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Effect of Dietary Palm Kernel Meal for Maize on the Haematological and Serum Chemistry of Broiler Turkey

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Target Audience: Animal Nutritionists, Turkey Farmers and Feed Millers

Abstract

A twenty four-week study was conducted to determine the effect of replacing maize with palm kernel meal on the haematology and serum chemistry of broiler turkeys. Six dietary treatments were formulated with palm kernel meal replacing maize at 0, 20, 40, 60, 80 and 100 percent and were used to feed 180 turkey poults. The study adopted completely randomized design with the six dietary treatments replicated trice; The turkey poults were randomly allotted to three dietary treatments having 30 poults per treatment and 10 per replicate. Two separate samples of blood were collected from one bird in each replicate for haematology and serum chemistry analysis. With the exception of red blood cells and mean corpuscular haemoglobin concentration significant differences existed in the values of all the other haematological parameters. The haemoglobin of turkeys fed diets 1, 3 and 4 (14.00, 14.20 and 13.80g/dl were significantly higher (P<0.05) than that of diets 5 (11.00g/dl) and 6 (12.40g/dl). The white blood corpuscles of diets 1, 2, 3 and 4 were not significantly different (P>0.05) from one another but that of diet 1 ($9.60x10^3/m^3$) and 4 ($9.00x10^3/m^3$) were significantly higher (P<0.05) than that of diets 5 ($8.20x10^3/m^3$). The packed cell volume (PCV) of turkeys fed diets 1, 3 and 4 (42.0, 43.0, and 41.0%) were not significantly different but were significantly higher (P<0.05) than that of diets 2, 5, and 6 (39.0, 33.0, 37.0%). In both MCH and MCV values, turkeys fed diets 2 were significantly greater ((P<0.05) than others whereas that of diet 4 was the least. Significant differences existed in all the values of blood chemistry examined except in glyceride and SGOT. The total protein of turkeys fed diets 1, 3, 4, 5 and 6 were not significantly different (P>0.05). The globulin of turkeys fed diets 2 and 3 were significantly higher (P<0.05) than others whereas the albumin of turkeys fed diets 2 to 6 were significantly greater (P<0.05) than that of diet 1. The glucose levels of turkeys fed diets 1, 2, 3, 4 and 6 were significantly higher (P<0.05) than that of diet 5. The urea (0.54mg/dl), creatinine (1.48mg/dl) and cholesterol (122.0mg/dl) of turkeys fed diets 3 were significantly the least when compared to others. The SGPT of turkeys fed diet 2 (48.001u/l) was not significantly different from others but was higher (P<0.05) than that of diets 1 (42.001u/l). Considering the high

values of Hb, WBC, PVC and the low urea and creatinine values of diet 3, it is recommended that PKM can replace maize at 60 percent for good blood status of turkeys

Key words: Palm Kernel Meal, Maize, Turkeys, Haematology, Serum Chemistry.

Description of Problem

The problem of low animal protein intake of average Nigerians of about 8g/day [1] as against 54g/capita/day by Americans which is about 27g/day less than the minimum quantity as recommended by [2] can be addressed by increased production of meat and eggs using poultry species that have fast growth rate, large size and excellent meat quality. The protein intake per person of 65g/day was recommended by [3] of which 35g/day should come from sources of animal origin.

Emphasis in the past had been on the use of broiler and laying chicken to address this problem of low animal protein intake of Nigerians. However, exploring greater production of other poultry species such as turkeys could be complimentary to broiler and laying chicken production to meet the animal protein need of Nigerians. Broilerindustry in Nigeria has suffered terrible setback in recent years due to abandonment of large scale farms by their owners resulting in mass importation of frozen chicken and turkey parts into the country.

Increased turkey production in Nigeria should be boosted taking advantage of the birds large size, fast growth rate, high fecundity and excellent meat quality. Turkeys seem to be more efficient than broiler chicken in converting dietary protein into edible carcass protein [4]. Since the yield of edible protein is the ultimate measures of success in animal production [5] and turkey breast meat contains more than 50 percent of edible turkey carcass protein, turkey therefore, is a good compliment to broiler chicken in meeting man's animal protein requirements.

High cost of maize in particular and other conventional feed resources in Nigeria has prompted the need to explore the use of unconventional feed resources as alternative or replacement for the conventional feed ingredients. The use of cheaper and more abundant feed ingredients such as palm kernel meal, for which there is less competion as replacement for maize, would help to reduce the high cost of feeds and increase the profit margin of farmers [6, 7].

Palm kernel meal is said to be cheap when compared to maize and available in abundance. It can be used up to 34 percent in poultry diets [8, 9 and 10]. Palm kernel meal with metabolizable energy value of about 2880 keal/kg feed [11, 12 and 12] could be used as a partial replacement for maize with metabolizable energy of about 3400 keal/kg feed [14] in poultry feeds. The objective of this study is to determine the effect of dietary palm kernel meal for

maize on the haemotological and serum chemistry of broiler turkey.

Materials and Methods

Location and Duration of Study

The study was conducted at the Poultry Unit of Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Umuahia in Abia State of Nigeria.

The duration of the study was 24 weeks, a period required for the production of turkey broiler (15). This period comprised of the starter phase (1-8 weeks of age), grower phase (9-16 weeks of age) and finisher phase (17-24 weeks of age).

Experimental Diets

Six treatment diets were formulated in which palm kernel meal replaced maize at 0, 20, 40, 60, 80 and 100 percent using the procedures for weight-to-weight (quantitative) replacement (16, 17 and 18). The diets constituted the turkey starter, grower and finisher rations (tables 1, 2 and 3).

Experimental Animals and Management

A total of 180 turkey poults procured from a reputable hatchery at Owerri, Imo State of Nigeria were used in the study. The turkeys were randomly allotted to the six treatment diets replicated trice with 10 turkeys per replicate and 30 per treatment diet in a Completely Randomized Design experiment.

The turkey poults were brooded for 4 weeks and reared on a deep litter. Feed and water were supplied *adlibitum.* The birds were vaccinated on the 1st day with new castle disease vaccines ($NDV^1/_0$) intraocular. The birds were also administered with new castle disease (lasota) via drinking water at 4 weeks of age. Booster doses of NDV (lasota) were given to the birds at 12 and 17 weeks of age respectively. Antibiotics, anti coccidial and vitamin drugs were also administered to the birds routinely [19].

Data Collection and Analysis

Blood samples were collected using syring to extract the blood from the prominent veins under the wings of the turkeys. Blood samples for evaluation of haematological indices were collected from one bird in each of the three replicates of the treatments into sterile bottles containing anti-coagulant (EDTA-ethylene diamine tetra-acetic acid powder) another blood samples were collected in sterile bottles without the anti-coagulant for serum chemistry parameters determination. Laboratory analysis of the blood samples were carried out using the procedures of [20] thus:

Haematological Indices

(i) Haemoglobin (Hb) - acid haematin method otherwise called sahli method was used to determine the Hb of the blood as $\frac{Hb}{100}$ x 17.2g where 17.2g is the sahli standard for 100 percent haemoglobin concentration.

(ii) Red blood cells (RBC) and white blood cells (WBC)

The RBC and WBC were determined with the aid of haemacytometer containing improved Neubaurer counting chamber.

(iii) Packed cell volume (PCV) was determined with the aid of micro-haematocrit (centrifuge method).

(iv) The MCH, MCV and MCHC were calculated using the values of Hb, RBC and PCV obtained above as

$$MCH = \frac{Hb \times 10}{RBC},$$

$$MCV = \frac{PCV \times 10}{PCV},$$

$$MCHC = \frac{Hb \times 100}{}$$

Serum Chemistry Indices

Total protein, serum cholesterol and glucose were determined using the absorbance of the light emitted during hydrolysis of the samples and values calculated using the absorbance of sample, blank and the standard. Computer analysis using statistical package for social science (SPSS) window 10.0 version was employed to analyze the data generated. The data were subjected to analysis of variance (ANOVA) to test for significance of the treatment effect according to the procedures [21] and mean separation was carried out where significance existed using Duncan Multiple Range Test [22].

Table 1: Percentage Composition of Experimental Diets- Starter Ration

	Experimental Diets					
Ingredients	1	2	3	4	5	6
Maize	40	32	24	16	8	0
Palm kernel meal	0	8	16	24	32	40
Soya bean meal	51	51	51	51	51	33
Fish meal	5.5	5.5	5.5	5.5	5.5	5.5
Bone meal	3	3	3	3	3	3
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit/Min. Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated analysis						
Crude Protein (%)	25.59	29.3	30.19	30.99	31.79	32.59
ME (Kcal/Kg)	2891	2827	2763	2699	2635	2571
Crude Fibre (%)	10.65	11.85	12.00	12.25	12.68	13.00
Ether Extract (%)	1.86	2.15	2.20	2.40	2.45	2.50
Ash (%)	6.92	7.02	7.60	7.80	7.94	8.12
NFE (%)	42.10	36.30	37.00	38.45	38.41	36.92

Table 2: Percentage Composition of Experimental Diets- (Grower Ration)

	Experimental Diets					
Ingredients	1	2	3	4	5	6
Maize	58	46.4	34.8	23.2	11.6	0
Palm kernel meal	0	11.6	23.2	34.8	46.4	58
Soya bean meal	33	33	33	33	33	33
Fish meal	5.5	5.5	5.5	5.5	5.5	5.5
Bone meal	3	3	3	3	3	3
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit/Min. Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated analysis						
Crude Protein. (%)	22.63	25.87	24.97	26.12	27.28	28.45
ME (Kcal/kg)	3019	2924	2831	2738	2645	2553
Crude Fibre (%)	11.65	12.40	13.00	14.00	14.40	14.50
Ether Extract (%)	2.12	2.20	2.40	2.12	2.40	2.36
Ash (%)	7.41	7.80	8.00	8.14	8.20	8.25
NFE (%)	38.24	36.40	37.20	38.40	38.14	38.00

Table 3: Percentage Composition of Experimental Diets- (Finisher Ration)

	Experimental Diets					
Ingredients	1	2	3	4	5	6
Maize	68	54.4	40.8	27.2	13.6	0
Palm kernel meal	0	13.6	27.2	40.8	54.4	56.4
Soya bean meal	24.5	24.5	24.5	24.5	24.5	24.5
Fish meal	4	4	4	4	4	4
Bone meal	3	3	3	3	3	3
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit/Min. Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated analysis						
Crude Protein (%)	19.01	20.36	21.72	223.0	24.40	25.81
Metabolisable Energy (Kcal/kg)	30.85	2976	2868	2759	2650	2541
Crude Fibre (%)	14.60	15.00	15.20	15.25	15.32	15.50
Ether Extract (%)	1.95	2.00	2.14	1.96	2.03	2.20
Ash (%)	7.95	8.00	8.15	8.30	8.34	8.42
NFE (%)	40.10	36.21	37.40	40.00	39.12	38.50

Results and Discussion

Haematologlical Indices

The results of the haematological and serum chemistry parameters analysis are shown in Table 4. The haematological values of the blood of turkeys fed diets 1, 2, 3 and 4 (14.00, 13.00, 14.00 and13.80g/100ml) were not significantly ($P>0.05$) different from one another. However, these values were significantly higher ($P<0.05$) than the haemoglobin of turkeys fed diets 5 (1.00g/100ml). Since haemoglobin is responsible for cellular respiration which is important in metabolic reactions [23 and 24] turkeys fed diets in which PKM replaced maize at 20, 40 and 60 percent had similar haemoglobin status whereas those fed diet 5 (80 percent replacement) was the least. The haemoglobin of the blood of turkeys fed the treatment diets (diets 1 = 14.00, 2 = 13.00, 3 = 14.20, 4 = 13.80, 6 = 12.40g/100ml) except that of diet 5 (11.00g/100ml) were higher than that reported by [25, 26 and 27].

The red blood cells (RBC) of turkeys fed all the treatment diets (diet 1 = 1.80, 2 = 1.34, 3 = 2.30, 4 = 2.60, 5 = 1.20 and 6 = 1.70 x $10^6/mm^3$) were not significantly different ($P>0.05$) from one another but the numerical value of the RBC of turkeys fed diet 4 was higher than other. The white blood cells (WBC) of turkeys fed diets 1, 2, 3 and 4 (9.60, 8.90, 9.40 and 9.00 x $10^3/mm^3$) were not significantly different ($P>0.05$) from one another. However, the WBC values of turkeys fed diets 1 and 3 were significantly higher ($P<0.05$) than that of diet 5 (8.20 x $10^3/mm^3$). This result implied that birds fed diets 1, 2, 3, and 4 were conferred with similar immunity since WBC are known to fight against diseases [23 and 28].

The packed cell volume (PVC) of turkeys fed diets 1, 3 and 4 (42.00, 43.00 and 41.00%) were not significantly different from one another ($P>0.05$) but they were significantly greater ($P<0.05$) than that of turkeys fed diets 2, 5 and 6 (39.00, 33.00 and 37.00%).

The mean corpuscular haemoglobin (MCH) of turkeys fed diet 2 (97.00pg) was significantly greater ($P<0.05$) than others followed by that of diets 5 (91.70pg) while that of diet 4 (53.10pg) was the least. This was probably because turkeys fed diet 2 had low RBC count with high haemoglobin resulting in the highest concentration of Hb per unit RBC. Since MCH is an indicator of the oxygen carrying ability of the RBC [23], the blood of turkeys fed diets 2 and 5 may be more efficient than other in performing respiratory functions.

The trend of the result of the mean corpuscular volume (MCV) of turkeys fed the diets was similar to that of MCH in that the MCV value of diet 2 (291.00um) was significantly greater than others followed by that of diet 5 (275.00um) while that of diet 4 (158.00um) was the least. The MCV of turkeys fed diets 3 and 4 (187.00µm and 158.0um) fell within the normal range (143.25-199.6µm) for turkeys reported by [25, 26 and 27]. This could imply that

birds fed diets 3 and 4 may neither stand the risk of haemoconcentration nor anaemia [23].

In terms of values of Hb, RBC and PCV, turkeys fed diets 3 and 4 (40 and 60 percent replacement) had comparable performance to those fed diet 1(0 percent replacement).

Serum Chemistry Parameters

With the exception of the values of triglyceride and serum glutamic oxaloacetate transanuinase (SGOT) significant differences occurred in the values of the other parameters examined.

The total protein content of the blood of turkeys fed diets 1, 3, 4, 5 and 6 (5.60, 5.40, 5.40, 5,80, 5.60g/dl) were not significantly different (P>0.05) from one another. However, the total protein of turkeys fed diets 1, 5 and 6 were significantly greater than that of diet 2 (4.70g/dl).

The globulin content of the blood of turkeys fed diets 2 to 6 (2.00, 2.20, 2.20 2.00 and 2.00g/dl) did not differ significantly from one another (P>0.05). However, the globulin of turkeys fed diets 3 and 4 (2.20 and 2.20g/dl) were significantly greater than that of diet 1 (1.60g/dl). Similarly, the albumin values of turkeys fed diets 2 to 6 (2.40, 2.40, 2.80, 2.80 and 2.80g/dl) did not differ significantly (P>0.05) from one another. The albumin content of turkeys fed diets 4, 5 and 6 were significantly higher (P<0.05) than that of diet 1 (2.00g/dl). These results implied that turkeys fed diets 3 and 4 (40 and 60 percent replacement) did better than those fed diet 1 (0 percent replacement) in terms of globulin as a component of RBC formation [23 and 24]. Albumin is said to be involved in blood clothing [23] and so birds fed diets 4, 5 and 6 may face less risk of haemorrhage than those fed diet 1.

There was no significant difference (P>0.05) in the serum glucose content of turkeys fed diets 1, 2, 3, 4 and 6 (98.80, 98.20, 98. 60, 98.00 and 98.80mg/dl). That of turkeys fed diet 5 (96.80mg/dl) was statistically lower than others.

The urea content of blood of turkeys fed diets 1, 2, 5 and 6 (0.68, 0.72, 0.60 and 0.66mg/dl) were not significantly different (P>0.05) from one another. However, that of diets 1 and 2 (0.68 and 0.72 mg/dl) were significantly higher than that of turkeys fed diets 3 and 4 (0.54 and 0.54mg/dl).

Similarly, there was no significant difference (P>0.05) in the creatinine values of turkeys fed diets 1, 2, 4, 5 and 6 (1.62, 1.68, 1.64, 1.68 and 1.68mg/dl) whereas that of turkeys fed diet 3 (1.48mg/dl) was statistically lower than others (P<0.05). It could imply that turkeys fed diets 2 to 6 (20-100 percent replacement) had similar efficiency of handling waste products of metabolism since urea and creatinine are regarded as waste in the blood [32 and 24].

Table 4: Haematological and Serum Chemistry Indices of Turkeys Fed the Treatment Diets.

Indices Haematology	1	2	3	4	5	6	SEM
Haemoglobin(g/100ml)	14.00^{a}	13.00^{ab}	14.20^{a}	13.80^{a}	11.00^{c}	12.40^{b}	0.39
RBC ($X10^{6}/mm^{3}$)	1.80	1.34	2.30	2.60	1.20	1.70	0.05
WBC ($X10^{3}/mm^{3}$)	9.60^{a}	8.90^{abc}	9.40^{ab}	9.00^{abc}	8.20^{c}	8.50^{bc}	0.31
PCV (%)	42.00^{a}	39.00^{b}	43.00^{a}	41.00^{a}	33.00^{d}	37.00^{c}	0.62
MCH (pg)	77.80^{c}	97.00^{a}	61.70^{e}	53.10^{f}	91.70^{b}	72.90^{d}	0.55
MCV (μm^{3})	233.30^{c}	291.00^{a}	187.00^{e}	158.0^{f}	275.00^{b}	218.00^{d}	1.52
MCHC (%)	33.30	33.30	33.30	33.60	33.30	33.50	0.26
Serum Chemistry							
Total protein (g/dl)	5.60^{a}	4.70^{b}	5.40^{ab}	5.40^{ab}	5.80^{a}	5.60^{a}	0.22
Globulin (g/dl)	1.60^{b}	2.00^{ab}	2.20^{a}	2.20^{a}	2.00^{ab}	2.00^{ab}	0.16
Albumin (g/dl)	2.00^{b}	2.40^{ab}	2.40^{ab}	2.80^{a}	2.80^{a}	2.80^{a}	0.17
Glucose (mg/dl)	98.80^{a}	98.20^{a}	98.60^{a}	98.00^{a}	96.80^{b}	98.80^{a}	0.39
Urea (mg/dl)	0.68^{a}	0.72^{a}	0.54^{b}	0.54^{b}	0.60^{ab}	0.66^{ab}	0.04
Creatinine (mg/dl)	1.62^{a}	1.68^{a}	1.48^{b}	1.64^{a}	1.68^{a}	1.68^{a}	0.04
Triglyceride (mg/dl)	5400	52.00	54.00	56.00	54.00	54.00	1.96
Cholesterol (mg/dl)	128.20^{a}	12433^{b}	122.00^{b}	128.80^{a}	128.60^{a}	124.20^{b}	1.00
SGOT (1µ/l)	32.00	30.67	36.00	36.00	34.00	32.00	1.93
SGPT (1µ/l)	42.00^{b}	48.00^{a}	46.00^{ab}	46.00^{ab}	44.00^{ab}	46.00^{ab}	1.15

a, b, c, means in the same row with different superscripts are significantly different from one another (P<0.05) RBC Red blood cells WBC White blood cells PCV Packed cell volume

The serum cholesterol of turkeys fed diets 1, 4, and 5 (128.20, 128.80 and 128.60mg/dl) were not significantly different (P>0.05) from one another but were significantly higher (P<0.05) than that of diets 2, 3 and 6 (124.33, 122.00 and 124.20mg/dl). The range of cholesterol obtained in this study (122.00–1288mg/dl) fell within the normal range (120–260mg/dl) reported by [24]. This implies that the birds fed the treatment diets may not face the risk of myocardial infarction usually associated with high blood cholesterol content and emaciation due to low serum cholesterol [23, 24 and 29].

There was no significant difference (P>0.05) in the values of serum glutamic-pyruvic transaminase (SGPT) of turkeys fed diets 1, 3, 4, 5 and 6 (42.00, 46.00, 46.00, 44.00 and 46.00 µ/L). However, the numerical values of SGPT of diets 2 to 6 were higher than that of diet 1 probably because higher values of the enzymes SGPT were required to contend with the higher dietary protein content of diets 2 to 6.

Conclusion and Application

Based on the results abstained in this study it could be concluded that replacing maize with PKM up to 100 percent will still maintain good blood status of turkeys.

References

1 Obioha, F.C (1992). A Guide to Poultry Production in the Tropics. Acena Publication, Enugu, Nigeria. Pp85-124.

2 NRC (1993). National Research Council nutrient requirements of poultry 8th revised edition. National Academy of Science, Washington D.C. USA.

3 FAO (1989). Food and Agricultural Organization, Rome Production year book Vol.42

4 Summers, J.D. Leeson, S., Belford, M and Spratt; D. (1985) Influence of dietary protein and energy on performance and carcass composition of heavy turkeys Poultry *Sci. J., 64:* 1921-1933.

5 Summers, J.D and Spratt, D (1990). Weight gain, carcass yield and composition of large white male turkeys reared to 28 weeks of age on growing and finishing diets with varying levels of dietary protein. *Poult. Sci.* 69: 584-591.

6 Oluyemi, J.A. and Roberts, F.A. (1979) Poultry Production in warm wet climates 1st edn. Published by Macmillan Publishers Ltd London. Pp 124-140.

7 Mustapha, G.G. and Tuned O. (1990). Performance of broilers given different dietary levels of Acasia Siberiana (D.C) Var Siberiana seeds. *Nig. J. of Anim. Prod.* 17,55.

8 Yeong, S.W (1980). The nutritive value pf palm oil by-products for poultry Proc. *Abstr. First Asia-Australasian. Sci. Cong. Abstr.* No.45, 17.

9 Hutagaluna, R.I. (1980). Availability of Feedstuff for Farm Animals. Asia-Australasia Animal Science congress. Abstract No 40, 15.

10 Onwudike, O.C. (1986a). Palm kernel as a feed for Poultry 1. Composition of palm kernel and availability of its amino acids to chicks. *Amin. Feed Sci. Technol. 16, 179-186.*

11 Fetuga, B.L., Babatunde, G.M,. and Onyenuga, V.A (1977a). The value of palm kernel meal in finishing diets for pigs 1: of varying the proportion of protein from blood meal and palm kernel meal on performance and carcass quality of finishing Pigs. *Journal of Agric. Sci.* 88, 655-661.

12 Nwokolo, E.N., Braga, D.B. and Saben, H.S. (1977). A nutritive evaluation of palm kernel meal for use in Poultry rations. *Trop. Sci.* 19, 147-154.

13 Aduku, A.O (1993). Tropical feedstuff analysis table. Dept. of animal science, faculty of agriculture, Ahmadu Bello University, Zaria, Nigeria.

14 Olomu, J.M. (1995). Monogastric Animal Nutrition. 1st edn. A. JACHEM publication Benin City, Nigeria. Pp 67-163.

15 Olomu, J.M. (2003). Poultry Production 1st edn. A JACHEM publication, Benin City, Nigeria. Pp 61-75

16 Onwudike O.C. (1986b). Palm kernel as a feed for poultry 2: diets containing palm kernel meal for starter and grower pullets. *Anim. Feed. Sci. Technol.* 16, 187-194.

17 Esonu, B.O. and Udedibie, A.B.I. (1993). The effect of replacing maize with cassava peel on the performance of weaned rabbits. *Nig. J. Anim. Prod.* 20:81-83.

18 Fanuyi, G.F. (1997). Effects of replacing maize with graded levels of mango seed kernel meal on the performance characteristics of broiler chicks and chicken. *Nig. J. Anim. Prod.* 24 (1) 26-30.

19 Bains, B.S. (1979). A manual of poultry disease. Published by F. Hoffmann-LaRoche and Co. Ltd. Company Basle, Switzerland. Pp. 133-161.

20 Baker, F.J. and Silverton, R.E. (1976). Introduction to medical laboratory technology 5th edn. Butter worth and Co. (Publishers) Ltd. London. 88. Kingsway. Pp 540-621.

21 Steel, R.G.D. and Torrie, J.H. (1980) principles and procedures of statistics Mc Graw-Hill Book Co. New York. Pp 65-86.

22 Duncan, D.B. (1955). Multiple Range Test. Biometrics, 11: 1-42.

23 Frandson, R.D. (1981). Anatomy and physiology of farm animals. 3rd edn. Published by Bialliere Tindall, London. Pp 62-94.

24 McDonald, P. Edwards, R.A. Greenhalgh, J.F.D and Morgan,C.A. (1995). Animal Nutrition. 5th edn. London Scientific and Technical, England. Pp 221-237.

25 Makinde, M.O. and Fatumbi O.O. (1985). Some haematological and biochemical values of turkeys in Ibadan. Bull *Anim. Hith. Prod. Afr*. 33:245-248.

26 Oyewala, J.O. and Ajibade, H.A. (1990). The Osmotic fragility of erythrocytes of turkeys of two age groups. Vet. Arhiv. 60, 91-102.

27 Olayemi, F.O., Alaka, O.O. and Sanni, A.A. (2002). Effects of infeciouscoryza disease in growing turkeys on some erythrocytes parameters. *Afric. J. of Biomed. Res*. Vol. 5: 83-86.

28 Murray, R.K., D.K., Mayes P.A, and Rodwell V.W. (1993). Harpers biochemistry 23rd edn. Prentice-Hall International Inc USA. Pp.470-770.

29 Gurr, M.I., and Harwood, J.L. (1991). Lipid biochemistry. 4th edn. Published by Chapman and Hall, 2-6. Boundary Row., London SE 18 HN. Pp 1-115.