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EFFECT OF TYROSINE, VITAMIN E AND BUTYLATED HYDROXYTOLUENE WITHOUT OR WITH SODIUM SULPHATE ON BROILER PERFORMANCE

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ABSTRACT: This study aims to examine the ability of L tyrosine 500mg/ kg diet (TYR), vitamin E 50mg/kg(E50) or Butylated hydroxytoluene 125mg/kg(BHT) without or with anhydrous sodium sulphate 0.3%(SS) in improving broiler performance . A total number of 240 male Arbor Acres broiler chicks one day old were randomly distributed into eight group received control diet or control diet supplemented with SS, TYR, TYR+SS, E50, E50+SS, BHT and BHT+SS. At 35 day, The body weights were 1850, 1953 ,2241 ,2333 ,2086 ,2080 ,1742, and 1846, respectively. The birds fed TYR+SS recorded the best feed conversion. The birds fed control diet recorded the highest value while birds fed TYR recorded the lowest values. All feed additives used in this study increased plasma phosphorus with range from18.70 to38.51% compared to control diet. That elevation in plasma phosphorus is not normal and close to Ca concentration. It is clear that tyrosine was the best additives under the condition of this study. Further studies are needed with different levels of TYR and SS under suboptimal levels of metabolizable energy and crude protein.

Key words: Tyrosine-vitamin E-Sodium sulphate-Broiler performance.

INTRODUCTION

Reactive oxygen species represent a broad category of molecules which give rise to reactive free radicals such as superoxide, hydrogen peroxide and hydroxyl radicals. These free radicals participate in oxidative reactions that damage organic substrates, such as lipids, proteins and DNA of living organisms, resulting in a deteriorative biological condition called oxidative stress (Kalam *et al.*, 2012).During infection, the natural antioxidant system of animals becomes weaker leading to increased free radicals in the body (Benzer and Yilmaz, 2009). Elevated levels of free radicals cause damage to body tissues (Halliwell and Gutteridge, 1999) which in turn impair the performance of broilers. This suggests that management practices (*e.g.* vaccination, high stocking density and transport) which subject broilers to stress can elevate the risk of excess free radical formation that could develop oxidative stress in birds (Surai, 2007). Iqbal et al. (2004) showed that If reactive oxygen species(ROS) did not removed by antioxidants, oxidation of critical structures in the mitochondria or cell or both, such as lipids, proteins and DNA, can lead to further inefficiencies that accentuate additional ROS generation. Antioxidants can decrease free radical level and improve broiler performance . For example, broilers fed normal fat supplemented with ethoxyquin had a higher weight gain during the starter phase compared with those fed unsupplemented normal fat (Wang *et al.*, 1997). Unfortunately, in practice, the maximum level of synthetic antioxidants that can be used in animal feeds is legislatively restricted due to their potential toxic effects. For example ,the US Food and Drug Administration established a maximum inclusion level of 150 ppm for ethoxyquin, 200 ppm for both BHT and butylated hydroxyanisole (BHA) in animal feeds. Similar regulatory standards have also been adopted by many other countries.(Salami et al. 2015).To achieve the best poultry performance, we must use dietary antioxidants with higher maximum level in diets and lower toxicity of its oxidized products Ali (2016). Grune et al. (1997) showed that the degradation of proteins is an essential part of the overall antioxidant defenses against free radical attack. Tyrosine and tryptophan in egg yolk are the main contributors to the antioxidant activities (Nimalaratne *et al.*, 2011). Tyrosine is known as antioxidants in seminal plasma (Van Overveld et al.2000). Moreover, a number of studies have found tyrosine to be medical useful in animal or human trials during conditions of oxidative stress (Deijen and Orlebeke 1994). L-tyrosine and L-Dopa are found to be effective antioxidants in different in vitro assay including anti lipid peroxidation, reductive ability, ABTS, DPPH and superoxide anion radical scavenging, hydrogen peroxide scavenging and metal chelating activities when they are compared to standard antioxidant compounds, such as BHA, BHT, alfa-tocopherol, a natural antioxidant, and trolox is a water-soluble analogue of tocopherol (Gulcin 2007). Tyrosine, is a precursor in dopamine synthesis and dopamine is also the precursor to norepinephrine. Tyrosine increased dopamine and norepinephrine (monoamines) turnover rates and effectively ameliorated signs of hyperactivity (Kabuki et al., 2011). Vitamin E is recognized as a potent chain-breaking biological antioxidant that protects tissue from lipoperoxidative damage (Franchini *et al.,* 1991).Chung and Boren (1999) also observed the benefits of vitamin E supplementation in broiler diets to improve FCR by 2.3%

compared to control diet .Nevertheless, broilers reared under low temperature and fed with diets supplemented with vitamin E and organic Se have a better daily weight gain than their counterparts supplemented with vitamin E and inorganic Se during both the fifth and sixth weeks (Özkan *et al.*, 2007). Several reports have suggested that the concentration of α‑tocopherol in poultry meat increased with the increase in its level of dietary supplementation (Taulescu et al., 2011).Correia-Da-Silva et al., (2014) showed that sulfated small molecules could be of value in therapeutics due to their hydrophobic nature that can contribute to improve the bioavailability. Ress *et al*. (2008) indicated that sulfation confers resistance to oxidation. Ali et al (2012) indicated that SS increased the activity of hydrophobic antioxidants and/ or protect it from free radical attach during circulation in the blood. Ali et al (2018) found that L tyrosine 0.5 g/kg diet alone or with sodium sulphate increased egg production in local laying hen from 39 to 58 weeks old and indicated that L tyrosine may help birds to elimination of free radical and sulphate increase its activity. To our knowledge , there no study has been conducted so far to determine whether L tyrosine can exert a positive effect on improve broiler performance or not . This study examine the effect of L tyrosine on broiler performance compare to vitamin E50 or BHT in presence or absent of SS.

MATERIALS AND METHODS

The experimental work was carried out at private farm, El-Monifia governorate, Egypt while the laboratory work was done at Poultry Nutrition Department, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. 240 one day-old of male Arbor Acres chicks from Cairo Poultry Company were used in this experiment. Chicks were wing-banded, individually weighed and randomly distributed into 8 groups each in three replicates of 10 chicks each and caged in battery brooders. Experimental diets and water were offered *ad-libitum* over the experimental period. Chicks in all treatments were kept under similar conditions of management. Artificial lighting was provided 24 h daily during the whole experimental period. The control diets were supplied (Table 1). Chicks were allotted on the following dietary treatments:

1- Control diet
2- Control diet+ 0.3% Anhydrous Sodium Sulphate(SS)
3- Control diet + 0.05% tyrosine(TYR).
4- Control diet + 0.05% tyrosine(TYR) + SS .
5- Control diet + 50 mg vitamin E/ kg diet(E50).
6- Control diet + E50 +SS.
7- Control diet + 125 mg BHT/ kg diet(BHT).
8- Control diet + BHT +SS.

Anhydrous Sodium Sulphate was supplied by the Egyptian Salt and Mineral Company. L Tyrosine was supplied by EVONIC Germany. The body weight (BW), feed intake (FI) and body weight gain (WG) values were weekly recorded while feed conversion (FC) was calculated as a unit of FI per unit of WG. At the end of experimental period (35 days) three birds were taken randomly from each treatment and slaughtered and the edible organs included heart, empty gizzard and liver were weighed. Carcass and organs weights percentage were calculated on the basis of live body weight. Individual blood samples were taken from 3 birds within each treatment, and collected into dry clean centrifuge tubes containing drops of heparin and centrifuged for 20 minutes on (3000 rpm) for obtaining plasma . Plasma total protein, albumin, phosphorus, and creatinine were determined by suitable commercial kits. Globulin concentration of each assayed sample was calculated by subtracting the albumin value from its total protein concentration.

The data collected were subjected to two-way analysis of variance to clear the main effects (Treatments , sulphate and their interaction).To obtain the differences among specific all 8 groups (four antioxidants with two level of sulphate) , data were analyzed as one-way analysis of variance. The statistical analysis was computed using the General Linear Models (GLM) procedure and the significant differences among treatments means were separated by Duncan's Multiple Range test as described in the SAS (SAS, 1990).

RESULTS AND DISSCUSION

Performance:

The effect of dietary treatment on body weight and weight gain is shown in Table (2) **.**At the end of starter periods, there were significant differences among different dietary treatments. The birds fed control diet plus TYR+SS recorded the highest value while birds fed control diet plus SS recorded the lowest value. The addition of TYR or TYR+SS to control diet significantly increased body weight by 11.84 and 15.53%, respectively compared to control diet. The beneficial effect of TYR may be due to its antioxidant capacity. In this respect, L-tyrosine and L-Dopa are found to be effective antioxidants in different in vitro assay including anti lipid peroxidation, reductive ability, ABTS, DPPH and superoxide anion radical scavenging, hydrogen peroxide scavenging and metal chelating activities when they are compared to standard antioxidant compounds, such as BHA, BHT, alfa-tocopherol, a natural antioxidant, and trolox is a water-soluble analogue of tocopherol (Gulcin 2007).Also, tyrosine may react with nitrogen radical since numerous studies have demonstrated that nitration of protein-bound tyrosine residues and free amino acid form of tyrosine may occur when cells are under oxidative/nitrative stress (Ischiropoulos, 1998). The beneficial effect of SS with TYR may be due that SS remove the oxidized products. For example, Sulfate conjugation may lead to the inactivation of substrate compounds and/or increase their water-solubility, thereby facilitating their removal from the body (Mulder and Jakoby 1990; Falany and Roth1993). Yasuda, et al. (2007) demonstrated the generation of nitrotyrosine O-[^{35}S]sulfate and its release into the medium of HepG2 human hepatoma cells labeled with [^{35}S]sulfate in the presence of nitrotyrosine and suggested that sulfation may indeed play a significant role in the metabolism of free nitrotyrosine generated under oxidative/nitrative stress. On the other hand , Tyrosine, is a precursor in dopamine synthesis and dopamine is also the precursor to norepinephrine and SS may increase their circulation in blood. In this respect, Studies have demonstrated that more than 95% of dopamine and approximately 70% of norepinephrine circulating in human blood exist in sulfate-conjugated form (Johnson 1980).Also, It has been estimated that as much as 1% of the total proteins in an organism may be tyrosine-sulfated (Baeuerle and Huttner,1985). At the end of grower period, addition of TYR or TYR+SS to control diet significantly increased bodyweight by 5.87 and 11.18 %, respectively .The addition of E50 or E50+SS significantly increased body weight by 5.02 and 8.92%, respectively compared to control diet. The beneficial effect of E50 may be due to its role in free radical scavenging. For example , Sahin et al. (2002) reported that by increasing dietary vitamin E, plasma concentrations of vitamin E and A significantly increased and consequently, serum MDA levels significantly decreased. In the current study, the addition of SS to E50 increased its beneficial effect on body weight and these results can be explained on the basis that vitamin E metabolites conjugate with sulphate (Leonard, *et al.* 2005). A long with previously reports (Mustacich, *et al.* 2010; Grammas *et al.* 2004) stated that cytoplamic sulfotransferase enzymes may catalyze sulfation of the intermediates to increase their solubility and allow excretion to prevent accumulation of γ-tocopherol intermediates and these metabolites have been reported to have potential health benefits**.** Addition of BHT or BHT+SS numerically increased live body weight by 2.33 and 3.82%,respectively compared to control diet**.** In The end of finisher period it was surprising that addition of TYR or TYR+SS significantly increased body weight by 21.13 , 26.10%,respectively compared to control diet. It is clear that the response to TYR or TYR+SS in the finisher period was higher than either starter or grower periods **.**As the bird increase in body weight, the production of free radical increase and consequently the response of antioxidants increase**.** For example, under normal physiological conditions about 3-5% of the oxygen taken up by the cell undergoes univalent reduction leading to the formation of free radicals (Singal *et al*.,1998). Addition of E50 or E50+SS increased body weight by 12.75 and 12.43%, respectively compared to control diet. These results indicated that the response to E50 increase with age and the role of SS was clear in starter and grower periods but not in finisher period . In general , vitamin E participates actively in the structure of organic compounds because it is situated at the membrane level, minimizing the peroxidation of fatty acids and phospholipid components. Thus, the fat soluble vitamins are called as growth vitamins (Bou et al., 2009).The addition of BHT significant decreased body weight compared to control diet. We are at a loss to explain the observed tendency of a reduction in body weight in the finisher period with addition of BHT . The effect of dietary treatment on feed intake and feed conversion of broiler is shown in Table (3). In the starter period, there were significant differences between values of feed intake recorded by different dietary treatments. The birds fed SS recorded the lowest value while birds fed E50 recorded the highest value. On the other hand , there were insignificant differences in grower periods. In finisher and all over periods, there were significant differences between values of feed intake recorded by different treatments .The birds fed TYR+SS recorded the highest values while birds fed BHT recorded the lowest values. In starter period, there were significant differences between feed conversion values, the birds fed TYR+SS recorded the best value while birds fed control diet recorded the worst values . In grower period, there were significant differences among feed conversion values, the birds fed TYR+SS recorded the best value while birds fed BHT+SS recorded the worst value . In finisher period, there were significant differences between feed conversion values, the birds fed TYR+SS recorded the best value while birds fed BHT recorded the worst value compared to control diet. In all over period , significant differences were detected in values of feed conversion recorded by different dietary treatments. The birds fed TYR+SS recorded the best value while birds fed SS recorded the lowest value. The beneficial effect of antioxidants on feed conversion may due to its protection from free radical which destroy lipid , protein,…etc. For example Bottje *et al*. (2004), found that the increase in H_2O_2 production and the high protein oxidation were consistently observed in low feed efficiency duodenum, breast muscle and liver mitochondria compared to high feed efficiency birds. However, Swain et al. (2000) reported that broilers receiving vitamin E supplementation (150 and 300 mg/kg) consumed less feed than those fed the basal diet. Data in Table (3) indicated that broiler need antioxidants to improve their performance but the utilization of antioxidants by chick differ from type to type of antioxidants. The birds need more and more antioxidants because their rapid its growth rate and excess of oxygen demand . For example, under normal physiological conditions about 3-5% of the oxygen taken up by the cell undergoes univalent reduction leading to the formation of free radicals (Singal *et al*.,1998). It is clear that tyrosine was the best additive under the condition of this study and the bird may use it as antioxidant and not as a protein. We hypothesized that the use single amino acid like tyrosine is more efficient as antioxidants than when it bound with peptide .However, previous studies have indicated that some amino acids may be more active than their parent peptides (Erdmann et al. 2008).further studies are needed with different levels of TYR and SS under suboptimal levels of metabolizable energy and crude protein.

Carcass characteristics

The effect of dietary treatments on carcass characteristics is shown in Table (4).There were insignificant differences between carcass percentage values recorded by different treatments . The birds fed TYR+SS recorded the highest value while birds fed BHT+SS recorded the lowest value. There were significant differences between neck percentage values with inconsistent trend. There were insignificant differences between liver weight percentage values recorded by different treatments. The birds fed control diet recorded the highest value while birds fed TYR recorded the lowest values.

Plasma parameters

The effect of dietary treatments on plasma phosphorus , Creatinine, total protein , albumin and globulin is shown in Table(5) .There were significant differences between phosphorus values recorded by different treatments . The addition of SS to control diet increased level of plasma phosphorus by 38.51% while other antioxidants alone or with SS increased its in range from18.70 to38.51% . The reason of increasing level of plasma phosphorus with using SS may be due that sulphate increase the circulation of vitamin D_3. Axelson (1985) showed that in man that 25-hydroxy vitamin D_3 3β-sulphate is a major circulating form of vitamin D_3 in man. The reason of increasing level of plasma phosphorus with using antioxidants may be due to its role in protecting vitamin D_3 from oxidation in digestive tract. In this respect, Khan et al 2010 showed Stressful conditions, such as high bird density, heat stress, mycotoxicosis, enteritis, malabsorption syndromes and certain immune disorders may impair absorption or liver hydroxylation of cholecalciferol, which is one rationale for the use of Vitamin D metabolites in broiler feed. Also, High levels of cholecalciferol have also been shown to increase the utilization of phytate phosphorus and the retention of calcium and phosphorus (Mohammed et al., 1991). These results agree with those obtained by Ali et al (2016) who demonstrated with broiler diet that antioxidants like canthaxanthin increased level of plasma phosphorus by 60.23 % compared to control diet and indicated that antioxidants may protect vitamin D3 from oxidation in digestive tract .To our knowledge, This is the first time that the relationship between antioxidants and the level of phosphorus in the plasma has been proven. Further studies are needed with different levels of antioxidants under suboptimal levels of available phosphorus. There were significant differences between values of creatinine recorded by different dietary treatments. The control diet recorded the highest value while birds fed TYR+SS recorded the lowest value. However, increased creatinine concentration is indicative of muscle protein turnover (Hochleithner, 1994). The additives used in this study may protect protein from free radical and decrease turnover protein. In these respect, Grune et al. (1997) showed that the degradation of proteins is an essential part of the overall antioxidant defenses against free radical attack.

There were significant differences between values of plasma albumin recorded by birds fed different dietary treatment with inconsistent trend.

CONCLUSION

Addition of TYR or TYR+SS significantly increased body weight at 35 day by 21.13, 26.10%, respectively compared to control diet. All feed additives used in this study increased plasma phosphorus with range from18.70 to38.51% compared to control diet. It is clear that tyrosine was the best additives under the condition of this study and the bird may use it as antioxidant and not as a protein. Further studies are needed with different levels of TYR and SS under suboptimal levels of metabolizable energy and crude protein.

Table (1): Ingredients and chemical composition for experimental diets.

Ingredients	**Starter**	**grower**	**Finisher**
Yellow corn	51.55	57.23	62.59
Soy bean meal 44%	35.00	29.79	24.70
Gluten 60%	5.20	4.90	4.60
Limestone	1.35	1.10	1.08
Di calcium phosphate	1.90	1.68	1.55
Salts(Nacl)	0.40	0.40	0.40
Premix*	0.30	0.30	0.30
Soy bean oil	3.50	4.00	4.25
DL. Methionine	0.31	0.24	0.21
L.lysine	0.32	0.25	0.23
L.Arginine	0.07	0.05	0.04
L.theoninine	0.10	0.06	0.05
Total	100	100	100
Chemical composition (%)			
CP	23.00	21.00	19.00
ME (kcal/kg)	3025	3150	3200
Ca	1.05	0.90	0.85
Avi. Phosphorus	0.55	0.45	0.45
Lysine	1.43	1.25	1.09
Methionine	0.50	0.45	0.41
Methionine+CYC %	0.99	0.98	0.88
Na	0.16	0.16	0.16

* Premix contain per 3kg vit A 12 000 000, vit D3 3000 000 IU, vit E 40 000mg, Vit K3 3000mg , vit B1 2000mg, vit B2 6000mg, vit B6 5000mg, vit B12 20mg, pantothenic acid 12000mg, Niacin 45000mg, Biotin 75 mg, Folic acid 2000mg, Choline 250 gm, Selenium 100mg, Copper 10000mg, Iron 30000mg, Manganese 60000mg, Zinc 50 000mg, Iodine 1000mg, Cobalt 100mg and $CaCO_3$ to 3000

Table (2) : Effect of treatments on body weight and weight gain of broiler chicks.

Items / Treatments	Body weight			Weight Gain			
	Starter	**Grower**	**Finisher**	**Starter**	**Grower**	**Finisher**	**Total**
T_1Control	515 ^{e}±3.92	1412^{d}±23.11	1850^{e}±7.85	475 ^{e}±3.92	870±26.03	438^{c}±23.05	1810 ^{e}±7.85
T2	510^{e}±3.33	1401 ^{d}±23.96	1953d±6.66	470e ±3.33	891 ±26.87	552^{b}±29.90	1913^{d}±6.66
T3	576^{b}±4.66	1495 ^{bc}±21.94	2241 ^{b}±26.5	536^{b}±4.66	920±26.55	746^{a}±46.60	2201 ^{b}±26.2
T4	595 ^{a}±2.96	1570 ^{a}±21.96	2333 ^{a}±27.32	556^{a}±2.90	973±26.03	764 ^{a}±29.86	2293^{a}±57.3
T5	562 ^{c}±3.92	1483 ^{bc}±23.90	2086 ^{c}±9.27	522 ^{c}+3.92	921+19.37	604 ^{b}+26.19	2047 ^{c}+9.27
T6	581^{b}±4.92	1538 ^{ab}±11.05	2080 ^{c}±27.71	541^{b}±4.93	958 ±11.34	542^{b}±20.73	2040^{c}±27.7
T7	536^{d}±7.96	1445 ^{cd}±17.47	1742^{f}±7.57	496^{d}±2.96	910 ±20.27	270^{d}±20.74	1702 ^{f}±7.27
T8	534^{d}±6.96	1466 ^{cd}±15.30	1846^{e}±3.66	494d±6.96	932 ±22.24	380cd±12.23	1806 ^{e}±3.66
P	0.0001	0.004	0.0001	0.0001	NS	0.0001	0.0001
Source of variation							
Sodium Sulphate	0.0192	0.0342	0.0008	0.0192	0.1179	0.0067	0.0008
Treatments	0.0001	0.0001	0.0001	0.0001	0.1377	0.0001	0.0001
Sulphate*Treatments	0.0187	0.241	0.1179	0.0187	0.6219	0.0281	0.1179

T1= Control diet
T2= Control diet+ Anhydrous Sodium Sulphate(SS)
T3= Control diet + 0.05% tyrosine(TYR).
T4= Control diet + 0.05% tyrosine(TYR) + 0.3% SS .
T5= Control diet + 50 mg vitamin E/ kg diet.
T6= Control diet + 50 mg vitamin E/ kg diet +0.3% SS.
T7= Control diet + 125 mg BHT/ kg diet.
T8= Control diet + 125 mg BHT/ kg diet +0.3% SS.

Table (3) : Effect of treatments on feed intake and feed conversion of broiler chicks.

Items / Treatments	Feed Intake				Feed Conversion Ratio			
	Starter	**Grower**	**Finisher**	**Total**	**Starter**	**Grower**	**Finisher**	**Total**
T_1Control	671^{bc} ±4.16	1402 ±47.05	881^{d} ±46.50	2954^{d} ±10.92	1.41^{f} ±0.006	1.56^{d} ±0.007	2.01$^{ab\ c}$ ±0.007	1.63^{cd} ±0.001
T2	662^{c} ±5.33	1399 ±41.23	1133^{c} ±44.23	3195^{c} ±9.06	1.40^{f} ±0.001	1.57^{d} ±0.001	2.05$^{ab\ c}$ ±0.003	1.66e ±0.001
T3	719^{a} ±6.65	1390 ±33.80	1453^{a} ±60.20	3562^{a} ±36.25	1.34^{c} ±0.001	1.51^{b} ±0.007	1.95^{ab} ±0.004	1.61^{bc} ±0.004
T4	714^{a} ±3.33	1457 ±42.27	1483^{a} ±44.09	3654^{a} ±88.50	1.28^{a} ±0.002	1.49^{a} ±0.003	1.94^{a} ±0.002	1.59^{a} ±0.004
T5	720^{a} ±4.07	1418 ±28.88	1258^{b} ±41.66	3396^{b} ±22.0	1.37^{d} ±0.003	1.54^{c} ±0.001	2.08^{bc} ±0.023	1.65e ±0.003
T6	717^{a} ±4.91	1454 ±16.53	1113^{bc} ±44.93	3284^{bc} ±41.28	1.32^{b} ±0.01	1.51^{b} ±0.006	2.05$^{ab\ c}$ ±0.04	1.60^{ab} ±0.01
T7	686^{b} ±2.96	1428 ±33.59	674e ±30.51	2787e ±0.33	1.38^{d} ±0.002	1.56^{d} ±0.001	2.28^{d} ±0.07	1.63^{cd} ±0.007
T8	684^{b} ±8.68	1465 ±31.76	787de ±18.77	2937d ±8.50	1.38^{d} ±0.001	1.57^{d} ±0.003	2.07^{bc} ±0.02	1.62^{bc} ±0.001
Source of variation	0.0001	NS	0.0001	0.0001	0.0001	0.0001	0.0006	0.0001
Sodium Sulphate	0.2321	0.188	0.0559	0.0034	0.0001	0.0439	0.0786	0.008
Treatments	0.0001	0.6082	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
Sulphate*Treatments	0.913	0.8077	0.0025	0.0021	0.0001	0.0081	0.0312	0.0001

T1= Control diet T2= Control diet+ Anhydrous Sodium Sulphate(SS)
T3= Control diet + 0.05% tyrosine(TYR). T4= Control diet + 0.05% tyrosine(TYR) + 0.3% SS .
T5= Control diet + 50 mg vitamin E/ kg diet. T6= Control diet + 50 mg vitamin E/ kg diet +0.3% SS.
T7= Control diet + 125 mg BHT/ kg diet. T8= Control diet + 125 mg BHT/ kg diet +0.3% SS.

Table (4):Effect of dietary treatments on carcass traits.

Items / Treatments	Carcass	Nek	Gizzard	Liver	Heart	Fat	T.E.P
T1	68.46 ±1.27	5.30[bcd] ±0.21	1.24 ±0.03	2.88 [a] ±0.04	0.54 ±0.04	1.64 ±0.26	73.14 ±1.34
T2	65.37 ±3.89	5.23[bcd] ±*0.20*	1.24 ±0.009	2.51[bc] ±0.15	0.54 ±0.01	1.23 ±0.04	69.68 ±3.98
T3	66.96 ±1.01	4.71 [d] ±0.34	1.08 ±0.09	2.33 [c] ±0.11	0.56 ±0.02	1.43 ±0.11	70.95 ±1.01
T4	68.86 ±2.06	4.87 [c d] ±0.10	1.07 ±0.07	2.64 [a bc] ±0.07	0.55 ±0.04	1.52 ±0.32	73.15 ±2.02
T5	67.88 ±0.49	5.09 [c d] ±0.05	1.29 ±0.05	2.34 [c] ±0.01	0.47 ±0.009	1.53 ±0.25	72.0 ±0.55
T6	66.30 ±0.27	5.42 [c d] ±0.28	1.12 ±0.16	2.92 [a] ±0.18	0.54 ±0.02	1.16 ±0.08	70.9 ±0.12
T7	67.59 ±1.92	5.84[ab] ±0.21	1.14 ±0.02	2.49[bc] ±0.07	0.62 ±0.009	1.33 ±0.13	71.80 ±1.16
T8	64.59 ±1.92	6.11 [a] ±0.12	1.18 ±0.05	2.76[ab] ±0.09	0.56 ±0.39	1.66 ±0.18	69.10 ±1.85
p	NS	0.004	NS	0.005	NS	NS	NS
Source of variation							
Sodium sulphate	0.291	0.262	0.538	0.018	0.995	0.522	0.352
Treatment	0.800	0.0004	0.236	0.299	0.119	0.886	0.860
Sulphate*treatment	0.157	0.801	0.584	0.002	0.316	0.224	0.460

T1= Control diet
T2= Control diet+ Anhydrous Sodium Sulphate(SS)
T3= Control diet + 0.05% tyrosine(TYR).
T4= Control diet + 0.05% tyrosine(TYR) + 0.3% SS .
T5= Control diet + 50 mg vitamin E/ kg diet.
T6= Control diet + 50 mg vitamin E/ kg diet +0.3% SS.
T7= Control diet + 125 mg BHT/ kg diet.
T8= Control diet + 125 mg BHT/ kg diet +0.3% SS.

Table (5): Effect of dietary treatments on plasma parameters.

Items / Treatments	Phosphorus Mg/dl	Creatinine Mg/dl	Total protein g/dl	Albumin g/dl	Globulin g/dl
T1	7.27b ± 0.61	1.09 ± 0.09a	3.80 ± 0.34	2.14 ± 0.10a	1.65 ± 0.34
T2	10.07 ± 0.03a	0.56 ± 0.04b	2.65 ± 0.04	1.22 ± 0.15b	1.43 ± 0.11
T3	9.98 ± 0.05a	0.64 ± 0.006b	3.46 ± 0.29	2.08 ± .15a	1.38 ± 0.34
T4	10.07a ± 0.01	0.53b ± 0.05	4.30 ± 0.18	2.14a ± 0.16	2.16 ± 0.03
T5	9.92a 0.03±	0.90a ± 0.04	3.66 ± 0.25	2.01a ±0.09	1.64 ± 0.32
T6	10.00a 0.00±	0.63b ± 0.03	3.25 ± 0.11	2.09a ± 0.21	1.15 ± 0.17
T7	8.63 1.16ab±	1.03a ± 0.08	3.73 ± 0.47	2.21a ± 0.22	1.52 ± 0.28
T8	9.98 ± 0.03a	0.60 ± 0.05	3.18 ± 0.21	2.00a ±0.007	1.37 ± 0.12
P	0.002	0.0001	0.03	0.01	NS
Source of variation					
sulphate	00.64	0.0001	NS	0.0460	NS
Treatment	0.0386	0.0072	NS	0.0400	NS
Sulphate*treatment	0.0341	0.0226	0.0194	0.0154	NS

T1= Control diet
T2= Control diet+ Anhydrous Sodium Sulphate(SS)
T3= Control diet + 0.05% tyrosine(TYR).
T4= Control diet + 0.05% tyrosine(TYR) + 0.3% SS .
T5= Control diet + 50 mg vitamin E/ kg diet.
T6= Control diet + 50 mg vitamin E/ kg diet +0.3% SS.
T7= Control diet + 125 mg BHT/ kg diet.
T8= Control diet + 125 mg BHT/ kg diet +0.3% SS.

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الملخص العربي

تأثير أضافة التيروسين و فيتامين هـ و البيتيولاتيدهيدروكسي تولين مع أو بدون كبريتات الصوديوم علي الأداء الأنتاجى لدجاج التسمين .

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تهدف هذه الدراسة إلى أمكانية أستخدام كل من التيروزين 500 مللجرام /كجم عليقة (TYR) ، وكذلك إضافة فيتامين هـ 50 مللجرام / كجم (E50) وأيضاً بوتيلاتيد هيدروكسى تولين (BHT) 125 مللجرام/كجم مع أو بدون كبريتات الصوديوم اللامائية 0.3%، وتأثير ذلك الأداء الأنتاجى لدجاج التسمين.
تم توزيع عدد 240 كتكوت (ذكور) أربرأيكرز عمر يوم بشكل عشوائى على ثمانى مجموعات وغذيت على (1- عليقة كنترول ، 2- كنترول مضاف إليها SS ، 3- كنترول مضاف إليها TYR ، 4- TYR+SS ، 5- E50 ، 6- E50+SS ، 7- BHT ، 8- BHT+SS .وكانت أوزان الجسم عند عمر 35 يوم 1850 جم ، 1953 جم ، 2241 جم، 2333 جم ، 2086 جم ، 2080 جم، 1742 جم ، 1846 جم على التوالى.
الطيور التى نغذت على TYR+SS سجلت أفضل معامل تحويل غذائى . سجلت المعاملات التجريبية المستخدمة زيادة فوسفور بلازما الدم بمدى يتراوح من 18.7 إلى 38.5% بالمقارنة بالعليقة الكنترول . ومن الواضح جلياً أن أضافة التيروزين كانت أفضل اضافة تحت الظروف التجريبية . وهناك الحاجة إلى مزيد من الدراسات على مستويات مختلفة من TYR ، كذلك SS تحت مستويات دون المستوى الأمثل من الطاقة الممثلة والبروتين الخام.