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Effect of Individual and Combining of Adding Quercetin and Vitamin E to Diets in Productive Traits of Broiler Chickens

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Abstract

The study was conducted to investigate the effect of adding quercetin and vitamin E to diets on productive performance of broiler .A total of 210 broiler chickens (Ross308)unsexed one day old chicks were randomly distributed to seven treatments with three replicates per treatment (10 chicks / replicate).Treatments were involvedT1: adding out any addition, T2: adding 30 mg sodium nitrate / kg,T3: adding 500 mg quercetin/ kg feed with 30 mg sodium nitrate / kg ,T4: adding 1000 mgquercetin / kg feed with 30 mg sodium nitrate / kg , T5: adding 250 mg vitamin E / kg with 30 mg sodium nitrate / kg,T6: adding 500 mg quercetin / kg feed with 250 mg vitamin E / kg with 30 mg sodium nitrate / kg , T7: adding 1000 mgquercetin / kg feed with 250 mg vitamin E / kg with 30 mg sodium nitrate / kg ,The obtained results showed that there were significant differences were detected between different treatments in productive performance traits at 42 days age of , which included live body weight, body weight gain, feed consumption and feed conversion ratio.

Key word: quercetin, vitamin E , sodium nitrate ,Productive Performance, Broiler.

Introduction

Oxidative stress is a major concern in poultry production, as well as other stresses caused by nutritional, environmental, microbiological, and management factors that negatively affect poultry health and production (Lin et al., 2017; Mishra and Jha , 2019) . Oxidative stress has been a major factor of concern due to rate of growth in broiler chickens which can be reduced by adding antioxidants to broiler diets (Keshavamurt, 2013) . Antioxidants from natural sources can extend shelf life, reduce fat peroxide and increase immunity and health status (Fellenberg and Speisky, 2006) . Researchers have reported increasing benefits by using natural and synthetic antioxidants to promote healthand productive performance of broiler (Makri et al., 2017) . Quercetin is a flavonoid complex, which belong to flavonoids with strong

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antioxidant potential ,which found in plant and vegetarian food sources (Sikder et al., 2014). Quercetin can prevent oxidative stress by scavenging free radicals and removing oxidative products, and stimulating antioxidant enzymes in several animal models (Sun et al., 2020) . Being a powerful free radical scavenger, it mitigates organ damage, and prevents harmful of oxidative stress (Yi et al., 2011; Sikder et al., 2014) .Vitamin E is a non-enzymatic antioxidant widely used as an additive to diets of poultry. This is due to its role as an antioxidant in eliminating reactive oxygen species(ROS) , resulting from heat stress (Ajakaiye et al., 2011) . Therefore, the aim of this study is to investigate role of quercetin and vitamin E in productive performance of Broilers.

Materials and methods

In this study, Two hundred - ten of Broiler (Ross 308) 1 day old with an initial weight of 39 g were randomly assigned to 7 treatments with 3 replicates per treatment (10 chicks / replication). Chicks were raised in poultry fields - College of Agriculture / Anbar University in Ramadi.The trial period was 42 days for the period from September 21 to November 2, 2020 the fame during the trial period was fed with balanced diet consisting of three stages (Starter- Grower -Finisher), (Table 1). Quercetin has been purchased from Guangzhou Ur, Trading. Co, Ltd, China , vitamin E from Prince Castle Office in Baghdad .experimental treatments were T1: basal diet without of any addition, T2: basal diet with 30 mg sodium nitrate / kg, T3: basal diet with 500 mg quercetin / kg feed with 30 mg sodium nitrate / kg , T4: basal diet with 1000 mgquercetin / kg feed with30 mg sodium nitrate / kg , T5:basal diet250 mg vitamin E / kg with 30 mg sodium nitrate / kg, T6: basal diet with 500 mgquercetin / kg feed with 250 mg vitamin E / kg with 30 mg sodium nitrate / kg , T7: basal diet with 1000 mgquercetin / kg feed with 250 mg vitamin E / kg with 30 mgsodium nitrate / kg .chicks weighed individually and weekly for each replicate at end of week during trial period .The Study results were analyzed with Complete Randomized Design (CRD) to investigate the effect of Treatments differ in the features studied as well The multivariate Duncan test was used (Duncan, 1955). Examine the differences between the averages inAverage level is 0.05 and 0.01 using analysis Statistical System (SAS).

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Table 1: Ingredient and Chemical composition of experimental diets.

ingredients%	1- 11 days Starter	12-22 Days Grower	23-42 days Finisher
yellow corn	29.6	31	33.7
Wheat	29	30.7	32
Soybean meal 48%*	31.5	27.8	23
Protein concentrate**	5	5	5
Oil	2.7	3.5	4.5
Limestone	1.05	1.2	1.2
Di-calcium phosphate	0.65	0.4	0.2
Methionine	0.22	0.16	0.16
Lysine	0.18	0.14	0.14
Salt	0.1	0.1	0.1
Total	100	100	100
Chemical analysis,Calculated***			
Crude protein	22.97	21.51	19.58
Metabolizable energy	3013	3095	3199
Methionine + cysteine(kcal / (kg feed	1.08	0.98	0.93
Lysine	1.43	1.30	1.17
Ether extract	5.11	5.97	7.06
fiber	2.86	2.80	2.71
Calcium	0.91	0.89	0.83
Available phosphorous	0.48	0.43	0.38
L-arginine	1.16	1.05	0.91
Phosphorus	1.52	1.53	1.54

*** Soybean meal 48% crude protein.**

**** The protein concentrate used by (WAFI B.V. ALBLASSERDAM HOLLAND)**

***** chemical analysis according to NRC (1994).**

Results and discussion

results showed in table 2. no significant differences between all treatments in body weight at first and second week. In the third week, a significant superiority was

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observed (P <0.05). In the average body weight of T3 , T4, T5 ,T6,T7 , compared to T2, which not differences with T1. As for the fourth week, significant differences was observed (P <0.05) in body weight for T1, T3,T4 ,T5, T6, T7 treatments compared with T2. The results in the fifth week indicated a significant differences (P <0.05) for treatment T6 compared with T1,T2,T4 treatments,also no significant differences were observed with between T3,T5, T7 treatments. On the other hand, there were a significant differences of T4,T6,T7, and T3 compare with T2 and T1. On the other hand, no significant differences were observed with treatment T5 . As for the weekly weight gain, Table (3) indicates effect of experimental treatments on body weight gain rates of broiler chickens during trial period for 42 days, wich noticed in first and second weeks that there are no significant differences in weight increase rate between all treatments . In the third week, a significant differences were observed(P <0.05) for treatments T4 ,T3 , T5, T6, T7compared to T2 and T1. In fourth week, a significant differences were obtained (P <0.05) in treatments T1 ,T3 ,T6 as compaed with T2, while no significant differences were observed with T4, T5,T7. In fifth week, a significant superiority were observed (P <0.05) for T5 , T6,T7treatments compared to T2 which did not differ significantly with T1, T3 ,T4 treatments. In the sixth week, no significant differences were observed between all treatments. As for cumulative weight gain, it was not significant . It is noticed through the results that addition of quercetin alone or in combination with vitamin E has a clear significant effect on the rates of body weight and weekly weight gain during the last four weeks. The improvement in body weight or body weight gain may be attributed to the ability of quercetin to regulate lipid catabolism and metabolism either by inhibiting expression Genetic adipocyte in broiler fat tissue (Li et al., 2013) or may be due to ability of quercetin on cAMP signaling pathways for lipid building and thus altering fat deposition in chicken meat or it may be related to further accumulation of adipose tissue and thus Increasing body weight resulting in an improvement in this ratio (Ouyang et al., 2013)The results of the statistical analysis in Table (2),agreed with findings of Parmar and others (2020), who observed significant differences (P <0.05) in body weight of broilers strain Vencobb -400 by adding quercetin at a concentration (1 g / kg) . Results were in agreement with van Krimpen et al. (2016) adding quercetin at a concentration (400 mg / kg) to broiler diet of Ross 308 had a significant effect on body weight gain.Villar-Patino (2002) found a significant differences (P <0.05) in live body weight in broiler chickens supplemented with 75 mg of vitamin E to diets of broilers (Ross 308). Agreed with Jang et al., (2010) found significant differences (P <0.05) in body weight gain when quercetin added at a concentration of 200 ppm / kg to broiler of the diets (Ross 308). Results agreed with Chae (2006) who found significant differences. (P <0.05) in body weight gain when supplemented with vitamin E 200 mg / kg to diets**.** Our results did not agree with Abid et al. (2020) who found no Significant differences (P <0.05) in body weight when quercetin-Birakis 300-200-100 mg / kg was added to diets of broiler the(Ross 308).

Table 2: Effect of adding quercetin and vitamin E on live body weight (gm) of broiler.

Treatments	Weeks					
	1	2	3	4	5	6

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1	147.33 ± 1.36	409.10 ± 4.40	AB 734.70 ± 5.80	A 1305.33 ± 11.35	B 2104.50 ± 62.25	B 2701.67 ± 30.32
2	136.00 ± 2.18	379.33 ± 20.98	B 668.33 ± 46.97	B 1109.97 ± 82.35	C 1758.83 ± 66.61	C 2351.67 ± 64.96
3	142.50 ± 3.04	399.50 ± 1.53	A 788.00 ± 27.40	A 1336.33 ± 27.72	A B 2150.67 ± 22.38	A 2861.67 ± 19.65
4	144.00 ± 3.61	390.67 ± 5.53	A 804.67 ± 16.13	A 1308.00 ± 7.51	B 2108.33 ± 30.85	A 2818.67 ± 17.70
5	142.83 ± 6.69	392.00 ± 6.64	A 801.83 ± 25.51	A 1305.67 ± 9.26	A B 2139.33 ± 45.99	A B 2808.00 ± 31.01
6	138.50 ± 2.00	398.17 ± 5.13	A 795.67 ± 8.09	A 1353.67 ± 19.55	A 2270.23 ± 38.59	A 2855.67 ± 43.34
7	141.83 ± 8.17	407.17 ± 5.95	A 799.33 ± 31.13	A 1305.83 ± 29.73	A B 2167.33 ± 19.46	A 2821.33 ± 20.19
	N.S	N.S	0.05	0.01	0.01	0.01

***Values represent mean ± standard error**

NS.: Not significant

a, b, c: the different letters within the same column indicate significant differences between the factors at a significant level (P≤0.01). T1 control treatment without any additives, T2 addition of sodium nitrate 30 mg / kg, T3 addition of quercetin 500 mg / kg feed with sodium nitrate 30 mg / kg, T4 addition of quercetin 1000 mg / kg with sodium nitrate 30 mg / kg, T5 vitamin E 250 Mg / kg with sodium nitrate 30 mg / kg, T6 add quercetin 1000 mg / kg with vitamin E 250 mg / kg with sodium nitrate 30 mg / kg, T7 add quercetin 500 mg / kg feed with vitamin E 250 mg / kg with nitrate Sodium 30 mg / kg.

Table 3: Effect of adding quercetin and vitamin E on body weight gain (gm) of broiler.

Treatments	Weeks						1-42 days
	1	2	3	4	5	6	
1	108.33 ± 1.36	261.77 ± 4.19	B 325.6 ± 5.12	A 570.63 ± 17.11	A B 799.17 ± 72.11	597.17 ± 83.91	B 2662.67 ± 30.32
2	97.00 ± 2.18	243.33 ± 18.95	B 289.0 ± 26.02	B 441.63 ± 35.39	B 648.87 ± 55.27	592.83 ± 27.45	C 2312.67 ± 64.96
3	103.50 ± 3.04	257.00 ± 3.55	A 388.5 ± 27.47	A 548.33 ± 11.17	A B 814.33 ± 49.77	711.00 ± 41.47	A 2822.67 ± 19.65
4	105.00 ± 3.61	246.67 ± 4.28	A 414.0 ± 10.97	A B 503.33 ± 16.83	A B 800.33 ± 25.26	710.33 ± 48.16	A 2779.67 ± 17.70
5	103.83 ± 6.69	249.17 ± 0.83	A 409.8 ± 18.96	A B 503.83 ± 16.28	A 833.67 ± 55.23	668.67 ± 67.30	A B 2769.00 ± 31.01
6	99.50 ± 2.00	259.67 ± 3.83	A 397.5 ± 3.28	A 558.00 ± 27.32	A 916.57 ± 57.97	585.43 ± 46.60	A 2816.67 ± 43.34

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7	102.83 ± 8.17	265.33 ± 9.90	A 392.1 ± 27.71	AB 506.50 ± 23.47	A 861.50 ± 13.05	654.00 ± 4.86	A 2782.33 ± 20.19
	N.S	N.S	0.05	0.05	0.05	N.S	0.05

***Values represent mean ± standard error**

NS.: Not significant

a, b, c: the different letters within the same column indicate significant differences between the factors at a significant level (P≤0.01). T1 control treatment without any additives, T2 addition of sodium nitrate 30 mg / kg, T3 addition of quercetin 500 mg / kg feed with sodium nitrate 30 mg / kg, T4 addition of quercetin 1000 mg / kg with sodium nitrate 30 mg / kg, T5 vitamin E 250 Mg / kg with sodium nitrate 30 mg / kg, T6 add quercetin 1000 mg / kg with vitamin E 250 mg / kg with sodium nitrate 30 mg / kg, T7 add quercetin 500 mg / kg feed with vitamin E 250 mg / kg with nitrate Sodium 30 mg / kg.

Table 4 showed effect of the experimental treatments on weekly and accumulative of feed consumption of broilers , as it is noticed in the first and second weeks that there were no significant differences in average of feed intak among all treatments. In the third week, a significant differences were observed (P< 0.05)of in treatments T1 ,T4,T5 ,T6,T7 compared to T2 while no significant differences were observed with T1. In the fourth week, no significant differences were observed between the treatments. In the fifth week, a significant differences were observed (P<0.05) inT6 compared with treatmentsT1 ,T2 ,T3 ,T4 ,T5 which did not differ significantly with T7. In last week, a significant differences were observed (P< 0.05)in T4 compared to treatments T1 ,T2 which did not differ significantly with treatments T3 ,T5, T6, T7 . The cumulative feed, results showed that there were a significant differences (P <0.05) in treatment T6 compared to treatments T1 and T2 , while it was not significantly different in treatmentsT3, T4, T5 ,T7. As for the Feed Conversion Ratio, Table (5) indicates the effect of experiment treatments on the weekly and cumulative rate of feed conversion Ratio (gm feed/gm body weight gain) of broiler during trial period, as it is noticed in first and second weeks that there were no significant differences in average of feed conversion ratio between treatments, either in the third week, a significant differences were observed (P<0.05) in treatments T1 and T2 compared to treatments T3,T4 ,T5, while no significant differences were observed with T7 and T6. In the fourth, fifth and sixth weeks, no significant differences were observed between treatments, as for the rate of feed conversion ratio. The results showed a significant imprement (P <0.05) for treatment T6 compared to T3, while did not differ significantly with treatments T1, T2 , T4, T5 and T7 . The reason for improvement in feed consumption and efficiency of feed conversion may be attributed to the Individual and combining role of quercetin and vitamin E, as quercetin a polyphenolic compound inhibits pathogenic bacteria, thus providing a healthy environment for the intestine and a positive effect on bird digestion, which may be reflected increased weight of birds(Sohaib et al., 2015; Hassan et al., 2018). The birds' body weights, feed consumption, and feed conversion ratio on 7 and 14 days did not show significant differences. This may be due to the fact that chicks hatch with a store of fat-soluble vitamins as well as water-soluble and other antioxidants and antioxidant enzymes that originate from breeders diet that are It is transferred to the chicks (Karadas et al., 2011) . results of statistical analysis in Table (5), represented by feed conversion, agreed with the findings of Abid et al. (2020), which noted the existence of significant differences (P <0.05) in rate of feed conversion ratio of broilers when quercetin was added at a concentration (200 mg / Kg)

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to diet.also withSohaib et al. (2016) who observed significant differences (P <0.05) in feed conversion efficiency of Ross 308 broilers when adding quercetin and alpha-tocopherol at concentration (300 mg / kg) to diets. Van Krimpen et al. (2016) agreed with our hinding for feed consumption when quercetin was added at concentration (400 mg / kg) to diets. Results agreed with Bolukbasi et al. (2006) who found that adding vitamin E at concentration (100 and 200) mg / kg feed to feed, a high significant (P≤0.01) superiority in the feed conversion ratio was obtained. Results of this study were also in agreement with findings of Al-Khuzai (2013), who observed a significant improvement (P <0.05) in feed consumption and efficiency of the nutritional conversion of broilers aged 42 days in for treatment of adding vitamin E to diets. . This result is in agreement with the findings of Habibian et al. (2014). They found that when adding vitamin E at levels of 125 to 250 mg / kg of feed to diets of broilers at 49 days of age under normal and heat stress conditions, they noticed a significant improvement (P <0.05) compared with control treatment in the feed conversion ratio. On other hand results disagreed with Kim et al. (2015), as they found no significant differences in feed consumption when quercetin was added at a concentration (20-200 mg / kg) to broiler diets. Also, results not agree with Simitzis et al. (2018) who confirmed that no significant differences in cumulative feed consumption when quercetin was added at a concentration of (200-400-800)mg/kg to broiler diets. Resultswere in agreement with findings of Hosseini et al. (2010). Who found that adding vitamin E (50 mg / kg feed) to a broiler diet under heat stress a significant improvement (P <0.01) in feed consumption compared to control treatments. The results did not agree with the findings of Malayoglu et al. (2009) who confirmed that there were no significant differences in feed consumed by birds fed diet contained vitamin E compared to control diet

In conclusion, the addition of quercetin and vitamin E to diets improve productive performance of broiler at 42 day of age in body weight and body weight gain , feed consumption , feed conversion ratio.

Table 4:Effect of adding quercetin and vitamin E on feed consumption (gm / bird) of broiler.

Treatments	Weeks						1-42 days
	1	2	3	4	5	6	
1	112.0 ± 2.08 *	305.97 ± 6.17	A 538.50 ± 15.09	729.53 ± 5.66	B 1118.0 ± 56.29	C 1008.0 ± 25.36	B C 3812.0 ± 74.25
2	105.0 ± 2.84	286.00 ± 6.54	B 466.33 ± 38.48	609.00 ± 41.49	C 895.67 ± 35.31	B C 1145.6 ± 32.79	C 3507.6 ± 146.7
3	113.3 ± 0.93	287.67 ± 3.90	A B 511.83 ± 15.01	610.00 ± 62.75	B 1085.0 ± 63.17	A B 1362.0 ± 13.01	A B 3969.8 ± 7.51
4	105.5 ± 5.57	284.33 ± 6.23	A 559.17 ± 20.17	641.03 ± 40.45	B 1156.3 ± 30.80	A 1419.6 ± 36.97	A B 4166.0 ± 63.10
5	111.23 ± 12.03	290.00 ± 2.75	A 553.83 ± 17.42	634.50 ± 15.79	B 1139.3 ± 38.48	A B 1277.6 ± 101.0	A B 4006.5 ± 138.9

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6	102.50 ± 1.73	298.50 ± 3.18	A 565.50 ± 12.55	740.87 ± 95.18	AB 1286.3 ± 20.51	A B 1353.5 ± 126.8	A AB 4347.2 ± 211.5
7	110.83 ± 4.21	293.33 ± 13.74	A 566.50 ± 9.58	658.00 ± 55.29	AB B 1200.6 ± 8.09	A B 1308.6 ± 96.31	A AB 4138.0 ± 161.9
	N.S	N.S	0.05	N.S	0.05	0.05	0.05

***Values represent mean ± standard error**

NS.: Not significant

a, b, c: the different letters within the same column indicate significant differences between the factors at a significant level (P≤0.01). T1 control treatment without any additives, T2 addition of sodium nitrate 30 mg / kg, T3 addition of quercetin 500 mg / kg feed with sodium nitrate 30 mg / kg, T4 addition of quercetin 1000 mg / kg with sodium nitrate 30 mg / kg, T5 vitamin E 250 Mg / kg with sodium nitrate 30 mg / kg, T6 add quercetin 1000 mg / kg with vitamin E 250 mg / kg with sodium nitrate 30 mg / kg, T7 add quercetin 500 mg / kg feed with vitamin E 250 mg / kg with nitrate Sodium 30 mg / kg.

Table 5 :Effect of adding quercetin and vitamin E on feed conversion coefficient (gm feed/gm of body weight gain) of broiler.

Treatments	Weeks						1-42 days
	1	2	3	4	5	6	
1	1.03 * ± 0.02	1.17 ± 0.02	A 1.66 ± 0.07	1.28 ± 0.05	1.41 ± 0.06	1.78 ± 0.34	AB 1.43 ± 0.04
2	1.08 ± 0.04	1.19 ± 0.07	A 1.62 ± 0.02	1.38 ± 0.02	1.41 ± 0.16	1.94 ± 0.11	AB 1.52 ± 0.02
3	1.10 ± 0.02	1.12 ± 0.03	B 1.33 ± 0.07	1.12 ± 0.13	1.34 ± 0.07	1.93 ± 0.13	B 1.41 ± 0.01
4	1.00 ± 0.02	1.15 ± 0.01	B 1.35 ± 0.07	1.28 ± 0.12	1.45 ± 0.05	2.01 ± 0.09	AB 1.50 ± 0.01
5	1.07 ± 0.05	1.16 ± 0.01	B 1.36 ± 0.10	1.26 ± 0.07	1.38 ± 0.14	1.94 ± 0.19	AB 1.45 ± 0.05
6	1.03 ± 0.03	1.15 ± 0.02	AB 1.42 ± 0.04	1.33 ± 0.16	1.41 ± 0.10	2.32 ± 0.22	A 1.54 ± 0.05
7	1.09 ± 0.05	1.11 ± 0.08	AB 1.46 ± 0.09	1.31 ± 0.13	1.39 ± 0.02	2.00 ± 0.15	AB 1.49 ± 0.05
	N.S	N.S	0.05	N.S	N.S	N.S	0.05

***Values represent mean ± standard error**

NS.: Not significant

a, b, c: the different letters within the same column indicate significant differences between the factors at a significant level (P≤0.01). T1 control treatment without any additives, T2 addition of

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sodium nitrate 30 mg / kg, T3 addition of quercetin 500 mg / kg feed with sodium nitrate 30 mg / kg, T4 addition of quercetin 1000 mg / kg with sodium nitrate 30 mg / kg, T5 vitamin E 250 Mg / kg with sodium nitrate 30 mg / kg, T6 add quercetin 1000 mg / kg with vitamin E 250 mg / kg with sodium nitrate 30 mg / kg, T7 add quercetin 500 mg / kg feed with vitamin E 250 mg / kg with nitrate Sodium 30 mg / kg.

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