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Response of Growing Guinea Fowls Fed Diets Containing Different Dietary Protein Sources and Effect on Age at First Lay

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Abstract
The study examined the effect of different dietary protein sources on growth performance, nutrient digestibility, haematology, serum biochemistry and age at first lay on guinea fowl.A total of 40 growing guinea fowls were use to evaluate the effects of different dietary protein sources on performance and blood profile. The birds were grouped into four dietary treatments of 10 birds and 2 replicates of 5 birds with varying combinations of protein sources: groundnut cake (GNC), soya bean meal (SBM), and fish meal (FM), were used to formulate diets to provide equal crude protein levels (18–22%) and 2800 kcal/kg of energy. Four experimental diets (T_1, T_2, T_3, and T_4) were compounded to contain different dietary protein sources and fixed energy source (i.e., maize), with Treatment 1 serving as the control, combining all three (3) protein sources (Fish meal, Groundnut cake and Soyabean meal), Treatments 2-4 contained only two different protein sources each. Data were collected on growth performance, nutrient digestibility, haematology, serum and age at first lay; they were analyzed using one – way analysis of variance (ANOVA). The highest ($p<0.05$) total feed intake (1395.67g) was recorded with bird fed combining all three (3) protein sources (Fish meal, Groundnut cake and Soya bean meal), while bird fed with diet containing Groundnut Cake and Fish Meal recorded the lowest intake (1377.40g). The best FCR (3.17) observed in the birds placed on GNC and fish meal, while the poorest value (4.87) was recorded in birds placed on SBM and GNC. The highest ($p<0.05$) percentage crude protein (56.08%) was observed in birds fed with GNC and SBM while birds placed on GNC and Fish meal based diet recorded the lowest value (52.28%). Highest ($p<0.05$) Packed Cell Volume (47.00%) was recorded with the birds fed diet containing GNC and FM while the birds placed on SBM and FM had the lowest value of 34.00. The highest ($P<0.05$) white Blood cell (173.00) was recorded in the birds placed on the three test ingredients GNC, SBM and FM has while birds placed on GNC and SBM has the least value of 124.00. The highest ($p<0. 05$) age at first lay (188. 0000) recorded in the diet containing GNC and SBM while diet containing all the three test ingredients (GNC, SBM and Fish Meal) had the lowest value of (154. 6000). The research concluded that different combination of dietary protein sources influenced feed intake and growth parameters, improve egg production as well as potentially preserving and enhancing the health of the birds.

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Introduction

Guinea fowls are exciting birds that have been bred for centuries. They are very resistant to most diseases that affect chickens and have low production costs (Ebegbulem, 2018) [4]. Recently, the demand for guinea fowl meat has increased (Sarica *et al.*, 2019). Guinea fowl meat is white like chicken meat, drier, and regarded as very lean but in terms of size at maturity is far lower to chicken as reported by (Okanlawon *et al.*, 2025 and Rafiu *et al.* 2025) [14, 18]. It may be considered a high-quality protein

source due to being rich in vitamins and containing fewer cholesterol and fats (ICAR, 2021). Guinea fowls reach 1.4 to 2.1 kg of body weight in 65-91 days because of their higher adaptable, which means muscles and organs grow in harmony, and they have excellent meat quality regardless of various environmental conditions.

Guinea fowl appears to be a promising poultry meat source but its production strength under most common extensive or semi-intensive impair the potential (Rafiu *et al.* 2021) [17]. They have marginally more protein than chicken or turkey. Their eggs are delicious and considerably better than those of chickens but in terms of egg weight is lesser when compare to chicken egg as reported by (Olayeni *et al.*, 2024). Guinea fowl eggs are noteworthy for their thick shell, a high proportion of yolk (Alkan *et al*., 2013), high content of vitamins and trace elements (Bashir *et al*., 2015) [2], and longer shelf life, in comparison to chicken eggs, and it has premium prices compared with commercial chickens and indigenous chickens (Dafwang, 2004) [3]. Chicken eggs have been exceptionally well studied for egg quality and composition, as well as meat quality. However, such information isn't sufficiently documented in other poultry species. Despite interest in guinea fowl production, it is vital to take cognizance of the fact that there is a shortage of information on the production and quality of guinea fowl products in contrast to commercial chickens.

Protein quality and quantity directly impact feed efficiency, the ability of the poultry to convert feed into body mass or eggs. Imbalances in protein levels can result in poor feed conversion ratios (FCR), affecting the economic efficiency of poultry production (Khan *et al.*, 2017). Protein is also essential for the synthesis of antibodies, cytokines, and other immune system components, thus influencing the bird's ability to respond to pathogens. A well-balanced protein diet can enhance disease resistance in poultry (Latif *et al* 2019). In laying guinea fowl, protein is vital for egg production and quality. Adequate protein intake ensures the synthesis of egg components, particularly albumin (egg white) and yolk, as well as the structural integrity of the eggshell. Insufficient protein can lead to reduced egg production, smaller egg sizes, and poorer hatchability (Tiwari *et al.*2019).

GNC (Groundnut Cake), SBM (Soybean Meal), and fish meal are commonly used as protein sources in animal feeds, each providing essential amino-acid for growth and development. Soybean meal (SBM) is a highly digestible plant-based protein that is rich in essential amino acids, making it a preferred choice for poultry and other livestock. It is widely used due to its high protein content and balanced amino acid profile. Fish meal, on the other hand, is an animal-based protein known for its excellent digestibility and high levels of omega-3 fatty acids, which promote growth and health in animals. Groundnut cake (GNC), a by-product of oil extraction from groundnuts, is another plant-based protein that is rich in protein, though it has a lower amino acid balance compared to SBM. These protein sources, when included in the diets of guinea fowl, can influence growth performance, feed conversion, and overall health, making them valuable components in poultry nutrition.

Materials and methods

Experimental site

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology Ogbomoso, Oyo State, Nigeria.

The area is located between latitude $8^0$07'N and 8^0 12'N and Longitude $4^0$04'E and $4^0$15'E. The latitude ranges from 300m and 600m above sea level while mean temperature and annual rainfall are 27^0C and 1247mm (Google Earth Map, 2022).

Test Ingredients

The test ingredients used were Groundnut Cake, Soyabean meal and Fish meal. The processed test Ingredients were purchased from a reputable feed mill.

Experimental animals and treatments

A total of 40 growing guinea fowl were used for the experiment. They were weighed, uniformly allocated to 4 dietary treatments, each containing 10 birds, and then further divided into two replicates, each including 5 birds, in a complete randomized design. T1 fed on the 3 protein sources and was tagged control treatment, T2 fed with GNC and FM, T3 fed diet contained SBM and FM and T4 contained GNC and SBM. Data on growth performance, nutrient digestibility, heamatology, serum biochemistry and age at first lay were collected. Before the arrival of the birds, the pen was cleaned, covered with insulated materials and fumigated with formalin. On arrival of the birds, they were fed a diet and water mixed with vitamins and glucose to reduce transportation stress and the pen was provided with electric bulb for lighting at all times. The experiment lasted for twelve (12) weeks.

Data collection and evaluation

Feed intake

Feed intake was recorded every week and calculated as;

Feed intake (g) = Quantity supplied (g) – leftover feed (g)

Weight gain

The difference between the initial body weight and final body weight was used to calculate weight gain (sensitive scale was used)

Average total weight gain = Final weight – initial weight.

Feed conversion ratio (FCR)

This was calculated as the ratio of the average feed intake to the average body weight gain.

$$FCR = \frac{\text{Feed intake}}{\text{Weight gain.}}$$

Nutrient digestibility

At 21 weeks of age, the birds were placed in a battery cage according to their experimental diet so as to ease collection of their feacal sample for apparent digestibility. The feacal samples were collected for five days after three days acclimatization. The collected feacal were oven dried at 70^0C for 24hours, then pulled together before sub samples were taken for proximate analysis.

The result obtained together with proximate analysis of the diet, total quantity of feacal voided and the amount of feed consumed were used for nutrient analysis.

Blood analysis

Two birds were randomly selected in each treatment. About 2.5 mL of blood were collected in tubes containing EDTA anticoagulant to determine the value of haematology concentration, packed cell volume, red blood cells count, total white blood cells count, platelets cunt as described by (iranloye *et al*., 2006). The blood was slowly expressed into EDTA tubes to reduce the risk of haemolysis after removing the needles from syringes.

Serum parameters

These include total protein, which was obtained by biuret method in the assay as described by Kohn and Allen (1995) [9]. The globulin concentration was obtained by subtracting albumin from the total protein. Albumin was determined using Bromocresol Green (BCG) method as described by Peter *et al*., (1982) [16]. Aspartate transferase (AST) activities were determined using spectrophotometric methods as described by Rej & Hoder (1983) [19]. Alanine transferase (ALT) activities were determined using spectrophotometric methods as described by Rej and Hoder (1983). Serum urea was determined using a kit (Quinica clinical spam) having a linear measurement of about 566.6 ml per litre of urea concentration. The serum urea will be determined calorimetrically. The serum cholesterol was determined using enzymatic endpoint method as described by Roeschlau *et al*., (1974) [20].

Age at first lay

The age at first lay of the birds was recorded on the day the guinea fowl laid their first egg for each treatment. Egg weight was determine using the sensitive weighing scale. The egg samples were weighed individually and the average weight was estimated.

Statistical analysis

All data collected were analysed using ANOVA as contained in SPSS (2010). Significant means were separated using *Duncan* Multiple Range Test of the same software package.

Results and Discussions

Growth Performance of Growing Guinea Fowl

Table 1 shows the growth performance of growing guinea fowl fed with different dietary protein sources. Significant ($p<0.05$) difference was recorded on total feed intake and feed conversion ratio. Significantly highest ($p<0.05$) total feed intake (1395.67g) was recorded with bird fed combining all three (3) protein sources (Fish meal, Groundnut cake and Soya bean meal), while bird fed with diet containing Groundnut Cake and Fish Meal recorded the lowest intake (1377.40g). However, best ($p<0.05$) FCR (3.17) observed in the birds placed on GNC and fish meal, while the poorest value (4.87) was recorded in birds placed on SBM and GNC. The result for growth performance indicated that combination of protein source and proper balance play an important role in productivity in term of feed intake, weight gain and feed conversion ratio of growing guinea fowl. Birds in treatment 1 and treatment 2 had the best growth outcomes, while birds in treatment 2 consistently recorded the lowest values for weight gain and FCR. This agrees with the findings of Olugbemi and Farinu (2018) [15], who reported that combining soyabean meal with fish meal supports higher growth and carcass yield in guinea fowl compared to single protein sources. Soyabean meal provides high lysine content (~2.8–3.0%), while fish meal is rich in methionine (~1.5–1.8%) and lysine (~4.5–5.0%), creating a complementary nutrient profile that supports lean tissue growth. The poorest performance in T4 suggests that although fish meal contributes high-quality amino acids, partial replacement of soyabean meal with groundnut cake without careful balancing may result in lysine limitation, as groundnut cake contains relatively low lysine (~1.3%) (Esonu and Udedibie,2017) [7]. This deficiency could have contributed to reduced protein synthesis efficiency and slower growth. Feed conversion ratio (FCR) was much better in treatment 2 compared to treatment 4, indicating more efficient feed utilization when groundnut cake and fish meal were combined. This agrees with Ukachukwu (2005) [23], who found that strategic inclusion of both plant and animal protein sources improves nitrogen retention and FCR in guinea fowl.

Table 1: Performance of growing Guinea Fowl fed different dietary protein sources.

Parameters	T_1	T_2	T_3	T_4	SEM(+-)
Final weight(kg)	1.92	1.83	1.82	1.68	0.057
Total weight gain(g)	448.00	452.80	429.60	329.60	23.603
Total feed intake(g)	1395.67^{a}	1377.40^{d}	1395.13^{b}	1387.00^{c}	1.189
Feed conversion ratio	3.54^{ab}	3.17^{b}	3.80^{ab}	4.87^{a}	0.239

^{abcd} means on the same row with different superscripts differ significantly ($p<0.05$)

T_1=SoyaBean Meal (SBM) + Groundnut Cake (GNC) + Fish Meal (FM), T_2= Groundnut Cake (GNC) + Fish Meal (FM), T_3= SoyaBean Meal (SBM) + Fish Meal (FM), T_4= SoyaBean Meal (SBM) + Groundnut Cake (GNC)

Nutrient Digestibility of Growing Guinea Fowl

Table 2 shows the nutrient digestibility of growing guinea fowl fed with different dietary protein sources. There was significant ($p<0.05$) different across the parameters measured.

The highest (p0.05) percentage crude protein (56.08%) was observed in birds fed with GNC and SBM while birds placed on GNC and Fish meal-based diet recorded the lowest value (52.28%). The highest ($p<0.05$) crude fibre (80.18%) was recorded in diet containing GNC and FM while birds fed with SBM and GNC showing the lowest value of 72.69%. The highest value (44.15%) of percentage Ether extract was recorded in birds fed with

diet contained GNC and FM, while the lowest value (38.15%) recorded in birds placed on SBM and GNC. The highest ($p<0.05$) value (74.25%) of percentage moisture content was recorded in birds fed with diet contained SBM and FM while birds fed with GNC and FM recorded the lowest value of 69.45%. The highest ($p<0.05$) percentage of ash significant (33.74%) was recorded on birds placed on SBM and FM while the birds fed with the 3 combinations had the lowest value of 31.26%. The percentage Nitrogen-free extract (NFE) was high (92.25%) in birds fed diet contained SBM and GNC while the least value (87.98%) was observed in diet contained SBM, GNC and FM. and intermediate values in T2 (91.22%) and T3 (91.21%). The highest value (76.25%) of percentage Metabolizable energy was recorded in birds fed with SBM and GNC while the lowest value (72.98%) was observed in birds placed on GNC and FM. The highest gross energy (kcal/kg) was recorded (2886.42 kcal/kg) in the birds placed on GNC and FM while birds fed with SBM and GNC having the lowest value of 2866.18 kcal/kg.

Digestibility results further support the growth performance trends but the growth impairment in some treatment, suggesting that digestibility alone does not guarantee performance if amino acid balance is suboptimal. This agrees with Esonu and Udedibie (2017) [7], who emphasized that GNC-based diets often limit lysine availability, which can impair growth despite reasonable digestibility values. The higher Crude fibre and ether extract digestibility in treatment 2, indicating that fish meal inclusion enhances lipid and fibre utilization. According to Leeson and Summers (2001) [10], the presence of long-chain polyunsaturated fatty acids in fish meal contributes to improved fat metabolism and energy supply, which may explain the superior feed efficiency.

Table 2: Nutrient digestibility of growing Guinea Fowl fed different dietary protein

Parameters	T_1	T_2	T_3	T_4	SEM(+)
CPD(%)	55.36^a	52.28^b	52.88^b	56.08^a	0.412
CFD(%)	75.15^c	80.18^a	78.44^b	72.69^d	0.691
EED (%)	40.12^c	44.15^a	42.76^b	38.15^d	0.564
Moisture(%)	73.64^a	69.45^b	74.25^a	73.08^a	0.467
ASHD(%)	31.26^b	33.34^a	33.74^a	31.77^b	0.301
NFED(%)	87.98^b	91.22^a	91.21^a	92.25^a	0.412
Energy(kcal/kg)	2879.38^b	2886.42^a	2867.54^c	2866.18^d	1.939

^{a,b,c,d} means on the same row with different superscripts differ significantly ($p<0.05$)

Haematological Parameters of Guinea Fowl

Table 3 shows the result of hematological analysis of guinea fowl fed different dietary protein sources. Significant ($p<0.05$) difference was recorded on packed cell volume, hemoglobin, red blood cell, white blood cell, MCV (fl), MCH (pg), MCHC (gl), WBC($x10^9$/l), N, L, PLT($x10^9$/l). Highest ($p<0.05$) Packed Cell Volume (47.00%) was recorded with the birds fed diet containing GNC and FM while the birds placed on SBM and FM had the lowest value of 34.00. Highest ($P<0.05$) Hemoglobin concentration (199.00) was recorded with birds fed diet containing GNC and FM while birds fed diet containing SBM and FM had the value of 138.00. Red blood cells (2.62) was recorded from birds fed diet containing GNC and FM while fed SBM and FM recorded the lowest value of 1.67. The highest ($P<0.05$) Mean Corposular Volume (199.00fl) was recorded in the birds feed diet containing SBM and FM while birds placed on GNC and FM had the least value (174.00 fl). The highest ($P<0.05$) Mean Corpusular Hemogllobin (80.00pg) was recorded in the birds feed diet containing SBM and FM while birds fed diet containing SBM, GNC and FM had the least value (72pg). The highest ($P<0.05$) white Blood cell (173.00 $x10^9$/l) was recorded in the birds placed on the three test ingredients GNC, SBM and FM has while birds placed on GNC and SBM has the least value of (124.00 $x10^9$/l). The highest ($P<0.05$) neutrophil (30.00%) was recorded in the birds fed diet containing GNC and FM while birds fed diet containing SBM and GNC had the least value (9.00%). The highest ($P<0.05$) lymphocyte (85.00%) was recorded in the birds fed diet containing SBM and GNC while birds fed diet containing GNC and FM had the least value (50.00%). The highest ($P<0.05$) Palatelet (191.00 $x10^9$/l) was recorded in the birds placed on the two test ingredients GNC and FM has while birds placed on SBM, GNC and FM has the least value of (141.00 $x10^9$/l). Red blood cell count (RBC), hemoglobin concentration (Hb), packed cell volume (PCV), and white blood cell count (WBC), are important indicators of the health and immune status of guinea fowl. The effects of different protein sources on these parameters provide insights into how each feed influences the bird's physiological condition GNC's impact on the hematological parameters of guinea fowl in some studies indicate that GNC-based diets can cause slight reductions in RBC and Hb levels, possibly due to the presence of anti-nutritional factors, such as tannins and phytates, that interfere with the absorption of essential nutrients (Adeoye *et al.*, 2019) [1]. Additionally, the presence of aflatoxins in poorly processed GNC can contribute to liver damage, which may further negatively affect hematological parameters (Ojediran *et al.*, 2020) [12]. SBM has a generally positive effect on the hematological parameters of guinea fowl. Adeoye *et al.* (2019) [1] observed that guinea fowl fed SBM exhibited higher Hb levels and RBC counts, reflecting better oxygen transport and overall health. This improvement in hematological characteristics in this study may be due to SBM's superior amino acid profile and digestibility, which supports the synthesis of hemoglobin and erythrocytes (El-Sayed *et al.*, 2022) [5]. Fish Meal has a profound impact on the hematological characteristics of poultry. Its high content of essential fatty acids and minerals, such as omega-3 fatty

acids, can improve red blood cell production and overall blood health. Studies have shown that guinea fowl fed Fish Meal tend to have higher RBC, Hb, and PCV values compared to those fed GNC or SBM alone this likely due to the bioavailability of nutrients in Fish Meal, which supports better hematopoiesis (Thompson *et al.*, 2021) [22]. Fish meals role in enhancing immune function through the provision of essential fatty acids and bioactive peptides also contributes to better immune responses, reflected in a balanced WBC count.SBM and FM (T2) have a more favorable effect on the hematological parameters of guinea fowl, enhancing blood health and immune responses. The high digestibility and nutrient composition of these proteins likely contribute to improved RBC production and overall health, Both SBM and Fish Meal have been associated with enhanced immune function in guinea fowl, due to the presence of bioactive compounds and high-quality proteins. Research has shown that the amino acids and essential fatty acids in SBM and Fish Meal diets can enhance immune responses, resulting in better disease resistance and fewer health issues (Thompson *et al.*, 2021) [22].

Table 3: Hematological characteristics of guinea fowl fed with different dietary protein sources

Parameter	T1	T2	T3	T4	SEM
PCV	43.00^{b}	47.00^{a}	34.00^{c}	40.00^{b}	1.51
HB(gdL)	164.00^{b}	199.00^{a}	138.00^{d}	151.00^{c}	6.87
RBC($x10^{12}$/l)	2.23^{b}	2.62^{a}	1.67^{c}	2.02^{b}	0.11
MCV(fl)	187.00^{c}	174.00^{d}	199.00^{a}	193.00^{b}	2.83
MCH(pg)	72.00^{b}	74.00^{b}	80.00^{a}	73.00^{b}	1.10
WBC($x10^{9}$/l)	173.00^{s}	150.00^{b}	130.00^{c}	124.00^{d}	5.81
N(%)	19.00^{b}	30.00^{a}	11.00^{c}	9.00^{c}	3.37
L(%)	81.00^{b}	50.00^{c}	83.00^{ab}	85.00^{a}	4.36
M(%)	4.00	10.00	3.00	2.00	1.14
PLT($x10^{9}$/l)	163.00^{c}	191.00^{a}	141.00^{d}	172.00^{b}	5.44

^{abc} means along the same row with uncommon subscript are significantly different (P> 0.05)

PCVHCT- Packed Cell Volume, HCTll- Hematocrit, HBGll- Hemoglobin, RBC- Red Blood Cell, MCV- Mean Corposular Volume, MCH- Mean Corpusular Hemogllobin, WBC- White Blood Cells, N-Neutrophils-, L- Lymphocytes, E- Eosinophils, M- monocytes, B-Basophils, PLT- Palatelet.

Serum Characteristics of Growing Guinea Fowl

Table 4. shows the effect of different dietary protein sources on the serum characteristics of growing guinea fowl. The impact of different dietary protein sources significantly ($p<0.05$) affected albumin, globulin, total protein, urea, creatinine, cholesterol, alkaline phosphate. The highest ($p<0.05$) total protein, albumin, Cholesterol and Low density lipoprotein (LDL) were observed in birds fed with diet containing GNC and SBM while birds fed with SBM and Fishmeal had the least value. The highest value (141.50iu/l) of Alkaline Phosphatase was recorded in birds fed with SBM and GNC while the lowest value (101.00iu/l) was observed in birds placed on GNC and FM. Highest total protein was recorded (43.00g/dL) in the birds placed on SBM and GNC while birds fed with SBM and FM having the lowest value of (33.33g/dL).The highest Albumin was recorded (18.50iu/l) in the birds placed on SBM and GNC while birds fed with SBM and FM having the lowest value of (14.67g/dL). The highest value (24.50g/dL) of Globulin was recorded in birds fed with SBM and GNC while the lowest value (14.67 g/dL) was observed in birds placed on GNC and FM. The highest ($P<0.05$) Urea (1.60mg/dL) was recorded in the birds fed diet containing SBM and GNC while birds fed diet containing GNC and FM had the least value (0.77mg/dL). Highest ($P<0.05$) Creatinine (54.00mg/dL) was recorded in the birds fed diet containing SBM and FM while birds fed diet containing SBM and FM had the least value (36.00mg/dL). Cholesterol recorded highest ($P<0.05$) value (3.80 mg/dL) on birds placed on the two test ingredients SBM and GNC has while birds placed on GNC and FM has the least value of (2.47mg/dL). Highest ($P<0.05$) Triglycerides (2.70mg/dL) was recorded in the birds fed diet containing SBM and GNC while birds fed diet containing SBM and FM had the least value (1.20mg/dL). High Density Lipoprotein recorded highest ($P<0.05$) value (1.53mg/dL) on birds placed on the two test ingredients SBM and GNC has while birds placed on SBM and GNC had the least value of (1.10mg/dL). Highest ($P<0.05$) Low Density Lipoprotein (1.50mg/dL) was recorded in the birds fed diet containing SBM and GNC while birds fed diet containing SBM and FM had the least value (0.73mg/dL). The serum total protein, albumin, creatinine, urea, triglycerides, alkaline phosphate and globulin are fall within the usual range for healthy birds as stated in the Merck Manual (2012) [11]. Thus support the liver and kidneys in maintaining their optimal health. Increased cholesterol and triglycerides in birds fed with GNC and SBM might signal enhanced lipid mobilization or altered liver function, though not necessarily pathological. It was observed that serum biochemical parameter increased when two plants protein sources are fed to guinea fowl. Possibly due to synergistic amino acid profiles in GNC and SBM, These outcomes agree with Nwakpu *et al.,(*2018) who observed better serum protein with fish meal-based diets.

Table 4: Serum biochemical parameters of growing guinea fowl fed different dietary protein source

Parameters	T1	T2	T3	T4	SEM(+-)
AST (iu/l)	99.67	98.33	95.00	93.50	1.62
ALT (iu/l)	36.33	34.00	36.67	36.50	0.69
ALP (iu/l)	108.00^{ab}	101.00^{b}	108.67^{ab}	141.50^{a}	7.65
TP (g/dL)	36.33^{ab}	34.67^{ab}	33.33^{ab}	43.00^{a}	1.44
ALB (g/dL)	15.67^{ab}	16.00^{ab}	14.67^{b}	18.50^{a}	0.50
GLB (g/dL)	20.67^{ab}	18.33^{ab}	18.67^{ab}	24.50^{a}	1.12
Urea (mg/dL)	1.03^{b}	0.77^{bc}	0.87^{bc}	1.60^{a}	0.07
Creat (mg/dL)	40.33^{ab}	44.67^{ab}	36.00^{b}	54.00^{a}	2.45
CHOL (mg/dL)	3.77^{a}	3.13^{b}	2.47^{c}	3.80^{a}	0.13
TRIG (mg/dL)	1.73^{ab}	1.20^{bc}	1.23^{bc}	2.70^{a}	0.19
HDL (mg/dL)	1.53^{a}	1.37^{ab}	1.20^{ab}	1.10^{b}	0.06
LDL (mg/dL)	1.47^{a}	1.27^{ab}	0.73^{c}	1.50^{a}	0.08

$^{ab.c}$= Means on the same row with different superscripts were significantly different($p<0.05$). AST=Aspartate Amino Transferases, ALT=Alanine Aminotransferases,ALP=Alkaline Phosphatase, TP=Total Protein, ALB=Albumin, GLB=Globulin, Urea=Urea, Creat=Creatinine, CHOL=Cholesterol TRIG=Triglycerides, HDL=High Density Lipoprotein, LDL=Low Density Lipoprotein, VLDL=Very Low Density Lipoprotein
SEM= Standard error of mean

Age at First Lay of Growing Guinea Fowl

Table 5. shows the effect of different dietary protein sources on the Age at first lay of growing guinea fowl. There was significant ($p<0. 05$) different among the treatment except for egg weight parameter. The age at first lay was significantly affected by dietary treatment. Birds fed diet containing SBM, GNC and FM began laying earlier (154. 6 days) compared to others. The birds on diet containing SBM and GNC laid highest number of eggs (20,00) within 38days when compared to other treatment group.

The age at first lay was significantly affected by dietary treatment. Birds on the T1 diet began laying earlier (154. 6 days) compared to those on T4 (188. 0 days). Early sexual maturity in birds fed with the three sources of protein may be attributed to better body condition and nutrient reserves facilitated by the balanced protein mix, as suggested by Emiola *et al*., (2011) [6]. Delayed onset of lay in birds consumed GNC and SBM could be linked to suboptimal amino acid availability and potential hormonal interference due to plant-based ANFs (Karr-Lilienthal *et al*., 2005) [8]. Despite the late onset of laying in birds fed GNC and SBM, birds in this group recorded the highest number of eggs laid at 38 days (2.00eggs), indicating that once sexual maturity was attained, laying capacity may have improved under certain plant-based protein combinations. However, these differences were not pronounced enough to indicate a consistent pattern in egg production trends across diets.

Table 5: Age at first lay of guinea fowl grower fed different dietary protein sources

Parameters	T1	T2	T3	T4	SEM
AGE1stLAY	154.6^{c}	172.0^{b}	172.0^{b}	188.0^{a}	2.27
NEL38Days	17.5^{ab}	12.5^{b}	14.0^{ab}	20.0^{a}	0.09
Egg weight	31.00	37.33	33.60	39.00	0.71

^{abc}Means treatment on the same row with different superscripts were significantly different ($p<0.05$). AGE1stLAY: Age at first lay, NEL-NO OF EGG LAID AT 38DAYS

Conclusion and Recommendation

The research concluded that different combination of dietary protein sources had positive effect on growth performance parameters, egg production as well as to enhance good health status of the birds. It is therefore recommended that the three dietary protein source (SoyaBean Meal, Groundnut Cake and Fish Meal) should be included in the diets of guinea fowl for optimum growth performance, health status and early laying of egg.

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Conflicts of Interest

No conflict of Interest

Author's Contributions

Rafiu Tirimisiyu Adewale, Sangoniyi, Olakiitan and Okanlawon, Eden Olusegun: conceptualize the study and write the article. Rafui Tirimisiyu A and Okanlawon Eden Olusegun: Design the study. Rafui Tirimisiyu A and Sangoniyi Olakiitan: proof read the write up. Rafiu Tirimisiyu Adewale, Okanlawon, Eden Olusegun, Sangoniyi Olakiitan, Abideen, Wliyullah Akanni., Adetunji, Janet Omowumi., Adediwura, Eniola Olusola., and Okiti, Temitope Kabirat: carried out the experiment.

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