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# HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF FINISHER BROILER CHICKENS FED GRADED LEVELS OF COMBINED RUMEN CONTENT AS SUBSTITUTE FOR WHEAT OFFAL

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## ABSTRACT

An experiment was carried out to partially substitute graded levels of combined (camel and cattle) rumen content (CCRC) for wheat offal and subsequently determined the haematological and serum biochemical parameters of broiler chickens. One hundred and twenty day-old (120) (Marshall) broiler chicks were randomly allotted to 4 dietary treatments of three replicates of 10 chicks each. The experimental diets were formulated with cow and camel rumen content (combined rumen content (CCRC)) in the diets of broiler chickens (ratio of 1:1) at 0%, 5%, 10% and 15% inclusion levels and designated as $T_I$, $T_2$, $T_3$, and $T_4$ respectively. Data obtained were subjected to analysis of variance(ANOVA) in a completely randomized design (CRD) using SAS (2009) and significant means were separated using Duncan's Multiple Range Test of same statistical package at 5% level of probability. Feed and water were supplied *ad libitum* for 8 weeks. Data were generated for haematological and serum biochemical parameters. Results from blood analysis revealed no significant (P>0.05) effect of CCRC on haematological parameters measured except for mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC). Birds fed 15% and 5% had the highest values of MCV (147.70 and 145.80 fl) compared to birds fed control diet (136.17 fl). Similarly, CCRC had no significant (P>0.05) influence on serum biochemical parameters examined except for creatinine, potassium and aspartate aminotransferase (AST). The highest creatinine and AST values were obtained at 0% inclusion level of CCRC while the least values recorded were obtained in birds fed 5%, 10% and 15% CCRC inclusion. It was concluded that CCRC at 15% inclusion level could be used to substitute wheat-offal in diet of broiler chickens as it pose no health risk to the chicken based on the haematological and serum biochemical results of the birds.

**Keywords:** Marshall Broiler Chicken, Combined Rumen Content (CCRC), Haematological and Serum biochemical indices.

## INTRODUCTION

Poultry birds especially broilers play a significant role in the provision of animal protein required by man to meet daily protein intake (Maidala and Istifanus, 2012). They have high growth rate, high feed conversion ratio, short generation interval (5-6 months), short intestinal feed transit of 2-3 hours and traits that respond to feeding and nutritional manipulations within days (Atteh, 2003). The energy level of the feed is the major factor influencing feed intake as birds under normal circumstances will eat to satisfy their energy needs (Maidala and Istifanus, 2012). In poultry nutrition, energy source generates body heat, physiological maintenance, growth and production of the body (Maidala and Istifanus,

2012).The high cost of poultry feed is largely attributed to the scarcity and exorbitant price of the conventional ingredient such as maize, groundnut cake, fish meal and soybean meal thus making it expedient for alternative and cheaper feed ingredients. However, the scarcity of feed ingredients necessitates the need to look for alternative feed ingredients which are cheap and without any negative effect on physiology and ultimately the health of the poultry birds an example of such is rumen content. Rumen content waste is an abattoir waste that is often environmentally unfriendly (Makinde *et al*., 2017). It has been reported to have potentials as source of protein and fibre in monogastric diets (Dairo *et al*., 2005; Mohammed *et al*., 2005; Adeniji, 2008). Akinmutimi (2004) reported that haematological and biochemical blood components are influenced by the quantity and quality of feed. Biochemical and haematological components of blood are sensitive to elements of toxicity in feed, especially with feed constituents that affect the formation of blood (Oyawoye and Ogunkunle, 1998).

Changes in the constituent compounds of blood when compared to normal values could serve as a health predicator of an animal as well as quality of feed (Wheater *et al.*, 1987). This study determined the effect of graded levels of CCRC on haematological and serum biochemical indices of broiler chickens.

## MATERIALS AND METHOD

### Experimental Site

The research was carried out at the Poultry Unit of the Teaching and Research Training Center, Federal University Dutse, Jigawa State.

### Collection and Processing of Test Ingredients

Camel and cattle rumen contents were collected differently from Dutse abattoir, Jigawa State. After slaughtering, the rumen of each animal was split opened with aid of sharp butcher's knife and the contents emptied into a polythene bags. It was allowed to drain in the sack, after draining, the rumen contents were then spread on a cemented floor and allowed to sundry while turning was done between 3-4 hours interval until the moisture content was below 15% after 4-5 days of sun drying. The dried rumen content was then grounded and incorporated into the diets.

### Experimental Design

A total of one hundred and twenty day-old, (Marshall) unsexed broiler chicks were reared for 56 days. The birds were allotted to 4 dietary treatments with 30 birds per treatment, replicated 3 times with ten (10) birds each. The experimental diets were formulated with cattle and camel rumen content (Combined rumen content (CCRC) at (0%, 5%, 10% and 15%) inclusion levels in broiler ration represented as T1, T2, T3, and T4 respectively. The experimental diets for starter and finisher phases were balanced such that the crude protein and metabolizable energy contents of the feeds for each phase of the broilers are balanced within the recommended range according to NRC (1994).

### Parameters Measured

At the end of the experiment, 6 birds per treatment were randomly selected, fasted over night from which blood samples were collected and used for haematological and serum biochemical measurements. Haematological samples were collected into sample tubes containing Ethylene Diamine Tetra- acetic acid (EDTA). Haematological parameters analyzed were packed cell volume (PCV), red blood cells (RBC) count, white blood cells (WBC) count, haemoglobin (Hb) concentration, mean cell volume (MCV), and mean corpuscular haemoglobin concentration (MCHC). They were measured according to the methods of Bush (1991). Serum was obtained after the blood in the anticoagulant free tubes was allowed to stand for two hours at room temperature and centrifuged at 2000 revolutions per minute for 10 minutes. Total proteins (TP), albumin, globulin, creatinine, total cholesterol,

alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

**Statistical Analysis**

All data generated were subjected to one-way analysis of variance (ANOVA) using SAS (2009). Significant means at 5% level of probability were separated using Duncan's Multiple Range Test of the same statistical package.

The experimental layout is presented below:

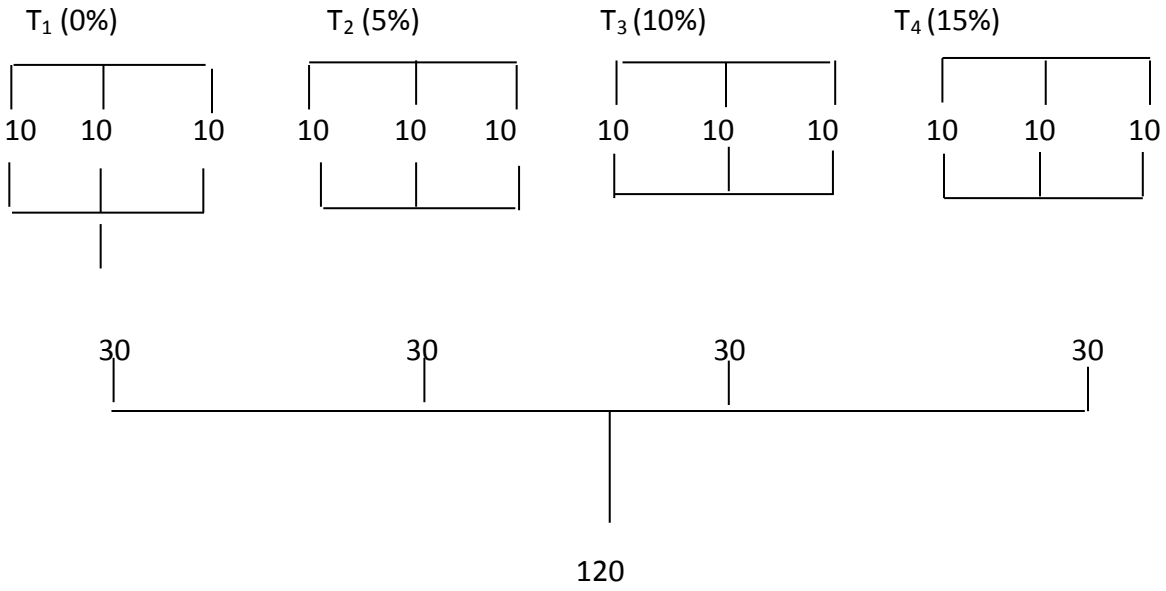


**Table 1: Composition of starting broiler diets (0-28 days)**

| | Level of inclusion of CCRC | | | |
|---|---|---|---|---|
| **Ingredients(g/kg)** | **0%** | **5%** | **10%** | **15%** |
| Maize | 47.00 | 47.00 | 47.00 | 47.00 |
| Wheat offal | 15.00 | 10.00 | 5.00 | - |
| Fish Meal | 3.00 | 3.00 | 3.00 | 3.00 |
| Camel Rumen | 0.00 | 2.50 | 5.00 | 7.50 |
| Cattle Rumen | 0.00 | 2.50 | 5.00 | 7.50 |
| Soybean meal | 16.00 | 16.00 | 16.00 | 16.00 |
| Groundnut cake | 14.60 | 14.60 | 14.60 | 14.60 |
| Bone meal | 1.80 | 1.80 | 1.80 | 1.80 |
| Oyster shell | 1.50 | 1.50 | 1.50 | 1.50 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.30 | 0.30 | 0.30 | 0.30 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** |
| **Calculated Analysis** | | | | |
| ME (kcal/kg) | 2,910 | 2,878 | 2,874 | 2,868 |
| Crude protein (%) | 23.02 | 22.22 | 22.03 | 21.52 |
| Ether Extract (%) | 4.06 | 3.87 | 3.72 | 3.54 |
| Crude fiber (%) | 3.78 | 3.36 | 2.93 | 2.51 |
| Calcium (%) | 1.16 | 1.16 | 1.15 | 1.15 |
| Phosphorus (%) | 0.41 | 0.41 | 0.40 | 0.40 |
| Lysine (%) | 1.29 | 1.23 | 1.22 | 1.21 |
| Methionine (%) | 0.59 | 0.63 | 0.62 | 0.61 |

*Composition of the premix: Vit A=8.000IU, Vit E=21.6, Vit D3=i44iIU, Vit.B1 1.8mg, vit. B2 Folic acid=100mg, Nicotinic acid=4000mg, Panthotanic acid=1500mg, 1=1750mg, Fe=40000mg, Zn=50000mg, Mn=100mg, Boitin=6000mg, Vit C =30000mg, Cu=1500mg, Co=200mg, Si=100mg, ME=Metabolizable energy.

**Table 2: Composition of Finishing Broiler Diets (28-56 days)**

| | Diets/ Treatment | | | |
|---|---|---|---|---|
| **Ingredients** | **$T_1$ (0%)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** |
| Maize | 54.00 | 54.00 | 54.00 | 54.00 |
| Wheat offal | 15.00 | 10.00 | 5.00 | - |
| Fish Meal | 2.00 | 2.00 | 2.00 | 2.00 |
| Camel Rumen | 0.00 | 2.50 | 5.00 | 7.50 |
| Cattle Rumen | 0.00 | 2.50 | 5.00 | 7.50 |
| Soybean meal | 12.00 | 12.00 | 12.00 | 12.00 |
| Groundnut cake | 13.00 | 13.00 | 13.00 | 13.00 |
| Bone meal | 1.50 | 1.50 | 1.50 | 1.50 |
| Oyster shell | 1.50 | 1.50 | 1.50 | 1.50 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** |
| **Calculated Analysis** | | | | |
| ME (kcal/kg) | 2,997 | 2,987 | 2,927 | 2,924 |
| Crude protein (%) | 21.02 | 20.67 | 20.07 | 20.02 |
| Ether Extract (%) | 4.03 | 3.85 | 3.68 | 3.50 |
| Crude fiber (%) | 3.63 | 3.20 | 2.78 | 2.35 |
| Calcium (%) | 1.06 | 1.05 | 1.05 | 1.04 |
| Phosphorus (%) | 0.35 | 0.34 | 0.34 | 0.33 |
| Lysine (%) | 1.05 | 1.04 | 1.03 | 1.02 |
| Methionine (%) | 0.56 | 0.54 | 0.53 | 0.52 |

***Composition of the premix: Vit A=1200 IU, Vit E=1500, Folic acid=100mg, Vit D3=2500 IU, Nicotinic acid=4000mg, Panthotanic acid =1500mg, 1=1750mg, Fe=40000mg, Zn=50000mg, Mn=100mg, Boitin=6000mg, Vit C =30000mg, Cu=1500mg, Co=200mg, Si=100mg, ME = Metabolizable energy*

## RESULTS

The proximate composition of the combined rumen content is presented in Table 3. The crude fibre and ash values of the CCRC were high compared to values obtained for individual test ingredient. The protein of CCRC is high and serves as good protein source for both broiler starter and finisher diet. The ether extract and nitrogen free extract were within the same range for CCRC and individual test ingredient.

Effect of combined rumen content on haematological parameters of broiler chickens is shown in Table 4. The haematological parameters measured shows that combined rumen content significantly (P<0.05) affects MCV and MCHC while other parameters measured were not influenced (P>0.05). The values obtained for packed cell volume ranged between 36.60 for birds fed control diet to 33.33% for birds fed 15%, white blood cells 223.00 to 265.00x$10^3$/$mm^3$ for diet T4 and T1. Similarly, values recorded for red blood cells ranged between 2.21x $10^6$/$mm^3$ for birds fed 15% CCRC to 2.54 x 106/$mm^3$ for control diet. Birds fed (15%) CCRC (147.70) and (5%) CCRC (145.80) had the highest MCV values compared to birds fed control diet (0%) and (10%) CCRC. Birds fed the control diet had the highest MCHC value (30.03) relative to birds fed 5%, 10% and 15% respectively. The differential count was not significantly (P>0.05) affected by the dietary treatment.

Effect of combined rumen content on biochemical parameters of broiler chickens is shown in Table 5. All the serum biochemical parameters measured were not significantly (P>0.05) influenced by the dietary treatment except for creatinine, potassium and AST. Birds fed the control diet and 5% recorded higher values of potassium than birds fed 10% and 15% CCRC which were similar. Meanwhile, the activity of AST enzymes was highest for bird fed the control diet compared to values recorded for 5%, 10% and 15% respectively. The ALT activity was not influenced although birds fed 10% are numerically higher than the control diet (0%) and 15%. Birds fed the control diet had the highest level of creatinine compared to those on 5%, 10% and 15% which were similar.

**Table 3: Proximate composition of the test ingredients**

| Parameters | Camel rumen | Cattle rumen | Combined Rumen(CCRC) |
|---|---|---|---|
| Dry matter | 91.55 | 93.7 | 92.75 |
| Ash (%) | 10.85 | 10.85 | 12.2 |
| Crude protein (%) | 12.76 | 18.59 | 25.69 |
| Crude fibre (%) | 11.86 | 11.17 | 18.49 |
| Ether extract (%) | 7.2 | 5.3 | 5.9 |
| Nitrogen free extract (%) | 57.33 | 54.08 | 57.72 |
| Metabolizable energy (Kcal/kg) | 2110 | 3150 | 3490 |

**Table 4: Effect of combined rumen content on haematological parameters of finisher broiler chickens**

| Parameters | $T_1$ (0%) | $T_2$ (5%) | $T_3$ (10%) | $T_4$ (15%) | SEM |
|---|---|---|---|---|---|
| PCV (%) | 36.60 | 34.33 | 33.67 | 33.33 | 1.01 |
| RBC ($x10^6/mm^3$) | 2.54 | 2.21 | 2.36 | 2.21 | 0.08 |
| WBC ($x10^3/mm^3$) | 265.0 | 258.23 | 277.43 | 223.00 | 5.70 |
| Hb (g/100ml) | 10.00 | 8.83 | 9.67 | 9.63 | 0.27 |
| MCV (fl) | 136.17[b] | 145.80[a] | 139.20[ab] | 147.70[a] | 1.80 |
| MCH (pg) | 40.93 | 43.83 | 40.83 | 42.53 | 0.39 |
| MCHC (%) | 30.03[a] | 28.00 [b] | 29.30[ab] | 28.83[ab] | 0.28 |
| Deferential Count (%): | | | | | |
| Neutrophils | 19.00 | 27.00 | 32.33 | 28.43 | 4.17 |
| Monocytes | 2.33 | 3.00 | 3.00 | 1.67 | 0.19 |
| Eosinophils | 1.00 | 1.33 | 1.00 | 3.33 | 0.23 |
| Basophilis | 1.00 | 1.33 | 1.00 | 1.33 | 0.23 |
| Lymphocytes | 96.67 | 96.00 | 96.00 | 95.33 | 0.34 |

[a,b] Means in the same row bearing different superscripts differ significantly ($p<0.05$). SEM= Standard error of mean. CCRC= combine camel and cattle rumen content. PCV= packed cell volume. RBC= red blood cell. WBC= white blood cell. Hb = haemoglobin. MCV= mean corpuscular volume. MCH= mean corpuscular haemoglobin. MCHC= mean corpuscular haemoglobin concentration.

**Table 5: Effect of combined rumen content on serum biochemical parameters of finisher broiler chickens**

| Parameters | $T_1$ (0%) | $T_2$ (5%) | $T_3$ (10%) | $T_4$ (15%) | SEM |
|---|---|---|---|---|---|
| Protein (g/dl) | 4.77 | 4.67 | 4.63 | 5.07 | 0.25 |
| Albumin (g/l) | 2.97 | 2.83 | 2.33 | 3.07 | 0.14 |
| Cholesterol(mmol/l) | 3.13 | 2.89 | 3.45 | 2.90 | 0.15 |
| Globulin (g/l) | 1.80 | 1.83 | 2.30 | 2.00 | 0.20 |
| Glucose(mmol/l) | 3.90 | 3.98 | 3.93 | 6.92 | 0.61 |
| Uric acid (mmol/l) | 2.07 | 1.83 | 1.67 | 2.20 | 0.13 |
| Creatinine ($\mu$mol/l) | 47.00[a] | 37.33 [b] | 30.00 [b] | 33.00[b] | 4.30 |
| Sodium($Na^+$) (mmol/l) | 139.67 | 133.00 | 136.33 | 143.33 | 1.79 |
| Chlorine(Cl) (mmol/l) | 98.00 | 98.00 | 88.00 | 95.00 | 3.30 |
| Potassium(K) (mmol/l) | 7.70[a] | 6.10 [a] | 4.83[b] | 5.50 [b] | 0.40 |
| AST ($\mu/l$) | 333.33[a] | 213.00[b] | 214.00[b] | 216.67[b] | 62.9 |
| ALT ($\mu/l$) | 6.90 | 5.67 | 7.04 | 5.82 | 0.99 |

[a,b] Means in the same row bearing different superscripts differ significantly ($p<0.05$), AST =asphatate amino transferase, ALT = alanine amino transferase, (G/L) gramm per litre, (MMOL) millimole per litre, **(**$\mu$MOL/L**)** micromole per litre, ($\mu/l$) unit per litre, (G/DL) gramm per decilitre.

## DISCUSSION

The results of this study showed that combined rumen content (CCRC) contained 92.75% dry matter, 12.2% ash, 7.25% moisture, 25.69% crude protein, 18.49% crude fiber, 5.90% ether extract and 57.33% nitrogen free extract. These results differ from the report of Musa *et al*. (2015) and Makinde *et al*. (2017) who reported that dried camel rumen content contains 93.7% dry matter, 23.7% crude protein, 28.1% crude fiber, 3.11% ether extract, 12% ash and 56.9% nitrogen free extract respectively. This variation could be due to specie differences. The proximate composition of the CCRC content showed that the test ingredient is a rich source of crude protein (25.69%) and can meet the protein requirement for broiler starter and finisher phase. The crude protein value recorded in this study was also at variance with the findings of Awesu *et al*. (2013) who reported that dried bovine rumen digesta contains 18.52% crude protein. Also, this disagreed with the report of Mohammad *et al*. (2008); White *et al*. (2009) and Esonu *et al*. (2011) who reported the following as the composition of bovine rumen contents: 27.70% crude protein, 28.11% crude fiber, 3.01% ether extract, 12.02% ash and 33.6 5% nitrogen free extract respectively.

Values of haematological parameters have been reported as a means of determining the responses of animals to different physiological and disease conditions in livestock (Yadav *et al***,** 2002; Khan and Zafar (2005)**.** The haematological results showed that the packed cell volume, red blood cell, white blood cells and haemoglobin concentration were not influenced by combined rumen content. The non-significant value obtained for haemoglobin concentration across the treatment is a confirmation of the good dietary protein quality of CCRC. Pellet and Young (1980) confirmed that haemoglobin levels were positively correlated with protein quality and level in the diets. Udo (1987) also reported that nutrition was the most important factor affecting haemoglobin concentration levels of the blood. The blood is often used as a physiological index or indicator for disease diagnosis, nutrition status and health condition of birds. Olafedehan *et al.* (2010) reported that blood acts as a pathological reflector of the status of exposed animal to disease and other conditions. This result is similar to the report of Makinde *et al*. (2017) who reported no significance in PCV, RBC and WBC when fed camel rumen content as replacement for maize in broiler diet. The work also agreed with the earlier report of Musa and Gambo (2015) who fed graded levels of camel rumen content to broiler chicken.

The significant values obtained for MCV and MCHC in birds fed 15% CCRC showed it had optimum MCV performance and suggestive of better performance of MCV (Musa *et al*., 2015; Anon, 1980). This is at variance with the work of (Musa and Gambo 2015; Makinde *et al*., 2017) who reported that MCV was not significant when fed camel rumen content to Broiler chickens. The MCV, MCH and MCHC are derived from red blood cells, haemoglobin, packed cell volume contents and concentration which are readily used in the assessment of nutritional status of the chickens as a result of the feed ingested (Ojebiyi *et al*., 2007). The differential count is divided into granulocytes which are nucleated white blood cells and comprise of basophils, eosinophils and neutrophils and agranulocytes which are nucleated white blood cells all comprised of monocytes and lymphocytes and were all not significant for the treatment imposed on the birds. All these parameters are associated with body defense mechanism. The basophils and monocytes were not significantly different across the dietary treatments. This is in agreement with the report of Makinde *et al*. (2017) who observed insignificance in basophils and monocytes when fed broiler chickens with camel rumen content. The results of the differential count fall within the normal range of healthy chickens reported by Igene (1999) who indicated that the diets had no

negative effect on the health status of the animal. The reduced creatinine and AST recorded for birds fed combined rumen content is an indication of good health status of live which shows that CCRC did not impair the liver function. Ekpenyoung and Biobaku (1986) confirmed that AST are normally low in blood but become high when the plane of nutrition is low or when there is occurrence of liver damage. This is in congruous with the earlier findings of Anonymous (2009) who reported that supplementation of rumen content in broiler diet influenced some biochemical parameters.

## CONCLUSION

The results of haematological and serum biochemical indices obtained in this study revealed significant effect of CCRC on some selected haematological parameters namely creatinine, AST, means corpuscular volume and mean corpuscular hemoglobin concentration of broiler chickens with no health risk on the broiler chickens as revealed by haematological and serum biochemical parameters. This therefore, revealed the potentials of CCRC as good alternative substitute for wheat offal in broilers production.

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