



## Haematology and Serum Biochemistry of Broiler Chicken Administered *Lagenaria breviflorus* Extract

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### Abstract

*Lagenaria breviflora* is a tropical plant that is frequently grown in Africa, particularly in the western part of Nigeria. It is considered innovative since it has historically prevented viral diseases in humans like measles, chicken pox, small pox, and new castle sickness in poultry. On broiler chicken that had been given a water-based extract of *Lagenaria breviflora*, a 35-day experiment was conducted at The Federal Polytechnic, Ilaro teaching farm to assess the haematological response and blood biochemistry. A treatment of 100, 200, and 300 mls of *Lagenaria breviflora* per 4 litres of water was given to 150-day-old broiler chickens, replicated three times (10 birds each). The acquired data were compared using Analysis of Variance (ANOVA), and the significance level was set at ( $P < 0.05$ ). To compare the data, Duncan's Multiple Range Test was employed. The results from all parameters studied were found to be significant across all treatments ( $P < 0.05$ ). Birds treated on 100 mls/4L of *Lagenaria breviflora* had the largest pack cell volume, red blood cell count, and haemoglobin (34.00, 11.30, 2.90, respectively), whereas 300 ml/4L had the highest WBC (16.50). With the exception of total cholesterol, *Lagenaria breviflora* also showed a significant ( $P < 0.05$ ) impact on all blood serum parameters. and aspartate transferase. The results of the study showed that *Lagenaria breviflora* in concentrations of 100 to 300 ml per 4 l of water had no negative or harmful effects on the haematological parameters and serum biochemistry of broiler chickens.

Keywords: *Lagenaria breviflora*, broiler chicken, haematology, serum biochemistry

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### Introduction

Poultry farming is popular among people all over the world, and it is a fantastic source of amino acids particularly for disadvantaged rural populations, it requires little capital, labour, or land. Poultry birds are the best at turning food into meat and egg protein (Abanikannda *et al.*, 2007). The chicken business is rapidly expanding in Africa specifically in Nigeria, and it plays a significant economical role and health benefit to its people (Awobajo *et al.*, 2009). The poultry industry in Nigeria is the most vibrant and fastest-expanding livestock agriculture, with over 180 million birds (FAOSTAT, 2017). With a population of 180 million chickens, Nigeria produced 45 000 metric tonnes of chicken meat in 2016. The increasing grill population, which produced enough meat per bird,

contributed to adequate progress (Adeyonu *et al.*, 2021). The inclusion of superficial and early-stage producers in the value chain might result from industry expansion. Chicken meat is a highly nutritious food because it includes all the crucial amino acids that the body cannot produce on its own but must be obtained through diet. It also contains fatty acids and micronutrients like vitamins and minerals, particularly selenium, iodine, phosphorous, iron, potassium, and zinc. The micronutrients in poultry meat support healthy bones and skin, as well as the development, maintenance, and repair of bodily tissues (Atteh, 2002). They also aid in digestion and metabolism. Antibiotics were commonly utilized as therapeutic and prophylactic dosages in broiler diets to improve or raise the birds' performance (Kim *et al.*, 2008). In total confinement poultry production,

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research since 1946 has demonstrated that the synthesis of antimicrobial growth promoters boosts feed productivity (Peterolli et al., 2012). Antibiotics can produce drug resistance bacteria and antibiotic residual effects in chicken feed as a growth stimulator also functions for the sustainability of health (Wray and Davies, 2000). The European Union placed an embargo on the use of all synthetic growth booster (antibiotics) in poultry in 2006. This ban has resulted in a surge in the hunt for alternative growth promoters. One major phyto-genic plant that has been underutilized in poultry production is *Lageneria breviflora*. This phyto-genic plant is commonly grown in the tropics especially in Africa (Morimoto et al., 2004).and is common in the western part of Nigeria. Its traditionally novel for its prevention of viral diseases in humans such as measles, chicken pox in humans, smallpox, and New Castle disease in poultry (Oridupa & Saba 2013; Arowosegbe et al. 2015).

Researchers (Oridupa et al. 2011; Tomori et al. 2007) reported that *Lageneria breviflora* fruit is widely used in traditional medicine due to its numerous benefits such as anti-inflammatory, anti-oxidant, anti-parasite, also serve as hepatoprotective (Onasanwo et al. 2010; Saba et al. 2012).

Haematological indices of an animal serve as a pointer to its physiological state (Khan & Zafar, 2005). Most clinical investigations and nutritional indices of an animal are carried out using its blood (Aderemi, 2004). However, the physiological state of an animal determines the volume and constituent of its blood, this includes infection, stress, toxicity, and reproductive state Khan & Zafar, 2005). Hence this investigation was done to evaluate the response of broiler chicken serum biochemistry and haematology to *Lageneria breviflora* extract.

## Materials and Methods

### Experimental Field

This study was conducted at The Federal Polytechnic Ilaro Teaching and Research Farm in Ogun State, which has roughly 46,999 residents, and is situated between latitude 6.8954N and longitude 3.0126E at an altitude of 68m above ocean level. The average temperature is between 23.8<sup>o</sup>C and 34.2<sup>o</sup>C, with 34.2<sup>o</sup>C being the highest and 23.8<sup>o</sup>C being the lowest.

### Preparation of *Lageneria breviflora* Extract

*Lageneria breviflora* was purchased from a local market (Sayedero market in Ilaro). A total number of 15kg of *Lageneria breviflora* was used for the extract. The melons (*Lageneria breviflora*) were thoroughly washed to remove all dirt and then peeled to expose the mericarp. The peeled melons were then sliced into bits to aid fermentation. After slicing, the melons were stored in a sealable container, and water was added in a ratio of 1:2 (i.e. 15kg of *Lageneria breviflora* to 30kg of water). The container was then covered with a lid and placed in a dark place to allow fermentation process for seven days. After seven days, the mixture was then strained to extract the fermented liquid. The liquid portion (*Lageneria breviflora* extract) was refrigerated to preserve for subsequent use.

### Experimental Birds and Their Management

A hundred and fifty (150) newly hatched broiler chicks were purchased from a reputable hatchery in Ibadan, Oyo State. Before the arrival of the birds, the pens were thoroughly disinfected against existing diseases on the farm. On arrival, all the routine managements were stuck to. The experiment lasted for a total of 35 days.

### Administration of *Lageneria breviflora* Extract

The *Lageneria breviflora* extract was administered into 4L of water for the chickens every morning for six weeks. This experiment consists of five treatments. **T1** (positive control) the birds on this treatment were adequately vaccinated as at when due; **T2** (negative control) birds on this treatment did not receive vaccination nor *Lageneria breviflora* extract, **T3** had 100 mls/4 liters of *Lageneria breviflora* extract in their drinking water, **T4** consist of 200 mls/ 4 litres of water *Lageneria breviflora* extract and **T5** consist of 300 mls/ 4 litres of water *Lageneria breviflora* extract respectively. Each treatment consists of 3 replicates with 10 birds per replicate. Feed was administered *ad libitum* to the birds.

### Determination of Haematological Parameters

At the start of the experiment and on the 35<sup>th</sup> day, two (2) broiler birds were selected arbitrarily from each replicate for haematological analysis; for each bird, the wing web vein piercing procedure was used to collect 2 ml of blood (initial) and neck decapitation (final) for determination of haematological indices.

Blood samples for haematology were collected into bottles containing Ethylene Diamine Tetra-Acetic acid (EDTA). Parameters that were evaluated include: packed cell volume (PCV), red blood corpuscles (RBC), white blood cells (WBC), differential counts (lymphocyte, heterophil, eosinophil, basophil, and monocyte), and heterophils lymphocyte ratio was also calculated.

#### Procedure for white Blood Cell and its differential counts' determination

Using a Neubauer haemocytometer counting chamber, an estimate of the aggregate number of WBC was made on blood samples taken from experimental birds (Jain, 1986). A pipette was used to extract 0.2 ml of blood from the samples, which was then combined

with 4 ml of WBC dilution fluid (WBC fluid is composed of 3% acetic acid in water and 1% gentian violet). The white blood cells were counted and expressed as 10<sup>9</sup> WBC per litre of blood after being placed into the hemocytometer. Making blood films, letting them air dry, and then staining them with Wright stain helped detect the differential counts. Ritchie et al. (1994)'s normal avian procedures were used to perform the WBC counts. Calculated heterophil/lymphocyte ratios.

#### Statistical Analysis

Using SAS (1993), the acquired data were subjected to a one-way analysis of variance (ANOVA), and the Duncan multiple range test was used to distinguish between means.

## Results

Table 1: Effect of *Lageneria breviflora* extract on Haematology of broiler production at 7 days post- hatch.

Treatment	T1	T2	T3	T4	T5	SEM
Pack cell volume	33.00	21.00	34.50	22.00	23.50	53.40
Red blood cell	2.80	1.80	2.90	1.85	1.95	0.37
Haemoglobin	11.40	7.20	11.55	7.40	7.85	6.11
White blood cell	14.20 <sup>a</sup>	10.40 <sup>b</sup>	12.70 <sup>ab</sup>	11.20 <sup>ab</sup>	11.80 <sup>ab</sup>	1.55
Basophil	0.00 <sup>b</sup>	0.00 <sup>b</sup>	0.00 <sup>b</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	0.00
Eosinophil	0.00	0.00	0.50	0.50	0.50	0.30
Heterophil	29.00	32.00	30.50	29.00	29.00	2.90
Lymphocyte	70.00	67.00	69.00	68.50	71.00	3.30
Monocyte	1.00 <sup>a</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	1.00 <sup>a</sup>	0.50 <sup>ab</sup>	0.10
Mean corpuscular volume	117.90 <sup>ab</sup>	116.70 <sup>b</sup>	118.95 <sup>ab</sup>	118.90 <sup>ab</sup>	120.70 <sup>a</sup>	2.13
Mean corpuscular Haemoglobin	40.70	40.00	39.75	39.95	40.35	0.19
Mean Corpuscular Haemoglobin Concentration	34.50 <sup>a</sup>	34.30 <sup>a</sup>	33.40 <sup>b</sup>	33.65 <sup>b</sup>	33.40 <sup>b</sup>	0.02

<sup>a,ab,b</sup>: Means on the same column having different superscripts are significantly ( $p < 0.05$ ) different

Table 1 displays the effect of *Lageneria breviflora* extract on the haematology of broiler production at 7 days after hatch. The administration of *Lageneria breviflora* extract was found to have a significant ( $P < 0.05$ ) impact on the WBC, Basophil, Monocyte, MCV, and MCH. The greatest significant ( $P < 0.05$ )

values for WBC, Monocytes, and MCHC, respectively, were seen in the T1 control group, which includes the vaccine group (14.20; 1.00, 34.50). Meanwhile, birds on 200 mls (1.00) and 300 mls (120.70) each provided the greatest significant value for basophil and MCV.

Table 2: Effect of *Lageneria breviflora* extract on Haematology of broiler chicken at 35 days post-hatch

Treatment	T1	T2	T3	T4	T5	SEM
Pack cell volume	24.00 <sup>c</sup>	31.00 <sup>c</sup>	34.00 <sup>a</sup>	32.00 <sup>b</sup>	30.00 <sup>d</sup>	28.40
Red blood cell	8.10 <sup>c</sup>	10.70 <sup>c</sup>	11.30 <sup>a</sup>	10.80 <sup>b</sup>	10.10 <sup>d</sup>	0.23
Haemoglobin	2.00 <sup>d</sup>	2.70 <sup>b</sup>	2.90 <sup>a</sup>	2.70 <sup>b</sup>	2.50 <sup>c</sup>	3.12
White blood cell	15.00 <sup>b</sup>	12.90 <sup>d</sup>	11.30 <sup>e</sup>	13.20 <sup>c</sup>	16.50 <sup>d</sup>	8.07
Basophil	25.00 <sup>d</sup>	30.00 <sup>a</sup>	26.00 <sup>c</sup>	25.00 <sup>d</sup>	28.00 <sup>b</sup>	0.00
Eosinophil	72.00 <sup>b</sup>	66.00 <sup>d</sup>	74.00 <sup>a</sup>	72.00 <sup>b</sup>	71.00 <sup>c</sup>	0.00
Heterophil	1.00 <sup>a</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	0.00
Lymphocyte	1.00 <sup>a</sup>	0.00 <sup>b</sup>	0.00 <sup>b</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	0.00
Monocyte	1.00 <sup>a</sup>	1.00 <sup>a</sup>	0.00 <sup>b</sup>	1.00 <sup>a</sup>	1.00 <sup>a</sup>	0.00
Mean corpuscular volume	120.0 <sup>a</sup>	118.5 <sup>b</sup>	117.2 <sup>c</sup>	118.5 <sup>b</sup>	120.0 <sup>a</sup>	2.80
Mean corpuscular Haemoglobin	40.50	39.60	39.00	40.00	40.40	0.76
Mean Corpuscular Haemoglobin Concentration	33.80	33.40	33.20	33.80	33.70	0.14

a,b,c,d,e: Means on the same column having different superscripts are significantly ( $p < 0.05$ ) different

In Table 2 all Parameters measured were observed to be significantly ( $p < 0.05$ ) influenced by the administration of *Lageneria breviflora* extract. Higher values for PCV, RBC, haemoglobin, and Eosinophil (34.00; 11.30; 2.90, and 74.00) were obtained in birds in T1 (100 mls), while T3 (300 mls) recorded the

highest WBC (16.50), -ve control group recorded the highest value for basophil (30.00) and the least monocyte was observed with T3 (0.00). The positive control group recorded the highest MCH and MCHC (40.50 and 33.80) respectively.

Table 3: Effect of *Lageneria breviflora* extract on Serum biochemistry of broiler chicken at 7 days post hatch

Treatment	T1	T2	T3	T4	T5	SEM
Total protein	4.10 <sup>c</sup>	7.50 <sup>a</sup>	5.15 <sup>bc</sup>	6.20 <sup>ab</sup>	5.40 <sup>bc</sup>	0.52
Albumin	2.90 <sup>b</sup>	3.80 <sup>a</sup>	3.05 <sup>b</sup>	3.25 <sup>ab</sup>	2.95 <sup>b</sup>	0.05
Globulin	1.20 <sup>c</sup>	3.70 <sup>a</sup>	2.10 <sup>bc</sup>	3.00 <sup>ab</sup>	2.45 <sup>abc</sup>	0.27
Total Cholesterol	86.40	105.40	103.20	84.85	100.60	251.00
Aspartate Transferase (U/L)	84.00	132.00	97.50	86.50	151.50	121.90
Alanine Transferase (U/L)	22.00 <sup>c</sup>	47.00 <sup>a</sup>	29.50 <sup>bc</sup>	38.00 <sup>ab</sup>	31.50 <sup>bc</sup>	63.40
Alkaline phosphatase (U/L)	16.00 <sup>d</sup>	23.00 <sup>ab</sup>	18.50 <sup>c</sup>	20.00 <sup>b</sup>	28.50 <sup>a</sup>	31.40

a,ab,abc,b,bc,c,d: Means on the same column having different superscripts are significantly ( $p < 0.05$ ) different

Table 3 shows the effect of *Lageneria breviflora* extracts on broiler chicken serum biochemistry at 7 days after hatching. The administration of *Lageneria*

*breviflora* extract was found to substantially ( $p < 0.05$ ) affect total protein, albumin, globulin, total cholesterol, and alanine transferase (U/L). The most

significant ( $p < 0.05$ ) values for total protein, albumin, globulin, total cholesterol, and alanine transferase were obtained by the T2 (-ve control) group (7.50, 3.80, 3.70, 105.40, and 47.00, respectively). While

this was happening, birds of T5 (300 mls) had the highest significant values for aspartate transferase and alkaline phosphatase (151.50 and 28.50, respectively).

Table 4: Effect of *Lageneria brevivflora* extract on Serum biochemistry of broiler chicken at 7 days post hatch

Treatment	T1	T2	T3	T4	T5	SEM
Total protein	6.20 <sup>a</sup>	6.10 <sup>b</sup>	5.10 <sup>e</sup>	5.40 <sup>d</sup>	5.60 <sup>c</sup>	0.57
Albumin	3.10 <sup>d</sup>	3.50 <sup>c</sup>	3.60 <sup>b</sup>	4.00 <sup>a</sup>	3.50 <sup>c</sup>	0.09
Globulin	3.10 <sup>a</sup>	2.50 <sup>b</sup>	1.50 <sup>d</sup>	1.40 <sup>e</sup>	2.10 <sup>c</sup>	0.45
Aspartate Transferase (U/L)	114.0 <sup>e</sup>	137.0 <sup>a</sup>	133.0 <sup>c</sup>	120.0 <sup>d</sup>	135.0 <sup>b</sup>	179.00
Alanine Transferase (U/L)	21.00 <sup>a</sup>	15.00 <sup>b</sup>	13.00 <sup>d</sup>	15.00 <sup>b</sup>	14.00 <sup>c</sup>	101.90
Alkaline phosphatase (U/L)	31.00 <sup>a</sup>	30.00 <sup>b</sup>	25.00 <sup>e</sup>	27.00 <sup>d</sup>	28.00 <sup>c</sup>	43.40
CHOL	152.80 <sup>c</sup>	114.90 <sup>e</sup>	164.60 <sup>a</sup>	139.10 <sup>d</sup>	158.40 <sup>b</sup>	51.40

a,b,c,d,e: Means on the same column having different superscripts are significantly ( $p < 0.05$ ) different

Table 4 shows the effect of *Lageneria brevivflora* extracts on Serum biochemistry of broiler chicken at 7 days post hatch. Total protein, Globulin, Alanine transferase, and Alkaline phosphate was observed to be significantly ( $p < 0.05$ ) influenced by the administration of *Lageneria brevivflora* extract. The T1 (+ve) control group recorded the highest significant ( $p < 0.05$ ) values for total protein, globulin, alanine transferase, and alkaline phosphate respectively (6.20, 3.10, 21.00, 31.00). Meanwhile, the highest significant value for albumin was obtained from birds on T4 (200 mls) to be (4.00), while aspartate transferase was obtained from birds on T2 (-ve) control and cholesterol also has the highest value on birds of T3 (100mls) to be (164.60) respectively

### Discussion

Blood parameter analysis has been proven clinically to be important in evaluating the health state of all livestock. It serves as a baseline in evaluating animal response to any therapy administered and also evaluates any damage done to blood cells (Nworgu et al., 2018). According to Ross et al., (1978) and Onyeli et al., (1991) Normal blood parameters for all species of animals are influenced by sex, age, nutrition,

strain/specie of animal, and climate. It is also used as a means of assessing the quality of feed ingredients administered to farm animals. In this study, the white blood cell of broiler birds were observed to be higher with birds administered vaccine while the broilers without vaccines recorded the least level of white blood cells, at 7 days post-hatch this result could be a result of the introduction of vaccines into the system of the birds which could invariably trigger the white blood cells which serves as the bod soldiers of the birds. At 35 days post-hatch, PCV, RBC, HB, and Eosinophil were observed to be higher with birds administered 100mls/ 4 litres of water of *Lageneria brevivflora* this result corroborates the discovery of Ekunseitan et al. (2017) as well as Nworgu et al., (2018), who reported a significance in the pack cell volume, red blood cells and haemoglobin of birds administered *Lageneria brevivflora*. The observed increase can be as a reaction to the stimulatory effect of the erythropoietic system, *Lageneria brevivflora* has been reported to have the therapeutic and haematic ability in curing anemia (Adamson and Longo 2001). The significance observed in the WBC counts revealed the influence of *Lageneria brevivflora* on its differential. Birds administered 300mls *Lageneria*

*breviflora* had the highest value for WBC, this could be an indication of resistance or fighting the invasion of pathogens. This is similar to the findings of Ekunseitan et al., (2017) who observed a significance in the WBC count of birds administered the same *Lagenaria breviflora*.

Blood protein secretion is thought to be controlled by the liver. It is impossible to overstate the importance of blood proteins in chicken since they are a crucial metric for assessing health and provide a foundation for general biochemistry, which enables the detection of metabolic changes (Tóthová et al., 2019). In addition to maintaining the amount of blood in the system through the colloidal osmotic effect, balancing blood pH, transporting hormones and medications, functioning in cell coagulation, catalysing chemical reactions (via enzymes), regulating metabolism (via hormones), and supporting the body's defense against foreign invaders, blood protein is also thought to be in charge of these additional functions, according to Melillo (2013). In this study, all serum biochemistry parameters measured at 7 days post hatch were observed to be significantly different with the negative control, i.e. birds with neither vaccines nor *Lagenaria breviflora* recording the highest values. However, at 35 days, blood protein, globulin, ALT, and ALP were observed to be higher with birds given vaccines while the least of these parameters was observed with birds 100mls/4l of *Lagenaria breviflora*. This result corresponds with the research of Nworgu et al., (2018), who outlined the ALT and ALP of broiler birds administered fermented *Lagenaria breviflora* to range between 35.00-40.00 and 192.00-231.00iu/L, respectively.

## Conclusion

Compared to the other treatments, the birds given 100ml of *Lagenaria breviflora* had greater levels of haemoglobin and cholesterol, but their levels of WBC were the lowest. The grill chicken's haematological and serum biochemical parameters after receiving 100 to 300 ml of *Lagenaria breviflora* were not toxic or detrimental.

## References

Abanikannda, O. Olutogun, A. Leigh O. & Ajayi L.A. (2007). Statistical Modelling of Egg Weight and Egg Dimensions in

Commercial Layers. *International Journal of Poultry Science* 6 (1): 59-63 DOI: 10.3923/ijps.2007.211.217

Adamson, J.W., & Longo, D.L. (2001). Anemia and polycythemia. Pages 348–354 in E. Braunwald, A.S. Fauci, D.L. Kasper, S.L. Hauser, D.L. Longo, and J.L. Jameson, eds. *Harrison's principles of internal medicine*. 15th ed. McGraw-Hill, New York, NY.

Aderemi, F.A. (2004). Effect of replacement of wheat bran with cassava root sieviate supplement or unsupplemented with enzymes on the haematology and serum biochemistry of pullet chicks. *Tropical Journal of Animal Science*. 7:147-153.

Adeyonu A, Ajiboye B, Visitor S, & Faseyi S. (2017). An analysis of the factors influencing access to credit by poultry farmers in Abuja Nigeria. *Agriculturae Conspectus Scientificus* 82 (1):55

Atteh, J. O. (2002). Principles and Practice of Livestock Feed Manufacturing. Adlek printers, Ilorin 137.

Arowosegbe, S., Olanipekun, M.K. and Kayode, J. (2015). Ethnobotanical survey of medicinal plants used for the treatment of diabetes mellitus in Ekiti South Senatorial district, Nigeria. *European Journal of Botany, Plant Sciences and Phytology* 2: 1-8.

Awobajo, O.K., Grace, O., Mako, A.A., Igboesan, A.O. and Ettu, R.O. (2009). Mortality Rate at the Brooding Stage of Various Broiler Breeds Reared in Sub Sahara Region of West Africa. *International Journal of Poultry Science* 8 (8): 792-797, 2009.

Ekunseitan, D.A., Abiola, S.S., Oluwatosin, O.O., Sogunle, O.M., Adeleye, O.O. Egbeyale, L.T. and Iyasere (2017). Health status of laying birds administered extracts of *Lagenaria breviflora* managed under two housing systems. *Canadian Journal of Animal Science* (97): 154-164.



- FAO/STAT. Food and Agricultural Organization of the United Nations; (2017). [Cited 2023 June]. Available from: <http://www.fao.org/statistics/en/>
- Khan, T.A. and Zafar, F. (2005). Haematological study in response to varying doses of estrogen broiler chicken. *International Journal of Poultry Science* 4(10): 748-751.
- Kim, S.W., Fan, M.Z., and Applegate, T.J. (2008). Non-ruminant nutrition symposium on natural phytobiotics for the health of young animals and poultry: Mechanisms and application. *Journal of Animal Science*. 86, E138–139.
- Melillo A. (2013). Applications of serum protein electrophoresis in exotic pet medicine. *Veterinary Clinics of North America Exotic Animal Practice*; 16 (1):211-225.
- Morimoto Y., Maudu P. and Fujimaki H. (2005). Diversify of landrace of the white flowered ground (*Lagenarias, ceraria*) and its wildlife in Kenya: fruit and seed morphology. *Genet Res Evol.*, 53:737-747.
- Nworgu, F.C., Oladipo, T.A., Nwufoh, O.C., Adeoye, Y.D., Adebayo, M.D., Ajayi, J.O. (2018). Effect of Fermented *Lagenaria* (*Adenopus breviflorus*) Fruit Extract on the Haematological and Serum Biochemical Indices of Broiler Chickens. *Journal of Biology, Agriculture and Healthcare* ISSN 2224- 3208 (Paper) ISSN 2225-093X (Online). Vol.8, No.22, 2018
- Oridupa O.A., Saba A.B. Sulaiman L.K. (2011). Preliminary report on the anti-viral activity of the ethionic fruit extract of *lagenaira breviflora* Roberts on new castle disease virus. *Tropical Veterinarian* 29 (1):22-33
- Onasanwo, S.A., Singh, N., Saba, A.B., Oyagbemi, A.A., Oridupa, A.O. & Palit, G. (2010). Anti-ulcerogenic and in vitro antioxidant of *Lagenaria breviflora* (LB) whole fruit ethanolic extract in laboratory animals. *Pharmacognosy Research* 3: 2-8.
- Onyeyili, P.A., Egura, G.O., Jibike, G.I., Pepple, D.J. & Chaegbulam, J.O. (1991). Seasonal variations as haematological indices in the grey-breasted Guinea fowls (*Numida meleagris* Gallata palla). *Nigerian Journal of Animal Production* 18 (2): 108-111.
- Osman, Z.M., Gomaa, A.M., Hussein, H.M., Soliman, F.H. & El-Shobaki, A.F. (2004). Association between retinol metabolism and diabetic retinopathy. *Polish Journal of Food and Nutrition* 2004; 13:54.
- Peterolli, T. G., Albino, L. F. T., Rostango, H .S. , Gomez, P. C. , Tavernari, F. de C.& Balbino, E. M. (2012). Herbal extracts in diets for broilers. *Revista Brasileira de Zootecnica* 41 (7):1683-1690
- Ross, J.G., Christien, C., Helliday, W.G. & Jorus, R.M. (1978). Haematological and blood chemistry. Comparison value for clinical pathology in *Poultry Veterinary record* 102:29-31.
- Tomori, O.A., Saba, A.B. & Dada-Adegbola, H.O. (2007). Antibacterial activity of ethanolic extract of whole fruit of *Lagenaria breviflora* Roberts. *Journal of Animal Veterinary Advances* 6:752 – 757
- Tóthová, C., Sesztáková, E., Bielik, B. & Nagy, O. (2019). Changes of total protein and protein fractions in broiler chickens during the fattening period. *Veterinary World*, 12, 598–604. [CrossRef] [PubMed]
- Wray, C. & Davies, R.H. (2000). Competitive exclusion - An alternative to antibiotics. *Veterinary Journal*, 59:107-108.