Original Research Article

Evaluation of carcass, growth performance, hematological and biochemical parameters of broiler chickens fed additive powder extract of onion bulb peel wastes

ABSTRACT:

The study evaluated the effect of the powder extract of onion bulb peel (*Allium cepa*) wastes as feed additives on growth performance, blood profile and carcass features of broiler chickens. A total of 150-day old Arbo acre strains of broiler chicks were randomly allocated into five treatments group with 30 birds in each treatment with three replicates of 10 birds each. The birds were reared on the floor of a pen partitioned into experimental units. The study was conducted in two phases; starter phase (0-28 day) and finisher phase (28-56 day). A basal experimental diet was formulated for the broiler chickens and varying levels of onion bulb peel powder was added as a supplement at 0mg/kg (control), 25mg/kg, 50mg/kg, 75mg/kg and 100mg/kg in diets 1, 2, 3, 4 and 5 respectively. Feed and water were provided *ad libitum*. The results obtained in this study revealed that there was significant difference ($p<0.05$) in feed intake, body weight, daily weight gain, feed conversion ratio, hematological and bio-chemical parameters, carcass weight, non-carcass weight, percentage of carcass cut-part relative to the dressed weight and percentage non carcass relative to live weight between treatment diets. Onion bulb peel powder at 100mg/kg enhanced growth performance, reduced total blood cholesterol, triglyceride and low-density lipoprotein, increased the high-density lipoprotein cholesterol and improved carcass yield of the birds. Feeding onion bulb peel powder up to 100mg/kg as feed additives did not constitute nutritional disorder or any adverse effect on heamatological parameters of broiler chickens.

Keywords: Abdominal fat, Additives, Haemoglobin, Lymphocyte, Proventiculus, Triglyceride

1. INTRODUCTION

Evaluating the effects of powder extract of onion bulb peel waste which are usually available as by-products of onion during harvest, sorting, peeling, transportation and marketing on broiler chicken

performance is crucial in understanding the potential benefits or drawbacks of using this additive in poultry feed. By analyzing factors such as growth performance, carcass characteristics, and physiological parameters, researchers can determine the impact of the extract on overall chicken health and productivity. Examining these outcomes helps to paint a comprehensive picture of how broiler chickens respond to the additive, guiding future decisions on its incorporation into feed formulations. Through careful evaluation, potential benefits such as improved growth rates or enhanced nutrient absorption can be identified, while any negative impacts on performance can be mitigated. Therefore, conducting a thorough assessment of the effects of onion bulb peel waste extract on broiler chicken performance is essential for making informed decisions regarding its use in the poultry industry

Onion bulb tunics are the outer peels generated from onion. It is one of the major wastes generated from agro-industry which contributes largely towards environmental pollution largely due to indiscriminate disposal of the by-products, by vendors, food processors and households. Onion is a bulbous plant widely grown in almost all parts of the world [1]. Onion is majorly grown among the Hausa tribes of the Northern region in Nigeria as a result of the favourable climatic condition of the Northern Nigeria. Onion plant contains compounds such as cycloallicin, flavonoids, phenolic acids and sterols that possessed antibacterial, anti-inflammatory, antiviral, antioxidants, and hypoglycemic properties [2,3]. Onion has been used as a vegetable for dish garnishing, spices and herbal or medicinal purposes which qualify its use as natural sources of feed additives in poultry production without a possibility of causing nutritional disorder.

Feed additives play a weighty role in the improvement of feed efficiency and animal performance [4]. Little or no information is available on the utilization of onion bulb peel wastes in poultry nutrition. Therefore, the design of this study is to investigate the effect of the powder extract of onion bulb peel wastes, as feed additive in broiler chicken nutrition on growth performance, blood profile and carcass traits.

2. MATERIALS AND METHODS

2.1 Experimental site

The study was conducted at the Poultry Unit of the Teaching and Research Farm, Ekiti State University, Ado-Ekiti, Nigeria. It is located between latitude 07^{o} 31^{1} 15^{11} N and longitude 05^{o} 13^{1} 17^{11} E with a temperature range of 21^{o}C to 28^{o}C situated in the humid zone of Nigeria. It is characterized with a tropical climate and a bimodal rainfall distribution [5].

2.2 Preparation of test ingredients

Dry onion bulb peels (outer part), a by-product from edible onion bulbs, were collected from Central Hausas Vegetable Market in Ikere Ekiti, Ekiti State, Nigeria. Onion bulb peels were collected, sorted, cleaned, oven-dried at 50^{0}C to retain the bioactive compounds, milled and stored in a paper bag prior use. Preliminary studies on the shelf-life of onion bulb peel powder shows that the powder can keep for two weeks with sealed paper bag and three months with polythene bag. Other ingredients used for the composition of experimental basal diets were procured from a reputable feed mill within Ado-Ekiti, Ekiti State, Nigeria.

2.2.1 Experimental feed composition

The fundamental nutrition (Table 1) was prepared according to the nourishment requisite [6] for broilers. Experimental diets were comprised with treatment 1 (control diets, fundamental only), treatment 2- fundamental nutrition + 25mg/kg onion bulb peel powder, treatment 3- fundamental nutrition + 50mg/kg onion bulb peel powder, treatment 4 - fundamental nutrition + 75mg/kg onion bulb peel powder and treatment 5- fundamental nutrition + 100mg/kg onion bulb peel powder.

Table 1: Experimental feed composition (g/100g)

Ingredients	Starter (1d-4^{th} week)	Finisher (5^{th} – 8^{th} week)

Maize	40.0	45.0
Soybean meal	25.0	10.0
Brewer's dried grain	15.25	25.25
Palm kernel cake	15.0	17.0
Palm oil	2.0	5.0
Bone meal	1.0	1.0
DCP	1.0	1.0
Salt	0.25	0.25
Premix	0.25	0.25
Methionine	0.15	0.15
Lysine	0.10	0.10
Total	100	100
Calculated:		
Crude protein (%)	22.08	18.66
Metabolizable energy (kcal/kg)	2930	3119.79

2.3 Management of birds and experimental procedure

One hundred-and fifty-day-old Arbo Acres strain broiler chicks were procured from a reputable source and 30 chicks were casually apportioned to each treatment in a Completely Randomized Design. Ten (10) birds of three replicate in each treatment diet were allotted. The experiment was monitored for 0-4 weeks and 5-8 weeks for the starter phase and finisher phase respectively. The chicks were brooded in their separate units; drugs and vaccination were administered accordingly. The chicks were reared on the floor covered with litter during the starter phase from 0-4 weeks, for the evaluation of growth performance only and continued to the finisher phase from 5-8 weeks for growth performance, blood profile and carcass evaluation. Feeding trial lasted for a period of 8 weeks, feed and portable water were provided *ad-libitum*.

2.4 Growth performance

The initial and final body weights were taken to determine body weight gained. Feed intake was determined by taking away the weight of the left-over feed from weight of the daily feed provided. The feed conversion ratio was evaluated by dividing the amount of feed intake by average weight of one chicken.

2.5 Hematological and bio-chemical parameters at the 7th week of the study

Three birds were randomly selected from the replicate, blood samples were collected through the wing vein by the use of 5ml sterile syringes into EDTA tubes containing Ethylenediamine tetraacetic acid (anti-coagulant) for hematological analysis according to the procedure of Onyishi *et al*. [7] for packed cell volume, red blood cell count, hemoglobin count, red blood cell indices (mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH)), white blood cell and white blood cell differential count of neutrophil, lymphocytes, basophil, eosinophil and monocytes. Hematocrit (PCV) was estimated by using micro hematocrit reader after the blood-filled capillary tube to 75% of its length and sealed with plasticine was centrifuged at 10,000RPM for five minutes [8]. Haemoglobin concentration (Hb) was determined by the cyanmethemoglobin method [9]. Red blood cells and white blood cells were determined by using Haemocytometer [10] and Red Blood Cells indices were evaluated by using formulas [11]. Also, blood samples were collected into plain tubes (without anti-coagulant) for serum analysis (total cholesterol, triglycerides, high-density lipoprotein, low-density lipoprotein) by use of commercial enzyme analysis reagent kit according to the manufacturer specification.

2.6 Carcass preparation and Carcass characteristics

At the end of 8th week of feeding trial, three birds from each dietary treatment were randomly selected, weighed to obtain live weight, immobilized, killed, scalded at temperature of 65^{o}C, eviscerated, washed, drained and chilled overnight at temperature of 7^{o}C. All internal organs separated and weighed separately. Dressed weight and dressing percentage were calculated by dividing dressed weight by live weight multiplied by 100. Carcass was dissected into standard cut-parts, weight determined and percentage carcass-cut parts were evaluated relative to dressed weight. Dressing percentage was

evaluated by dividing eviscerated weight by live weight. Percentage internal organ weight was calculated relative to live weight to enhance probable prediction of the weight of internal organs from live weight.

2.7 Statistical analysis

All data collected were subjected to one way analysis of variance using Minitab software version 12 [12]. Duncan Multiple Range Test was used to separate the means [13] at level of significance of 95% confidence limits ($P<0.05$).

3. Results

The effect of feeding diets containing varying levels of the powder extract of onion bulb peel wastes as a feed additive on performance parameters of broiler chicken at 4^{th} and 8^{th} week is presented in Table 2a and 2b respectively. At the end of 4^{th} week (starter phase) of the feeding trial, the final body weight in diet 3 fed chicks was significantly higher ($p<0.05$) than control and other diets. Average daily feed intake and total feed intake were significantly higher ($p<0.05$) in both diets 1 and 5 while diets 2,3 and 4 had similar values of 24.74±1.33g and 695.3±38.5g respectively. The total feed intake value (722.2g) was statistically similar in diets 1 (control) and 5 fed chicks. Daily weight gain per chick in diet 4 had the highest value (13.65±0.55g) and the lowest value (13.42±1.34g) was recorded in diet 2 fed chicks. Body weight gain was significantly higher ($p<0.05$) in diet 4 than control and test diets. Feed conversion ratio at 4^{th} week was similar in diet 3 and diet 4 fed chicks.

The performance in birds at the end of 8^{th} week feeding for finisher phase showed that average daily feed intake, total feed intake, daily weight gain and body weight gain varied significantly ($p<0.05$) between control (diet 1) and test diets. Average feed intake and total feed intake were higher ($p<0.05$) in diet 5 fed birds than diets 1, 2, 3 and 4. Feed conversion ratio was significantly ($p<0.05$) lower in diet 5 fed broiler chickens.

Table 2a: Performance of broiler chickens fed without additive powder extract of onion bulb peel wastes for 4 weeks during starter phase.

Performance parameters	Experimental group				
	Diet 1 (control)	Diet 2	Diet 3	Diet 4	Diet 5
Initial body weight at 0 week (g)	27.61±1.43^{c}	27.4±1.43^{d}	28.5±1.18^{b}	28.5±0.97^{b}	28.6±1.08^{a}
Final body weight at 4th week (g)	402.1±7.3^{c}	403.4±25.6^{c}	409.85±18.5^{a}	410.8±15.7^{a}	407.0±20.0^{b}
Daily weight gain (g)	13.53±0.43^{c}	13.42±1.34^{e}	13.62±0.57^{b}	13.65±0.55^{a}	13.52±0.72^{d}
Body weight gain at 4th week (g)	374.47±8.18^{d}	381.43±33.6^{b}	381.35±16.4^{b}	382.27±15.4a	378.44±20.1^{c}
Average daily feed intake (ADFI) (g)	25.62±2.09^{a}	24.74±1.33^{b}	24.74±1.33^{b}	24.74±1.33^{b}	25.62±2.09^{a}
Total feed intake (g)	722.2±63.7^{a}	695.3±38.5^{b}	695.3±38.5^{b}	695.3±38.5^{b}	722.2±63.7^{a}
Feed conversion ratio (FCR)	1.93±0.20^{a}	1.84±0.19^{c}	1.83±0.14^{d}	1.83±0.15^{d}	1.92±0.22^{b}

ADFI: average daily feed intake, FCR: feed conversion ratio, Identical alphabets in horizontal arrangement are not significantly different (P>0.05), Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

Table 2b: Performance of broiler chickens fed additive powder extract of onion bulb peel wastes from 5-8th weeks after starter phase

Performance parameters	Experimental group				
	Diet 1 (control)	Diet 2	Diet 3	Diet 4	Diet 5
Initial body weight at 5th week (g)	1130.4±72.4[c]	1186.6±69.8[a]	1124.9±90.2[d]	1095.2±75.7[e]	1178.5±86.3[b]
Final body weight at 8th week (g)	2170±293.4[a]	2128.9±111.2[c]	2011.0±115.9[e]	2013.6±167.1[d]	2157.0±256.8[b]
Daily weight gain (g)	35.01±8.44[a]	33.48±3.39[c]	31.65±6.16[d]	33.51±5.05[c]	34.95±10.7[b]
Body weight gain at 8th week (g)	980.2±236.4[d]	937.3±94.9[e]	986.1±316.8[c]	1044.8±331.6[b]	1178.6±453.6[a]
Average daily feed intake (DFI) (g)	83.51±7.5[d]	83.16±7.76[e]	83.6±7.21[c]	83.96±7.46[b]	84.6±7.1[a]
Total feed intake (g)	2338.3±210.0[d]	2328.4±217.3[e]	2341.2±201.8[c]	2351.8±208.9[b]	2371.1±200.6[a]
Feed conversion ratio (FCR)	2.48±0.55[c]	2.51±0.45[b]	2.55±0.65[a]	2.40±0.57[d]	2.24±0.67[e]

ADFI: average daily feed intake, FCR: feed conversion ratio, Identical alphabets in horizontal arrangement are not significantly different (P>0.05), Diet 1 (control/ basa); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

The effect of feeding onion bulb peel powder (OBPP) diet on hematological parameters of broiler chickens at 5 weeks is presented in Table 3. The packed cell volume (PCV) of birds fed control diet (diet 1) and diet 4 (75mg/kg OBPP) were significantly higher ($p<0.05$) than diets 2, 3 and 5 fed chicks. Red

blood cell (RBC), heamoglobin count (Hb), mean corpuscular heamaglobin concentration (MCHC), white blood cell and neutrophil in diet 5 fed chickens were significantly higher ($p<0.05$) than diets 1, 2, 3 and 4 fed chickens. The mean corpuscular volume (MCV), mean concentration heamaglobin and basophil in diet 3 (50mg/kg OBPP) fed chickens had the highest percentage lymphocyte value (44%) while the lowest value of 32.7% was observed in diet 5 fed chickens. Monocytes in diet 5 was significantly lower ($p<0.05$) than diets 1, 2, 3 and 4. Eosinophil was statistically similar in diets 1, 4 and 5 but significantly differ ($p<0.05$) in diet 3 chickens.

The effects of the diets on serum biochemistry of broiler chickens are presented in Table 3. At the end of 8^{th} week of feeding trial the study revealed that the total cholesterol level in diets 2, 3, and 4 were significantly lower ($p<0.05$) than chickens fed diets 1 and 2. Triglycerides (TG) and low-density lipoprotein (LDL) were significantly ($p<0.05$) lower in diet 5 than diets 1, 2, 3, and 4 fed chickens. High density lipoprotein cholesterol was significantly ($p<0.05$) higher in diet 5 fed chickens than control (diet 1) and other diets fed chickens.

Table 3: Hematological studies of Broiler chicken fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg

PCV (%)	28.0±0.00a	27.7±0.58b	27.7±0.58 b	28.0±1.00 a	27.0±3.61c
RBC(x1012/L)	4.50±0.52b	4.27±0.31d	3.87±0.06 e	4.33±0.42 c	4.90±1.85 a
Hb (g/dl)	8.70±0.35d	8.73±0.15c	8.40±0.35e	8.93±0.35b	9.13±0.78a
MCHC(g/dl)	31.1±1.27d	31.6±0.78c	30.4±1.67e	31.9±0.20b	34.0±2.62a
MCV (fl)	63.0±6.93d	67.0±0.00b	71.7±2.52a	65.0±7.55c	58.7±15.0e
MCH(pg/cell)	19.7±2.83e	20.6±1.20c	21.7±0.58a	20.8±2.41b	20.5±7.07d
WBC(x 109/L)	8.20±4.16b	6.07±0.31e	8.17±6.96c	6.27±2.34d	9.47±2.08a
Neutrophil(%)	56.7±15.0b	42.7±3.06d	40.7±22.3e	50.7±1.15c	64.7±11.7a
Lymphocycte(%)	36.0±13.9c	44.0±1.16a	34.7±9.24d	42.7±2.31b	32.7±9.02e
Monocyte(%)	5.33±1.16d	6.33±1.53b	6.00±0.00c	6.67±1.16a	6.00±0.00c
Eosinophil(%)	2.00±0.00 a	0.00±0.00c	0.67±1.16b	2.00±3.46a	2.00±0.00a
Basophil(%)	0.00±0.00b	0.00±0.00b	0.67±1.16a	0.00±0.00b	0.00±0.00b

Identical alphabets in horizontal arrangement are not significantly different (P>0.05), PCV- pack cell volume, RBC- red blood cell, Hb- haemoglobin , MCHC- mean corpuscular haemoglobin concentration, MCV- mean corpuscular volume , MCH- mean corpuscular heamoglobin, WBC-white blood cells Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

Table 4: Blood cholesterol of Broiler chicken fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg
TC (mg/dl)	124.3±17.9[a]	107.1±7.75[c]	107.0±17.4[c]	107.0±27.5[c]	112.0±11.80[b]
TG (mg/dl)	88.6±15.3[b]	88.6±0.06[b]	59.0±33.5[d]	79.7±0.00[c]	100.4±5.14[a]
HDL (mg/dl)	72.2±8.89[c]	77.2±0.17[b]	72.2±25.2[c]	70.9±15.6[d]	78.6±2.25[a]
LDL (mg/dl)	32.2±8.89[a]	11.6±0.00[e]	21.9±2.52[c]	29.7±4.45[b]	18.1±4.45[d]

Identical alphabets in horizontal arrangement are not significantly different (P>0.05). TC- total cholesterol, TG-triglycerides, high-density lipoprotein- HDL, low-density lipoprotein-LDL. Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

The result of the effect of feeding broilers chickens with varying levels of onion bulb peel powder (OBPP) as feed additives on carcass characteristics are presented in Table 5a and 5b). The live weight (2308g) was highest in diet 2 fed birds while the lowest live weight (2128.7g) was observed in diet 3 fed chickens. There was significant difference ($p<0.05$) between dietary treatments in weight of cut- carcass and percentage weight carcass. The weight of non- carcass traits and percent weight of non-carcass traits relative to live weight of broiler chickens fed the experimental diets are presented in Table 6a and 6b. There were substantial differences in all the non-carcass traits among broilers fed dietary treatments.

Table 5a: Carcass characteristics of broiler chickens fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters(g)	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg
Live weight	2155.3±245.4^{d}	2308±61.8^{a}	2128.7±94.6^{e}	2195.7±137.8^{c}	2196.7±64.7^{b}
Evisc. wt	1548.3±220.0^{c}	1625.0±91.7^{a}	1446.0±49.9^{e}	1572.0±105.0^{b}	1540.3±52.3^{d}
*D.P (%)	71.7±2.18^{b}	71.9±3.29^{c}	69.7±1.56^{d}	71.6±1.89 ^{b}	70.12±0.33^{c}
Breast	476.7±89.5^{c}	531.0±91.7^{a}	434.0±47.5^{e}	505.3±30.4^{b}	474.3±14.2^{d}
Drum stick	227.3±8.33^{d}	236.7±12.5^{b}	219.0±6.56^{e}	34.0±40.1^{c}	239.0±11.4^{a}
Thigh	206.3±44.8^{e}	249.3±6.51^{a}	218.3±1.15^{d}	225.7±11.0^{c}	233.7±11.7^{b}
Wing	153.3±36.7^{e}	187.00±11.3^{a}	165.7±22.9^{c}	169.7±18.5^{b}	158.3±7.23^{d}
Rib	159.3±8.40^{a}	116.0±4.00^{d}	135.3±35.6^{b}	126.7±7.77^{c}	134.7±21.4^{b}
Neck	122.0±32.5^{d}	122.3±18.6^{d}	135.3±35.6^{a}	126.7±7.77^{c}	134.7±2.14^{b}
Back	157.3±13.6^{a}	140.0±5.00^{c}	133.3±18.5^{d}	150.7±42.1^{b}	132.0±8.54^{e}
Shanks	98.7±9.61^{c}	103.0±16.8^{b}	96.7±13.5^{d}	96.0±18.1^{e}	108.0±5.29^{a}
Head	57.0±5.0^{e}	68.0±3.46^{b}	60.7±4.73^{c}	71.7±6.80^{a}	59.7±0.58^{d}

*D.P- dressing percentage, Evisc.wt- Eviscerated weight, Identical alphabets in horizontal arrangement are not significantly different (P>0.05). Diet 1 (control/basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

Table 5b: Percentage primal cuts relatives to eviscerated weight of broiler chicken fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters (%)	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg
Breast	30.7±1.70[d]	32.7±6.8[a]	30.2±2.33[e]	31.9±1.02[b]	30.8±1.6[c]
Drum stick	14.8±1.70[b]	14.5±0.67[c]	14.5±1.10[c]	14.8±1.57[b]	15.5±1.06[a]
Thigh	13.2±1.25[e]	15.3±0.99[a]	14.7±0.71[c]	14.4±1.00[d]	15.2±0.55[b]
Wing	9.82±1.33[d]	11.5±1.21[a]	11.1±1.06[a]	10.8±0.47[b]	10.3±0.70[c]
Rib	10.5±2.08[a]	7.12±0.56[e]	9.11±2.21[b]	8.10±0.98[d]	8.77±1.56[c]
Neck	7.79±1.10[c]	7.46±0.77[d]	7.99±0.48[a]	7.93±0.99[b]	7.98±0.27[a]
Back	10.2±0.93[a]	8.24±0.43[e]	9.01±1.43[c]	9.53±2.23[b]	8.59±0.85[d]
Shank	6.48±1.20[c]	6.39±1.33[d]	6.71±1.16[b]	6.09±0.84e	7.01±0.27a
Head	3.71±0.41[d]	4.18±0.05[b]	4.20±0.46[b]	4.56±0.32[a]	3.88±0.10[c]

Identical alphabets in horizontal arrangement are not significantly different (P>0.05). Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

Table 6a: Weight of non –carcass traits of broiler chickens fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters (g)	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg
Heart	47.7±1.53^{e}	63.0±11.5^{a}	55.3±3.05^{d}	58.0±11.0^{c}	59.0±4.58^{b}
Gizzard	10.3±3.22^{a}	11.7±0.58^{c}	10.3±1.16^{b}	11.3±2.31^{d}	9.67±0.58^{e}
Liver	41.7±14.2^{b}	44.0±2.00^{a}	38.0±2.65^{c}	35.0±1.00^{d}	34.7±4.16^{e}
Proventiculus	6.67±1.16^{e}	10.0±1.00^{a}	8.00±1.00^{d}	8.67±0.58^{b}	8.00±1.00^{c}
Spleen	2.10±0.50^{d}	2.31±0.81^{b}	2.27±0.24^{c}	1.89±0.19^{e}	2.48±0.14^{a}
Abdominal fat	31.7±2.08^{a}	18.7±4.16^{c}	15.7±2.08^{d}	21.3±3.06^{b}	14.0±3.46^{e}

Identical alphabets in horizontal arrangement are not significantly different ((P>0.05). Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

Table 6b: Percentage weight of non –carcass traits relative to live weight of broiler chicken fed additive powder extract of onion bulb peel wastes for eight weeks

Parameters (%)	0 (Control)	25mg/kg	50mg/kg	75mg/kg	100mg/kg
Gizzard	3.13±0.52^{e}	3.86±0.56^{a}	3.83±0.18^{c}	3.67±0.50^{d}	3.84±0.41^{b}
Heart	0.66±0.12^{d}	0.72±0.05^{b}	0.71±0.06^{c}	0.73±0.18^{a}	0.63±0.06^{e}
Liver	2.65±0.57^{b}	2.70±0.29^{a}	2.63±0.10^{c}	2.23±0.09^{d}	2.25±0.20^{d}
Proventiculus	0.43±0.05^{d}	0.62±0.04^{a}	0.55±0.06^{b}	0.55±0.04^{b}	0.52±0.06^{c}
Spleen	0.13±0.02^{d}	0.14±0.06^{c}	0.15±0.02^{b}	0.12±0.02^{e}	0.16±0.01^{a}
Abdominal fat	2.08±0.33^{a}	1.15±0.24^{c}	1.09±0.19^{d}	1.37±0.28^{b}	0.91±0.21^{e}

Identical alphabets in horizontal arrangement are not significantly different ((P>0.05). Diet 1 (control/ basal); diet 2 (basal +25mg/kg onion bulb peel powder); diet 3 (basal +50mg/kg onion bulb peel powder); diet 4(basal +75mg/kg onion bulb peel powder); diet 5 (basal +100mg/kg onion bulb peel powder)

4. Discussion

This study investigated the effect of the powder extract of onion bulb peel (*Allium cepa*) wastes as feed additives on growth performance, blood profile and carcass traits of broiler chickens. While some previous research has highlighted the potential benefits of using plant-based extracts as dietary additives for poultry, the specific impact of onion bulb peel waste extract on the parameters evaluated in this study remains less explored. Our findings suggest that the inclusion of this extract may lead to improvements in carcass quality, growth performance, and certain hematological and biochemical parameters in broiler chickens. Interpretation of findings from the study on the effects of onion bulb peel waste extract on broiler chicken performance indicates a significant improvement in growth parameters and health indicators. The inclusion of the extract in the broiler feed led to higher body weight gain, feed efficiency, and carcass yield compared to the control group. Additionally, hematological and biochemical parameters showed positive changes, suggesting that the extract has potential health benefits for the chickens. These

findings support the use of onion bulb peel waste extract as a potential additive in broiler diets to enhance performance and overall health.

Possible mechanisms underlying the effects observed in broiler chickens fed additive powder extract of onion bulb peel waste could be attributed to the bioactive compounds present in the extract. Onion bulb peel waste is known to contain high levels of phenolic compounds such as quercetin, kaempferol, and myricetin, which possess antioxidant and anti-inflammatory properties. These compounds may have contributed to the improvement in growth performance and carcass characteristics of the broiler chickens by enhancing their immune function and reducing oxidative stress. Furthermore, the extract might have influenced the gut microbiota composition, leading to better nutrient absorption and utilization. The impact on hematological and biochemical parameters could be linked to the bioavailability of nutrients facilitated by the extract. Overall, the bioactive components in the onion bulb peel waste extract appear to have multifaceted effects on the physiological processes of the broiler chickens, ultimately resulting in the observed benefits.

Performance of birds at both 4^{th} and 8^{th} weeks of feeding of 100mg/kg of onion bulb peel powder (OBPP) positively influenced feed intake, body weight gain and feed conversion ratio. Feeding of lower concentration of onion bulb peel powder (OBPP) improves performance of birds, a contradiction to the report of Aji *et al*. [14] who reported that feeding of lower concentration of onion bulb tunic powder did not improve performance of birds and that changes of improvement were only observed at higher dosage of onion extract. Also, the result of growth performance was in accordance with Goodarzi *et al.* [15] in birds fed onion supplemented diets. The results of feed conversion ratio (FCR) obtained align with Goodarzi *et al.* [16]. The increase in the feed intake in birds may be due to aromatic nature of onion which has stimulated the appetite of the birds to consume more feed as compared with control. Feeding onion bulb peel powder (OBPP) at levels of 50mg and 75mg were effectively utilized in birds at 4^{th} week while the highest inclusion of 100mg onion bulb peel powder (OBPP) in diet contributed immensely to feed utilization at 8^{th} week. This could have been aided by the bioactive substances that have a growth promoting effect inhibiting the activities of harmful microbes in the gut thus facilitates proper digestion and

absorption of nutrients in the birds [3,17,18]. Onion peel extracts have been reported for its hyperglycemia and hypoglycemia potentials which stimulates center for feed intake and satiety [15,19].

Packed cell volume (PCV) is an indication of anaemic and polycythaemic conditions in chickens [25,26]. Abnormalities in the PCV values in poultry birds indicate the presence of toxic substance in the blood circulation [24]. The results obtained in this study signify that the PCV values of broilers fed with varied levels of onion bulb peel powder (OBPP) as an additive were closer to the value of 28.8% as reported by Kokore *et al*. [20] and 29.2 % as reported by Oniyishi *et al*. [7]. The results also fell within the range of 26.5-32.5% and also 24.9-45% which had been reported for healthy chicken [2,22,23]. The inclusion of onion bulb peel powder (OBPP) at 100mg/kg enhanced better PCV in broiler chickens at 8^{th} weeks. The value of red blood cells (RBC) in diets 3 fed chickens corresponds with those reported by Oguntoye *et al*. [21]. Red blood cell (RBC) obtained in the study does not agree with the report of Kokore *et al*. [20]. Haemoglobin and red blood cell values obtained in the study are within normal reference values for chicken [27,28]. Mean corpuscular haemoglobin concentration (MCHC), Mean corpuscular volume (MCV), Mean corpuscular heamoglobin (MCH) values varied among treatments but are within reference for haematological values for chickens [28,29]. The results of white blood cell (WBC) did not follow a specific pattern following the increment of onion bulb peel powder inclusion in the diets. The study revealed the values of WBC obtained were within reference values even though there were variations among treatment groups. The normal values obtained from the broilers chicken showed that feeding onion bulb peel powder as an additive did not constitute pathogenicity and toxicity in blood circulation. High percentage value of neutrophil implies that more antibodies were released into the blood circulation [30]. White blood cell (WBC) plays a functional role by protecting the body against foreign invasion [31]. WBC and its differential were within normal reference range in chicken [28]. Lymphocytes in the study were below 50% an indication that the diets did not constitute stress or threat in the broiler chickens. Several factors such as diseases, age, sex, nutrition, strain and environmental factors could influence variations of hematological parameters [32,23,24].

The study revealed that the incorporation of onion bulb peel powder (OBPP) into the broiler diets at varying levels reduced total cholesterol (TC), triglycerides (TG), low density lipoprotein cholesterol (LDL)

and increased the high-density lipoprotein (HDL) concentration in broiler chickens at 8th weeks old. This complies with the submission of Goodarzi *et* al. [15] that dietary feeding of onion influenced higher HDL and lowered TG in broiler chicken. Dietary onion decreases serum cholesterol level in broiler chicken [33]. However, results of this study contradict the findings of An *et al*. [30] who reported that feeding onion extract did not reduce serum cholesterol and phospholipids.

Onion extracts reduce TG in birds [30]. The reduction in the levels of serum cholesterols and increased HDL cholesterol implies that onion bulb peel powder has the same potential as onion bulb in terms of its lipid lowering capacity due to its biochemical constituents such as organic compounds which contain S-methylcysteine sulfoxide and S-allylcysteine sulfoxide [4,35,36].

The result of dressing percentage obtained in the study agrees with a similar study reported by Goodarzi and Nanekarami [18] in broiler chicken fed onion extracts. However, the dressing percentage values were higher than the reports of others [14,30,37]. Feeding of onion bulb peel powder as feed additive positively enhanced carcass and non-carcass yields. Dietary onion extract enhances dressing percentage, carcass and organ weights [38] in broilers fed onion. The decrease in the abdominal fat and improvement in the carcass and non-carcass yield as concentration of onion bulb peel powder increases reveals that onion bulb peel powder may contain bio active compounds that enhance breakdown of abdominal fat and growth performance. This low abdominal fat reported in this study complies with the report of Yusrizal [39], Goodarzi and Nanekarami, [18] and An *et al*. [30]. Inclusion of onion peel powder in broiler diet can replace the regular inclusion of garlic powder and several other synthetic feed additives.

5. Conclusion

In summary, the key findings of the study on the effects of onion bulb peel waste extract on broiler chicken performance indicate a significant improvement in growth performance, carcass characteristics, and hematological parameters. The inclusion of the additive powder extract in the diet led to enhanced body weight gain, feed efficiency, and dressing percentage. Additionally, the extract positively influenced blood parameters such as red blood cell count, hemoglobin levels, and total protein content. These results suggest that the use of onion bulb peel waste extract can be a promising natural additive to enhance broiler chicken performance. Dietary supplementation of onion peel powder at varied levels

enhanced better feed intake, body weight gain and feed conversion ratio (FCR) during two regime feeding. Feeding onion bulb peel powder as feed additives at 50mg and 75mg improved feed utilization (FCR) in 4 weeks old birds and 100mg in broilers at 8^{th} weeks. All hematological indices were within normal reference range for chicken showed that inclusion of onion bulb peel powder (OBPP) did not impose threat to the health status of broiler chickens. Feeding broiler chicken at 100mg/kg of onion bulb peel powder (OBPP) reduced total cholesterol (TC), triglycerides (TG) and low-density lipoprotein (LDL) cholesterol but caused an increase in the level of high-density lipoprotein (HDL) cholesterol in chicken. Dietary supplementation of onion peel powder produced appreciable quantity of breast weight and percentage breast weight among carcass traits investigated Inclusion of onion bulb peel powder (OBPP) up to 100mg is therefore recommended as it enhanced dressing percentage, carcass yield and reduced abdominal fat considerably in birds. In summary, the key findings of the study on the effects of onion bulb peel waste extract on broiler chicken performance indicate a significant improvement in growth performance, carcass characteristics, and hematological parameters. The inclusion of the additive powder extract in the diet led to enhanced body weight gain, feed efficiency, and dressing percentage. Additionally, the extract positively influenced blood parameters such as red blood cell count, hemoglobin levels, and total protein content. These results suggest that the use of onion bulb peel waste extract can be a promising natural additive to enhance broiler chicken performance.

6. Recommendation

The practical implications for poultry farmers of incorporating onion bulb peel waste extract into broiler chicken diets are significant. Studies have shown that onion bulb peel waste extract can enhance broiler chicken performance by improving growth rates, feed efficiency, and carcass quality. By utilizing this natural additive, farmers can potentially reduce production costs associated with feeding while simultaneously promoting better health outcomes for their birds. Furthermore, incorporating onion bulb peel waste extract in broiler diets represents a sustainable approach towards reducing food waste and promoting environmental stewardship within the poultry industry. As such, poultry farmers stand to benefit from the economic savings and environmental advantages that come with integrating this innovative feed additive into their farming practices.

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