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Effects of feed probiotics on serum biochemistry and carcass characteristics of tropically bred exotic turkey

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Abstract: *This study was conducted to examine the effect of feed probiotics substituents in serum biochemistry and carcass characteristics of tropically bred exotic turkey. A total of 80 British united turkey (BUT) were assigned to 4 dietary treatments consisting of 4 supplemental levels of equal mixtures of RoxazymeG2® at 200 ppm, 250 ppm, 300 ppm and 350 ppm. The polynomial contrast (linear and quadratic) was applied to determine the effect of inclusion of varying mixtures of enzyme and yeast supplementations using SPSS 1999. At starter phase (5-8 weeks), turkeys fed diet containing combination of 200 ppm enzyme and yeast recorded highest (P < 0.05) PCV, Hb, WBC, RBC and glucose values. AST and serum uric acid values were highest (P<0.05) for turkeys fed diet containing combination of 350 ppm enzyme and yeast. At grower phase (9-12 weeks), the values of WBC reduced significantly (P < 0.05) with increased combination of enzyme and yeast levels in the diet whereas RBC recorded higher values. Turkeys fed diet containing combination of 200 ppm enzyme and yeast recorded a significantly (P < 0.05) high values of total serum protein and serum globulin relative to other combination levels. At finisher phase (13-16 weeks), birds on 350 ppm combined supplementation of enzyme and yeast recorded a significantly (P < 0.05) higher PCV HB, ALT and WBC compared to other treatments. The value for uric acid was significantly (P < 0.05) elevated in birds fed 200 ppm and 300 ppm enzyme and yeast combination. There was no significant (P > 0.05) effect of enzyme and yeast supplementation on live weight, dressing percentage, weights of head, neck, drum stick, thigh, breast, lungs, liver, heart, kidney, spleen, gizzard, proventriculus, crop and abdominal fat except back weight and wing weight that were significantly (P<0.05) affected by dietary treatment. In conclusion, inclusion of feed additives in MSP diet such as enzymes and yeast is a good measure in enhancing serum biochemistry and production performance of exotic turkey bred in the humid tropics.*

Key words: *Blood parameters, carcass performance, roxazyme G2 ® yeast, and MSP.*

I. Introduction

One of the major constraints challenging poultry industry in Nigeria and other developing countries is the inadequate supply of conventional feed ingredients. It has therefore become imperative to find alternatives that are cheap and have no deleterious effect on poultry performance. Sorghum sprout is an example of agro-industrial by-product which could be used as an alternative feed ingredient.

Sorghum *spp* (Guinea corn) had replaced barley as a raw material in confectionery and brewering industry in many tropical countries (Banjoko, 1992). Malt is extracted from germinated sorghum seeds and the residue consists of sorghum shoots and roots. These residues are collectively referred to as malted sorghum sprouts (MSP). This MSP has a lot of prospects as a livestock feed but its usefulness is limited by its tannin content and non-starch polysaccharides (Elkin et al., 1995). Therefore, there is need for supplementation with probiotics which can enhance poultry performance.

Non-antibiotic growth promoters, such as organic acids and probiotics are increasingly being included in animal nutrition (Windisch et al., 2008). Gong et al. (2002) posited that probiotics are healthy bacteria, fungi or other beneficial microbes meant to inhabit the gastrointestinal tract of both humans and animals towards enhanced health, feed efficiency and production function. Probiotics are viable single or mixed cultures of micro-organisms that when given to animals, they beneficially affect the host by improving the properties of the indigenous microflora (Kyriakis et al., 1999 and Lee et al., 2008). The positive effects of probiotics on animals can result from its direct nutritional effect, where they act as bio-regulators of the intestinal microflora thus reinforcing the host's natural defense mechanisms.

Furthermore, addition of live yeast to livestock ration has been shown to enhance the nutritive quality of feed and production performance of animals (Martin et al., 1989; Glade and Sist, 1998). Studies on both humans and animals on the ability of probiotics to change the types and numbers of gut microflora and feed utilization have been reported (Endo et al., 1999; Roberfoid, 2007 and Saulnier, 2007). In this wise, probiotics are used to

get rid of stress induced abnormalities in the gastrointestinal tract, thus normalizing and restoring gut activity (Kutlu et al., 2001). Some reports (Midilli and Tuncer, 2001 and Jin et al., 1998) revealed that additional benefits are obtainable by the supplementation of broiler diets with probiotics as feed additives. In a bid to address this challenge, concerted efforts have been made to incorporate anti-microbials and other natural products such as yeast and enzyme in animal feeds. This study therefore, intends to determine the effects of RoxazymeG2® and yeast as a dietary probiotic sources on turkey serum biochemistry and carcass traits of tropically bred exotic turkey.

II. Materials and method

2.1 Enzyme and yeast

The commercial enzyme used in this study was a blend of multi-enzymes consisting of endo – 1, 4 – β – xylanase (EC 3.2.1.8), endo – 1, 3 (4) – β – glucanase (EC 3.2.1.6) and endo – 1, 4 – β – glucanase (EC 3.2.1.4) produced by Trichoderma reesei and bakers' yeast (*Saccharomyces cerevisiae*).

2.2 Experimental birds and Management

This study was carried out at the Poultry unit of the Teaching and Research Farm, Federal University of Agriculture, Abeokuta, Nigeria ($7^o10'$N and $3^o2'$E). Eighty day old male British United turkeys (BUT) were purchased from a reputable commercial hatchery. The poults were brooded intensively for 1-28 days pre-experimental period in deep litter housing system during which the birds were fed together with pre-starter turkey ration (Table 1). During brooding, temperature was controlled at 34.5^{o}C for the first 0 to 2 days and then gradually reduced by 2^{o}C per week to a final ambient temperature of 27^{o}C at the last week of brooding. Feed and clean water were supplied *ad libitum*. The birds were reared intensively on deep litter system. Required vaccination program and medication schedule were adhered to religiously.

2.3 Dietary treatments

At day 28, eighty male turkeys of similar weights were selected and assigned on weight equalization basis to four dietary treatments having Malted sorghum sprout (MSP) based diets supplemented with combination of varying levels (200, 250, 300 and 350ppm) of Roxazyme G and baker's yeast (*Saccharomyces cerevisiae*) at ratio 1:1 levels for 28-56 days (starter phase), 56-84 days (grower phase) and 84-132days (Finisher phase) (Table 1). Each treatment group consisted of 20 turkeys replicated four times with 5 birds each.

2.4 Serum bio-chemistry

Blood samples were collected from 4 randomly selected turkeys per treatment (1 turkey/pen) at 56th and 84th day of the study to determine the blood serum chemistry. Blood collections were done through brachial vein puncture into vacuum tubes containing anticoagulants to obtain blood serum. Blood samples were immediately centrifuged at (1200 for 15 min) for separation of plasma. Aliquots of plasma were taken according to requirements of test and were refrigerated at -20^{o}C for further analysis. The total serum protein, albumin, globulin, serum creatinine and serum uric acid concentration were analysed according to Jain (1986). Serum enzymes; alanine amino transaminase (ALT) and aspartate amino transferase (AST)) were analysed using the commercial kits **(**Qualigens India. Pvt. Ltd., Catalogue number 72201-04). The serum cholesterol was estimated using the enzymatic colorimetric methods (according to the manufacturer's manual) using using Randox^R diagnostic cholesterol kit.

2.5 Carcass Measurements

At the end of the study, two birds whose weights were nearest to the average weight of birds in each replicate were selected, slaughtered, defeathered and eviscerated. The live weights of the birds were taken prior to slaughtering and the dressed weight was also recorded. The head, neck, breast, back, thigh, drumstick, shank were weighed and recorded, the spleen, kidney, lungs, gizzard, liver, heart, abdominal fat, proventriculus were also weighed using a sensitive digital electronic pocket scale. The weights were expressed as percentage of live weights.

2.6 Statistical analysis

Data obtained were analyzed using Polynomial contrast (linear and quadratic) using SPSS (1999) to determine the trends (linear and quadratic) inclusion of feed additives (enzyme and yeast). A probability ($P < 0.05$) was considered to be statistically significant. Means were separated using Duncan multiple range test.

III. Results

Effect of supplementation of varying dosage/mixtures of additives (enzyme and yeast) on haematological measurements of turkey poults fed basal diets containing 100 g/kg MSP based diets for 28-56d (Table 2). The

results revealed no significant effect (P > 0.05) on ALT values. The PCV, Hb, WBC, RBC, glucose, albumin, globulin, STP decreased significantly (P<0.05) as inclusion of additives increases. Above 200ppm dietary combination of enzyme + yeast, PCV, Hb, WBC and RBC of the turkeys recorded lower values. However, turkeys fed diet containing combinations of 350 ppm enzyme and yeast recorded highest AST and uric acid values. The serum uric acid values significantly (P < 0.05) increased for turkeys fed diet containing 200 ppm and 350ppm enzyme and yeast. Birds fed diet containing combination of 200 ppm enzyme and yeast had significantly (P < 0.05) high glucose and TSP values relative to other combinations. The effect of various combinations of enzyme and yeast supplementation levels on blood parameters of growing turkeys is presented in Table 2 (56-84days). The results showed no significant effect (P > 0.05) on PCV and Hb values. The values of WBC reduced significantly (P < 0.05) with increased combinations of enzyme and yeast. Relative to this, turkeys fed diet containing combinations of 250 ppm, 300 ppm and 350 ppm enzyme and yeast recorded significantly (P < 0.05) higher RBC values.

Turkeys fed diet containing combinations of 200 ppm enzyme and yeast recorded a significantly (P < 0.05) high values of total serum protein, globulin and serum globulin relative to other combination levels. Significantly (P < 0.05) higher values of AST were obtained for turkeys fed diet containing combinations of 200 ppm and 250 ppm enzyme and yeast. Turkeys fed diet containing combinations of 350 ppm enzyme and yeast recorded the least significant (P < 0.05) AST values. ALT values showed significance (P < 0.05) with no regular pattern. Dietary combinations of enzyme and yeast at 350 ppm recorded a significantly (P < 0.05) high serum uric acid concentration followed by 200 ppm and 250 ppm while dietary combinations of 300 ppm enzyme and yeast resulted in the least serum uric acid concentration. Turkeys fed diet containing combinations of 250 ppm enzyme and yeast had a higher significant (P < 0.05) serum creatinine values. Those fed diet containing mixtures of 200 ppm enzyme and yeast recorded the least serum creatinine values. Glucose values ranged from 168 mg/dl for birds fed 350 ppm to 130 mg/dl in birds fed mixtures of 300 ppm enzyme and yeast.

The results of finishing turkey showed that all the blood parameters measured were significantly (P < 0.05) affected by the treatment imposed (Table 2). Birds on 350 PPM supplementation recorded the highest significant (P < 0.05). PCV and HB values and were closely followed by birds on 200 ppm and 250 ppm while the least value was recorded for birds fed 300 ppm. Birds fed 350 ppm recorded superior RBC values which were statistically similar with birds on 250 ppm, while the least RBC values were recorded for 200 ppm and 300 ppm which were statistically similar. The WBC did not follow a particular pattern but birds on 350 ppm recorded the highest significant (P < 0.05) WBC values while the least values were recorded for birds on 200 ppm. The result revealed that turkey fed 200 ppm and 350 ppm had a significantly (P < 0.05) higher total serum protein and albumin. Birds fed 200 ppm, 300 ppm and 350 ppm were statistically similar but were significantly (P < 0.05) higher than those fed 250 ppm for AST. The highest ALT value of 8.00 iu/l was recorded when birds were offered 350 ppm, while the least statistically similar values were recorded for birds fed 200 ppm, 250 ppm and 300 ppm. However, the values for uric acid were elevated significantly (P < 0.05) when birds were fed 200 ppm and 300 ppm, closely followed were birds on 250 ppm, while the least value was recorded for birds on 350 ppm supplementation.

Table 1: Gross composition of pre-starter (1-28d), starter (28-56d) grower (56-84d) and finisher (84-124d) diets and chemical composition of malted sorghum sprout (MSP)

Ingredients	Pre-starter (1-28d) diets	*MSP basal diets			Chemical Composition of MSP
		Starter (28-56d)	Grower (56-84d)	Finisher (84-124d)	
Maize	430	425	505	560	
Soybean meal	412	240	180	135	
Full fat soybean	-	100	80	80	
Fish meal	80	80	60	40	
Vegetable oil	-	-	20	30	
MSP	-	100	100	100	
Bone meal	45	30	30	30	
Oyster shell	20	14	14	14	
Lysine	1	1.5	1.5	1.5	
Methionine	4	2	2	2	
Premix †	5	5	5	5.0	
Salt	2.5	2.5	2.5	2.5	
Total	1000	1000	1000	1000	
Chemical composition					
Dry matter (g/kg)	900.5	911.1	901	911	912
ME(MJ/kg) ‡	11.93	12.27	12.75	13.21	11.69

Crude protein (g/kg)	281.9	263.6	223.2	194.5	163.7
Ether extract (g/kg)	37.6	53.0	48.8	47.7	38.2
Crude fibre (g/kg)	30	35.1	32.4	31.1	107.5
Calcium (g/kg)	21.6	15.6	15.0	14.5	9.2
Phosphorus (g/kg)	8.6	6.7	6.0	5.9	11.1
Lysine (g/kg)‡	19.1	18.6	15	12.8	-
Methionine (g/kg)‡	8.8	6.8	6.8	5.5	-
NDF (g/kg)					217
ADF (g/kg)					147
ADL (g/kg)					103
Gross energy (MJ/kg)					14.9
HCN (mg/kg)					3.02
Tannin (mg/kg)					0.09

Table 2: Effect of supplementation of varying dosage of mixtures of additives (enzyme and yeast) on haematological measurements of turkey poults fed basal diets containing 100 g/kg MSP based diets.

Starter phase	**Enzyme and Yeast Levels (mg/kg)**					**P value**	
Parameters	**200 ppm**	**250 ppm**	**300 ppm**	**350 ppm**	**SEM**	**L**	**Q**
Packed cell volume (%)	40.25^{a}	37.25^{b}	32.25^{bc}	35.75^{c}	0.47	0.000	0.000
Haemoglobin (g/l)	13.43^{a}	12.40^{b}	12.08^{bc}	11.93^{c}	0.16	0.000	0.000
White blood cell ($x10^{9}$/L)	189.25^{a}	159.50^{c}	160.75^{c}	180.00^{b}	3.30	0.387	0.000
Red blood cell ($x10^{12}$/L)	204.75^{a}	143.75^{b}	133.25^{b}	141.50^{b}	7.59	0.001	0.000
Glucose (mg/dl)	183.75^{a}	164.20^{c}	172.30^{b}	159.53^{d}	2.42	0.000	0.002
Total serum protein (g/dl)	43.13^{a}	40.35^{ab}	39.15^{b}	39.23^{b}	0.51	0.001	0.001
Albumin (g/l)	17.83^{a}	16.80^{b}	17.33^{ab}	17.10^{ab}	0.14	0.207	0.165
Globulin (g/L)	25.30^{a}	23.53^{ab}	21.83^{b}	22.13^{b}	0.48	0.004	0.006
AST (iu/L)	67.25^{b}	59.00^{b}	67.00^{b}	79.25^{a}	2.15	0.016	0.000
ALT (iu/L)	6.25	5.50	5.50	10.50	1.00	0.162	0.127
Uric acid (mg/dl)	2.13^{a}	1.85^{b}	1.40^{c}	2.03^{a}	0.07	0.269	0.000
Creatinine (mg/dl)	1.05^{c}	2.43^{a}	1.58^{b}	1.70^{b}	0.13	0.356	0.018
Grower Phase							
Packed cell volume (%)	43.25	44.00	4300	44.75	0.28	0.172	0.272
Haemoglobin (g/l)	14.43	14.70	14.333	14.93	0.09	0.193	0.305
White blood cell ($x10^{9}$/L)	238.25^{a}	144.00^{b}	111.00^{d}	121.00^{c}	13.06	0.000	0.000
Red blood cell ($x10^{12}$/L)	193.50^{b}	198.00^{ab}	197.50^{ab}	205.25^{a}	1.51	0.005	0.019
Glucose (mg/dl)	152.88^{c}	162.75^{b}	130.00^{d}	168.00^{a}	3.76	0.721	0.016
Total protein (g/dl)	45.91^{a}	39.80^{c}	38.85^{d}	41.10^{b}	0.70	0.009	0.000
Albumin (g/l)	19.78^{a}	18.40^{bc}	17.93^{c}	18.50^{b}	0.19	0.005	0.000
Globulin (g/L)	26.13^{a}	21.40^{c}	20.93^{c}	22.60b	0.54	0.015	0.000
AST (iu/L)	21.00^{a}	21.00^{a}	18.00^{b}	12.00^{c}	0.97	0.000	0.000
ALT (iu/L)	7.00^{c}	10.05^{b}	38.50^{a}	7.00^{c}	3.44	0.373	0.015
Uric acid (mg/dl)	2.40^{b}	2.13^{c}	1.50^{d}	2.78^{a}	0.12	0.658	0.000
Creatinine (mg/dl)	1.03^{c}	2.50^{a}	1.88^{b}	1.83^{b}	0.14	0.154	0.001
Finisher phase							
Packed cell volume (%)	46.75^{ab}	46.25^{ab}	44.25^{b}	48.50^{a}	0.52	0.001	0.042
Haemoglobin (g/l)	15.58^{ab}	15.43^{ab}	14.75^{b}	16.15^{a}	0.17	0.507	0.044
White blood cell ($x10^{9}$/L)	136.25^{d}	158.50^{b}	147.50^{c}	179.75^{a}	4.26	0.000	0.001
Red blood cell ($x10^{12}$/L)	165.50^{bc}	178.75^{ab}	157.50^{c}	184.00^{a}	3.20	0.244	0.004

Glucose (mg/dl)	203.63[a]	161.15[c]	173.25[b]	159.58[c]	4.62	0.001	0.000
Total protein (g/dl)	53.38[a]	43.80[b]	45.35[b]	49.55[ab]	1.25	0.391	0.005
Albumin (g/l)	20.40[a]	16.33[b]	17.70[b]	20.20[a]	0.51	0.871	0.000
Globulin (g/L)	32.98a	27.45c	27.65c	29.35b	0.83	0.157	0.020
AST (iu/L)	67.25[ab]	63.25[b]	79.25[a]	76.00[ab]	2.19	0.025	0.090
ALT (iu/L)	4.00[b]	4.00[b]	4.00[b]	8.00[a]	0.45	0.000	0.000
Uric acid (mg/dl)	3.73[a]	3.18[a]	3.93[a]	2.78[c]	0.12	0.045	0.053
Creatinine (mg/dl)	4.63[b]	3.88[c]	3.95[c]	4.93[a]	0.12	0.366	0.000

[abc] Means on the same row having different superscripts are significantly different (P < 0.05)

Table 3. Effect of supplementation of varying dosage of mixtures of additives (enzyme and yeast) on carcass traits of turkey fed basal diets containing 100g/kg MSP based diets.

	Enzyme and Yeast Levels (mg/kg)					P value	
Parameters	**200ppm**	**250ppm**	**300ppm**	**350ppm**	**SEM**	**L**	**Q**
Carcass traits							
Live weight (g)	8175.00	8775.00	8500.00	8875.00	169.12	0.240	0.488
Carcass weight (g)	6408.38	7032.29	6686.1	6981.08	97.86	0.110	0.241
Dressing percentage (%)	78.39	80.14	78.84	78.66	0.75	0.944	0.832
Cut parts (% of LW)							
Head	1.84	2.30	2.24	1.83	0.11	0.927	0.162
Neck	4.96	6.09	5.68	5.87	0.22	0.249	0.297
Shank	2.90[b]	3.69[a]	3.53[ab]	3.65[ab]	0.11	0.037	0.030
Drum stick	11.16	12.24	11.31	11.94	0.17	0.367	0.551
Back	16.20[a]	14.74[ab]	13.89[b]	14.90[ab]	0.32	0.102	0.029
Wings	9.79[b]	11.67[a]	11.87[a]	11.48[a]	0.28	0.028	0.004
Thighs	12.23	12.98	11.84	12.67	0.17	0.920	0.989
Breast	25.52	24.51	24.57	24.03	0.28	0.078	0.204
Organs weight (% of LW)							
Lungs	0.35	0.47	0.38	0.38	0.02	0.913	0.293
Heart	0.32	0.39	0.33	0.36	0.01	0.460	0.420
Liver	1.50	1.39	1.37	1.38	0.03	0.161	0.239
Kidney	0.32	0.44	0.33	0.35	0.02	0.941	0.534
Spleen	0.10	0.88	0.08	0.07	0.01	0.228	0.496
Gizzard	3.07	2.87	2.93	2.83	0.06	0.207	0.429
Proventiculus	0.22	0.24	0.25	0.23	0.01	0.550	0.228
Crop	0.34	0.36	0.28	0.34	0.02	0.624	0.734
Abdominal fat	0	0	0	0	0	0	0

[abc] Means on the same row having different superscripts are significantly different (P <0.05)

IV. Discussion

The highest values of PCV, Hb, RBC, glucose, TSP, albumin and globulin were recorded at the starter phase and finisher phase following the inclusion of the lowest dosage of enzyme and yeast supplementation (200 ppm). However, TSP, Albumin and Globulin were highest at lower dosage of enzyme and yeast supplementation at the grower phase. This implies that poults fed diet containing 200ppm mixtures of enzyme + yeast had higher blood plasma.This finding in total serum protein (TSP) corroborrated Serrano et al. (2008) who found that TSP is applicable in the monitoring of body condition and nutritional status of Iberian wild goats (*Capra pyrenaica*). The PCV varied proportionately with the serum total protein (STP), thus suggesting that PCV is beneficial in assessing the protein status and possibly forecasting the degree of protein supplementation at different physiological states (Daramola et al., 2005). This also implies that poults fed diet containing 200ppm mixtures of enzyme + yeast had higher blood plasma protien. Futhermore, addition of enzyme and yeast supplementation could be responsible for increaseed total serum protein and glucose levels witnessed at both starter and finisher growth phase (Shereef and Al Dabbagh, 2009). The increased level of TSP concentrations observed both at starter phase (200 ppm of enzyme and yeast supplementation) and grower phase (>300 ppm of enzyme and yeast supplementation) is an indication that the diet is rich in amino acid that led to increased TSP levels which invariably led to increase in serum albumin and globulin (Thrall et al., 2012).

Highest glucose value obtained for grower turkeys fed diet containing 350ppm enzyme and yeast supplementation showed sufficient energy for the bird thus sustaining physiological activities, physical activities

and normal blood function (Adebisi, 1997). The higher levels of Hb and RBC obtained at the finisher phase with enzyme and yeast supplementation (>300 ppm) suggested that the turkeys had high oxygen carrying capacity (Brij et al., 1977). This indicates that the nutritional profile of the diet was more enriched when supplemented with high level of enzyme and yeast additives. Nutrition was reported to influence the haemoglobin level of the blood (Udo, 1987). Pellet and Young (1980) confirmed that haemoglobin levels are positively correlated with protein quality and level in the diets.

The reduced serum enzymes (AST and ALT) obtained across all phases of growth could be associated with hepatho-protective effects of the yeast probiotics supplemented in the diet (Aluwong et al., 2013), any exaggerated increase in levels of serum enzymes (AST, ALT) could be an indication of liver damage and necrosis (Yalcin et al., 2012). In addition, reduced serum uric acid was recorded for finishing turkeys fed diets containing 350ppm enzyme and yeast supplementation informs efficient protein utilization by the turkeys. Kumta and Harper (1961) and Eggum (1970) reported a general fall of serum urea concentrations with time in nutritionally balanced amino acids based diets. Dietary inclusion of 350 ppm dosage of enzyme and yeast supplementation recorded the highest WBC at the finisher phase. This increase suggested the introduction of antibodies into the systems of birds as they grow probably through feed ingredients or compromised management systems which could consequently trigger the production of WBC with a view to enhancing phagocysis and elevating immune respose mechanisms, white blood cells played prominent roles in disease resistance and immune response mechanisms especially with respect to the generation of antibodies and the process of phagocytes (Wintrobe, 1983).

However, the reduced values of WBC obtained for turkeys fed with diets containing >200 ppm enzyme and yeast additives at starter and grower phases could be due to the absence of foreign bodies which could have triggered or raised the leucocyte count at this phase of growth (Wintrobe, 1983). A very high serum creatinine levels obtained across all stages of experiment revealead the extent of muscle wastage occurring in a livestock animal. In respect of carcass characteristics, weights of head, neck, drumstick, thigh, breast, gizzard, proventriculus, crop and abdominal fat were not affected by increased dosage of enzyme and yeast supplementation. This implies that the inclusion of enzyme and yeast supplementation did not influence the parameters aforementioned. However, significantly higher shank and wing weights were obtained for turkeys fed diet containing combined dosage of (250 ppm, 300 ppm and 350 ppm) enzyme and yeast supplementation. Therefore, dietary inclusion of increased dosage of enzyme and yeast supplementation favoured higher production of shank and wing weight. Our findings agreed with the previous studies that inclusion of enzymes, synthetic amino acids and other feed additives/probiotics significantly influence some cut parts of poultry birds (Crouch et al., 2000).

The highest back weight was recorded with turkeys fed diet containing combined dosage of 200ppm enzyme and yeast supplementation. Similar trend was obtained in the values of back weight documented for turkeys fed diet containing combined dosage of 250 ppm, 300 ppm and 350 ppm enzyme and yeast supplementation. Finally, increased inclusion of yeast and enzyme supplentation in our study showed no effect on weights of the organs examined.

In conclusion, the inclusion of feed additives such as enzyme and yeast in turkey nutrition profile plays a significant role in enhancing haematological and serum biochemical traits of exotic turkey bred under humid tropical condition with increased immune-capacity to withstand harsh tropical environment and that hematological and serum biochemical traits are good measures to assess health status and livestock productivity. Similarly, inclusion of feed additives such as enzyme and yeast in turkey nutrition enhances the tissue performance of wing weight, shank weight and back weight of tropically bred exotic turkeys.

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