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RESPONSE OF BROILER CHICKEN TO PELLETIZED FEED COATED WITH THE OIL EXTRACTED FROM *CHRYSOPHYLLUM ALBIDUM* KERNEL

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ABSTRACT

Poultry birds consume coated pelletized feed more than mashed or crumbs. For optimum performance, it is very important to use oils/grease that has quality nutrients to coat the pellets. Also, oils that are of less competition with humans and industries will reduce the cost of production. *Chrysophyllum albidum* oil is one such oil that has not been explored enough. It has been shown that the oil is composed of all the essential amino acids needed by broiler birds and exhibit characteristics that make it suitable as preservatives in animal feed. Pelletized (5mm) feed was coated with Palm Kernel oil (PK), *Chrysophyllum albidum* kernel oil (CAK) and a combination of the oils at the rate of 1 liter/100 kg of feed. Totally, 120 chicks of day-old age were used for the experiment. All data obtained were subjected to ANOVA and significant differences were compared using the Duncan multiple range test. It was observed, that the physical qualities of CAK oil contributed to the attractiveness of the pellets, which, in turn, increased feed intake and more flesh deposition by birds on T3 (feed coated with CAK alone). The synergy of CAK and PK oils was able to utilize the feed (FCR – 2.80) significantly ($P < 0.05$) better than the individual oil. The haematology and serum biochemistry results of all the treatments fell within the range for normal physiological and nutritional stable chicken. There were indications that CAK oil had advantages over the PK oil. It can be concluded that CAK oil can successfully replace PK oil in broiler pellets for optimum performance. It exhibits potential to serve as natural preservatives in feed and its amino acid profile served as added advantage. Its inclusion in feed did not pose any negative effect on physiological and nutritional status of the experimental birds. Limitations to this study include access to funds, as this study was self-sponsored. Also, the inconsistence weather conditions prolonged the estimated time for drying the kernels.

Key words: feed; oil; broiler chicken; *Chrysophyllum albidum*; pellets

INTRODUCTION

Broilers and other poultry birds are naturally grain eaters, and this makes them to select grains first whenever they are presented with mash feeds, thereby reducing the optimization of nutrients in the mash. Recent technology had improved on presentation of ration to poultry birds, such presentation includes crumbles or pelletize feed forms. This has been proven to enable these birds pick up all the ingredients in the feed and access all the embedded nutrients. It also reduces wastage. Pelletized and crumbled feed has shown to increase feed intake and improve FCR (*feed conversion ratio*) (Abdollahi *et al.*, 2013; Idan *et al.*, 2023).

These crumbs and pellets require oil/grease for proper binding during pelleting, to reduce dust and for shelf-life extension. Often, quality of oil/grease used in pelleting is given less concern. It is worth noting that for optimum performance, quality animal products and economic efficiency, the nutritional value and degree of oxidation of oil/grease used becomes critical. Oxidized lipids in broiler feed may cause rancidity (Lulin *et al.*, 2019), which may affect feed intake and probably have negative impact on FCR and on the long run affect the growth performance of the broiler.

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Vegetable oils are significant raw materials for many industrial/processed products. Various products can be obtained from vegetable oils. Lubricants, soaps, emulsifying, thickening and plasticising agents can be produced from oils. Many of these oils are also used to fortify, preserve and improve the appearance of other food products. Various oil/greases are employed in coating feeds, such as animal fats (tallow and lard), Palm Kernel oil (PK oil), soya bean oil, groundnut oil, among others. Nowadays, the use of animal fats is becoming less popular (Alli *et al.*, 2012; Wan Nooraida and Abidah, 2020) due to its high cholesterol, which has been associated with chains of health problems in humans. Hence, feed millers prefer vegetable oils that are rich in essential fatty acids, which pose no threats to animal and human (consumers) health. These vegetable oils, though costly, pose competition between humans, industries and animals. Therefore, there is a need to use vegetable oils that are of less importance to humans, available and less costly, thereby, reducing the cost of production. *Chrysophyllum albidum* kernel oil (CAK oil) is one of such oil that has potentials (Adedire *et al.*, 2022) but has not been explored.

The *Chrysophyllum albidum* kernel contains appreciable amount of oil (11.60 % reported by Michael *et al.*, 2019) and composed of all the essential amino acids needed by broiler birds (Adedire *et al.*, 2022). According to Osuntokun *et al.* (2017), the antimicrobial activity of *C. albidum* oil shows that it represents a potential source of novel antibiotics. The oil contains flavonoids and phenolics and, therefore, exhibits high antioxidant activities (George *et al.*, 2018), which indicate that it can be used as preservative in animal feed (Nartey *et al.*, 2021). It is also low in acids (Adebayo *et al.*, 2012) and the peroxide value (Nartey *et al.*, 2021), which indicates that the oil can resist lipolytic hydrolysis and oxidative deterioration. With these indications, the oil will be stable and can stay fresh for a longer period.

This study is aimed at evaluating the growth performance, carcass yield and haematological parameters of broilers fed with pelletized feed coated with CAK oil.

MATERIAL AND METHODS

Sample preparation and pre-treatment

C. albidum seeds were collected at Ogbagba, Olaoluwa Local Government in Osun State, Nigeria (8°14'21"N, 4°24'51"E). The samples were identified and authenticated at the International Institute of Tropical Agriculture (IITA) Ibadan, Oyo State. The identified samples were subjected to laboratory analyses at the laboratory of Federal Institute of Industrial Research, Oshodi (FIIRO), Lagos state. The seeds of *C. albidum* were cracked manually to obtain the kernels. These kernels were allowed to dry at room temperature (≤ 90 % DM) during the harmattan period to protect the oil content. The dried kernels were sorted to remove foreign materials, pulverized and then grinded into 0.5 mm particles before cooking. The oil was extracted using hexane with the Soxhlet apparatus at a temperature of 65 °C for 4 hours (Michael *et al.*, 2019). Samples of the extracted oil were assessed physically and then analysed for fatty and amino acids profiles, some selected minerals and vitamins. The results of the chemical analysis are presented in Table 1, 2 and 3.

Determination of amino acids profile

The amino acid profile of the seed kernel was determined according to the method described by Spackman *et al.* (1958) using Technicon TSM-1 amino acid analyser (model: DNA 0209). The known samples were dried to constant weight, defatted, hydrolysed, evaporated in a rotary evaporator and loaded into the

Table 1. Fatty acid composition of *C. albidum* seed oil

Fatty Acids	Fatty Acids numbers	Quantity (%)
Saturated Fatty Acids (SFA)		
Undecanoic acid	C11:0	4.28
Lauric acid	C12:O	2.04
Myristic acid	C14:0	59.95
Palmitic acid	C16:0	1.56
Magaric acid	C17:0	1.56
Stearic acid	C18:0	1.64
Total SFA	71.02	
Unsaturated Fatty Acids		
Palmitoleic acid	C16:1	0.26
Elaidic acid	C18:1	4.34
Oleic acid	C18:1	23.18
Linoleic acid	C18:3	1.21
Total MUFA	27.78	
Total PUFA	1.21	

MUFA – Monounsaturated Fatty Acids.
PUFA – Polyunsaturated Fatty Acids.
Values are mean of triplicate determination.

Technicon sequential Multi-Sample Amino Acid Analyser (TSM).

Determination of vitamins

Vitamins B_1, B_2, A and E were determined according to the method described by Adepoju and Adeniji (2012) using UV Spectrophotometer (Cecil A20 Model). The absorbance of the sample as well as that of the standards was read at a wavelength of 285 nm for thiamine, 460 nm for riboflavin, 436 for vitamin A and 470 nm for vitamin E.

Table 2. Amino acid composition of *C. albidum* seed kernel

Amino Acid	Amount (g/100 g)
Glycine	4.57
Alanine	4.29
Serine	5.67
Proline	3.67
Valine	5.96
Threonine	3.19
Isoleucine	4.53
Leucine	7.43
Aspartate	8.76
Lysine	5.43
Glutamate	17.96
Methionine	1.60
Phenylalanine	4.99
Histidine	2.58
Arginine	7.70
Tyrosine	1.89
Tryptophan	1.23
Cystine	1.78
Total Amino Acids (g/100 g)	93.22

Values are mean of triplicate determination.

Table 3. Vitamins determination of *C. albidum* seed kernel

Vitamins	Quantity (mcg)
Vitamin A	18.83 ± 3.07
Vitamin E	50.98 ± 5.51
Vitamin B_2	25.78 ± 0.11
Vitamin B_1	62.76 ± 0.24

Values are mean of triplicate determination.

Determination of fatty acids profile

The oil of the kernel was extracted mechanically to determine the fatty acid profile of the oil. The fatty acids, contained in the oils, were determined following the method used by Bello *et al.* (2011) with some modifications. The compounds were confirmed by their retention time, percentage area, molecular weight and formula, respectively: Potassium hydroxide−Methanol methylation−The methods and conditions of fatty acid methyl esters (FAME) preparation were set up. 60 µL of oil were placed into 10 ml centrifugal tubes to which 5 ml of KOH−MeOH solution (0.5 M) were added. The mixture was heated at 70 °C for 15 mins. After cooling to room temperature, 5 ml of n-hexane and 3 ml of distilled water were added and mixed thoroughly. The extracts were collected for GC-MS analysis.

Feed and pellet preparation

Feed was compounded to supply 23 % CP and 2900 kcal/kgME at the starter phase and was pelletized (3 mm), while 20 % CP and 3200 kcal/kgME were compounded for finisher and then pelletized (5 mm) coating with PK, CAK and combination of both oils at the rate of 1 liter/100 kg of feed. The compounded feed was coated with 100 % PK oil as the control; the second treatment was coated with 50 % PK + 50 % CAK oil, while the third treatment was coated with 100 % CAK oil.

Experimental procedure

The experiment was carried out at the Animal Science Poultry Unit, Teaching and Research Farm, College of Agriculture, Osun State University, Osogbo, Ejigbo campus, Osun State.

Totally, 120 chicks of day-old age from a reputable hatchery were used for the feeding trial. The birds were raised under intensive management system on a deep litter system in two phases: the starter phase and the finisher phase. The starter phase lasted for 4 weeks (0−4th week), while the finisher phase lasted for the next 4 weeks (4th−8th weeks). The chicks were brooded for the first two weeks under regulated temperature between 31 °C and 35 °C. Both routine and occasional management practices were carried out with strict hygiene measures under the stipulated guidelines of the Faculty of Agriculture ethics committee.

The birds were randomly allocated into 3 treatments of four replicates with 10 birds per replicate:
T1 (feed coated with 100 % PK oil)
T2 (feed coated with 50 % PK oil +50 % CAK oil)
T3 (feed coated with 100 % CAK oil).

At the 4th week of the experiment, the birds were introduced to the finisher diet in phases. They were served with 75 % starter + 25 % finisher pellets for the first two days of the week. The next two days it was 50/50 and the last two days it was 25/75. By the end of the fourth week, the birds were set fully on finisher diet till the eighth week of the experiment. The experiment was arranged in a completely randomized design (CRD). The gross compositions of the starter and finisher diets are presented in Table 4.

Table 4. Gross composition of the starter and finisher diets

Ingredients	Starter/ percentage	Finisher/ percentage
Maize	50.00	60.00
Groundnut cake	12.00	10.00
Soya bean meal	20.00	12.00
Wheat offal	8.75	10.55
Fishmeal	5.00	4.00
Bone meal	3.00	2.50
Salt	0.25	0.25
*Premix	0.50	0.30
Lysine	0.25	0.20
Methionine	0.25	0.20
Total	100.00	100.00
Determined analysis		
Metabolizable energy (kcal/kg)	2870	3236
Crude protein %	23.03	20.12

*Premix (added at 2.5 kg/ton of feed) contained Vit. A, 8.5 M IU; Vit. D3, 150000 IU; Vit. E, 10,000 mg; Vit. K3, 1,500 mg; Vit. B1, 1,600 mg; Vit. B2, 4,000 mg; Niacin, 20,000 mg; Pantothenic acid, 5,000 mg; Vit.B6, 1,500 mg; Vit. B12, 10 mg; Folic acid, 500; Biotin, 750 mg; Choline chloride, 175,000 mg; Cobalt, 200 mg; Copper, 3000 mg; Iodine, 1,000 mg; Iron, 1,000 mg; Mn, 40,000 mg; Se, 200 mg; Antioxidant,1250 mg.

Data collection

During the feeding trials, performance parameters, such as weekly weight and feed intake, were collected, while weekly weight gain was determined. At the end of the experiment, the feed conversion ratio (FCR) was calculated. On the last day of the experiment, blood samples were collected from three live birds, each from the replicates (making a total of 12 birds/treatment), into EDTA and non-EDTA bottles using a 25-guage, 1-inche needle through the jugular vein for haematology and serum analyses. Three birds with similar average weight were selected from each replicate (making a total of 12 birds/treatment) and were slaughtered to analyse the carcass of the experimental birds.

Statistical analysis

All data obtained were subjected to one-way analysis of variance (ANOVA) using the statistical analysis system (SAS version 8.1.2010); significant differences were calculated using Tukey multiple range test.

RESULTS AND DISCUSSION

Results in Table 5 show that coated pellets were dark and shining immediately after coating irrespective of the type of oil used. Though pellet coated with CAK oils were darker compared with other treatments immediately after production. This may be attributed to the dark brown colour of the oil, as reported by Akpe *et al.* (2020) and Rafiu *et al.* (2021). All pellets from the three treatments were shining at production, what indicated their freshness. At 21 days, pellets coated with T1 and T2 were still dark but dull. T3 was observed to be lighter, than others three weeks later. At the third week, the pellets were dull and dusty, but the degrees of dullness and dustiness were lower in treatment coated with CAK oil. This observation indicates on the reduction in freshness. The texture of

Table 5. Physical properties of pelletized feed coated with PK oil, CAK oil and combination of the oils at initial (Day 0) and 21 Days

	TI		T2		T3	
	Day 0	Day 21	Day 0	Day 21	Day 21	Day 15
Colour	Shining/Dark	Dull/Dark	Shining/Dark	Dull/Dark	Shining/Dark	Lighter/Dull
Flavour	Roasting	Mild foul	Roasting	Mild foul	Fruity	Dusty
Texture	Hard/smooth	Softer/dusty	Hard/smooth	Softer/dusty	Hard/smooth	Softer/dusty

the pellets was the same across the treatments, the pellets were hard and smooth to touch but softer after three weeks. Each treatment had their specific odour aroma. Pellets coated with CAK oil had fruity smell. This may be attributed to sweet aromatic odour of the kernel (Ishola *et al.*, 2017). Those pellets coated with PK oil had roasting smell, while the roasting smell was somehow suppressed in those pellets coated with both oils. Three weeks later, the odour of pellets in T1 and T2 treatments had changed to foul odour but not intense. The foul odour may be an indication of early stage of rancidity. The odour of CAK was somewhat dusty with no signs of foul odour. Foul odour is an indication that rancidity has occurred in oils or oily substance. This is as a result of oxidation in the oil, which represent spoilage. Therefore, the absence of foul odour in feed coated with CAK indicates no spoilage, which means that the feed can still stay longer than others coated with PK and combination of PK and CAK. This observation supports the fact that the oil can resist lipolytic hydrolysis and oxidative deterioration because of low acid content and peroxide value (Adebayo *et al.*, 2012; Nartey *et al.*, 2021) thereby increasing shelf-life of feed. Potential longer shelf-life of feed coated with CAK can also be attributed to its antimicrobial and antioxidant properties (Bazaka *et al.*, 2015).

The results of growth performance of broiler chicken fed pelletized feed coated with PK and CAK oils are presented in Table 6. The birds in T3 showed the highest final body weight (3240.44 g) and weekly feed intake (1178.66 g), which are significantly ($p < 0.05$) higher than in the other two treatments. This higher body weight resulted in higher weight gain (399.55 g) during the experimental period, which may be due to the rate of consumption by the experimental birds (Zhi-Guo *et al.*, 2014; Wen *et al.*, 2014). The higher feed intake may be attributed to the fruity flavour of the CAK oil in T3 treatment (Table 5), which may encourage the birds to consume more, as food choice is determined by flavour, among other factors (Berg *et al.*, 2016). The higher final weight, as a result of higher saturated fatty acids in CAK oil (Table 1), cannot be neglected. This is also evident in the results of carcass yield as the T3 treatment showed highest fat content (Table 7). Contrary to the results of weight gain and feed consumption, the feed conversion ratio showed that the birds in T2 treatment utilized the feed significantly ($p < 0.05$) better than in T1 and T3. This indicates that combination of PK and CAK oils can provide better quality nutrients than the individual oil. PK oil has been reported to contain health-promoting phytonutrients, which include Vitamin E and carotenoids (Jacqueline, 2013). Also, CAK oil has been reported to contain similar phytonutrients and amino acids essential for broiler growth (Adedire *et al.*, 2022).

The results of carcass yield by the experimental birds fed pelletized feed coated with PK oil, CAK oil and combination of the oils (Table 7) demonstrate that slaughter weights correspond to dressing percentages, which were not significantly different from each other. Birds in T3 recorded the highest live weights (3240.44 g), slaughter weights (2171.08 g) and all the fleshy parts viz-a viz: breast (651.34 g), thigh (315.66 g) and drumstick (300.52 g). All these values in T3 were significantly ($p < 0.05$) higher than in T1 and T2 except that of drumstick. The birds in T3 had higher weights in the fleshiest parts – breast and drumstick, what contributed to the higher final weights recorded. The observed results may be because of quality protein supplied by CAK oil, as this oil contained all the essential amino acids (methionine, lysine, threonine, leucine, isoleucine and phenylalanine) required by broiler chicken in appreciable

Table 6. Growth performance of broiler chicken fed pelletize feed coated with PK oil, CAK oil and combination of the oils

Parameters / treatments (g)	T1	T2	T3	*SEM*
Initial body weight	43.52	43.51	43.52	0.05
Final body weight	2981.67^{c}	3145.27^{b}	3240.44^{a}	1.45
Average weekly feed intake	1119.51^{c}	1085.23^{b}	1178.66^{a}	0.41
Average weekly weight gained	367.19^{c}	387.69^{b}	399.55^{a}	0.56
Feed conversion ratio	3.05^{a}	2.80^{c}	2.95^{b}	0.48

^{a,b,c}Means on the same row having different superscript are significantly ($p < 0.05$) different. *SEM* = Standard error of mean. Values are mean of triplicate determination.

Table 7. Carcass yield of broiler chicken fed pelletize feed coated with PK oil, CAK oil and combination of the oils

Parameters / treatments (g)	T1	T2	T3	*SEM*
Live weight	2981.67^{c}	3145.27^{b}	3240.44^{a}	1.15
Slaughter weight	1997.89^{a}	2107.89^{b}	2171.08^{a}	1.70
Dressing percentage (%)	67.20	67.23	67.30	0.05
Wing	249.46^{ab}	242.94^{b}	256.59^{a}	0.20
Breast	596.37^{c}	632.36^{b}	651.34^{a}	0.60
Thigh	299.68^{b}	310.18^{ab}	315.66^{a}	0.32
Back	252.19	257.86	259.47	0.28
Drumstick	269.35	281.35	300.52	0.29
Fat content	15.13^{b}	18.02^{b}	22.59^{a}	0.03

^{a,b,c}Means on the same row having different superscript are significantly ($p < 0.05$) different. *SEM* = Standard error of mean. Values are mean of triplicate determination.

amount (Obasi, 1991; Adedire *et al.*, 2022), whereas these amino acids were lacking in PK oil (Chang *et al.*, 2014). Apart from been essential, methionine and lysine are also limiting, and it must be fortified in feed, as most of the cereals that are used in broilers feed had little or no methionine and lysine after processing. The presence of these two amino acids in appreciable amounts in CAK oil (Table 2) can be of great influence in flesh deposit in broiler chicken, as these has been proved to vital for muscle protein synthesis (Akter *et al.*, 2020). The fat deposited in birds of T3 is higher compared to other treatments. This may be attributed to high content of saturated fatty acids, as reported by Adedire *et al.* (2022). Although, the authors also reported an appreciable amount of linoleic and oleic acids, these data are contrary to the earlier study of Ajewole and Adeyeye (1991), who reported a higher content of unsaturated fatty acids. The variation may be because of methodology used earlier, as there is more efficient methodology evolving over the years.

The results of the haematological parameters of the experimental birds (Table 8) revealed that all values for PCV, WBC, RBC, Haemoglobin, Basophils, Lymphocytes, Platelets and Monocytes fall within the range for a normal physiological and nutritional parameter for stable chicken, as reported by Bounous and Stedman (2000). Haematological parameters are influenced mainly by diets, among other factors. These results indicate that inclusion of CAK oil had no negative effects on the physiological and nutritional status of the experimental birds. The birds in T3 had a significantly higher ($p < 0.05$) value of PCV (27.50 %), which may be a results of higher fat content in CAK oil, because higher level of fat increases PCV. The fact that the PCV

Table 8. Haematology of broiler chicken fed pelletize feed coated with PK oil, CAK oil and combination of the oils

Parameters / treatments (g)	T1	T2	T3	*SEM*
Packed cell volume (%)	24.00^{b}	23.50^{b}	27.50^{a}	1.05
Haemoglobin (g/dl)	9.50^{ab}	8.00^{b}	9.40^{a}	0.33
Red blood cells (x 10^{6}/ µl)	2.81^{ab}	2.62^{b}	3.30^{a}	0.35
White blood cells (x 10^{3}/µl)	1.75	1.58	1.53	0.15
Platelet (x 10^{6}/µl)	2.69	2.82	2.86	0.45
Lymphocytes (%)	65.50	61.50	66.00	2.04
Heterophils (%)	27.50	30.50	28.50	2.34
Basophils (%)	2.00^{ab}	3.00^{a}	1.00^{b}	0.52
Eosinophils (%)	4.00	4.50	4.50	0.52
Monocytes (%)	1.20^{a}	0.70^{b}	0.20^{c}	0.26

^{a,b,c}Means on the same row having different superscript are significantly ($p < 0.05$) different. *SEM* = Standard error of mean. Values are mean of triplicate determination.

Table 9. Serum biochemistry of broiler chicken fed pelletize feed coated with PK oil, CAK oil and combination of the oils

Parameters / treatments (g)	T1	T2	T3	*SEM*
Aspartate aminotransferase ASP (iμ/l)	170.79	147.23	169.22	6.26
Alanine aminotransferase ALT (iμ/l)	18.65	22.91	23.49	0.88
Cholesterol (mg/dl)	120.73^{b}	162.77^{a}	184.94^{a}	5.67
Total protein (g/dl)	3.27^{b}	3.55^{ab}	3.74^{a}	0.49
Albumin (g/dl)	1.91	2.21	1.97	0.33
Globulin (g/dl)	1.34^{b}	1.36^{b}	1.77^{a}	0.54
Triglyceride (mg/dl)	49.82^{b}	145.77^{a}	66.59^{b}	1.27
Alkaline phosphate (iμ/l)	460.41^{ab}	424.72^{b}	496.47^{a}	6.95
High density lipoprotein (mg/dl)	32.82	30.99	29.67	1.86

^{a,b,c}Means on the same row having different superscript are significantly ($p < 0.05$) different. *SEM* = Standard error of mean. Values are mean of triplicate determination.

value falls within the normal range (22 – 35 %), indicates that T1 and T2 treatments did not make the broiler anaemic, and T3 treatment did not induce dehydration, because the PCV value, higher than the normal, may indicate a dehydration (Ogbuewu, *et al.*, 2023).

The higher value of Hb (9.40 g/dl) in T3 may be due to nutritional quality of CAK oil, especially the amino acids content, that has all the essential amino acids for broiler chicken (Table 2), as it has been reported, that Hb and PCV are very sensitive to the level of protein intake by poultry (Mitruka and Rawnsley, 1977; Saki *et al.*, 2018). This higher value does not indicate polycythaemia (thick blood) in the experimental birds, as it falls within the range (7 – 13 g/dl) for a normal healthy broiler chicken. The value of RBC ($4.30 \times 10^6/mm^2$) is also significantly higher than in T1 and T2 treatments. This may be due to nutritional quality of CAK oil, especially the amino acid content, which has all the essential amino acids for broiler chicken (Adedire *et al.*, 2022). WBC values were not significantly ($p > 0.05$) different from each other, but the combination of the oils resulted in highest value. This may be attributed to cumulative carotenoid concentration in both oils, because supplementation with vitamin A increased WBC concentration in chicken (Akbari *et al.*, 2008; Odunitan-Wayas *et al.*, 2018).

The results of serum biochemistry of broiler chicken fed pelletized feed coated with PK, CAK and combination of the two oils (Table 9) show that all the parameters were within the range for a normal physiological and nutritional stable chicken (Meluzzi *et al.*, 1992; Odunitan-Wayas *et al.*, 2018). This indicates that oils introduced into the pelletized feed did not exert any negative effect on the physiology of the experimental birds, because increase in ALT and ALP indicates damaged and or diseased cells in the liver (Meluzzi *et al.*, 1992). ALT is a liver enzyme that indicates malfunctioning of the liver, when found in the blood stream (Ogbuewu, *et al.*, 2023). Serum cholesterol level was significantly ($p < 0.05$) higher in T3 treatment (184.94 mg/dl). This may be attributed to the fatty acid profiles of the CAK oil. This oil contains about 71.02 % of saturated fatty acids (Adedire *et al.*, 2022). Total protein (3.74 g/dl) and globulin (1.77 g/dl) values were significantly ($p < 0.05$) higher in T3 than T1 and T2 treatments. This is because of additional protein content of CAK oil compared to the PK oil, which has no or little protein content. The triglyceride values indicate that the combination of the oils generate more fatty acids, than the birds required in the body tissues, what resulted in its higher concentration in the blood.

Determination of haematological and serum biochemical parameters is essential and effective to evaluate the effectiveness of diets in optimizing animal performance without compromising their health, as changes in haematological levels may usually signal to onset of loss of weight, feathers, weak movement etc. (Mnisi and Mlambo, 2017). However, there are some factors (age, environmental, method of collection etc.) that can cause variation in data obtained from an assay. Nevertheless, the results, falling within normal range, indicate that the diet has no negative effect on physiological status of the birds, and such feed can be used as a feed stuff for broiler chicken.

CONCLUSION

It can be concluded, that *Chrysophyllum albidum* oil can be used as coating material in pelletizing feed for broiler chicken to enhance performance and optimum flesh deposition without posing any negative effect on the physiological and nutritional stability of broiler chicken.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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