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EFFECTS OF A HIGH LEVEL OF VITAMIN E ON COMMERCIAL BROILER CHICKS

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Abstract

Graded doses of vit. E (30, 60, 100 ppm) were fed to one-week-old commercial balady native strains broiler chicks for one month. Results indicated improvement in blood profile. Biochemical analysis at mega dose revealed significant increase of serum cholesterol, aspartate amino-transferase (AST), alanine amino-transferase (ALT), urea and creatinine. Protein electrophorosis indicated hyperproteinaemia and hyper β and γ globulinaemia at 60 ppm dose (immunostimulant), while, mega dose 100 ppm lead to hypoproteinaemia and hypo β and γ globulenaemia.

It was concluded that mega dose of vit E at 100 ppm was associated with biochemical hepato-nephrotoxic disorders in broiler chicks, while at suitable dose of vit. E revealed an immunostimulant effect and improved blood profile.

INTRODUCTION

The important role of vitamin E (lipophilic antioxidant vitamin) as an antioxidant and free radical scavenger is well established and it has the advantage of being nontoxic at required levels (McCay and King, 1980). Vit. E as an antioxidant nutrient can modify cell mediated immune responses in younger human individuals to middle-aged human subjects (Hughes, 1999). Its function as an antioxidant by stopping propagation of potent oxidants formed during cellular metabolism also protects the poly-unstaturated fatty acids from peroxidation.

It is required in the nutrition of poultry for normal protection, reproduction and effective antioxidant activity for the prevention of encephalomalica and myopathies.

Vitamin E is generally considered to be of low toxicity to promote growth, hypervitaminoses E increase requirement for vit. D & K. Abdo *et al.* (1986) reported that ex-

cessive amount of vit. E (2000 mg/kg BW) in rats is potentially toxic. Moreover, Letimad *et al.* (1989) concluded that excess amount of vit. E to poultry induced hepatotoxicity, and severe haemorrhage.

The present work throws light on the adverse effect of mega doses of vit. E fed to broiler chicks on certain haematological and serum biochemical parameters.

MATERIALS AND METHODS

Vitamin E is L-α-tocopheryl acetate. It was obtained from Memphis Co. for Pharmaceutical Industries.

Experimental design

Sixty 1-day old balady (native) chicks of both sexes were obtained from the general poultry company and maintained in brooder batteries. Feed and water were provided ad libtum. At the age of 7 days the chicks were divided at random into 4 groups of 15 each.

Group I chicks was used as control and were fed the starter ration obtained from the General Poultry Company. Groups II, III and IV received vit. E added to the starter ration at 3 final dietary concentrations of 30 ppm, 60 ppm and 100 ppm, respectively, and were fed for 4 weeks. At the end of the experiment, birds were slaughtered and heparinized and non heparinized blood samples were collected for haematological and biochemical studies.

Haematological pattern

Erythrocytic count, hemoglobin, haematocrit, total leucocytic count and haemocytic indices were determined according to Natt and Herrik (1952) and Oser (1979).

Biochemical study

Non heparinzied samples were left for coagulation and serum was separated by centrifugation at 3000 r.p.m. for 15 minutes and kept for biochemical examination of: (1) Alanine amino transfererase (ALT) and aspartate amino transferease (AST) activities according to Reitman and Frankel (1957). (2) Alkaline phosphatase (ALP) activity

were determined (Kind and King, 1954); (3) Cholestrol (Lopes, *et al.*,1977). (4) Urea (Patton and Crouch, 1977); (5) Serum total proteins (Peters, 1968) and protein electrophoretic pattern (Henry *et al.*, 1974).

Statistical analysis

The data were analyzed using student ANOVA test and comparison was done between means using LSD (Least Significant Difference) at $P<0.05$ as outlined by Patrie and Watson (1999).

RESULTS & DISCUSSION

Results given in table 1, showed no significant differences in determined haematological parameters between control and G_1, G_2 and G_3. Abdel Khalek *et al.* (1996) reported that also, rats treated with vit. E had no changes in the studied haematological parameters. Moreover, dietary tocopherols protect erthrocytes against lipid peroxidation by regulating the level of glutathion via an effect of the enzyme glutathion peroxidase. Abdo *et al.* (1986) and Khal and Kappus (1993) concluded that, to induce a marked haematological effect, tocopherols must be used in mega doses. They also reported that excess vit. E doses either retard blood cell maturation or shorten their life span.

Regarding serum enzyme activities (table 2) ALT showed increase in G_1, G_2 and G_3 when compared with control (C), while, AST revealed a slight elevation in G_1 when compared with control (C), but significant increase in G_2 and G_3. Moreover, alkaline phosphatase revealed a significant increase in G_1, G_2 and G_3 when compared with control (C). This increase may be due to enzymatic activity as a result of effect of vit. E high dose on the activities of membrane bound enzyme (angiotensin) that could disrupt the endothelial barrier function. Letimad *et al.* (1989) concluded that excessive dietary vit. E was associated with hepato-nephrotoxicity and lead to significant increase in hepatic enzymes which are useful indicators of hepatic damage in chickens.

Urea and creatinine levels in chicken revealed a significant increase in all treated groups (G_1, G_2 and G_3) when compared with control (C), which may occur due to renal impairment or reduction in glomerular filtration. These elevations reflect the nephrotox-

icity of chickens. Letimad *et al.* (1989) reported that vit. E treated broilers showed epithelial proliferation and necrosis of renal tubules, which consequently were unable of purifying blood from uric acid. Abdo *et al.* (1986) recorded haemorrhagic inflammation in kidneys of vit. E treated rats.

The mega dose of vit. E resulted in significant elevation of cholesterol level in the sera of G_1, G_2 and G_3 when compared with control (C). In contrast, Letimad *et al.* (1989) noticed that serum cholesterol was reduced in the test groups with vit. E at graded doses, whereas Fukal *et al.* (1986) recorded a slight elevation of cholesterol level in one-day old chick sera.

Table 3 revealed that, there were positive correlations between vit. E supplementation in G_2 and serum total proteins (Hyperproteinaemia), albumin (hyper albuminaemia) and β & γ globulin's (hyper globulinaemia). These results agreed with McCay and King (1980). Also, our results suggest that vit. E at suilable doses leads to stimulation of B-lymphocyte proliferation and function which results in improved bio-synthesis of plasma globulins immuno stimulant effect.

Mega dose of vit. E supplementation to broilers was associated with hypoproteinaemia, hypo-albuminaemia and hypoglobulinaemia. This could be accounted for stimulation of β-oxidation capacity which leads to hydrogen peroxidation production that becomes toxic to the cells and increase lipid peroxidation products resulting in oxidative damage and inhibit liver cell proliferation (Nanji *et al.*, 1995).

It was concluded that mega dose supplementation of vit E at 100 ppm lead to biochemical hepato-nephrotoxic disorders and immuno-deficiency effect on broiler chicks, while, suitable doses of 30 and 60 ppm vit. E induce immunostimulatnt effect and improve blood profile.

Table 1. Effect of supplementing diets with different doses of vit. E on certain haematogical parameters in broiler chicks.

	R.B.Cs	Hb	P.C.V	M.C.V	M.C.H	MCHC	WBcs
Control	$10^6/mm^3$	gm/dl	%	Fl	pg	g/dl	$10^3/mm^3$
	3.43^{A} ±0.12	9.76 ±0.52	36.60^{A} ±0.25	107.06^{a} ±2.98	28.38 ±0.69	26.65 ±1.27	10.13^{a} ±0.01
G_1	3.37^{b} ±0.02	9.96 ±0.12	36.30^{b} ±0.39	107.30^{b} ±1.56	29.56 ±0.51	27.57 ±0.17	9.53^{ab} ±0.12
G_2	3.50^{c} ±0.04	10.30 ±0.17	34.52^{ac}±0.97	98.77^{ab} ±3.64	29.42 ±0.13	29.97 ±1.27	9.13^{a} ±0.03
G_3	3.70^{abc}±0.02	10.72 ±0.24	37.00^{c} ±0.32	100.02 ±1.13	28.58±0.66	28.98 ±0.72	9.53^{a} ±0.24
F. calculated	4.63	1.863	3.770	3.130	0.932	2.300	9.27

Mean values with different letters in the same row are significantly different ($P<0.05$).

R.B.Cs= red blood cells; Hb= haemoglobin; P.C.V.= packed cell volume; M.C.V.= mean corpuscular volume; M.C.H.= mean corpuscular haemoglabin; MCHC= mean corpuscular haemoglobin content (in g per 100 ml of cells).; WBCs= white blood cells.

Table 2. Effect of supplementing diets with different doses of vit. E on certain serum biochemical parameters in broiler chicks.

Dose	ALT U/l	AST U/l	A/P U/l	Urea mg/100ml	Creatinine mg/100 ml	Cholesterol mg/100ml
Control	19.4^{a}±1.50	7.80 ^{a} ±0.663	5.26 ^{a} ±0.191	4.66 ^{a} ±1.36	0.32 ^{a} ±0.03	135.6 ^{a} ±1.5
G1	30.6 ^{ab} ±0.509	10.00 ^{b} ±0.316	9.28 ^{b} ±0.435	6.92 ^{ab} ±0.159	0.48 ^{b} ±0.03	147.6 ^{b} ±6.87
G2	25.2 ^{bc} ±1.74	16.80 ^{abc} ±0.663	6.98 ^{abc} ±0.361	7.80 ^{ab} ±0.122	0.76 ^{abc} ±0.04	164.6 ^{ab} ±1.74
G3	25.8 ^{abc} ±0.58	18.80 ^{ab} ±1.24	7.34 ^{abc} ±0.32	7.98 ^{ab} ±0.68	0.64 ^{abc} ±0.04	150.8 ^{a} ±6.24
F. calculated	14.271	44.24	23.69	106.48	11.829	6.21

F. calculated significantly at P<0.05

Mean values with different letters in the same row are significantly different (P<0.05).

ALT= alanin amino-transferase; AST= aspartate amino-transferase; ALP= alkaline phosphatase;

Table 3. Effect of supplementing diets with different doses of vit. E on total protein and its fractions in sera of broiler chicks.

	T. Protein (g/100ml)	Albumin (g/dl)	α globulin (g/dl)	β globulin (g/dl)	γ globulin (g/dl)	Total globulin (g/dl)	A/G ratio
Control	3.80±0.4	1.46±0.01	0.68±0.04	0.54±0.06	1.0±0.06	2.21±0.03	0.6±0.03
G1	4.13±0.06	1.62±0.01	0.70±0.04	0.56±0.03	1.09±0.04	2.09±0.05	0.6±0.05
G2	4.45*±0.07	1.88*±0.02	0.75±0.03	0.56±0.02	1.25*±0.04	2.56±0.06	0.7±0.06
G3	2.86*±0.021	1.38±0.03	0.40±0.01	0.38±0.02	0.7*±0.06	1.5*±0.01	0.9±0.04

Volues are mean ± SD.

* significantly different from controls ($P \leq 0.05$)

T. Protein = total protein; A/G = albumin/globulin.

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تأثير الجرعات العالية من فيتامين هـ فى الدواجن

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يشمل هذا البحث إعطاء بدارى بلدي التسمين التجاري عمر أسبوع جرعات مختلفة من فيتامين هـ مخلوطة بالعليقة بنسب ٣٠، ٦٠، ١٠٠ جزء فى المليون (ملليجرام/كجم عليقه) وذلك لمدة شهر.

وقد أشارت نتائج فحص الدم إلى تغير غير معنوي في نسبة الهيموجلوبين وكرات الدم الحمراء وكرات الدم البيضاء والحجم النسبي لكرات الدم الحمراء. أما نتائج الفحوص البيوكيميائية للمصل فقد أثبتت زيادة نسبة إنزيمات الاسبرتيت (AST) والألانين (ALT) والكلسترول والكرياتينين اليوريا في المجموعات المعطاه فيتامين هـ بجرعات عالية (١٠٠ ملليجرام/كجم عليقة). كما أثبت التحليل الكهربى للبروتينات فى المصل زيادة فى الجلوبيولينات الكلية فى حالة الطيور المعطاه ٦٠ ملليجرام/كجم عليقة متمثله فى ارتفاع نسبة البروتين الكلى والبيتا والجاما جلوبيولين. أما الجرعة العالية ١٠٠ ملليجرام/كجم عليقة أدت الى انخفاض ملحوظ فى نسبة البروتين الكلى والبيتا والجاما جلوبيولين.

ويتضح من النتائج السابقة أن إعطاء فيتامين هـ بنسبة ١٠٠ ملليجرام/كجم عليقه أدت إلى تأثير ضار فى الصورة البيوكيميائية للمصل فى بدارى التسمين التجارية.