Plant Archives Vol. 21, Supplement 1, 2021 pp. 1877-1881 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
doi link : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.S1.303

EFFECT OF DIET SUPPLEMENTATION WITH MIXTURES OF ORGANIC TRACE MINERALS ON PRODUCTIVE PERFORMANCE OF BROILER CHICKS

Ahmed Thamer Mohsen and Rashad S.R. Al-Mahdawi
Department of Animal Production, College of Agriculture, Engineering Sciences, University, of Baghdad, Baghdad, Iraq

ABSTRACT

The present study was at the poultry field department of Animal recourse – College of Agriculture Engineering Science University of Baghdad from the period 12/10/2019 to 23/11/2019 determine the study effect add mixture of Organic Trace Minerals(OTM) and the mixture between them and in different proportions to the broiler diets on productive performance ,carcass characteristics and immunological responses and some physiological traits .Three hundred (300) unsexed of broiler chicks breed of 41.30g (Ross 308) One day age were use in the study .the birds distributed to five treatment with three replications per treatment (60 bird /treatment) as follows : T1 supplemented with (Zn 40 + Fe 30) mg/kg diet respectively, T2 supplemented with (Zn 40 + Mn 40 + Cu 7) mg/kg diet respectively, T3 supplemented with (Zn 40 + Se 0.3) mg/kg diet respectively, T4 supplemented with (Zn 40 + Cr 0.4) mg/kg diet respectively, T5 control (without addition). Were fed on starter diet from age 1- 21 day, the starter diet consists of (23 % protein and 3003 Kcal metabolic energy /kg diet) and finisher diet from 22-42 day consists of (20 % protein and 3201 Kcal metabolic energy /kg diet). The results of the present study following: 1- Significant improvement ($P<0.05$) in the average of body weight and body weight gain for T4 compared with control group. 2- No significant improvement average feed intake weekly, while it was significant ($P<0.05$) feed intake consumption for T4, and no significant improvement in feed conversion.

Keywords: Zinc, Copper, Manganese, Iron, Chrome, selenium, Broiler chicken, Productive Performance

Introduction

The poultry industry is one of the most important food industries that would contribute to improving economic conditions in many countries of the world (Mottet *et al*., 2017). Therefore, interest in poultry projects requires knowledge of the most important technologies that contribute to a high body weight rate in the shortest period of time (Batres, 2018). Therefore, most of the recent studies related to poultry farming have focused on food additives that would contribute to improving the productive, immunological, physiological and other characteristics of broiler chickens especially since the cost of nutrition is estimated at more than two-thirds of the total cost in poultry projects. Adding trace minerals to the diets of broiler meat is important for the growth, development and strengthening of the immune system and the skeleton (Tom Dieck *et al*., 2003) and despite the small proportions of mineral substances inside the body, it is of importance Great in performing the vital functions that the body performs (Bao *et al*., 2007). Many mineral elements act as co-factor factors, as their presence is necessary to complete the interaction of some enzymes and a substance for the Substrate reaction. Many mineral elements act as auxiliaries in anabolism or the synthesis of fats and proteins or in the catabolism process. In addition, the synthesis of some vital components in Like hemoglobin, the body depends on the presence of minerals, including iron (Dibner *et al*., 2007)As indicated by Jankowski and others (2018), there are trace minerals in several forms, whether organic or inorganic, organic ones are associated with protein, peptide and amino acid, and this increases their bioavailability as they work very efficiently in the gut where they are easily absorbed and spread into the bloodstream and then transported to the tissues and organs to benefit from them. Zinc, copper and manganese participate in an important role in physiological functions as enzyme catalysts as well as their positive effect on the reduction of lipids and cholesterol in blood plasma. An increase in high-density lipoproteins (HDL) and a decrease in lipoproteins were also observed. Low density (LDL) (Sun *et al*., 2012). The important role of these mineral elements in many productive functions, such as food conversion factor and feed consumption, as well as improvement in the characteristics of carcass, tissues, bones and skin, creating and collagen formation, an increase in absorption and a high growth rate, as well as their important role in the high level of immunity in the body to many diseases such as Newcastle, Gambro and influenza and others (Muszynski *et al*., 2018). In addition to its role in improving egg production, such as quality, thickness of the shell, increase in egg weight, higher hatchability, and improvement in leg skin in laying hens (Maciel *et al*., 2010). Organic zinc, when added to poultry diets, improves intestinal walls, increases villi length, and thus increases absorption (Bortoluzzi *et al*., 2019).

Materials and Methods

This experiment was conducted in the poultry field Dependent to the Department of Animal resource at the College of Agricultural Engineering - University of Baghdad

for the period from 12/10/2019 to 11/23/2019. The aim of this experiment was to study the effect of adding rare organic minerals and the combination between them on the productive performance of broilers. In the study, 300 non-naturalized commercial hybrids (Ross 308), one day old, with a starting weight of 41 g / chick, were used in the study. The birds were randomly distributed among 5 treatments, with 3 replicates per treatment, and within each replicate 20 chicks were randomly assigned. Where the treatments included: - T1 addition of a mixture of zinc and iron in a ratio of (Zn 40-Fe30) mg / kg of feed from one day to 42 days of experiment. T2 addition of a mixture of zinc, manganese and copper with a ratio of (Zn 40)-Mn 40 -Cu 7 mg / kg feed from one day to 42 days of experiment. T3 zinc and selenium in a ratio of (Zn 40- Se 0.3) mg / kg feed from one day to 42 days of experiment. T4 add a mixture of zinc and chromium in a ratio of (Zn 40-Cr 0.4) mg / kg feed from one day to 42 days of experiment.T5 is a control treatment that is without addition minerals. The birds were fed during the experiment stage on two types of diets, which are the starting feed for a period of 1-21 days of age, and the final feed for a period of 42-22 days, and as shown in Table (1), and the minerals were mixed manually according to the experiment treatments with crushed feed according to each treatment. The average live body weight, weight gain, amount of feed consumed, and feed conversion efficiency were calculated as indicated by Al-Zubaidi (1986). The data of this study were analyzed according to Complete Randomize Design (CRD), to study the effect of different parameters on the studied traits. The significant differences between the averages were compared with the Duncan (1955) polynomial test at a significant level (0.05). The statistical program SPSS (2010) was used in the statistical analysis.

Table 1: % Diet Composition

Article in the Bush	Bush initiator 1-21% days	Bush initiator 22-42 % final days
Yellow corn	30.6	40.5
Soy	31.7	24.9
Wheat	28	22.7
Centre for animal protein	5	5
Vegetable oil	2.5	4.7
Salt	0.3	0.3
Lime stone	1	1
Di-calcium phosphate	0.7	0.7
complex vitamins,minerals	0.2	0.2
Total	100	100
* Chemical analysis calculated		
Representative power	3003	3201
(kilo price/kg)	23	20
C.P Crude protein (%)	0.96	0.87
Phosphorus (%)	0.48	0.43
Lysine (%)	1.44	1.29
Methionine (%)	0.56	0.51
Methionine + cysteine (%)	1.08	0.99

Results and Discussion

Body weight average

Data regarding the effect of adding different levels of the Origin mineral trace and the combination between them on the average live body weight of broilers of different ages, as shown in Table (2), if the results indicate a significant improvement($p < 0.05$) in treatment T4 at age (14-21-28-35-42) weeks for a control group.

Weight increase

The following data shows the average weight gain of birds, as shown in Table (3). As it was found that there were no significant differences in the rate of weight gain between all the experimental treatments, ages 7 and 28 days. On the other hand, the results of the statistical analysis indicate the adding different levels of the Origin mineral trace and the combination between them on the rate of weight gain, indicating the presence of significant differences between the treatments. It was noticed that the treatment was significantly improvement to T4 ($P < 0.05$) at the age of 14 days on the control treatment, which did not show any significant difference with the other additional treatments, and at the age of 21 days, the significant improvement was ($P < 0.05$) for the treatment side (T5, T2, T3 and T4), which recorded the highest weight gain. It reached (454.25, 457.91, 463.00, and 474.15 g/bird), respectively, compared to treatment T1, which recorded the lowest rate of weight gain of (430.41 g/bird), and at 35 days of age we noticed a significant improvement ($P < 0.05$) for treatment T5. It was (685.31 g/bird) compared to treatment T2, which recorded the lowest rate of weight gain (637.00 g/bird), which did not differ significantly with the rest of the addition factors for the same period, and it was found at 42 days that treatment T4 was significantly higher ($P < 0.05$). As a weight gain was recorded (858.95 g/bird) than in treatment T5, which recorded the lowest rate of weight gain of (685.31 g/bird), while the coefficients did not differ significantly between them, and on the other hand when calculating the cumulative weight increase rate for the period (1 - 42). It showed a significant improvement in favor of treatment T4 as it achieved a weight gain of (2886.76 g/bird) over treatment T1 and T5 (2645.25 and 2660.40), respectively, while the results of the analysis did not indicate a significant difference for the rest of the treatments for the same character.

Feed consumption average

Table 4 shows the results of statistics analysis of feed consumption average, where there were no significant differences in feed consumption between All transactions in the feed rate consumed during the breeding period (7, 14, 21, 28, 35 and 42) days, and on the other hand, when calculating the total or cumulative feed consumption, the research results show that treatment T4 was significantly improvement (P <0.05) in the rate of consumption. The total feed amounted to (4373.83 g / bird) compared to the treatment T3, T2 and T1, which recorded the lowest amount of feed consumed (4306.92, 4344.83 and 4356.58 gm. / bird). At the time, it did not differ significantly with the control treatment.

Feed conversion coefficient

Feed conversion coefficient is one of the important economic indicators demonstrating bird efficiency in converting the feed to live body weight. Table 5, which shows adding different levels of the Origin mineral trace and the combination between them the statistics data of feed conversion coefficient, the results did not show any significant differences between the treatments at age (7, 14, 28, 35 and 42) and the total, while it was clear that there was a significant improvement (P <0.05) at 21 days in the food conversion factor in favor of treatment T3 compared to treatment T1, while the rest of the treatments did not differ significantly between them in The same studied adjective.

Table 2 : Effect of adding different levels of the Origin mineral trace and the combination between themon body weight, from broiler chickens in 42 days.

Treatment **	Body weight (g/bird)					
	7 day	14 day	21 day	28 day	35 day	42 day
T1	3.64±135.25	7.54 ± 392.08 B	6.00± 822.50B	32.63± 1314.13B	39.16± 1967.91B	112.14± 2689.25B
T2	4.79±137.41	16.25± 399.50 AB	26.96± 857.41 AB	20.37±1364.66 AB	12.5± 2001.66 AB	27.55 ± 2777.33 AB
T3	1.01±139.08	3.42 ± 396.41 B	5.96±859.41AB	5.36±1347.83 B	21.16± 1999.50 AB	40.30 ±2747.68 AB
T4	5.59±150.16	6.64±277.34A	7.68±901.50A	2.56±1417.85 A	9.61± 2071.81A	47.17± 2930.76 A
T5	6.00±144.58	600 ± 250.66B	10.06±848.91B	15.51± 1341.08B	23.69± 2019.08AB	24.61± 2704.40B
Moral value	NS	0.05	0.05	0.05	0.05	0.05

NS :It means that there are no significant differences between the averages of the treatment.

(**) The treatments include adding rare organic metals to the diet as follows: T1 (Zn 40 + Fe 30), T2 (Zn 40 + Mn 40 + Cu 7), T3 (Zn 40 + Se 0.3), T4 (Zn 40 + Cr (0.4 mg). / Kg feed T5 control treatment without addition.

Table 3: Effects of adding different levels of the Origin mineral trace and the combination between them on the Weight Increase, from broiler chickens in 42 days.

Treatment **	Weight Increase .Body weight gain (g/bird)						
	7 day	14 day	21 day	28 day	35 day	42 day	1-42 day
T1	3.64 ± 91.25	4.54±256.83AB	2.74±430.41B	29.62±491.63	5.56±653.78AB	73.53±721.33AB	112.14±2645.25B
T2	4.79 ± 93.41	11.45±262.08AB	10.80±457.91A	8.09±507.25	8.14±637.00B	17.98±775.66AB	27.55±2733.33AB
T3	1.01 ± 95.08	2.59±257.33 AB	.59±463.00A	1.83±488.41	16.96±651.66AB	24.32±748.18AB	40.30±2703.68AB
T4	5.59±106.16	2.80±277.17A	6.66±474.15A	7.15±561.35	10.78±653.95AB	52.03±858.95A	47.17±2886.76A
T5	6.00±100.58	4.06±250.08B	4.34±454.25A	10.06±492.16	8.17±678.00A	37.23±685.31B	24.61±2660.40B
Moral value	NS	0.05	0.05	NS	0.05	0.05	0.05

NS :It means that there are no significant differences between the averages of the treatment.

(**)The treatments include adding rare organic metals to the diet as follows: T1 (Zn 40 + Fe 30), T2 (Zn 40 + Mn 40 + Cu 7), T3 (Zn 40 + Se 0.3), T4 (Zn 40 + Cr (0.4 mg). / Kg feed T5 control treatment without addition.

Table 4: Effects of adding different levels of the Origin mineral trace and the combination between the month of feed consumption average, from broiler chickens in 42 days.

Treatment **	Feed Consumption Average (g / h): in production stages						
	7 day	14 day	21 day	28 day	35 day	42 day	1-42 day
T1	3.12± 117.91	4.95 ± 336.33	7.50 ± 632.16	4.52 ± 818.75	29.45± 1078.41	33.33± 1373.00	67.46 ± 4356.58B
T2	5.26 ±122.75	12.47 ± 334.41	26.18 ± 638.58	21.08 ± 826.58	21.77± 1062.25	26.43± 1360.25	69.11± 4344.83B
T3	1.47± 122.83	7.48 ± 339.25	11.80± 617.91	7.12± 818.83	18.91± 1054.91	16.33±1353.17	20.25 ± 4306.92B
T4	1.98± 127.50	6.29 ± 360.65	13.01± 669.81	16.91± 865.87	11.47± 1118.74	14.41± 1396.00	6.03 ± 4538.60A
T5	2.98± 123.50	5.18± 338.66	12.39 ± 640.75	20.93± 837.00	18.55± 1106.66	18.40± 1327.25	64.42± 4373.83AB
Moral value	NS	NS	NS	NS	NS	NS	0.05

NS : It means that there are no significant differences between the averages of the treatment.

(**) The treatments include adding rare organic metals to the diet as follows: T1 (Zn 40 + Fe 30), T2 (Zn 40 + Mn 40 + Cu 7), T3 (Zn 40 + Se 0.3), T4 (Zn 40 + Cr (0.4 mg). / Kg feed, T5 control treatment without addition.

Table 5: Effects of adding different levels of the Origin mineral trace and the combination between the month of feed conversion coefficient, from broiler chickens in 42 days.

Treatment **	Weekly food conversion coefficient						
	7 day	14 day	21 day	28 day	35 day	42 day	1-42 day
T1	0.03 ± 1.29	0.03± 1.31	0.02± 1.67A	0.10± 1.67	0.03± 1.64	0.16 ± 1.93	0.05 ± 1.65
T2	0.01 ± 1.31	0.01± 1.27	0.02 ± 1.39AB	0.03 ± 1.62	0.02 ± 1.66	0.01 ± 1.75	0.01± 1.58
T3	0.01± 1.29	0.02 ± 1.31	0.04 ± 1.33B	0.01 ± 1.67	0.02 ± 1.61	0.03 ±1.81	0.01± 1.59
T4	0.04± 1.20	0.02± 1.30	0.04± 1.41AB	0.05 ± 1.67	0.04 ± 1.71	0.08 ± 1.64	0.02 ± 1.57
T5	0.04 ± 1.23	0.03 ± 1.35	0.03 ± 1.41AB	0.05 ± 1.70	0.02 ± 1.63	0.07± 1.94	0.01± 1.64
Moral value	NS	NS	0.05	NS	NS	NS	NS

NS : It means that there are no significant differences between the averages of the treatment.
(**) The treatments include adding rare organic metals to the diet as follows: T1 (Zn 40 + Fe 30), T2 (Zn 40 + Mn 40 + Cu 7), T3 (Zn 40 + Se 0.3), T4 (Zn 40 + Cr (0.4 mg). / Kg feed T5 control treatment without addition.

The results of the previous results revealed the significant improvement shown by the treatments added to the mixture of minerals and the combination between them to the diets of broiler meat, in particular, both of treatment T4 (Zn 40 + Cr) 0.4 mg / kg and treatment T2 (Zn 40 + Mn 40 + Cu 7) mg / kg. Productive characteristics represented by live body weight, weight gain, and feed consumption may be due to the effective role of minerals when added to diets. As the amount of minerals in the diet has become insufficient to meet the body's need, especially modern breeds of broilers that are characterized by high growth on the one hand, and on the other hand, the forage materials included in the formation of diets may not fully provide minerals to meet the body's need and the reason for this may be the presence of Phatic acid as a lion. In some plant sources included in the composition of the diet, including (yellow corn and soybean meal), which works on binding with minerals, making them unavailable inside the body and not benefiting from them (Yan *et al*., 2001). Therefore, chromium is one of the important elements in poultry and its functions were discovered recently, although it was not mentioned in the recommendations (NRC, 1994). Birds (Kani *et al*., 2015; Zheng *et al*., 2016; Mir *et al*., 2017; Farag *et al*., 2017; Li *et al*., 2018). The prominent roles of chromium in the metabolism of carbohydrates, fats and proteins are evidenced by the activation of some important enzymes in the metabolism and the enzyme (Tyrosine kinase) important in building some proteins inside the body (Hayirli *et al*., 2005). Kain and others (2015) have shown; Rao *et al*. (2016) that chromium has an effective role in increasing body weight when added to broiler diets by improving absorption in the gut by 10-15%.

References

Bao, Y.M.; Choct, M.; Iji, P.A. and Bruerton, K. (2007). Effect of organically complexed copper, iron, manganese, and zinc on broiler performance, mineral excretion, and accumulation in tissues. Journal of Applied Poultry Research, 16(3): 448-455.

Batres-Marquez, S.P. (2018). U.S. Broilers: Recent production, exports, and projections for .Accessed Aug. Industry Poultry Science Association Inc., 28: 791–800.

Bortoluzzi, C.; Vieira, B.S.; Lumpkins, B.; Mathis, G.F.; King, W.D.; Graugnard, D.; Dawson, K.A. and Applegate, T.J. (2019). Can dietary zinc diminish the impact of necrotic enteritis on growth performance ofbroiler chickens by modulating the intestinal immune-system and microbiota?. Poultry Science, 98(8): 3181-3193.

Dibner, J.J.; Richards, J.D.; Kitchell, M.L. and Quiroz, M.A. (2007). Metabolic challenges and early bone development. Journal of Applied Poultry Research, 16(1): 126-137.

Duncan, D.B. (1995). Multiple range and multiple "F" tests. Biometrics.; 11:1-42.

Farag, M.R.; Alagawany, M.; Abd El-Hack, M.E.; Arif, M.; Ayasan, T.; Dhama, K.; Patra, A. and Karthik, K. (2017). Role of chromium in poultry nutrition and health: beneficial applications and toxic effects. International Journal of Pharmacology, 13(7): 907-915.

Hayirli, A. (2005). Chromium nutrition of livestock species. In *Nutrition Abstracts and Reviews. Series B, Livestock Feeds and Feeding* (Vol. 75, No. 5). CAB International.

Jankowski, J.; Ognik, K.; Stępniowska, A.; Zduńczyk, Z. and Kozłowski, K. (2018). The effect of manganese nanoparticles on apoptosis and on redox and immune status in the tissues of young turkeys. PloS one, 13(7).

Kani, M.M. (2015). The Effects of Different Sources of Organic and Inorganic Chromium on Blood Parameters of Broiler Chickens. Indian Journal of Science and Technology. 8(28):1, DOI: 10 .

Li, R.; Zhou, Y.; Li, Y.; Guo, L.; Zhang, Y. and Qi, Z. (2018). Effects of Chromium Picolinate Supplementation on Growth Performance, Small Intestine Morphology and Antioxidant Status in Ducks Under Heat Stress Conditions. International Journal of Morphology, 36(1).

Maciel, M.P.; Saraiva, E.P.; Aguiar, É.D.F.; Ribeiro, P.A.P.; Passos, D.P. and Silva, J.B. (2010). Effect of using organic microminerals on performance and external quality of eggs of commercial laying hens at the end of laying. Revista Brasileira de Zootecnia, 39(2): 344-348.

Mir, N.A.; Tyagi, P.K.; Biswas, A.K.; Tyagi, P.K.; Mandal, A.B.; Sheikh, S.A.; Deo, C.; Sharma, D. and Verma, A.K. (2017). Impact of feeding chromium supplemented flaxseed based diet on fatty acid profile, oxidative stability and other functional properties of broiler chicken meat. Journal of food science and technology, 54(12): 3899-3907.

Mottet, A. and Tempio, G. (2017). Global poultry production: current state and future outlook and challenges. World's Poultry Science Journal, 73(2): 245-256.

Muszyński, S.; Tomaszewska, E.; Kwiecień, M.; Dobrowolski, P. and Tomczyk, A. (2018). Effect of dietary phytase supplementation on bone and hyaline cartilage development of broilers fed with organically

complexed copper in a Cu-deficient diet. Biological trace element research, 182(2): 339-353.

National Research Council (1994). Nutrient requirements of poultry: 1994. National Academies Press.

Rao, S.R.; Prakash, B.; Raju, M.V.L.N.; Panda, A.K.; Kumari, R.K. and Reddy, E.P.K. (2016). Effect of supplementing organic forms of zinc, selenium and chromium on performance, anti-oxidant and immune responses in broiler chicken reared in tropical summer. Biological trace element research, 172(2): 511-520.

Sun, Q.; Guo, Y.; Ma, S.; Yuan, J.; An, S. and Li, J. (2012). Dietary mineral sources altered lipid and antioxidant profiles in broiler breeders and posthatch growth of their off springs. Biological trace element research, 145(3): 318-324.

Tom dieck, H.; Döring, F.; Roth, H.P. and Daniel, H. (2003). Changes in rat hepatic gene expression in response to zinc deficiency as assessed by DNA arrays. The Journal of nutrition, 133(4): 1004-1010.

Yan, F.; Kersey, J.H. and Waldroup, P.W. (2001). Phosphorus requirements of broiler chicks three to six weeks of age as influenced by phytase supplementation. Poultry Science, 80(4): 455-459.

Zheng, C.; Huang, Y.; Xiao, F.; Lin, X. and Lloyd, K. (2016). Effects of supplemental chromium source and concentration on growth, carcass characteristics, and serum lipid parameters of broilers reared under normal conditions. Biological trace element research, 169(2): 352-358.