J. Food. Stab (2020) 3 (3): 111-122 Journal homepage: www.foodstability.com

Received: 06/05/2020 / Revised: 05/09/2020 / Accepted: 12/09/2020 / Available online: 01/10/2020

DOI: 10.36400/J.Food.Stab.3.3.2020-0022

Journal of Food Stability

ORIGINAL ARTICLE

Growth Performance, Carcass Characteristics and Lipid Profile of Broiler Finishers Fed varying Dietary Levels of Ripe and Unripe Garden Egg Meal

[*a] Ajayi, M. A / [b]Ugwu, S. O. C / [c]Ayodele, E.A /

Authors' Affiliation

[a]Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State, Nigeria

[b]Department of Animal Science, University of Nigeria, Nsukka, Nigeria

[c]Department of Food Technology, Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State

Corresponding author

Ajayi, M. A

Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State, Nigeria

Email: morenikejifaa@gmail.com

Funding source

None

Abstract

The use of vegetables as an alternative to feed ingredient for bird is gaining attention due to the cost of feed. The study was conducted to evaluate the nutritive value of ripe and unripe garden egg meal on finisher broiler chickens. A total of one hundred and fifty ANAK breed four weeks old were obtained from commercial hatchery with an average body weight of 0.83 ± 0.12 kg. They were randomly divided into five dietary treatment groups (T1: control diet 0% edible and ripe garden egg meal, T2: 5% edible garden egg meal, T3: 10% edible garden egg meal, T4: 5% ripe garden egg meal and T5: 10% ripe garden egg meal). The experiment was conducted for a period of four weeks. The daily feed consumption, body weight gain, carcass performance and lipid profile were measured. There was no significant difference between the average final weights of the treatment groups compared to the control. However, T3 was significantly ($p < 0.05$) reduced. For the daily weight gain, average daily weight gain, daily feed intake, feed conversion ratio, feed efficiency and mortality, no significant difference was observed among treatment groups. The carcass characteristics showed no significant ($p > 0.05$) difference between the treatment groups across the parameters except the residual weight which showed significant ($p < 0.05$) reduction in T3 compared to the control group. The liver, serum and breast meat lipid profile of the treatment groups showed significant ($p < 0.05$) difference between the treatment groups. The study suggests that supplementing broiler diets with 2.73% inclusion of edible garden egg and 5.1% of ripe garden egg meals in broilers diets have a variety of growth-promoting effects and suppress lipogenesis in finishing broiler.

Practical application

This study reveals that both ripe and unripe garden egg are good supplement in the formulation of broiler chicken feed because it shows a better growth performance with lowest conversion ration without adverse side effect on the health of the chicken. However, the observed benefits can be achieved without compromising growth performance of broiler chicken only with the incorporation of 2.73% inclusion of unripe garden egg meal and up to 5.1% inclusion of ripe garden egg meal.

Keywords: Garden egg; lipid profile; broiler chicken; carcass characteristics; growth.

1. Introduction

One of the greatest challenges facing livestock production especially the mono gastric animals in Nigeria is the high cost of feed stuffs (Igwebuike *et al*., 2001; Ogundipe *et al*., 2003).

In view of this, the exploitation of agricultural by-products and farm wastes as alternative feed ingredient for poultry and livestock feeding trials has been the current trend in animal production

Atteh & Ologbenla (1993). The current high cost of feeding animals due to high cost of conventional feed ingredients has necessitated the need to intensify effort on the discovery of alternative feed ingredients in feeding the animals. It is therefore necessary to channel research effort towards exploring avenues for utilizing most of the agricultural waste products including ripe garden egg fruits in feeding animals. Such move will not only reduce production cost, but also serve as an avenue of evacuating the waste in order to avert the environmental hazard and danger posed by these wastes.

Garden egg is a fruit but an unusual kind of fruit, which is even used for the preparation of stew, botanically known as *Solanum melongena*, of the *Solanaceae* family and locally called Igba among the Yoruba of Southwest Nigeria also known as "Anyara" in the Eastern part of Nigeria is used in the preparation of vegetable stews and yam dishes. Typically in Africa, the garden egg is chopped, cooked and mixed into a variety of vegetable, meat, or fish stews and sauces. It is characterized with bitter taste as the result of the presence of cyanogenic glycosides in it (Adegbola, 2004). Many African eggplants are bland, especially in the immature stages in which they are eaten. The unripe fruits are usually cooked in a sauce after being chopped, parboiled, ground, or otherwise prepared. Peeling is unnecessary because the skin becomes tender enough to be consumed along with the rest. They are among the few vegetables that reach full flavour only after being cooked *beyond* the crisp stage (Anosike *et al*., 2011).

This populous African fruit remains a delight for researchers as the effects of garden egg are not only nutritional but significantly of health benefits as the tree that bears them. The nutritional contents of vegetables which are eaten in variety of ways vary considerably. *Solanum melongena* is an African fruit that is used as a vegetable (Bello *et al*., 2005). It is widely distributed in Enugu state and other parts of Nigeria. Among the Igbo people in Nigeria community, they can hardly do without eating garden egg, because it is considered good for the sight (Igwe *et al*., 2003). Although garden egg is generally said not to contain huge amount of protein and other nutrients, it is low in sodium, low in calories and very rich in high dietary fibre. It is also high in potassium, a necessary salt that helps in maintaining the function of the heart and regulate blood pressure. It has been reported that *Solanum melongena* had cholesterol reducing effects on albino rat (Anosike *et al*., 2011). It was also found that garden egg consumption might be of great benefits to glaucoma patients in a study conducted by Igwe *et al.* (2003). However, this fruit (*Solanum melongna*) has not been used as feed ingredient in livestock feed. Therefore, to take the advantage of the nutritional composition of this novel feed stuff (Garden egg), This study aimed at evaluating the growth performance, carcass characteristics and health benefits of broiler chickens fed graded levels of garden egg meal as replacements for dietary wheat offal.

2. Materials and Methods

2.1 Experimental materials

Unripe garden egg fruits were purchased while ripe garden egg fruits were collected at Eke Market, Afikpo, Ebonyi state, Nigeria. The fruits were cut into pieces, sundried for five days and milled with milling machine after which they were analyzed for their proximate composition.

Then incorporated at 0%, 2.73%, 5.43%, 2.71% and 5.1% in the experimental diets.

2.2 Experimental diets

The starter and finisher diets were formulated and fed to the experimental birds. The compositions of the diets are as shown in Table 1 and 2.

Table 1: Percentage composition of the starter diet

Ingredient (%)	Quantity (kg)
Maize	45.57
Wheat offal	5.06
Palm kernel cake	4.51
Groundnut cake	18.05
Soya bean meal	20.30
Fish meal	2.26
Bone meal	3.00
Salt	0.5
Methionine	0.25
Lysine	0.25
Premix	0.25
Total	**100**
Calculated analysis	
Crude Protein	23 (%)
Crude Fibre	5.00 (%)
Energy	2800 Kcal/kg

2.3 Experimental birds and management

A total of one hundred and fifty (150) ANAK strains of broilers were managed and fed *ad libitum* with broiler starter ration for 27 days after arrival from the hatchery prior to the commencement of this experiment, and thereafter transferred to the rearing pens at 28 days of age with an average weight of 0.83±0.71 kg. The broilers were randomly assigned to five treatment groups in a completely randomized design involving dietary inclusion of five levels (0%, 2.73%, 5.43%, 2.71% and 5.51%) of unripe garden egg meal and ripe garden egg meal. Each treatment group was replicated in triplicate to obtain a total of 15 groups of 10 birds each. The chickens were randomly assigned to an experimental unit of 1m by 1m each partitioning and raised in a deep liter system of management. Feed and water were given *ad-libitum* and proper routine management practices and medications strictly adopted. The feeding trial lasted for 28 days.

2.4 Data collection and measurements

Data were collected on the growth performance, carcass and organ characteristics; and the cost implication of using the dietary levels of edible and ripe garden egg meal in the broiler production. The day old chicks were brooded together and were weighed at the beginning of the experiment and on weekly basis thereafter. To determine the weight gain of the birds; feed intake was recorded daily and was determined by the weigh back technique which involved obtaining the difference between quantity of feed offered and the left over the following morning. Feed conversion ratio (FCR) was calculated from the data on feed intake and weight gain as the quantity of feed taken per kilogram of weight gain over the same period. At day 28 of the experiment, one bird was randomly selected from each replicate of the treatments. Determination of the carcass characteristics was done by slaughtering the selected birds (decapitation of the neck). They were dressed and weighed to determine the dressing weight. Blood was collected from the wing vein of each chick and stored in vacuumed capillary tubes to determine the serum triglyceride, cholesterol.

Table 2: Percentage composition of the experimental diets

Ingredient	T1(kg)	T2(kg)	T3(kg)	T4(kg)	T5(kg)
Ripe garden egg meal	0.00	0.00	0.00	2.71	5.51
unripe garden egg meal	0.00	2.73	5.43	0.00	0.00
Maize	48.97	49.05	49.13	48.81	49.63
Wheat offal	5.44	1.14	0.00	2.71	0.00
Palm kernel cake	4.03	4.03	4.02	4.05	3.96
Groundnut cake	16.14	16.09	16.06	16.21	15.84
Soya bean meal	20.17	20.13	20.08	20.26	19.81
Bone meal	4.00	4.00	4.00	4.00	4.00
Salt	0.5	0.5	0.5	0.5	0.5
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated analysis					
Crude Protein (%)	21	21	21	21	21
Crude Fibre (%)	4.94	4.99	5.15	5.17	5.34
Crude fat (%)	4.82	4.48	4.15	3.81	3.51
Energy Kcal/kg	2994	2897	2800	2900	2880

** To provide the following per kilogram of feed; vit A 10,000IU; vit. D3 1,500 IU; vit. E 2 mg; riboflavin 3 mg; pantothenic acid 10 mg; nicotinic acid, 2.5 mg; choline 3.5 mg; folic acid 1mg; magnesium 56 mg; lysine 1mg; iron 20 mg; zinc 50 mg; cobalt 1.25 mg.*The metabolizable energy of the test ingredient was calculated using prediction equation as reported by Pauzenga, 1985 with the formula M.E = 37 X %CP + 81.8 X %EE + 35.5 X%NFE. Note: GNC =ground nut cake. PKC=Palm Kernel Cake. CP=crude Protein.CF=Crude Fibre. T1= control diet 0% ripe and unripe garden egg meal, T2= 2.73% unripe garden egg meal. T3= 5.43% unripe garden egg meal. T4= 7.43% ripe garden egg meal. T5= 5.51% ripe garden egg meal.

HDL and LDL levels. Portion of the Livers and breast meat plus the attached skin were cut and stored in bottles and sent to laboratory for the analysis of the High density lipoprotein, Low density lipoprotein, cholesterol and triglyceride.

Data collected were analyzed in a 2x3 factorial arrangement in a completely randomized design ANOVA. Differences among means were determined with Duncan's multiple-range test with 5% level of significance as described by Steel & Torrie (1980). The data were computed with IBM SPSS statistical 16 of 2013 software. Feed samples were assayed for their proximate composition by the method of AOAC (1990).

3. Results and Discussion

3.1 Results

3.1.1 Proximate composition of experimental materials

The proximate composition of the experimental materials and diets are presented in table 3 and 4 respectively.

The results exhibited in table 3 shows that the values observed for the moisture content (18.40 g/100g), crude protein 13.00 g/100g), ash (10.60 g/100g) and crude fat (4.00 g/100g) were higher in unripe garden egg meal compared to the ripe ones. However, ripe garden egg meal had higher values of crude fibre (17.00 g/100g) and carbohydrate (49.80 g/100g) compared to unripe garden egg meal.

The results of the proximate composition of the experimental diets presented in table 4 revealed that, the moisture content and crude fat of the experimental diets increased with the inclusion level of unripe garden egg meal. However, reverse is the case for increased inclusion of ripe garden egg meal. The crude fibre and total ash increase with the inclusion level of unripe and ripe garden egg meal in the diets. Furthermore, the crude protein of the experimental diets increased with the inclusion level of unripe garden egg meal. However, the value declined when ripe garden egg meal increase. Lower value was observed as the inclusion level of unripe garden egg meal increased but declined at higher inclusion level of ripe garden egg meal.

3.1.2 Growth performance of broiler chickens fed varying dietary levels of unripe and ripe garden egg meal

The results of performance of finisher broiler chickens fed with varying dietary levels of unripe and ripe garden egg meal are presented in table 5. Average final weight of the experimental birds fed with varying dietary level of unripe garden egg formulated meal (T2 and T3) show no significant ($p > 0.05$) increase compared to the control group (T1). The final live weight of the experimental groups fed with varying level of ripe and unripe garden egg meal (T2, T3, T4 and T5) revealed significant ($p < 0.05$) reduction compared to the control group (T1). The finisher broiler fed with 2.73% unripe garden egg meal formulated (T2) feed showed no significant ($p > 0.05$) reduction in the average daily weight gain, daily feed intake and deed conversion ratio but no significant ($p > 0.05$) increase in Feed efficiency compared to the control group (T1).

Table 3: proximate composition of edible and ripe garden egg meal (dry weight bases)

Accessions	Moisture (g/100 g)	Crude protein (g/100 g)	ash (g/100 g)	Crude fiber (g/100 g)	Crude fat (g/100 g)	Carbohydrate (g/100 g)
Unripe garden egg meal	18.40	13.00	10.60	13.00	4.00	40.00
Ripe garden egg meal	12.20	10.00	10.00	17.00	2.00	49.80

Table 4: The proximate compositions of the experimental diets

Samples	Moisture content (g/100 g)	Crude protein (g/100 g)	Total ash (g/100 g)	Crude fiber (g/100 g)	Crude fat (g/100 g)	Carbohydrate (g/100 g)
1	10.72	22.20	5.19	5.19	3.70	53.00
2	11.21	22.30	9.11	5.25	2.00	50.13
3	11.50	22.36	9.81	5.45	2.47	49.31
4	9.22	22.16	9.87	5.44	3.31	50.00
5	7.83	22.20	10.20	5.69	3.30	50.78

1= control diet formulated with 0% ripe and unripe garden egg meal, 2= experimental diet formulated with 2.73% unripe garden egg meal. 3= experimental diet formulated with 5.43% unripe garden egg meal. 4= experimental diet formulated with 7.43% ripe garden egg meal. 5= experimental diet formulated with 5.51% ripe garden egg meal.

3.1.3 Carcass yield of finisher broiler chickens fed varying dietary level of edible and ripe garden egg meal

The result of the carcass yield of finisher broiler chickens fed with varying dietary level of edible and ripe garden egg meal are presented in table 6. The finisher broiler chicken in group T2 showed no significant ($p > 0.05$) increase in final body weight, dressed weight and thigh weight compared to control group (T1). T4 and T5 fed broiler chicken showed no significant ($p > 0.05$) reduction in final body weight, eviscerated weight and breast weight compared to the control group (T1). No significant difference ($p > 0.05$) was observed among all the treatments for all the parameters except for the residual in which T3 was significantly lower ($p < 0.05$) when compared with the control, T2 and T4 but favorably compared with T5 ($p > 0.05$).

Table 5: Performance of finisher broiler chickens fed varying dietary level of unripe and ripe garden egg meal

Parameter	T1	T2	T3	T4	T5	SEM
Average initial weight	0.870	0.921	0.905	0.870	0.860	0.02547
final live weight (kg/bird)	2.75^{b}	2.440^{ab}	1.925^{a}	2.265^{ab}	2.215^{ab}	0.08687
Daily weight gain	0.308	0.320	0.275	0.310	0.295	0.0571
Average daily weight gain	0.044	0.047	0.039	0.036	0.042	0.0021
Daily feed intake	0.139	0.140	0.135	0.136	0.130	0.0016
Feed conversion ratio	3.147	3.000	3.449	3.055	3.135	0.0664
Feed efficiency	31.760	33.303	28.995	32.845	32.035	0.6648
Mortality	0.000	0.000	0.000	0.000	0.000	0.000

^{a,b} Different superscripts within each row indicate significant differences ($p < 0.05$) (n =10). Without superscript = not significant. SEM= standard error of mean, T1= control diet 0% ripe and unripe garden egg meal, T2= 2.73% unripe garden egg meal. T3= 5.43% unripe garden egg meal. T4= 7.43% ripe garden egg meal. T5= 5.51% ripe garden egg meal.

Table 6: Carcass weight of finisher broiler chickens fed varying dietary level of edible and ripe garden egg meal

Parameter	T1	T2	T3	T4	T5	SEM
Final body weight(kg)	2.450	2.600	2.250	2.250	2.255	0.1389
Dressed weight(kg)	2.250	2.400	1.650	2.300	2.100	0.1293
Eviscerated weight(kg)	1.800	1.800	1.225	1.775	1.600	0.1089
Breast weight(kg)	0.550	0.450	0.350	0.500	0.400	0.0477
Thigh weight(kg)	0.450	0.550	0.450	0.500	0.250	0.3516
Residual weight(kg)	0.450^{b}	0.450^{b}	0.225^{a}	0.400^{b}	0.350^{ab}	0.0309
Head and neck(kg)	0.150	0.150	0.050	0.125	0.175	0.0238
Wing(kg)	0.200	0.200	0.150	0.250	0.150	0.1795

^{ab} Different superscripts within each row indicate significant differences ($p < 0.05$) (n =10). Without superscript = not significant. T1= control diet 0% ripe and unripe garden egg meal, T2= 2.73% unripe garden egg meal. T3= 5.43% unripe garden egg meal. T4= 7.43% ripe garden egg meal. T5= 5.51% ripe garden egg meal. SEM= standard error of mean

3.4 Lipid profile (liver, serum and breast meat) of finisher broiler chickens fed varying dietary levels of unripe and ripe garden egg meal

The result of the lipid profile (liver, serum and breast meat) of finisher broiler chickens fed varying dietary levels of unripe and ripe garden egg meal are presented in table 7.

All the parameters differed significantly when the control was compared to other treatments. The liver, serum and breast meat had the highest significant values when the cholesterol, low density lipoprotein and triglyceride of the control were compared to other treatments. However, T4 and T5 were favorably similar for the serum. High density lipoprotein differed significantly for the control of all the parameters when compared with other treatments. The highest values were observed at T3

3.2 Discussion

3.2.1 Proximate composition of unripe and ripe garden egg meals

The results of the proximate composition of unripe and ripe garden egg meal in table 3 showed that unripe and ripe garden egg meal are rich in nutrients such as, ash (10.60% and 10.00% respectively). These results are in line with those of Edem *et al*. (2009) who reported that *Solanum gilo* and *Solanum melongena* contained 10% crude ash. They were however poor in crude carbohydrate, 40.00 and 49.80% respectively against 52.13 and 58.50% respectively as reported by Edem *et al.* (2009). They were also lower than the values recorded for some selected vegetables grown in Nigeria (Adegbenro *et al*., 2012).

Moisture; 18.40 and 12.20 and fibre percentage (13.00 and 17.00) were higher than 8.38 and 8.00% recorded for *Sesbibia sesban* seeds by Ogunbode *et al*. (2013) but lower than 94.8 and 94.6% reported by Edem *et al.* (2009).

The crude protein; 13.00% and 10.00% were also lower than estimated average composition of 16-21% crude protein recorded for wheat offal (Asiedu, 1989), but higher than the average value recorded for maize (9.00%) (NRC, 1994).

Table 7: Lipid profile (liver, serum and breast meat) of finisher broiler chickens fed varying dietary levels of edible and ripe garden egg meal

Parameter	T1	T2	T3	T4	T5	SEM
Liver						
Triglyceride mg/dl	2.890^{a}	1.010^{d}	0.955^{d}	1.645^{c}	1.9850^{b}	0.2377
Cholesterol mg/dl	12.750^{a}	9.110^{b}	5.475^{c}	9.265^{b}	5.360^{c}	0.9203
High density lipoprotein mg/dl	1.680^{a}	2.725^{bc}	2.875^{c}	2.650^{b}	2.790^{bc}	0.1470
Low density lipoprotein mg/dl	4.890^{a}	4.335^{b}	3.100^{c}	4.220^{b}	3.165^{c}	0.1650
Serum						
Triglyceride mg/dl	1.880^{a}	1.530^{c}	1.570^{bc}	1.800^{a}	1.765^{ab}	0.0495
Cholesterol mg/dl	8.700^{a}	7.350^{bc}	6.150^{d}	6.850^{cd}	7.600^{b}	0.2895
High density lipoprotein mg/dl	2.060^{a}	2.910^{b}	2.845^{b}	2.755^{b}	2.795^{b}	0.1075
Low density lipoprotein mg/dl	3.750^{a}	2.400^{b}	2.550^{b}	2.450^{b}	2.605^{b}	0.1701
Breast meat						
Triglyceride mg/dl	1.8250^{a}	1.365^{b}	0.820^{c}	1.475^{b}	0.910^{c}	0.1257
Cholesterol mg/dl	12.450^{a}	7.875^{b}	6.810^{c}	7.955^{b}	6.225^{c}	0.7345
High density lipoprotein mg/dl	2.600^{a}	3.910^{bc}	4.305^{d}	3.785^{b}	4.175^{cd}	0.2050
Low density lipoprotein mg/dl	5.810^{a}	4.765^{b}	3.700^{c}	4.915^{b}	3.780^{c}	0.2647

[a,b,c,d] Different superscripts within each row indicate significant differences ($P < 0.05$) (n =10). T1= control diet 0% ripe and unripe garden egg meal, T2= 2.73% unripe garden egg meal. T3= 5.43% unripe garden egg meal. T4= 7.43% ripe garden egg meal. T5= 5.51% ripe garden egg meal.SEM= standard error of mean.

The high crude protein content present in garden egg is an indication that it can be used at certain percentage in poultry diet. However, its usage should be limited because of its high fiber content as this may negatively affect feed intake in poultry if used in excess hence the growth performance is adversely affected.

Furthermore, the high moisture content of the garden egg would make processing to be a bit difficult and also reduce the life span of the feed as moisture encourages the growth and reproduction of microbes.

3.2.2 Proximate compositions of the experimental diets

Table 4 showed the proximate composition of experimental and control diets. The experimental diets formulated with 2.73 and 5.43% of unripe and ripe garden egg and 7.43% of ripe garden egg showed an increase in moisture, crude protein, total ash and crude fibre content compared to the control diet. The proximate composition across the experimental diet and control revealed the trend in the composition to be as follow: crude protein > total ash > crude fibre > crude fat. The crude fibre of the experimental diets was observed to be lower than the NRC (1994) recommended value. Therefore, ripe and unripe garden egg could serve as a valuable intake of dietary fibre which can lower cholesterol level (Igara *et al*., 2017). The protein content of the experimental and control diet were observed to be higher than the NRC (1994) recommended value. Therefore, ripe and unripe garden egg could be a source of nutrient for countries including Nigeria where cost of animal protein is beyond their per capital income (Obasi *et al*., 2012; Igara *et al*., 2017). The low moisture content of the experimental diet revealed that, the diet would possess long shelf-life without microbial spoilage since high moisture content has been attributed to microbial spoilage (Edem *et al*., 2009).

3.2.3 Performance of finisher broiler chickens fed varying dietary level of unripe and ripe garden egg meal

Average final weight of the experimental birds had no significant difference (p>0.05) when the value recorded for the control was compared with T2, T4 and T5. However, T3 was significantly decreased (p <0.05). This in an indication that both unripe and ripe garden egg meal can only be used in formulating feeds for finisher broilers without compromising the growth performance at 2.71 and up to 5.51% respectively. However, the least value recorded for the test ingredient 3 shows that 5.43% inclusion of unripe garden egg meal negatively affected the growth of the birds. The least value recorded for feed intake and feed efficiency although not statistically different are evidence for the poor performance of the treatment. This is in line with the finding of Adegbola (2004) who reported that unripe garden egg contained cyanogenic glycosides which is responsible of the bitter taste. This bitter taste of unripe garden egg meal at 5.43% inclusion might have reduced the palatability of the feed, hence reduced the feed intake that eventually negatively affected the proper growth of the birds.

3.2.4 Carcass yield of finisher broiler chickens fed varying dietary level of edible and ripe garden egg meal

The carcass characteristic of the experimental birds did not show any significant difference, except for the residual of the treatment 3 which had the least value. This is also in line with the result of the growth performance as earlier reported. These results is consistent with the findings of Issa and Omar (2011) who reported that, the relative weight of carcass of broiler chickens were not by garlic powder formulated diet.

3.2.5 Lipid profile of broiler chickens fed varying dietary level of unripe garden egg meal and ripe garden egg meal

The breast meat homogenate was observed to have higher level of triglyceride (TG), cholesterol (Chol), high density lipoprotein (HDL) and low density lipoprotein (LDL) than the liver homogenate and serum. The result also revealed that, serum, liver and breast meat homogenate were significantly ($p < 0.05$) reduced in TG, Chol and LDL level of broiler chicken fed with experimental diet formulated with varying percentage of ripe and unripe garden egg compared to control group while the HDL level was significantly ($p<0.05$) higher in the experimental groups (T2, T3, T4, and T5) compared to the control group (T1).

The result may probably be due to the possible mechanism of hypocholesterolemic and hypolipidemic action of garden egg which was supported by the findings of Nwozo *et al.* (2018) who reported the effect of *solanium melongena* fruits supplemented diet on hyperglycemia, overweight, liver function and dyslipidemia in male New Zealand rabbits fed high fat and sucrose diet. The result was also in agreement with the findings of Issa and Omar (2011) who reported the effect of garlic powder on performance and lipid profile of broiler.

The significant ($p<0.05$) reduction in total cholesterol level of broiler chicken fed with ripe and unripe garden egg formulated diet suggest that garden egg can induce activity of enzymes which convert cholesterol to bile salt and reduce the level of cholesterol in the carcass (Kim *et al.*, 2009; Issa and Omar, 2011). The significant ($p < 0.05$) in TG level observed in broiler chicken fed with ripe and unripe garden egg formulated diet could explain the inhibitory effect of garden against acetyl CoA synthase that is require for fatty acid biosynthesis (Qureshi *et al.*, 1983). Ripe and unripe garden egg formulated diet reduce the level of LDL also known as bad cholesterol in broiler chicken compared to control group. This could be due to the possible inhibition of hepatic production of very low density lipoprotein (VLDL) which serves as precursor for LDL synthesis in circulation (Isaa & Omar, 2011). The broiler chicken fed with varying percentage of ripe and unripe garden egg formulated diets showed significant ($p < 0.05$) increase in LDL often called good cholesterol because of its function as cholesterol transported from the peripheral to the hepatocyte as precursor for bile salt formation and possible excretion of residual cholesterol (Regar *et al.*, 2019). This mechanism enables the HDL to maintain cholesterol homeostasis in the blood.

4. Conclusion

The results of the present study showed that both unripe garden egg meal and ripe garden egg meal reduced serum triglyceride, low-density lipoprotein (LDL) cholesterol and increased high-density lipoprotein (HDL) cholesterol when fed to finisher broiler up to 5.43% and 5.51% respectively. The results demonstrate that the observed benefits can be achieved without compromising growth performance only with the incorporation of 2.71% unripe garden egg and 5.51% ripe garden egg meal . The findings of this study are evidence that the use of ripe garden egg fruits will make unripe and ripe garden egg fruits to be ideal for healthier broiler production. The utilization of ripe of ripe garden egg fruits will also be an efficient means of averting the environmental hazard and danger likely to be posed by the increasing generation of the ripe garden egg fruits waste‘. The resultant effect will lead to attainment of food security, national transformation and social emancipation among the citizenry.

Conflict of interest

The authors declare that there are not conflicts of interest.

Ethics

All animal care and experimental protocols were ethically reviewed and approved by the Department of Animal Science, University of Nigeria, Nsukka, Nigeria. This study does not involve any human testing.

References

Adegbenro, M., Ayeni, A.O., Olowoye,J., Bankole, O. M, Agbede, J. O., Onibi, G. E., & Aletor, V. A. (2012). Leaf composite mix as alternative premix to commercial premix in Broiler finisher diets. Conference on international research on food security, National resources and Rural development. Tropentog 2012, Gottingen, Germany

Adegbola, T.A. (2004). Utilizing Proven Alternative Feed Ingredients in the Livestock Industry. *Proceedings of the 27th Annual Conference of the Nigerian Society for Animal Production*, March 17-21, 2004, Akure, pp: 431-43

Anosike, C., Abonyi, O., & Ubaka. C. (2011). Evaluation of the possible anti-ulcer effect of the African garden egg. *Pacific Journal of Tropical Medicine* 4(2), 163-166

Asiedu, J. J. (1989), English, Book, Illustrated edition: Processing tropical crops: a technological approach

Association of Official Analytical Chemist, (1990). Official methods of analysis of the AOAC,15th edition

Atteh, J.O. & Ologbenla, F. D. (1993). Replacement of Fish Meal with Maggots in Broiler Diets. Effects on Performance and Nutrient Retention. *Nigerian Journal of Animal Production*, 20, 44-49

Bello, S.O., Muhammad, B.Y., Gammaniel, K.S., Abdu-Aguye I., Ahmed, H., Njoku, C.H. (2005). Preliminary evaluation of the toxicity and some pharmacological properties of the aqueous crude extract of *Solanum melongena*. *Research Journal of Agriculture and Biology Sciences*, 1(1), 1-9

Edem, C. A., Dosumu, M. I., Bassey, F. I., Wilson, C., & Umoren, P. A comparative assessment of the proximate composition, ascorbic acid and heavy metal content of two spcies of gargen egg (*solanum gilo* and *Solanum aubergine*). *Pakistan Journal of Nutrition*, 8(5), 582-584

Igwe, S. A., Akunyili, D. N., & Ogbogu, C. (2003). Assessment of the "Effects of garden eggon some visual functions of visually active Igbos of Nigeria. *Journal of Ethnopharmacology* 86(2-3), 135-8

Igwebuike, J. U., Kwari, I. D., Ubosi, C. O., & Alade, N. K. (2001). Replacement Value of Spent Sorghum Grains for Maize in Broiler Finisher Diets. *Journal of Sustainable Agricultural Environment*, 3, 224-233

Khoo, H. E, Azlan, A., Tang, S.T., & Lim, S.M. (2017). Anthocyanidins and anthocyanins: colored pigments as food, pharmaceutical ingredients, and the potential health benefits. *Food and Nutrition Research* 61, 1361779.

Liu, Y., Li, D., Zhang, Y., Sun, R., & Xia, M. (2014). Anthocyanin increases adiponectin secretion and protects against diabetes-related endothelial dysfunction. *American Journal of Physiology- Endocrinology and Metabolism* 306, E975-E988.

Liu, C., Sun, J., Lu, Y. and Bo, Y. (2016). Effects of anthocyanin on serum lipids in dyslipidemia patients: A systematic review and meta-analysis. Plos One, 11 (9): e0162089

Ogunbode, A. A., Akanni, E.O., Abegunde, P.T., & Fatola, O.S.G. (2013). Determination of chemical composition of *sesbibia sesban seeds;* proc.18th Annual Conference of Nigerian Society for Animal Production ASAN-NIAS PP290-293

Ogundipe, S.O., Abeke, F. O., Sekoni, A. A., Dafwang, I. I., & Adeyinka, A. I. (2003). Effect of duration of cooking on the utilization of lab lab purpureus by pullet chicks. In*: Proceedings of the 28th Annual conference of the Nigerian Society for Animal Production held at Ibadan, Nigeria.* Pp 233-235

Pauzenga, U. (1985). Feeding parent stock (pp. 22-25). Zootecnia International.

Steel, R. G. D., & Torrie, J. H. (1980). Principles and procedures of statistics. A biometrical approach, 2nd Edition, McGraw-Hill Book Company, New York

World Health Organization, 1991. International Program on Chemical Safety (IPCS): Environmental Health Criteria. Vol. 134, World Health Organization, Geneva, Switzerland, page: 321-342

Igara, C. E., Omoboyowa, D.A., Uchegbu, R. I., & Ahuchaogu, A. A. (2017). Phytochemical Composition, Proximate Analysis and Vitamin Content of (*Tetracarpidium conophorum*) Wall Nut Seed. *Chemistry Research Journal*, 2(5), 1-8

Obasi, N. A., Ukadilonu, Joy, Eze E., Akubugwo, E. I., & Okorie, U. C. (2012). Proximate composition, extraction, chacterisation and comparative assessment of Coconut (*Cocos nutrifera*) and Melon (*Colocynthis citrullus*) seeds and seed oils. *Pakistan Journal of Biological Science*, 15, 1-9.

Nwozo, S. O., Adeneye, D. A., & Nwawuba, S. U. (2018). Effect of *Solanium melongena* fruits supplemented diet on hyperglycemia, overweight, liver function and dyslipidemia in male New Zealand rabbits fed high fat and sucrose diet. *Integrative Obesity and Diabetes*, 4(3): 2-5

Issa, K. J., & Omar, J. M. A. (2011). Effect of garlic powder on performance and lipid profile of broilers. *Open Journal of Animal Sciences* 2(2), 62-68.

Kim, Y.J., Jin, S.K., & Yang, H. S. (2009) Effect of dietary garlic bulb and husk on the physicochemical proper-ties of chicken meat. *Poultry Science*, 88, 398-405.

Qureshi, A.A., Abuirmeileh, N., Din, Z.Z., Elson, C.E., & Burger, W.C. (1983) Inhibition of cholesterol and fatty acid biosynthesis in liver enzymes and chicken hepatocytes by polar fractions of garlic. *Lipids*, 18, 343-348.

Regar, M. N., Tulung, B., Londok, J. J. M. R., Moningkey, S. A. E., & Tulung, Y. R. L, (2019). chicken as affected by a combination of Feed restriction and different crude fiber sources. IOP Conf. Series: Earth and Environmental Science, 387, 1-4

Cite this paper as: Ajayi, M. A., Ugwu, S. O. C., Ayodele, E. A. (2020). Growth Performance, Carcass Characteristics and Lipid Profile of Broiler Finishers Fed varying Dietary Levels of Ripe and Unripe Garden Egg Meal. *Journal of Food Stability*, 3 (3), 111-122

DOI: 10.36400/J.Food.Stab.3.3.2020-0022