}	1.40^{c}	1.55^{bc}	1.34^{c}	1.42^{c}	0.26
Mortality (%)	10.00	10.00	3.30	13.30	6.70	-	3.30	

abc Means with different superscripts on same row are significantly (P<0.01) different
T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Economics of Production of Starter Broilers fed Experimental Diets

Parameters	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE	SEM
Cost of feed/kg (N)	98.00	88.20	88.60	83.30	83.70	78.40	78.80	
Cost of total feed cons/bird (N)	183.42^{a}	173.40^{ab}	165.41^{b}	163.98^{b}	157.22^{bc}	155.28^{c}	149.95^{c}	1.95
Cost of feed cons/day/bird (N)	5.24^{a}	4.96^{ab}	4.72^{b}	4.69^{b}	4.49^{b}	4.44^{b}	3.95^{bc}	0.37
Cost of feed/kg (Lw) gain (N)	270.60^{a}	250.72^{b}	222.94^{b}	292.42^{a}	270.88^{a}	297.25^{a}	260.66^{ab}	2.94
Cost saving (%)	-	7.35	17.61	-	-	-	3.67	

abc Means with different superscripts on same row are significantly ($P<0.01$) different
T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Table 7: Performance Characteristics of Finisher Broilers fed Experimental Diets

Parameters	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE	SEM
Initial body weight (g)	850.30	839.70	851.30	846.00	847.70	849.00	851.24	
Final body weight (g)	2253.30^{ab}	2208.30^{bc}	2396.30^{a}	2030.00^{c}	2086.70^{c}	1998.30^{c}	2049.40^{c}	6.95
Body weight gain(g)	1406.30^{ab}	1368.70^{bc}	1545.00^{a}	1184.00^{c}	1239.00^{c}	1149.30^{c}	1198.30^{c}	6.95
Daily weight gain(g)	40.18^{ab}	39.11^{bc}	44.14^{a}	33.83^{c}	35.40^{c}	32.84^{c}	34.24^{c}	1.18
Total feed intake(g)	4318.00^{a}	4335.70^{a}	3936.70^{bc}	4223.70^{b}	4170.00^{b}	4280.00^{ab}	4225.30^{b}	6.71
Daily feed intake(g)	123.37^{a}	123.88^{a}	112.48^{bc}	120.68^{b}	119.14^{b}	122.29^{a}	120.72^{ab}	1.13
Daily water intake	428.70	445.10	426.50	401.70	409.40	413.20	396.10	2.39
Feed conversion ratio	3.07^{a}	3.20^{ab}	2.55^{b}	3.62^{a}	3.39^{a}	3.74^{a}	3.60^{a}	0.37
Daily protein intake	26.07^{a}	24.73^{a}	22.45^{c}	23.04^{ab}	22.75^{bc}	22.61^{c}	22.32^{c}	0.69
Protein efficiency ratio	1.54^{b}	1.58^{ab}	1.97^{a}	1.47^{b}	1.56^{b}	1.45^{b}	1.54^{b}	0.24
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

abc Means with different superscripts on same row are significantly ($P<0.01$) different
T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

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Table 8: Haematological Parameters of Finisher Broilers fed Experimental Diets

Parameters	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE	SEM
Packaged cell volume (%)	24.00	21.23	21.67	27.67	26.33	27.67	23.33	0.95
Haemoglobin (g/dl)	7.97	7.10	7.00	9.23	8.77	9.23	7.80	0.56
Red blood cell ($x10^{12/1}$)	4.17	4.07	3.77	4.50	4.40	4.40	4.13	0.29
White blood cell ($x\ 10^{9/1}$)	3.81	4.84	3.80	3.59	4.40	4.30	4.10	0.37
Mean corpuscular volume (fl)	68.00	61.67	72.33	73.00	4.25	70.00	67.33	1.14
Mean corpuscular haemoglobin (pg)	22.33	21.33	22.67	27.00	66.00	25.00	23.00	0.80
Mean corpuscular haemoglobin conc (%)	24.33	22.00	23.00	28.67	24.00	30.00	26.67	0.99

Means on same row did not differ significantly (P>0.05)26.00
T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

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Table 9: Carcass Characteristics of Finisher Broilers fed Experimental Diets

Parameters	**T_1 0%**	**T_2 10%**	**T_3 10%PE**	**T_4 15%**	**T_5 15%PE**	**T_6 20%**	**T_7 20%PE**	**SEM**
Live weight (g)	2250.00^{ab}	2218.00^{bc}	2385.00^{a}	2030.00^{c}	2088.00^{c}	2000.00^{c}	2052.00^{c}	6.87
Dressed weight(g)	1800.00^{ab}	1768.00^{bc}	1930.00^{a}	1580.00^{c}	1638.00^{c}	1550.00^{c}	1595.00^{c}	6.85
Dressing percentage	80.00^{ab}	79.65^{bc}	80.76^{a}	77.72^{c}	78.43^{c}	77.46^{c}	77.62^{c}	0.66
Cut Parts (%)								
Head	2.03	1.87	2.45	1.83	2.00	1.88	1.84	0.27
Neck	3.71	5.38	4.72	4.17	4.61	4.37	5.02	0.43
Breast	21.12	20.91	21.68	20.69	20.91	20.76	20.56	0.35
Wing	5.26	6.04	6.77	6.01	6.59	6.89	7.27	0.48
Thigh	16.31	15.18	16.18	15.55	16.35	16.68	17.14	0.47
Shank	1.49	1.70	1.57	1.86	2.00	1.88	1.84	0.25
Internal Organs								
Liver	1.63	2.20	2.10	2.04	2.19	2.50	2.68	34
Heart	0.56	0.57	0.60	0.58	0.60	0.63	0.61	0.09
Kidney	0.82	0.79	0.88	0.74	0.85	0.79	0.83	0.12
Gizzard	3.29	2.82	3.14	3.09	3.20	2.93	3.29	0.24

abc Means bearing different superscripts on same row are significantly ($P<0.05$) different.
T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping

Table 10: Economics of Production of Finisher Broilers fed Experimental Diets

Parameters	T_1 0%	T_2 10%	T_3 10%PE	T_4 15%	T_5 15%PE	T_6 20%	T_7 20%PE	SEM
Cost of feed/kg (N)	86.00	77.40	77.80	73.10	73.50	68.80	69.20	
Cost of total feed consumed (N)	371.35^{a}	353.58^{a}	306.27^{b}	308.75^{ab}	306.50^{b}	294.46^{c}	292.39^{c}	3.06
Cost of feed consumed/day (N)	10.60^{a}	9.59^{a}	8.75^{b}	8.82^{ab}	8.76^{b}	8.41^{c}	8.36^{c}	0.52
Cost of feed/kg gain (N)	264.32	247.63	198.34	264.39	247.72	257.44	248.96	2.75
Cost saving percentage	-	6.31	24.96	-	6.28	2.60	5.81	

abc Means bearing different superscripts on same row are significantly ($P<0.05$) different. T_1 = Control; T_2 = 10%GD; T_3 = 10% GD + PE; T_4 = 15% GD; T_5 = 15%GD+PE; T_6 = 20%GD; T_7 = 20%GD+PE.PE = Probiotics and Enzyme; GD = Goat Dropping