PROXIMATE ANALYSIS OF COMMERCIAL STARTER FEEDS AND EFFECTS OF THEIR CONSUMPTION ON SOME BLOOD PARAMETERS IN BROILER CHICKS

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The study evaluated the nutritional composition of four commercial feeds coded (RBF, ACF, TPF and JKF) and their effect on selected blood parameters in Cochin broiler chickens. A total of forty Cochin broiler chickens were divided into groups, A – D (n = 10) and known weight of the feeds (20 g weekly increment) was administered for a period of 14 days. Proximate analysis of the four starter feeds indicated a crude protein range of 18.67 – 19.98%; fiber moisture, ash and fat contents were in the range 1.9- 2.9%, 8.2- 8.2%, 1.5- 4.5% and 1.5- 2.8% respectively. With the exception of TPF, the protein content of the feeds obtained in this study did not correspond to the manufacturers claimed values. Average weekly weight gain of birds following consumption of the four feeds was not statistically different ($P > 0.05$). The mean serum urea concentration of birds fed with TPF (value here) was significantly higher than those fed with RBF, ACF and JKF ($P < 0.05$). There was no significant difference observed in the serum concentration of calcium for all the boiler chicks fed with the different feeds ($P > 0.05$). The serum activity of Aspartate aminotransferase (AST) in birds fed with JKF significantly increased compared to those fed with RBF, ACF and TPF ($P< 0.05$). The serum activity of Alanine aminotransferase (ALT) in birds fed with RBF was significantly higher than that of broiler chicks fed with ACF and JKF ($P< 0.05$). The results indicated that the feeds met the requirement of the birds and had no adverse effect on the boiler chicks based on the blood parameters tested. Therefore, all four feeds are good as starter feeds and recommended for broiler production.

Key words: Proximate analysis, starter feed, broiler chicks, biochemical parameters.

INTRODUCTION

Poultry industry is the most dynamic and fastest growing segment in the animal husbandry subsector. It represents an important source of high quality proteins, minerals and vitamins to balance human diet (Heise et al., 2015); and undoubtedly, it plays an important role in the Nigerian economy (Burker and Saeed, 2014). With the increasing human population, the consumption of meat is increasing in the world and as a result, intensive animal production has many challenges to solve which include environmental pollution, feed contamination, poor feed and animal welfare (Ishibashi and Yonemochi, 2002; Francis et al., 2017; Nashowan and Anas, 2019).

Poultry products are among the most important food items in Nigeria that cut across all barriers of religions, races and age class all over the world. It is basically a source of economical, palatable and healthy food protein (Mahasar et al., 2010). Poultry birds are kept for poultry meat and egg production (Krutchen, 2002). Broilers are the best meat producers because of their ability to put on much weight in the shortest possible time. The short production cycle of broiler chicks is one of the special characteristics of poultry production that provide animal protein for human feeding (Edney et al., 2014). Broiler chicks are also easy and convenient to distribute over a wide territory. Poultry products also serve as the most common source of animal protein available for the rapid growing population in Nigeria (Heise

et al., 2015).

It has been established that feeding constitutes over 70% of the total cost of egg and broiler production (Afolayan & Afolayan, 2008); hence effort to increase poultry industry productivity should be directed towards improving feed formulation system. Poultry bird requires adequate amount of carbohydrate, protein, fat and oil, vitamins, minerals and water for successful development, optimum growth, maintenance and reproduction. The composition of different animal feeds varies from formulation to formulation and from species to species. The growth and development of broiler chicks depends largely on the quality of poultry feed (Anjum and Naseem, 2000; Farhat and Mohammed, 2014).

The present study was therefore undertaken to analyze different broiler feeds commercially available in Nigeria for their nutritional constituents and to determine the effects of these selected poultry feeds on some selected serum biochemical parameters. This study will provide useful information between the manufacturer claim values and the proximate analysis carried out in this work. It will also show if the poultry feeds are health friendly to broiler chicks.

MATERIALS AND METHODS

Experimental diet

Experimental feed samples appropriately designated as broiler starter feed were purchased from poultry feed stores in Abraka, Delta State. The Poultry feed samples were coded: RBF, ACF, TPF and JKF; sample preparation involved thorough grinding and mixing of feed constituents to obtain a homogenous mixture, which was used for proximate analysis.

Proximate analysis

In most cases, proximate analysis of the feed was carried out on dried feed samples, except for moisture determination. The proximate composition of moisture, ash, lipid, fiber, energy and carbohydrate (as nitrogen-free extract, NFE) contents of the feeds were determined according to the AOAC methods (AOAC, 1990). Estimation of crude protein involved the determination of total nitrogen, using the Kjeldahl method described by Nielsen (2003). The amount of crude protein was calculated by multiplying the nitrogen content percent obtained by 6.25.

Feeding of birds

Forty days old Cochin broiler chicks, both male and female, were purchased at Obohor Agricultural Enterprises, Otorho- Agbon, Delta State. The birds were housed in the poultry house in African Research Laboratories, Otorho-Agbon, Delta State. The birds (n = 10) were randomly allocated to groups according to the four different feeds. Prior to the arrival of the chicks, all necessary sanitary measures were carried out; this included: thorough washing and disinfection of poultry house, application of fresh sawdust (up to 5 cm depth), provision/checking of lightening, heating and feeding equipment, etc.; a clean white laboratory coat was worn as protective garment during feeding/treatments. The chicks were kept in the poultry house near heat and light sources; about 10 ml multivitamins were added to 6 L of water, which was administered as anti-stress for five days. All treatment and vaccination schedules, as well as all necessary husbandry practices were duly observed throughout the experimental period. The initial weights of the birds were measured and thereafter, weekly. From days 0 - 7, the birds were fed 20 g of homogenized feed samples, thereafter the amount was increased to 40 g until day 14.

Determination of serum biochemical parameters

At the end of the 14-day feeding period, 5 birds were randomly selected from each group and blood samples collected. Bleeding was done from the punctured wing vein with a 5 ml scalpel vein needle set. About 2ml of blood was collected from each bird, into sterile containers; which were allowed to stand for some hours to generate serum for biochemical analysis. Serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), urea and calcium measurements were carried out using commercially available kits (Randox Laboratories, UK) and followed methods previously described by Reitman and Frankel (1957) and Weatherburn (1967). The activities of

both enzymes in the serum samples were determined according to the procedures described by the Manufacturer; thereafter the absorbances (A) of samples were read against blank, using the spectrophotometer at a wavelength of 546 nm.

Statistical analysis

Results were inputed into the computer, and statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software. The one-way analysis of variance (ANOVA) was utilized while comparing the degree of significance of different parameters estimated and the difference between mean were considered significantly at $p< 0.05$.

All data were expressed as means ± SD. n= 10.

RESULTS AND DISCUSSION

The proximate analysis of four commercial feeds, RBF, ACF, TPF and JKF, were carried out to ascertain the chemical composition of the feed diets and they are presented in Figures 1-3. The calculated energy content of the feeds and the weight gain of birds are presented in Figures 4 and 5 respectively. Values of the blood parameters of birds fed with the different commercial feeds are presented in Figures 6-7. All data were expressed as means ± SD. N= 10

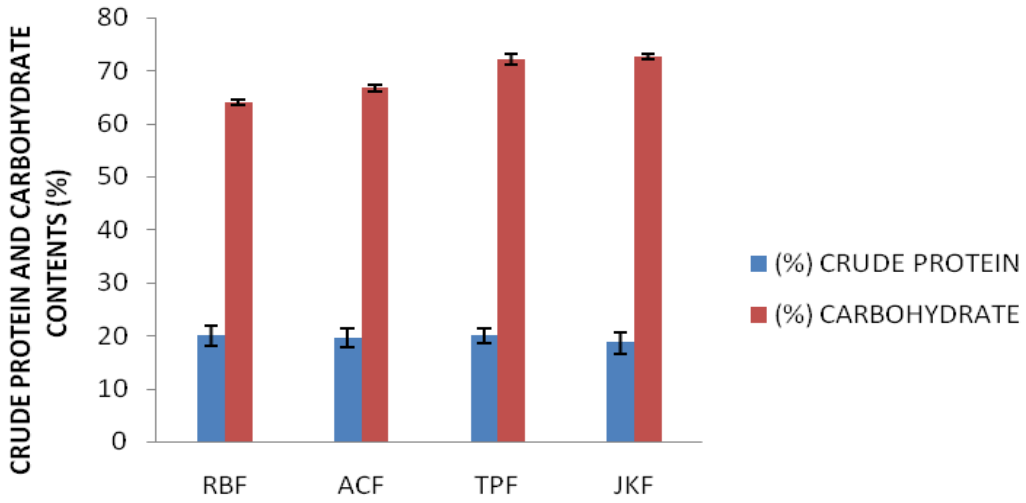

Figure 1. Crude protein and carbohydrate contents of RBF, ACF, TPF and JKF feeds. Data were expressed as means ± SD.

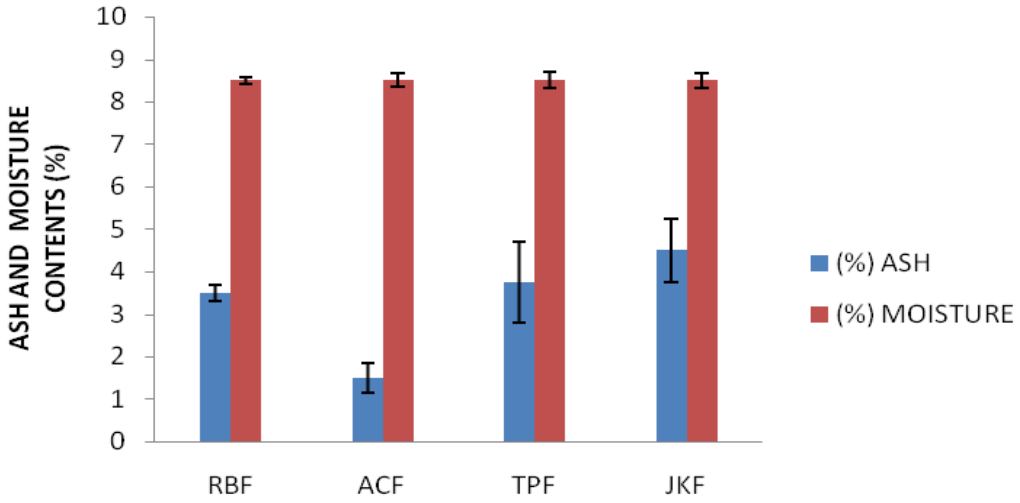

Figure 2. Ash and moisture contents of RBF, ACF, TPF and JKF feeds. Data were expressed as means ± SD.

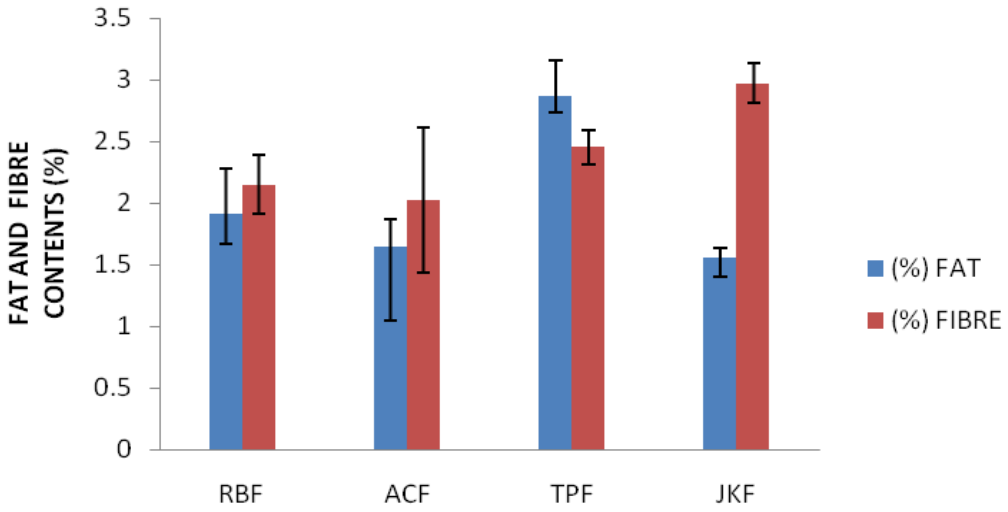

Figure 3. Fat and fibre contents of RBF, ACF, TPF and JKF feeds. Data were expressed as means ± SD.

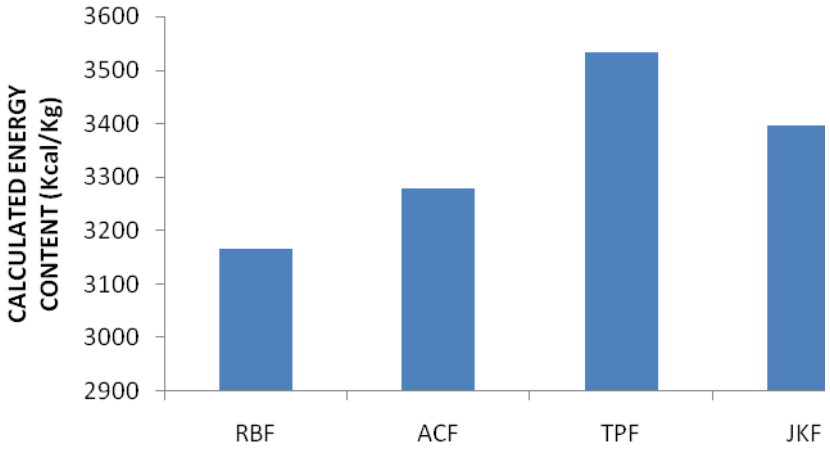

Figure 4. Calculated energy content (Kcal/ Kg) of RBF, ACF, TPF and JKF feeds.

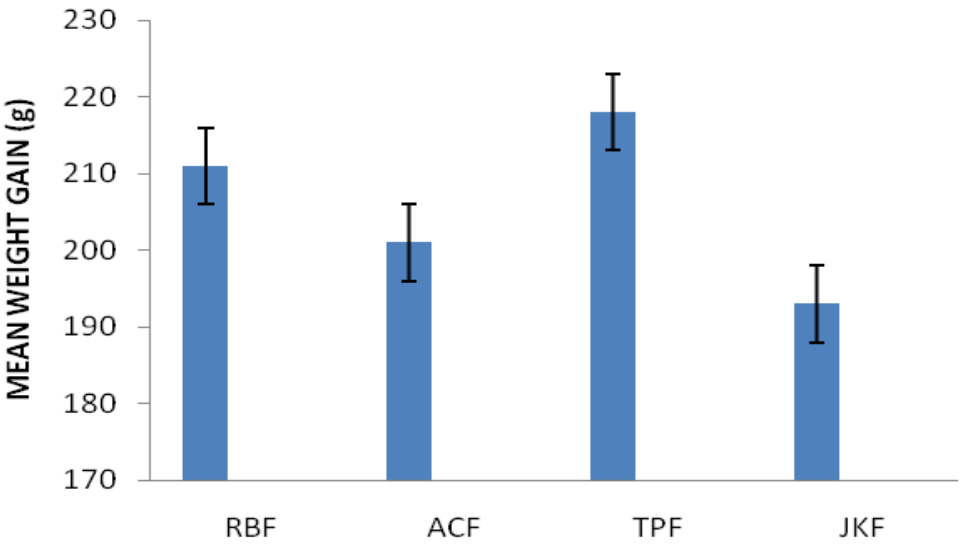

Figure 5. Mean weight gain of birds fed with RBF, ACF, TPF and JKF. Data were expressed as means ± SD.

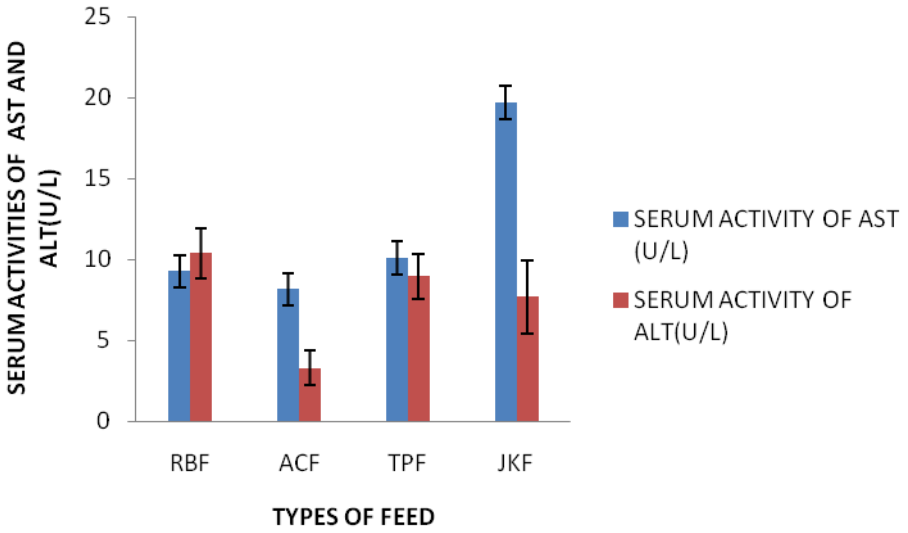

Figure 6. Serum activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) of the birds fed with the RBF, ACP, TPF and JKF after two weeks of feeding. All data were expressed as means ± SD. n= 10.

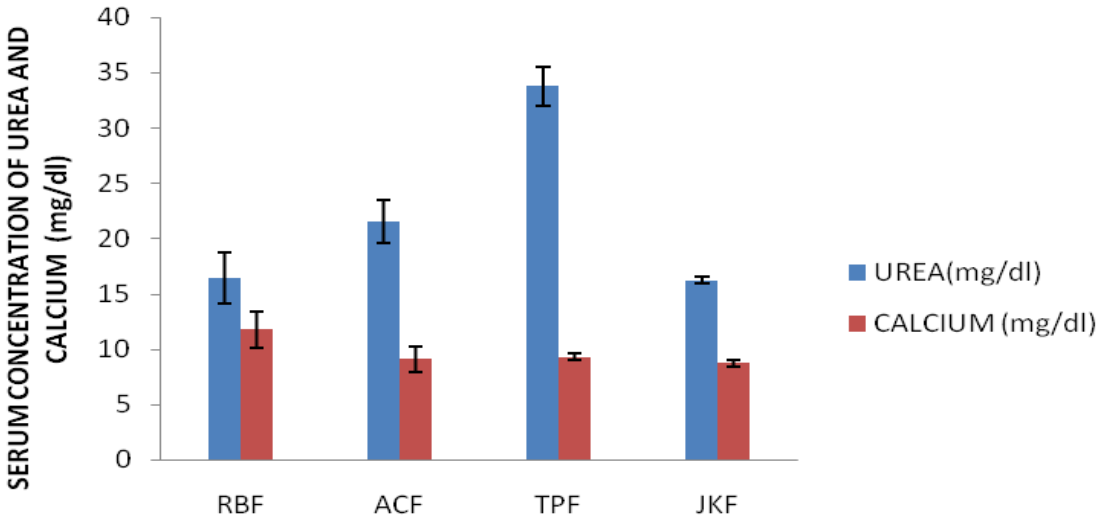

Figure 7. Serum concentration of urea and calcium of the birds fed with the RBF, ACP, TPF and JKF after two weeks of feeding. All data were expressed as means ± SD. n= 10.

The crude protein content (%) (Table 1) in Feed TPF (19.98%) was equivalent to the manufacturer's claimed value (20.0%); while the crude protein content (%) of RBF, ACF and JKF (19.98, 19.63 and 18.67%) respectively are lower than the manufacturer's claimed value for RBF, ACF and JKF (24.00, 21.00 and 21.68%) respectively. Crude protein is one of the vital constituents of poultry feed and it also serves vital metabolic roles as blood plasma proteins, enzymes, hormones, and antibodies; each of which has a specific role in the body. Furthermore, despite the fact that protein is one of the most expensive ingredients in the feed, there is need for proper protein usage in all feeding systems (Sleman et al., 2015). The fat contents (%) (Table 1) in all the feeds in this study was lower than the claimed value of the manufacturers. The Nitrogen free extract and calculated metabolizable energy (Table 1) of the different feed obtained in this study was higher than the manufacturer's claimed values. The recommended energy value (NRC, 1994) for the poultry depends on the age, stage of production and environmental temperature. The differences between the manufacturers claimed values and

Table 1. Comparison of manufacturer and present study values of feeds (%) composition and energy levels

Parameter	RBF		ACF		TPF		JKF	
	MV	PSV	MV	PSV	MV	PSV	MV	PSV
Crude Protein (%)	24.0	19.98	21.0	19.68	20.0	19.98	21.68	18.67
Fat (%)	3.0	1.91	2.75	1.64	5.0	2.87	3.45	1.56
Nitrogen- free extract (%)	52.2	63.96	51.78	66.71	54.95	72.08	41.31	72.62
Metabolizable Energy (Kcal/Kg)	2990	3166	2840	3279	3100	3533	2551	3396

MV = Manufacturer's value; PSV = Present study values.

the present study values might be as a result of the standards and procedures used. Nevertheless, the observed mean weight of birds fed with the different feeds (Figure 5), which was in the order: TPF>RBF>ACF>JKF, indicating that all feeds had an effect on bird performance.

The crude fiber contents (%) in (Figure 3) are in line with nutritional standards laid down for such groups of chickens (NRC, 1994). The fiber content in poultry ratio are critical as levels above recommendation affects feeds conversion efficiently in birds; thus lowers economics of efficient production (Mateos et al., 2012). The fiber contents in this study, in regard to feed ingredients, were found to be within normal range. The moisture contents (%) of the different feeds (Figure 2) were similar. JKF and ACF had the highest and lowest ash content (%) respectively (Figure 2). The different feeds contained fat (%) (Figure 3) but TPF had the highest percentage of fat; this feed also gave the highest mean weight gain of birds. TPF and JKF feeds had the highest carbohydrate (%) content (Figure 1). The energy content (Kcal/Kg) (Figure 5) of TPF was higher compared to other three feeds.

Significant growth performance was evident in all experimental birds which might be the response to good management, this include feeding of good feeds and general wellbeing of the birds (Addass et al., 2010). There was, however, no significant ($p>0.05$) difference in weight gain (Figure 5) among the boiler chicks fed with the different feeds.

Biochemical markers play an important role in accurate diagnosis and also for assessing risk and adapting therapy that improves clinical outcome. Elevation of AST and ALT reflects hepatic injury, some inflammatory disease and hepatic cellular damage (Ayalogu et al., 2001; Svoboda et al., 2001; Babu et al., 2016; Adenira et al., 2017). Any abnormal increase in serum activity of AST and ALT may imply liver damage (Yalcin et al., 2012; Deepesh et al., 2016; Sugiharto et al., 2016). In this study, the serum activity of AST concentration of birds fed with JKF was significantly ($p<0.05$) increased than those fed with RBF, ACF and TPF feeds as well as the reference value (12 U/l) [Figure 6]. The significant ($p<0.05$) increase in serum activity of AST observed in the boiler chick fed with JKF feed (19.69 U/l) may not suggest liver damage, since the serum activity of ALT (7.67 U/l) of birds fed with the same feed was not higher than the reference value (12 U/l).

The significant increase ($p<0.05$) of serum activity of the ALT concentration of birds fed with ACF (10.37 U/l) may not also suggest liver damage, since it is lower than the reference value (12 U/l). However, the increase in the serum activity of AST observed in ACF may not be due to the feed given but to other factors like changes in serum appearance during blood collection and coagulation, since these feeds are also rich in the basic nutrients previously measured as shown in the proximate analysis (Figures 1- 3) (Dominika et al. 2010) . Hence, it could be inferred that the poultry feeds RBF, ACF and JKF do not appear to induce liver damage, at least, for the period of time under study (0- 2 weeks).

Serum urea levels in animals are indicative of muscular wastage (Fashina, 1991). Higher urea values may be brought about by the inadequacy or unavailability of the dietary protein, poor digestibility or inefficient utilization of the protein (Adesehinwa and Ogunmodede, 2004). Serum urea depends on both the quality and quantity of the protein supplied in the diet. High levels of serum urea in the birds could be attributed to the presence of some anti - nutritional factors which might have lowered the quality of the protein indicating imbalances of amino acids in the diet which caused elevated

blood urea concentration (Iyayi and Tewe, 1998; Kiran et al., 2015). Furthermore, crude fibre (CF) also known as non-starch polysaccharides (NSP) which was abundant in the feeds tested, has been reported as having anti- nutritional effects in the gastrointestinal tract (GIT) of poultry and pigs (Bautil and Couttin, 2019). Kidney malfunction may also raise the level of blood urea. In this study, the serum urea concentration of birds fed with TPF feed (33.74 ±1.72 mg/dl) significantly ($p<0.05$) increased compared to those fed with RBF and JKF feed ((16.41±2.32 mg/dl and 16.22±0.31 mg/dl respectively) (Figure 7). Though, significant, the observed high blood urea level is not enough to suggest the presence of anti-nutritional factors and kidney malfunction in the broiler chicks since it is not above the reference range (10 -50 mg/dl).

The serum calcium concentrations of the birds in this study were not statistically different ($p> 0.05$) (Figure 7). This suggests that all the feeds contain adequate amount of calcium and the birds were able to metabolize the calcium in the feeds. This finding is very important because rapid growth rate in broiler chicken rearing is often associated with skeletal abnormalities (Scott, 2002). The mineral content in the serum of birds is considerably dependent on its mineral concentration in feeds as well as factors influencing the degree of their absorption in the digestive tract (Monika et al., 2012). Calcium deficiency has been closely associated with poor bone formation in birds and other vertebrates, aside other deficiency symptoms. According to Garner et al. (2002), birds are unable to effectively eat and drink because of the pain associated with the pathology of leg weakness, usually due to poor bone formation. The experimental birds in this study were able to develop feathers and strong legs which aided them in flying and agile working within the experimental house. This again validates the findings that the feeds are rich in calcium ion which help the poultry birds in the bone and feather formation.

Conclusion

The data included in this study represented the slight variation among the quality of the poultry feeds from selected manufacturers. The feed used in this study can be concluded to contain the necessary nutrient (protein, ash, crude fibre, moisture, lipid and NFE) essential for the growth of the boiler chicks. Moreover none of the feeds imposed liver damage. Poultry farmers can use these feeds for their broiler chicks.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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