RESPONSES OF BIOCHEMICAL INDICES OF GROWING TURKEYS FED GRASSHOPPER MEAL AS A SUBSTITUTE FOR FISH MEAL

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Abstract
Fifty grower turkeys were randomly assigned into five dietary treatments and replicated three (3) times. The turkeys were fed diets containing 0%, 2.25%, 4.50%, 6.75% and 9.00% grasshopper meal. The experimental diets and clean drinking water were supplied *ad libitum* throughout the experimental periods of 10 weeks. All data generated were subjected to one-way analysis of variance in a completely randomized design. The result showed a significant difference due to treatments on urea, cholesterol, globulin and creatinine. Non-significant difference was recorded on glucose, total protein and albumin. The urea (mmol/L) levels recorded on T1 (3.00), T2 (2.95), T3 (3.08) and T4 (3.00) were statistically ($P<0.05$) higher than values recorded on treatment T5 (2.90). The cholesterol (mmol/L) and globulin (g/L) contents of T and T5 were similar and significantly ($P<0.05$) higher compared to other treatments. The result for creatinine (mmol/L) indicated ($P<0.05$) higher values in T4 (36.25) and T5 (36.00) compared to T1 (32.50). All these values were still within the recommended range for healthy turkey; hence, it was concluded that inclusion of grasshopper meal in the diet of turkey grower up to 9.00% had no adverse effect on their blood profile.
Key words: Responses, Biochemical, Turkeys, Diet and Grasshopper Meal

Introduction
Turkey (*Meleagris gallopavo)* is one of the poultry birds whose potentials as an alternative source of animal proteins have not been effectively exploited in Nigeria. Turkey has been around for a long time, its domestication dates thousands of years. It is eaten in the course of large feast during Christmas as well as other religious activities, yet, turkey production is limited by cost of feed and poor growth relative to local chicken (HTRT, 2009).Turkey feeding was based on rations with higher crude protein content compared to that fed to local chicken. The addition of a protein rich concentrate such as fishmeal is common to raise the level of protein in poultry diet. Turkey of ten weeks age requires a ration containing about 23% crude protein (Payne, 1990).
Grasshopper (*Zonocerus variegates*) is a major pest of food and tree crops and it is common to Sudan and Sahel savannahs of West Africa. It feeds on plant parts especially the leaves, stem and fruits. The level of availability of grasshopper species during the rainy season signifies its potential as a source of protein in place of fishmeal. The crude protein level in dried grasshopper was reported as 64.32% (Njidda and Isidahomen, 2010). The nutritional significance of grasshopper meal in Turkey diet especially in terms of growth performance, carcass quality, Nitrogen balance, blood parameters and nutrients digestibility need to be determined (Ojebeyi *et al.*, 2007). The study was aimed to determine the effect of grasshopper meal on biochemical parameters of Turkey.

Materials and Methods
The experiment was conducted at the University Farm (Poultry section) of Bayero University Kano located at Ungogo Local Government Area of Kano State. The State is located within longitude 90º31ˈ and 130º30ˈ North and latitude 90º31ˈ and 90º42ˈ East (KNARDA, 2001) and falls within Sudan savanna vegetation zone (Olofin, 1985). The area has a wet and a dry season with the wet season spanning from May to

September and dry season coming between October to April (Olofin, 1987). The annual rainfall of the area ranged from 787mm to 960mm while temperature is between 21 and 40°C (KNARDA, 2001).

Experimental diets were formulated such that grasshopper meal was included at 0% (control), 2.25%, 4.50%, 6.75% and 9.00% levels for diets T1, T2, T3, T4 and T5 respectively, as shown in Table 1 The ingredients for formulating the feed were acquired from Abubakar Rimi Market in Kano Metropolis, and Sheka Market in the Suburbs of Kano Metropolis.

A total of fifty (50) local breeds of turkey birds at eight weeks age were randomly allocated into 5 treatment groups. Each treatment had ten turkeys, which was replicated with 5 turkeys per replicate. The birds were managed under deep litter system with wood shaving as litter materials. The pen was cleaned and disinfected using recommended disinfectant (7% Tar Acid Phenol and 2% Cresylic Creosote) to avoid microbial contamination. Routine management was carried out as described by Oluyemi and Roberts (2000). Experimental feed and fresh clean water were provided *ad-libitum*. The feeding trial lasted for ten weeks.

At the end of the trial, two birds per replication were randomly selected, 6 ml of blood was collected from each bird via the wing vein using sterilized syringes and needles; 2 ml was transferred into an Ethelyne Diamine Tetra Acetic Acid (EDTA) container for haematological parameters analyses while the remaining 4 ml was transferred into Lithium Heparin containers for biochemical analyses. The blood samples for the biochemical analyses were arranged in sample trays at right angle and allowed to sediment for 2 hours. Automated pipettes and tips were used to collect the already separated sera and transferred into a micro-tube for biochemical analysis using Automated Chemistry Analyser (Selectra Junior Pro-S). Parameters determined included urea (mmol/L) cholesterol (mmol/L), glucose (mmol/L) total protein (g/dl), globulin (mmol/L), creatinine (mg/dl) and albumin (g/dl).

Data collected were subjected to one way analysis of variance using the SAS system (1999). Least significant difference test was used to determine difference among means of the treatment as described by Steel and Torrie (1980).

Table 1: Ingredient Composition of the Experimental Diet

Ingredients	Treatment				
	T1	T2	T3	T4	T5
White Maize	60.00	60.00	60.00	60.00	60.00
Wheat Offal	12.65	12.55	12.50	12.45	12.40
Grasshopper Meal	0.00	2.25	4.50	6.75	9.00
Groundnut Cake	12.00	12.00	12.00	12.00	12.00
Bone Meal	5.00	5.00	5.00	5.00	5.00
Fish Meal	9.00	6.75	4.50	2.25	0.00
Common Salt	0.10	0.10	0.10	0.10	0.10
*Premix	0.25	0.25	0.25	0.25	0.25
Palm Oil	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

* Premix=Vitamin A 12,000,000 I.U; Vitamin D_3 3,000,000 I.U ; Vitamin E 30,000mg; Vitamin K_3 2,500mg; Folic acid 1,000mg; Niacin 40,000mg; Calpan 5,000mg; Vitamin B_2 5,000mg; Vitamin B_{12} 20mg; Vitamin B_1 2,000mg; VitaminB_6 3,500mg; Biotin 80mg; Antioxidant125,000mg;Cobalt 250mg; Selenium 250mg; Iodine 1,2000mg; Iron 40,000mg; Manganese 70,000mg; Copper 8,000mg; Zinc 60,000mg; Choline Chloride 200,000mg

Table 2 shows the result of blood chemistry of turkey fed graded level of grasshopper in replacement for fishmeal.

Table 2: Blood chemistry of turkey fed graded levels of grasshopper meal in replacement of Fishmeal

Parameter	Treatment					
	T1	T2	T3	T4	T5	LSD
Urea (mmol/L)	3.00^{ab}	2.95^{ab}	3.08 ^{a}	3.00^{ab}	2.90^{b}	0.17*
Cholesterol (mmol/L)	3.43^{a}	3.30^{ab}	3.20^{b}	3.20^{b}	3.40^{a}	0.22*
Glucose (mmol/L)	1.28	1.38	1.28	1.28	1.40	0.19^{ns}
Total protein (g/dL)	33.50	32.25	32.75	33.25	33.00	1.31^{ns}
Globulin (g/L)	9.75^{a}	8.75^{b}	9.50^{ab}	9.00^{ab}	9.75^{a}	0.89*
Creatinine (mmol/L)	32.50^{b}	34.75^{ab}	35.25^{ab}	36.25^{a}	36.00^{a}	2.79*
Albumin (g/L)	23.75	24.00	23.50	23.00	23.50	1.50^{ns}

Results and Discussion

The result showed a significant difference due to treatments on urea, cholesterol, globulin and creatinine. Non-significant difference was recorded on glucose, total protein and albumin. The urea levels recorded on T1 (3.00), T2 (2.95), T3 (3.08) and T4 (3.00) were statistically ($P<0.05$) higher than values recorded on treatment T5 (2.90). The cholesterol contents of T1 (3.43) and T5 (3.40) were similar and significantly ($P<0.05$) higher than other treatments (T2, T3 and T4). The globulin contents of T1 (9.75) and T5 (9.75) were similar and significantly ($P<0.05$) higher compared to T2 (8.75) which was the least. The result for creatinine indicated ($P<0.05$) higher values in T4 (36.25) and T5 (36.00) compared to T1 (32.50).

The serum biochemical indices observed were all within normal range as reported by Dukes (1975). Creatinine content has been shown to depend upon quantity and quality of feed and environmental temperature (Ewuola *et al.*, 2004). The lower values of urea obtained support the quality of the feed. According to Iyayi and Tewe (1998) blood urea level depend on both the quality and quantity of the protein supplied in the diet and higher level of urea in the blood could be attributed to the presence of some anti-nutritional factors which might have lowered the quantity of the protein indicating imbalance of amino acid in the diet and caused elevated blood urea concentration.

Globulin and albumin are important component of blood plasma (Guache *et al.,* 1991). The values of Albumin, Globulin and Total Protein in this research agree with the findings of Al-Homidan (2005), Ademola *et al.* (2009), Nweze and Ekwe (2012) and Wafaa *et al.,* (2012). Total Protein, Albumin and Globulin have been reported to be directly responsible to protein intake and quality (Onifade *et al.,* 1999).

Conclusion

Grasshopper meal can be used to replace fishmeal in the diet of turkey without any adverse effect on the health of Turkey.

Recommendation

Similar experiment should be conducted for turkey of age 0-8weeks.

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