Influence of Feed Supplementation and Preventive Medication on Survivability and Growth of Free Range Broilers Chickens

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ABSTRACT

This study evaluated the influence of feed supplementation and preventive medications on the survivability, carcass yield, haematological profile and revenue generation of free range broiler chickens. A Completely randomized Design (CRD) experiment was conducted with 200 HYBRO^R broiler chicks randomly allocated to Five treatment groups:Treatment1 intensively reared broiler chickens (control), free range broiler chickens without intervention (Treatment 2, free range broiler chickens that were given preventive medications (treatment 3), free range broiler chickens that were given feed supplementation (treatment 4), free range broiler chickens that were given feed supplementation plus preventive medications (treatment5) and local free range chickens (treatment 6). Treatment 2 -5 each consisted of 4 local hens and a brood, each of10 HYBRO^R broiler chickens adopted by the hens at day – old. Each hen and her brood served as a replicate. Treatment 1 chickens attained 1.86kg live weight in 9 weeks with a feed conversion efficiency of 2.68 and 95% survival rate. at 15 weeks of age, the live weights and rates of survival for the free ranging broiler chickens were 1450g, 38%, (treatment 2), 1570g, 75% (treatment 3), 1580g, 56 %, (treatment 4), 1760g, 77% (treatment 5). Treatment 6 chicks were 0098g at 15 weeks 50% survival and were 1230g at 25 weeks of age. Carcass yield (dressing %) were 77, 68.4, 72.3, 74.3, 75.7 and 54.5 for treatment 1, 2,3,4,5 and 6 respectively. Statistical differences between treatments means was tested at 5% significance level. Carcass yield was significantly higher for broiler chickens compared to local chickens, while among broiler chickens carcass yield was significantly lower foe those that received neither preventive medication or feed supplementation. Intensively reared broiler chickens at 9 weeks had significantly higher PCV (38.75%), RBC (2.5 (x 103/ml), and WBC (237.3 (x 103/ml) values compared to free range broiler chickens and local chickens at 15 and 25 weeks of age. The free range broiler chickens without intervention had least values for PCV, WBC and Hbc values compared to free range broiler chickens medicated or feed supplemented. Survival rates were significantly lower for broiler chickens reared on free range, compared to intensive rearing, but preventive medication improved this significantly. The return on investment was 60% for broiler chickens on treatment 5. This study concluded that the combination of preventive medications and feed supplementations yielded the best performance and survival rates amongst the free range broiler chickens. Sustainable use of medications is recommended to minimize antimicrobial resistance.

Keywords; *Free range, broody hens, local chickens, broilers, adoption antimicrobial*

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INTRODUCTION

Chickens production is an important component of livestock production system and a key source of animal protein in many developing countries (FAO, 2021). Among the various systems of poultry rearing, *free-range broiler production* has gained prominence due to its perceived welfare benefits, low input costs, and consumer preferences for organically raised poultry (Mottet &Tempio, 2017). However, the productivity of free-range broiler chickens is often constrained by inconsistent nutrient intake, exposure to pathogens, and environmental stressors Fanatico et al, (2007).

Feed supplementation strategies, including the provision of balanced concentrates, vitamins, and mineral additive es, can improve the growth rate and survivability of broilers under free-range systems (Leeson& Summers, 2009). Similarly, preventive medication, such as coccidiostats and broad-spectrum antibiotics, has been employed to reduce mortality due to infectious diseases (Huyghebaert *et al*., 2011).

Nevertheless, concerns about antimicrobial resistance and the cost-effectiveness of such interventions require empirical evaluation (Van Boeckel *et al*., 2015). (2021), Huyghebert *et al.* (2011), and Adene, (1990). Several attempt has been investigated to improve the meat production potential of the local chickens by way of subjecting them to intensive housing and good health system and supplementary feeding has proved uneconomical, (Dou, 2005, Goromela, 2008).

The rural masses of the developing countries stand a better chance of acquiring the ability to rear free range broiler chickens. According to (Carew *et al*., 2015), the free ranging production system provides quick returns and readily available animal protein a critical nutrient which is essential for proper growth and development in children and good health and revenue generation, and the best way to promote the production of free range broiler chickens would be to develop production system which minimizes cost of production and integration of the traditional system, Carew *et al.* (2015), Dolberg *et al.,* (2007). Other associated problems with free range broiler chickens includes the necessity for artificial brooding and rearing since the chicks do not come whit a mother hen. Artificial brooding and rearing is money, time, and energy consuming and incompatible with the reality that the rural poor have very little and have to combine many production activities in their effort to meet up with challenges. It has already been demonstrated by Carew *et al*, (2015), that local broody hens can be made to adopt, brood and rear hybrid broiler chicks thus eliminating the need to spend time and other resources on artificial brooding and rearing. The objective of this study is evaluate the influence of feed supplementation and preventive medication on the growth and survivability, haematology, carcass yield and economics of free-range broiler chickens reared by local hens.

MATERIALS AND METHODS

The study was carried out at Shabu Development Area of Lafia Local Government Area, for a period of 25 weeks. Shabu is about 10 km North of Lafia town, the Capital of Nasarawa state of Nigeria. Shabu is located at Latitude 08° 22N and Longitudes 08° 32E and at an Altitude of about 181.33 meters above Sea level. The vegetation cover of the area is Guinea Savannah, and is characterized by a mean annual rainfall of 1136mm.The length of the rainy season is on the average 7 months (May - October). Mean minimum and maximum temperatures are 22.95°C and 35.05°C, respectively (NIMET, 2024).The experiment was carried out under household management conditions with 30 participants, 30 broody hens and 300 day - old HYBRO® broiler chicks of mixed sexes.

Experimental treatment

Two hundred day – old *HYBRO*^{R} broiler chicks of mixed sexes (average weight of 50 g) were weighed and randomly allocated to 5 treatment groups in a Completely Randomized Design (CRD format. Each treatment was replicated 4 times with 10 broiler chicks per pen (intensive broilers). Treatment 1, consisted of 40 day- old HYBO^{R} broiler chicks stocked 10 per replicates Treatment 2 – 4, Sixteen local broody hens 4 per treatment, that had being incubating their own eggs for 17 – 20 days, were made to adopt the broiler chicks according to the method described by (Carew *et al.,* 2005). Each hen and her adopted broods of 10 broiler chicks served as a replicate. Standard broiler husbandry procedure was used to manage the birds.

Treatment 1: intensively reared broiler Chicks (Control).

This treatment comprised of forty day – old Hybro broiler chicks of mixed sexes, (average weight of 50 g) were divided into 4 replicates of 10 chicks each. The chick were brooded and grown on deep litter. Lightening was provided using electric bulbs and kerosene stoves as source of heat and was fed a 22.16% crude protein and 2965.65kcal/kg broiler starter diet to 4 weeks of age and 20.20% Crude protein and 3234.34kcal/kg broiler finisher diet to 9 weeks of age. Clean water was provided *ad libitum.* The chicks were vaccinated against New Castle diseases at 7 and 21days of age and were also vaccinated against Gumboro at 14 and 28 days of age. Medications that contain antibiotics, vitamins and Electrolyte were administered in drinking water from 1 to 7 days and from 14th to 16th days. Amprolium was administered against Coccidiosis from 28th to 35th days of age and the experiment lasted for 9 weeks.

Treatment 2: .Free range broiler chicks without intervention.

Forty day – old HYBRO broiler chicks of mixed sexes

(average weight of 50 g) and 4 local broody hens were used for this treatment. 10 broiler chicks were randomly allotted to each of 4 local broody hens that have been incubating their own eggs for between 17 – 20 days by placing the chicks under the hens at night and withdrawing the incubated eggs. The hens and their adopted broods were allowed to scavenge freely and no any form of intervention was given to the chicks throughout the 15 weeks duration of the study.

Treatment 3: Free broiler chicks receiving preventive medications

Forty day – old HYBRO^R broiler chicks of mixed sexes and 4 local broody hens were used for this treatment. 10 broiler chicks were randomly allotted to each of the 4 local broody hens as in treatment2 and 3. The hens and their adopted broods were allowed to scavenge freely for 15 weeks and were offered preventive medications that contained Antibiotics, Vitamins and Electrolyte in drinking water during the first week of life and from the 14th - 16th days of age. The chicks were given Amprolium^R Coccidiostat at 25th days of age and at 8th and 12th week of age and dewormed with Piperazin^R at 4th, 6th and 10th weeks of age.

Treatment 4: Free range broiler chicks receiving feed supplementation

Forty day – old HYBRO^R broiler chicks of mixed sexes and 4 local broody hens were used for this treatment. 10 broiler chicks were randomly allotted to each of the 4 local broody hens as in treatment 2. The hens and their adopted broods were allowed to scavenge freely and were offered supplementary feed that contained 22.16% crude protein and 2965.65kcal/kg broiler starter for 4 weeks and 20.20% Crude protein and 3234.34kcal/kg broiler finisher diet throughout the 15 weeks rearing period.

Treatment 5: Free range broiler chicks receiving preventive medications and feed supplement

Forty day – old HYBRO^R broiler chicks of mixed sexes and 4 local broody hens were used for this treatment. 10 broiler chicks were randomly allotted to each of the 4 local broody hens as in treatment 2, 3 and 4. The hens and their adopted broods were allowed to scavenge freely for 15 weeks and were given preventive medications as in treatment 4 and feed supplementation as in treatment 3.

Treatment 6: Free range local chickens

This treatment consisted of four local hens with their own natural brood of chicks, which varied from 8 – 12 per hen. The hen and their chicks were studied while on free range for 25 weeks, with no interventions of any kind. Each hen and her brood of chicks served as replicate.

Management of experimental birds

The experimental broiler chicks were wing tagged for their individual identification and weekly weighing on the same day of the week throughout the study period. The local hens and broiler chicks were housed together and with other chickens belonging to the owner. During the weekly visit, the owners of the chickens were asked to explain the reasons for chicken losses or death during the previous week. All data obtained was recorded for each `treatment. Growth rate were measured by weekly weighing of all chicks.

Survivability

Number of birds alive X100 / Initial Number of birds.

Mortality and other forms of losses were kept throughout the study period, Carcass Evaluation; a total of 2 birds per replicate were randomly selected for complete carcass evaluation

Haematology Parameters

2 birds per replicates were randomly selected and scarified by severing the jugular vein and blood allowed to flow freely into labeled bottles, containing a drop of Ethylene Dimine Tetra Acetic Acid (EDTA) for processing at the Laboratory.

Economic of Production

Cost of production: this was estimated as cost of day old chicks plus cost of feed plus cost of vaccines and medications plus cost of labour.

Revenue: this was calculated as the market price of equivalent chickens multiplied by number of surviving birds.

Gross margin: this was estimated as the difference between revenue and cost of production

Data Management and Analysis

Data generated from these measurements were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure for SPSS version 26. Differences between treatment means were tested at 5 % significant level (Tables 1 and 2).

RESULTS AND DISCUSSION

Results of the influence of feed supplementation and preventive medication on the growth and survival of free ranging broiler chickens are presented in (Table 3).

Table 1: Composition of Experimental Starter Diets (0 – 5 weeks).

Ingredients	***Percentage***
Maize grain	46.00
Soya bean cake	25.00
Rice Offal	10.00
Maize Offal	16.00
Bone meal	2.00
Salt (NaCl)	0.25
Methionine	0.25
Lysine	0.25
Vitamin Premix*	0.25
TOTAL	**100.00**
Calculated value	***Percentage***
ME (kcal/kg)	2965.64
Crude protein (%)	22.16
Ether extract (%)	6.93
Crude fibre (%)	3.60
Calcium (%)	1.16
Phosphorus (%)	0.62

Table 2: Composition of Experimental Finisher Diets (5 - 9 weeks).

Ingredients	**Percentage**
Maize grain	56.00
Soya bean cake	20.00
Rice Offal	10.00
Maize Offal	10.00
Bone meal	2.00
Salt (NaCl)	1.00
Methionine	0.25
Lysine	0.25
Vitamin Premix*	**0.25**
TOTAL	100.00
Calculated value	**Percentage**
ME (kcal/kg)	3234.34
Crude protein (%)	22.20
Ether extract (%)	7.53
Crude fibre (%)	4.40
Calcium (%)	1.65
Phosphorus (%)	0.84

Table 3: Growth performance of broiler chicks brooded and reared by local hens.

Age (Weeks)	**Treatments Mean Live Weight (kg)**							
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**SEM**	**P. Value**
5	1.15^{a}	0.36^{c}	0.58^{b}	0.56^{b}	0.59^{b}	0.12^{d}	0.005	0.001
9	1.86^{a}	0.87^{b}	0.96^{b}	0.88^{b}	0.97^{b}	0.17^{c}	0.006	0.017
15	-	1.45^{a-}	1.57^{a-}	1.58^{a}	1.76^{a}	0.48^{b}	0.015	0.027
25	-	-	-	-$^{-}$	-	1.23	0.002	0.00
		-	-		-			
Wt gain (kg)	2.25^{a}	1.34^{b}	1.56^{b}	1.67^{b}	1.94^{b}	0.97^{c}	0.04	0.000
Survival (%)	95^{a}	38^{c}	75^{b}	56^{d}	77^{b}	50^{d}	4.6	0.000

abcd = Mean in the same row with different superscripts are significantly different ($p<0.05$); T_1 Intensive broiler chicks, T_2 = Free range broiler without intervention; T_3 = Free range broiler chicks feed supplemented; T_4 = Free range broiler chicks medicated; T_5 Free range broiler chicks feed supplemented and medicated Wt = Weight.

The result indicated that broiler chickens raised on intensive system had significantly higher weight gain 1.56 and 1.86kg body weight at 5 and 9 weeks of age compared to those on free range, and the free ranging broiler chickens had higher weight gain 0.59kg and 1.66kg (T5) than their local chickens counter parts at 15weeks of age . This observation was in agreement with the findings of Onu & Ajan (2011). Similar trend were also observed in the rate of growth. It was also observed that by 5 weeks of age the intensive broiler chickens had already attained the live weight of 1.56kg that will take 15 weeks and 25 weeks for free range broiler and local chickens respectively. This observation is in line with the earlier report of (Carew and Ejembi, 2005). The significantly ($p >005$) higher values for growth rate in intensively raised broiler chickens *vis – a - vis* free ranging broiler chickens and local chickens was

Table 4: Carcass characteristics of broiler chickens reared by local broody hen.

Parameters	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	SEM	P. Value
Live weight (g)	2323.40[a]	1234.6[b]	1632.4[b]	1642.6[b]	1737.4[b]	1021.5[c]	70.90	0.000
Plucked weight (g)	1958.0[a]	1252.5[b]	1493.5[b]	145.7[b]	1486.6[b]	7336.6[c]	78.00	0.000
Dressed weight (g)	173.54[a]	122.55[b]	126.87[b]	136.26[b]	141.25[b]	67.00[c]	122.20	0.000
Dressing (%)	77.8[a]	68.4[c]	72.3[b]	74.3[a]	75.7[a]	54.5[d]	0.068	0.000
% of dressed weight								
Breast	28.38[a]	18.47[b]	20.53[b]	20.764[b]	22.83[b]	14.86[c]	1.78	0.000
Back	14.75[a]	12.46[b]	14.55[b]	14.85[b]	15.86[b]	9.75[c]	0.98	0.000
Thigh	8.25	7.30	7.47	8.40	7.99	6.54	0.67	0.000
Shank	2.32[ab]	2.92[a]	3.73[a]	3.53[a]	3.57[a]	1.57[b]	0.55	0.000

abcd = Means in the same r ow with different superscripts are significantly different ($P<0.05$); T_1 Intensive broiler c hicks; T_2 = Free range broiler without intervention; T_3 Free range broiler chicks feed supplemented; T_4 Free range broiler chicks medicated; T_5 Free range broiler chicks feed supplemented and medicated; Wt = Weight.

due to the fact that the intensive broiler chickens are in a more control environment and are adequately fed and provided with clean water, whereas, the local chickens on the other hand had to combine their inherent low genetic potential for growth and feed conversion. These finding are comparable with the findings by Castellini *et al*. (2002) and Carew &Ejembi, (2005). As may be expected the growth of chickens in the free range raising system were inferior because the scavenging broilers exposed to fluctuating temperature and higher rate of expenditure of energy on physical activity. This observation is in agreement with the findings of Carew & Ejembi, (2005) and Pontes (2008) who separately reported that growth rate and feed conversion efficiencies of free range broiler chickens were significantly lower than the intensively raised broiler chickens. In this study, free range broiler chickens that have been both given preventive medications and feed supplementation had better growth rate compared to other categories of free range chickens. The survival rate was significantly different in all the treatments groups except treatment 4 (56%) and treatment 6 (50%) which were similar. The significantly higher (95%) survival rate was for intensive broiler chickens T1, followed by free range broilers that had been given preventive medication and feed supplemented (77%), while the lowest was for free range broiler chickens that were neither medicated nor feed supplemented (38%) T2. The significant variations in survival rate between the two rearing system would be because of the fact that the intensively raised broiler chickens were given adequate attention and had unrestricted access to feed and clean water *ad- libitum*, The free range broilers and local chickens on the other hand had little protection against diseases and parasites and had to face the challenges of scavenging. The survivability (38 %) observed in treatment 2 in this study is higher than the 25% reported by Carew & Ejembi (2005) in an experiment to study the feasibility of making broody local hens to adopt and rear broiler chicks on free range. Loses among the scavenging broiler chicks and local chicks were due to various agents of mortality, such as predators, diseases and disappearance which was high during the first 4 weeks, but decreased steadily with age, and due innate immunity as well as resistant against diseases and parasites. The observation of this study is in line with the earlier reports by Carew & Ejembi, (2005) who reported that the free range environment is not friendly for young chicks and mortality is often high within the first 3 – 8 weeks of age.

Carcass Characteristic

The result obtained from the carcass analysis is presented in (Table 4). The result shows that the intensively raised broiler chickens had significantly ($p<0.05$) higher live weight 2323.49g, plucked weight 1958.00g and dressing percent 77.9% at 9 weeks of age and was compared to free range broiler chickens and local chickens at 15 and 25 weeks of age respectively. Amongst the broiler chickens that were raised on free range, those that received preventive medication and feed supplementation T5 had higher meat yield expressed as dressing percent (75.5%) than those that received only medical attention T3 (72.3%) or feed supplementation T4 (74.3%). There were significant differences between treatment groups for the proportions of the shank, breast and back. The carcass of intensively raised broiler chickens had higher proportion of these parts (shank 2.32g, breast 28.38g, and back 14.75g) than the carcasses of free range broilers, which in turn had higher proportion than the carcasses of local chickens. These results are comparable with the findings of Castellini *et al* (2002) and Carew *et al* (2015).

Haematological parameters

The results from the estimate of haematological parameters of intensively raised broiler chickens, free range broiler chickens and local chickens are presented in (Table 5). The results shows a significant difference only in haemoglobin (10.93%) and Creatine (46.8gm/ml) in both cases, the local chickens had higher values (12.44%, 56.70 gm/ml) compared to broilers on free range (10.30%, 48.34gm/ml). The haematological parameters, Packed cell volume (PCV %), White blood cells (WBC %), and Haemaglobin concentration (Hbc) of free range broiler chickens, intensive broiler chickens and local chickens were not affected by the rearing systems. In this study

Table 5: Haematology and scrum biochemistry of broiler chickens reared by local hens.

Parameters	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	SEM	P. Value
PCV (%)	38.75	34.88	35.38	36.13	35.75	35.00	1.37	0.008
RBC (x 106ml)	2.51	2.80	2.93	2.99	3.06	2.91	5.91	0.403
WBC (x 103/ml)	237.13	211.25	225.75	228.75	215.13	210.13	0.88	0.876
Haemoglobin	10.93^{b}	10.14^{b}	10.30^{cb}	10.48	10.30	12.44^{a}	0.29	0.000
Cholosteral (mg/dl)	61.09	50.23	51.28	53.23	53.24	52	3.43	0.000
Creatimine (gm/ml)	46.8^{b}	47.23^{b}	48.28^{b}	48.24^{b}	48.34^{b}	56.70^{a}	2.29	0.000

abcd = Mean in the same row with different superscript differ significantly ($p<0.05$); PCV = Packed Cell Value; WBC = White Blood Cell; T1 = Intensive; T2 = Not intervention; T3 = Medicated; T4 = Feed supplemented, T5= Medicated and feed supplemented T6 = Local chicken no intervention; P. value = probability value, SEM= Standard error of means.

Table 6: Economics of producing free range broiler and local**.**

Cost factor Parameters	Treatment					
	T_1	T_2	T_3	T_4	T_5	T_6
Day old chicks (₦)	1,000	1,000	1,000	1,000	1,000	50.00
Feed Cost/kg (₦)	63.72	0.00	63.72	63.72	63.72	0.00
Cost of Med. (₦)	620..00	0.00	620.00	0.00	620.00	0.00
COB(₦)	1,5 00	0.00	0.00	0.00	0.00	0.00
Total Cost (₦)	2,1	1,000	1,683.72	1,063.72	1,683.72	50.00
No of days	83.72	105	105	105	.105	105
Sale Price/Bird (₦)	56	2,000	2,300	2,500	2,700	1,200
Gross Margin (₦)	3,500	1,000	616.28	1,436.28	1,016.28	1,150
% Survival	95	38	75	56	77	50
Return on Invest %	60	50	37	135	60	-

there was no significant ($p>0.05$) difference between the two rearing systems in the mean values for PVC and WBC. The intensively raised broiler chickens at 9 weeks of age had significantly higher (PCV (38.74%), RBC 2.53 (x 106ml) and WBC 237.13 x 106ml)) values compared with free range broiler chickens and local chickens at 15 and 25weeks of age. However, the free range broiler chickens without intervention had the least values for Packed Cells Volume (34.88%), White Blood Cells (211.25 x 103/ml, and Haemoglobin concentration (Hbc) (10.14) values compared to free broiler chickens, that were medicated (35.38% PVC) or feed supplemented (36.13% PVC). This therefore implies that feed and medication has significant ($p <0.05$) effect on the relative quality of blood cells.

Economics of producing free range broiler chickens and local chickens

Results of estimate of cost of production and revenue associated with the production of broiler chickens on free range are presented in (Table 6). The result shows that free ranging boiler chickensT4 that were offered feed supplementation had the highest gross margin (₦1, 436.28) and return on investment (136%). While free ranging broiler chickens that were given preventive medications and feed supplemented T5 also demonstrated high gross margin of (₦1,016.28), and return on investment (60%). Free range broiler chickens that had no intervention T2 show the lowest gross margin of (₦ 1,000) with return on investment of (50 %).The intensively raised broiler chickens was higher than those of free ranging broiler chickens and local chickens yielded a gross margin of (₦1,316.28) and return on investment of (60%). Free range broiler production, using local broody hens as foster mothers, is far superior to local chickens as a revenue earner, even without health management intervention and feed supplementation.

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