Egypt. Poult. Sci. Vol. (44) (II): (219-229) (2024) **(2405-1290)**

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EFFECT OF CR-METHIONINE AND PEPPERMINT OIL ON THE PRODUCTIVE PERFORMANCE OF BROILER CHICKS RAISED UNDER HEAT STRESS CONDITIONS

Waleed M. Dosoky[1], Soliman M. Zahran[1], Samia M. Ghaleb[2] and Mohamed M. Khalifah[2]

1 Dep. of Anim. and Fish Prod, Fac. of Agric. (Saba Basha), Alexandria Uni..

2 Dep. of Poult. Nut., Anim.Prod. Res. Inst., Minis. of Agric. and Land Reclamation, ARE,

Corresponding author: Samia M. Ghaleb Email: samiamosa29@gmail.com

Received: 19/05/2024 Accepted: 13 /06/2024

ABSTRACT:A total of 225 7-day-old Ross 308 chicks were randomly assigned to nine groups consisting of 25 birds each. In a completely randomized design, each treatment was repeated 5 times with 5 chicks. The following diets were used as treatments: providing merely a basic meal without additives and acting as a control group,, the 2nd and 3rd were received basal diet supplemented with Chromium-l-methionine complex (Cr-Meth) at a dose 0.3 and 0.4 gm/kg diet, the 4th and 5th were received basal diet supplemented with peppermint oil (PO) at a dose 0.6 and 0.8 gm/kg diet, while 6th, 7th, 8th and 9th were given the basal diets supplemented with a combination of Cr-Meth (0.3 and 0.4 gm/kg diet) and PO (0.6 and 0.8 gm/kg diet), respectively. The results showed that the best values of body weight, body weight gain, feed intake and feed conversion ratio were recorded in T7, T9, T3 and T8, respectively. The relative weights of gizzard, liver, heart, and spleen were non-significantly ($P \leq 0.05$) affected expect relative weight of bursa and abdominal fat which were significantly ($P \leq 0.05$) affected by tested materials and their mixture. Different additives added alone or in combination significantly ($P < 0.01$) reduced serum total cholesterol and triglycerides. Exposing birds to high temperature conditions resulted in elevated ($P \leq 0.05$) serum malondialdehyde as presented in the control one, however, it was significantly decreased by all dietary treatments. Besides, numerical increase in serum total antioxidant capacity was observed due to supplementation of different feed additives. In conclusion, dietary inclusion of Cr-Meth and PO could be applied as an antioxidants in broiler chicks' diets under heat stress conditions.

Key Words: broiler, Chromium-l-methionine,peppermint oil, broiler performance, Serum biochemicals.

INTRODUCTION

In tropical regions, a major concern in poultry production is heat stress (HS). Due to its negative effect on broiler performance, carcass characteristics and mortality which leads to financial losses (Li et al, 2018). According to calculations, heat stress in broilers especially suppresses the immune system, which leaves chickens less responsive to vaccination and immune system involvement (Rajkumar et al., 2015).

Chromium (Cr) is an essential micronutrient for humans and animals. It has influence on glucose and lipid metabolism, mostly through improved insulin signaling (Lewicki et al., 2014). Castro et al., (2019) found that the differences in body weight gain (BWG) of birds fed a diet supplemented with (250 ppb CrCl3) had the greatest values of 45.0g/bird whereas and the least of 40.0g / bird was for birds received a control diet. Sahin and Sahin (2002) noticed that increased supplemental Cr from 200 to 1200 ppb diet resulted in an increased feed intake (FI) linearly ($P \leq 0.05$). Jaiswal et al., (2017) discovered an increase in triglycerides concentration in response to acute HS exposure and duration of HS. Plasma cholesterol levels were found to be significantly elevated in chronic HS patients, according to Attia and Hassan (2017). Supplementing with chromium increased serum IgG or plasma IgM and IgG in broilers raised under high stress (Bahrami et al., 2012). The effect of Cr on immune functions may be due to a decrease in corticosteroid secretion and potentiation of insulin's action (Jahanian and Rasouli, 2015). El-Kelawy (2019) found that Cr supplementation to the diet of quails during the growing period increased economic efficiency due to increased body weight (BW) and improved feed conversion ratio (FCR). Also, Hassan et al., (2020) found that diets supplemented with different levels of CrY resulted in higher net return and economic efficiency values than the control.

Essential oils have been incorporated into poultry diets due to their recognized health benefits, which include antibacterial, antiviral, antifungal, antioxidant, digestive stimulant, immunomodulatory, hypolipidemic, and thermal stress alleviating properties (Ruff et al., 2021). In this regard, there are several studies indicating that some herbal substances have a positive effect on the growth performance of broilers, their antioxidant status, and the oxidative stability of meat. Peppermint is a good medicinal plant, it has some properties, astringent, warming, stimulating, carminative, antiseptic, antifungal, antiviral, blood purifying, and aiding digestion (Yalcin et al., 2012 and Beigi et al., 2018).

The objective of this research was to investigate the effects of supplementing diets with Cr-Meth, peppermint oil (PO), and their mixture on performance, carcass traits, antioxidant activity, and some blood biochemical constituents of broiler chicks raised under heat stress conditions.

MATERIALS AND METHODS

The present study contains an experiment that was carried out in El-Sabahia Poultry Research Station, Alexandria Governorate belonging to Animal Production Research Institute, ARC, Ministry of Agriculture, and the chemical analysis carried out in Faculty of Agriculture, (Saba Basha) Alexandria University, Egypt.

A total of 225 unsexed seven day old of broiler chicks (Ross 308) were randomly divided into 9 experimental groups composed of 25 chicks per group with 5 replicates of 5 birds each in completely randomized design. The 1st group (control) received basal diet without supplementation, the 2nd and 3rd were received basal diet supplemented with Chromium-l-methionine complex (Cr-Meth) at a dose 0.3 and 0.4 g / kg diet, the 4th and 5th were received basal diet supplemented with peppermint oil (PO) at a dose 0.6 and 0.8 g / kg diet, while 6th, 7th, 8th and 9th groups were fed the basal diets supplemented with a combination of Cr-Meth (0.3 and 0.4 gm/kg diet) and PO (0.6 and 0.8 gm/kg diet), respectively. Treatments were applied for a 35-day feeding trial (from 7 to 42 days of age). The birds were fed the experimental diets, *ad libtium*, and given free access to fresh water. All groups were housed at thermal comfort temperature from day 1to 21 as recommended in the Ross 308 breed line manual. At day 22, the experiment was started because HS of 33C± 2C cause deleterious damages in the productivity of the birds due to the increase of the muscular protein deposition that increase the production of endogenous heat (Dalolio et al., 2018). The relative humidity was kept at 65.0 ± 4.0% and the lighting program consisted of 23 h light and 1 h of darkness. The basal diets (starter from 7 – 21 d and finisher from 22 – 42 d old) were formulated to meet the nutritional requirements for broiler chicks according to NRC (1994) and shown in Table (1).

Growth performance, carcass traits.

Body weight (BW), BWG, FI and FCR were recorded each week. At the end of the experiment (42 d), 5 chicks/treatment group were randomly chosen, overnight fasted but with access to water, then slaughtered according to Islamic regulations, and de-feathered. After evisceration, the dressing percentage and relative organs weights were calculated (liver, heart, gizzard, spleen) and abdominal fat (%).

Blood biochemical analyses

Blood samples were withdrawn from 5 chicks per treatment group by wing vein puncture using sterilized needles in vacutainer tubes. Birds were still feeding before blood collection and feed was not withdrawn from the feeder. Blood was let for short time to allow separation of serum naturally, then centrifugation (4000 rpm for 15 minutes) of all samples were done to harvest all serum. Sera were decanted in dry and clean Eppendorf tubes and stored frozen (at -20oC) till the biochemical analysis. Serum proteins, glucose, cholesterol, LDL-cholesterol and triglycerides, antioxidant capacity (TAC), glutathione peroxidase (GSH-Px) and lipid peroxide (MDA) were measured by spectrophotometer by using available commercial kits according to the manufacturer outlines.

Statistical analysis of data

The obtained results were subjected to one way ANOVA using the general linear model (GLM) procedure of SAS 9.2 software (SAS Institute, 2009). Significant differences between means were detected by Duncan multiple range test (Duncan, 1955), where $P \leq 0.05$; P values less than 0.001 are expressed as "≤0.001" rather than the actual value.

RESULTS AND DISCUSSION

The effect of Cr-meth, PO and their mixture supplementation on the BW, BWG, FI and FCR at six weeks are shown in Table (2). The BW of the groups fed diets with varying amounts of Cr-meth, PO, and their combination was considerably higher than that of the control group. The groups that were fed on T7, T9, T3, and T8 had the greatest ($P \leq 0.05$) BWG values, respectively.

Impact of Cr-meth, PO and their mixture supplementation on BWG of broilers had the same trend that observed on BW. The present findings also demonstrated that FI increased with increasing Cr-meth level and their mixture with PO at level 0.4 gm at 42 days of age. At 42 days of age, the groups fed 0.4 g Cr-meth, 0.6 g PO (T8) , and 0.3 g Cr-meth and 0.8 g PO (T7) had the best ($P \leq 0.05$) values of FCR.

Similar observations were found with EL-Kelawy (2019) and Desoky et al. (2020) who observed that Cr-meth supplementation improved BW, BWG, FI and FCR of Japanese quails. In regard to the impact of PO, Akbari and Torki (2014) demonstrated that supplementation with PO did not have a statistically significant effect on the average BW, ADG, and daily FI of broiler chicks. On the contrary to the aforementioned results, Emami et al. (2012) demonstrated that, when compared to the FCR of the control group of birds, the FCR of chicks supplemented with the PO at a dose of 200 mg/kg of DM in their diet tended to improve (P = 0.039). In addition, Arab Ameri et al. (2016) found that 1% peppermint powder supplementation diets decreased the ADG of birds; however, a 2% increase in peppermint powder led to a higher ADG at 21 days of age compared to the control group. Abdel-Wahab et al. (2018) demonstrated also that supplementing quails diet with peppermint significantly enhanced all growth performance parameters.

The carcass percentage and their organs of broiler as affected by dietary supplementation of either CR-meth, PO or their mixture during the experimental period are presented in Table (3). Supplementation of Cr-meth or PO either individually or at any mixture significantly ($P \leq 0.05$) increased carcass and organs percentage comparable to control group.

With the exception of bursa and abdominal fat, which were considerably ($P \leq 0.05$) influenced by the studied materials and their mixture, the relative weights of the gizzard, liver, heart, and spleen were not significantly ($P \leq 0.05$) altered by Cr-meth, PO, and their mixture supplementation. According to EL-kelawy (2019), the administration of Cr-organics resulted in a substantial reduction in abdominal obesity and an increase in carcass percentage. However, edible parts were not significantly impacted. Conversely, Sands and Smith (1999) documented that the addition of Cr during periods of HS resulted in improved live performance and a higher percentage yield of carcass. Additionally, Norain et at., (2013) found that broiler chickens fed organic Cr had significantly higher dressing percentage than control group. On the other hand, EL-Kelawy (2019) reported that no significant impacts of Cr were detected on relative weights of Bursa. Also, Gurbuz and Ismael (2016), reported that there were non-significant effects on the carcass, carcass yield and abdominal fat of broiler fed 0.5, 1.0 and 1.5% of peppermint.

Varied levels of Cr-meth, PO and their combination considerably ($P \leq 0.05$) reduced serum cholesterol and triglycerides concentrations as compared to the control group; however, serum creatinine were non significantly ($P \leq 0.05$) decreased by different treatments. The groups fed 0.4 Cr + 0.8PO /kg (T9) had the lowest creatinine concentration value (Table 4).

Data in Table (4) revealed that all groups supplementation with Cr-meth, PO and their mixture recorded the highest value on GSH-Px compared to control group. On the other hand, TAC numerically increased in all groups as compared to the control group. While, serum lipid peroxide (MDA) decreased in all groups while the control group increased significantly. The role of Cr-meth, PO in alleviating the oxidative stress on broilers is obvious, since Cr-meth, PO and their mixture increased TAC which indicates the activity of the antioxidant system as well as it decreased MDA concentrations which is a secondary by-product of lipid peroxidation caused by oxygen free radicals (Bento et al. 2013) the present data are in agreement with Rao et al. (2012) who reported that Cr-meth supplementation in broilers diets is assumed to augment the antioxidant defense system . Supplementation of Cr-meth, PO and their mixture enhanced the actions of antioxidant enzyme (GSHPx) revealing that supplementation with Cr-meth and PO decreased oxidative stress with an increase in its level in of birds (Rao et al .2012 and Desoky et al., 2020).

In conclusion, the best values of BW, BWG, FI and FCR were observed in groups supplemented with a combination of Cr-Meth and PO. Moreover, the results showed significant improvements in blood serum in comparison with control group. Therefore, Cr-Methionine and peppermint oil could be applied successfully in broiler diets as an antioxidant under heat stress conditions.

broiler, Chromium-l-methionine,peppermint oil, broiler performance, Serum biochemicals.

Table (1): Composition and calculated analyses of the experimental basal diets.

Ingredients	**Starter diet (%), 7-21 d of age**	**Finisher diet (%), 22-42 d of age**
Yellow corn	49.0	55.0
Soybean meal (48% CP)	42.0	35.8
Vegetable oil	5.0	5.4
Di-calcium phosphate	2.0	1.5
Limestone	1.0	1.25
Salt (NaCl)	0.3	0.3
Vitamin+ mineral premix[1]	0.3	0.3
Dl-Methionine	0.25	0.25
L- Lysine HCl	0.15	0.20
Total	**100**	**100**
Calculated analysis		
ME (Kcal/ Kg diet)	3035	3135
Crude protein (%)	22.9	20.8
Ether extra (%)	4.7	4.8
Crude fiber (%)	3.3	3.8
Calcium (%)	0.95	0.91
Available phosphorus (%)	0.52	0.42
Methionine (%)	0.60	0.56
Methionine + Cysteine (%)	0.96	0.91
Lysine (%)	1.37	1.26

[1]Vit+Min mixture provides per kg of the diet: vitamin A (retinyl acetate) 24mg, vitamin E (dl-α-tocopheryl acetate) 20mg, menadione 2.3mg, Vitamin D_3 (cholecalciferol) 0.05mg, riboflavin 5.5mg, calcium pantothenate 12mg, nicotinic acid 50mg, choline chloride 600mg, vitamin B12 10µg, vitamin B6 3mg, thiamine 3mg, folic acid 1mg, d-biotin 0.50mg. Trace mineral (mg per kg of diet): Mn 80 Zn 60, Fe 35, Cu 8, Se 0.60.

Table (2): Effect of diets supplementation with Cr-Meth, PO, and their mixture on performance of broiler chicks raised under heat stress from 7-42 days of age.

Treatments	Body weight (g)			Body weight gain (g/ period)			Feed intake (g/ period)			Feed conversion (g/g/period)		
	7d	**21 d**	**42d**	**7-21**	**21-42**	**7-42**	**1-21**	**21-42**	**7-42**	**7-21**	**21-42**	**7-42**
T1 Cont.	171.15	858.46^{b}	1650.00^{c}	686.90^{b}	792.00^{c}	1478.90^{c}	739.0^{b}	2200.00^{b}	2939.0^{b}	1.08	2.78^{a}	1.99^{a}
T2	173,00	879.51^{ab}	1938.00^{b}	706.50^{b}	1058.50^{ab}	1765.00^{b}	711.0^{b}	2677.0^{ab}	3388.0^{a}	1.01	2.53^{a}	1.92^{a}
T3	172.31	880.23^{ab}	2044.00^{a}	707.70^{b}	1164.00^{a}	1871.70^{a}	718.0^{b}	2837.0^{a}	3555.0^{a}	1.01	2.44^{b}	1.90^{ab}
T4	174.00	881.52^{ab}	1923.00^{b}	707.50^{b}	1041.50^{b}	1749.00^{b}	755.0^{ab}	2650.0^{a}	3405.0^{a}	1.07	2.54^{a}	1.95^{a}
T5	172.12	900.69^{a}	1938.00^{b}	727.90^{a}	1038.00^{b}	1765.90^{b}	800.0^{a}	2600.0^{a}	3400.0^{a}	1.10	2.50^{b}	1.93^{a}
T6	175.01	891.42^{a}	2030.00^{ab}	716.00^{ab}	1139.00^{a}	1855.00^{ab}	798.0^{a}	2854.0^{a}	3652.0^{a}	1.11	2.51^{a}	1.97^{a}
T7	172.91	948.55^{a}	2210.00^{a}	775.60^{a}	1261.50^{a}	2037.10^{a}	818.0^{a}	2950.0^{a}	3768.0^{a}	1.05	2.34^{b}	1.85^{b}
T8	173.22	950.13^{a}	2108.00^{a}	777.00^{a}	1158.00^{a}	1935.00^{a}	810.0^{a}	2700.0^{a}	3510.0^{a}	1.04	2.33^{b}	1.81^{b}
T9	172.82	955.0^{a}	2100.00^{a}	782.20^{a}	1145.00^{a}	1927.20^{a}	815.0^{a}	2799.0^{a}	3614.0^{a}	1.04	2.44^{b}	1.88^{b}
P Value	0.785	0.031	0.042	0.024	0.001	0.00	0.00	0.02	0.05	0.64	0.023	0.043
SEM	1.61	6.90	26.53	13.62	20.77	25.54	12.45	25.89	30.24	0.04	0.10	0.17

Cr-Meth: Chromium-l-methionine complex PO: peppermint oil

T_1 Control, T2 Control+ 0.3 gm CrMet /kg diet, T3 Control+ 0.4 gm CrMet /kg diet, T4 Control+ 0.6 gm PO /kg diet, T5 Control+ 0.8 gm PO /kg diet, T6 Control+0.3 gm CrMet +0.6 gm PO /kg diet, T7 Control+0.3 gm CrMet 0.8 gm PO /kg diet T8 Control+0.4 gm CrMet 0.6 gm PO /kg diet, T9 Control+0.4 gm CrMet 0.8gm PO /kg diet.

$^{a-c}$ Means in the same column having different letters are significantly different ($P<0.05$).

Table (3): Effects of diets supplementation with Cr-Meth, PO, and their mixture on carcass characteristics (%) of broiler chicks raised under heat stress at 42 days of age.

Treatments	Carcass	Gizzard	Liver	Heart	Spleen	Abdominal fat	Bursa
T1 Cont.	66.00	1.85	2.49	0.692	0.115	1.010^{a}	0.064^{e}
T2	69.90	2.00	2.82	0.619	0.189	0.816^{b}	0.074^{d}
T3	70.73	1.81	2.37	0.552	0.151	0.773^{b}	0.073^{d}
T4	68.72	2.08	2.48	0.636	0.134	0.817^{b}	0.092^{c}
T5	69.71	2.02	2.01	0.688	0.128	0.634^{c}	0.062^{e}
T6	68.62	1.98	2.49	0.609	0.166	0.789^{b}	0.061^{e}
T7	70.57	1.77	2.57	0.638	0.115	0.666^{c}	0.065^{e}
T8	67.69	1.92	2.74	0.562	0.156	0.848^{b}	0.107^{b}
T9	69.24	1.95	2.90	0.571	0.085	0.779^{b}	0.138^{a}
P Value	0.192	0.091	0.765	0.233	0.082	0.034	0.0001
SEM	0.34	0.045	0.081	0.022	0.014	0.096	0.001

Cr-Meth: Chromium-l-methionine complex PO: peppermint oil

T_1 Control, T2 Control+ 0.3 gm CrMet /kg diet, T3 Control+ 0.4 gm CrMet /kg diet, T4 Control+ 0.6 gm PO /kg diet, T5 Control+ 0.8 gm PO /kg diet, T6 Control+0.3 gm CrMet +0.6 gm PO /kg diet, T7 Control+0.3 gm CrMet 0.8 gm PO /kg diet T8 Control+0.4 gm CrMet 0.6 gm PO /kg diet, T9 Control+0.4 gm CrMet 0.8gm PO /kg diet.

$^{a-e}$ Means in the same column having different letters are significantly different ($P<0.05$).

Table (4): Effect of diets supplementation with Cr-Meth, PO, and their mixture on antioxidant activity, and some blood biochemical constituents of broiler chicks raised under heat stress at 42 days of age.

Treatments	Blood serum metabolites			Antioxidant profiles		
	Total cholesterol mg/dl	**Triglycerides mg/dl**	**Creatinine mg/dl**	**TAC mg/dl**	**MDA nmol/ml**	**GSH-Px, mg/dl**
T1 Cont.	135.00^{a}	142.01^{a}	1.087	414	9.374^{a}	9.755^{b}
T2	114.00^{b}	99.34^{c}	0.917	423	8.341^{b}	10.342^{b}
T3	116.67^{b}	113.00^{c}	0.987	430	8.488^{b}	10.318^{b}
T4	118.45^{b}	129.34^{bb}	0.890	421	8.473^{b}	10.663^{b}
T5	118.23^{b}	131.67^{bb}	0.917	417	8.445^{b}	10.802^{b}
T6	101.33^{c}	125.78^{b}	0.843	426	8.660^{b}	10.963^{b}
T7	105.35^{c}	93.05^{c}	0.913	426	8.704^{b}	10.745^{b}
T8	104.62^{c}	100.46^{c}	0.787	427	8.452^{b}	10.299^{b}
T9	110.67^{bc}	99.87^{c}	0,704	428	8.371^{b}	10.417^{b}
P Value	0.002	0.007	0.061	0.2030	0.0001	0.0333
SEM	2.34	1.64	0.035	1.21	0.07	0.16

Cr-Meth: Chromium-l-methionine complex PO: peppermint oil

T_1 Control, T2 Control+ 0.3 gm CrMet /kg diet, T3 Control+ 0.4 gm CrMet /kg diet, T4 Control+ 0.6 gm PO /kg diet, T5 Control+ 0.8 gm PO /kg diet, T6 Control+0.3 gm CrMet +0.6 gm PO /kg diet, T7 Control+0.3 gm CrMet 0.8 gm PO /kg diet T8 Control+0.4 gm CrMet 0.6 gm PO /kg diet, T9 Control+0.4 gm CrMet 0.8gm PO /kg diet.

$^{b-c}$ Mebns in the same column having different letters bre significbntly different (P<0.05).

broiler, Chromium-l-methionine,peppermint oil, broiler performance, Serum biochemicals.

REFERENCES

Abdel-Wahab, A.; Abdel-Kader, I. and Ahmad, E. A. 2018. Evaluation of dried peppermint leaves as natural growth promoters alternative to antibiotics on Japanese quail. Egypt Poult Sci J 38.

Akbari, M. and Torki, M. 2014. Effects of dietary chromium picolinate and peppermint essential oil on growth performance and blood biochemical parameters of broiler chicks reared under heat stress conditions. Int. J. Biometeorol., 58: 1383-1391

Arab Ameri, S., Samadi, F., Dastar, B. & Zerehdaran, S., 2016. Effect of peppermint (*Mentha piperita*) powder on immune response of broiler chickens in heat stress. Iran. J. Appl. Anim. Sci. 6, 435-445

Attia, Y.A. & Hassan, S.S. 2017. Broiler tolerance to heat stress at various dietary protein/energy levels. European Poultry Science, 81: 171-186

Bahrami, A.; Moeini, M.M.; Ghazi, S.H. & Targhibi, M.; 2012. The effect of different levels of organic and inorganic chromium supplementation on immune function of broiler chicken under heat-stress conditions. J. Appl. Poult. Res., 21(2): 209–215.

Beigi, M., M. Torki-Harchegani and A.G. Pirbalouti, 2018. Quantity and chemical composition of essential oil of peppermint (*Mentha × piperita L.)* leaves under different drying methods. Int. J. Food Prop., 21:267–276.

Bento M.H.L, A.C. Ouwehand , K. Tiihonen , S. Lahtinen , P. Nurminen , M.T. Saarinen , H. Schulze , T. Mygind , J. Fischer 2013. Essential oils and their use in animal feeds for monogastric animals – Effects on feed quality, gut microbiota, growth performance and food safety: a review. Veterinarni Medicina, 58, 2013 (9): 449–458.

Castro, F.L.S.; Su, S.; Choi, H.; Koo, E. & Kim, W.K. 2019. L-Arginine supplementation enhances growth performance, lean muscle, and bone density but not fat in broiler chickens. Poultry sci, 98(4), 1716-1722.

Dalólio FS, Albino LFT, Silva JN, Campos PHRF, Lima HJD, Moreira J, Ribeiro Junior V 2018. Dietary chromium supplementation for heat stressed broilers. World's Poultry Science Journal 74, 101–116. doi:10.1017/S0043933917001064

Desoky ,Waleed M, Hassan S. Zeweil, Soliman M. Zahran , Tarek A. Ebeid, Ayman M. Khalifah and Walaa A. Kashyout 2020. Effect of Organic Chromium on Performance, Physiological and Anti-oxidative Stress Indicators of Growing Japanese Quail under High Ambient Temperature. J. Sus. Agric. Sci. Vol. 46, No. 4, pp 113-124.

Duncan, D. B. **1955.** Multiple ranges and multiple tests. Biometrics, 11: 1-42.

El-Kelawy, M.I. 2019. Effect of different sources of chromium on productive performance of Japanese quail under heat stress conditions. Egypt Poultry Science, (39) (I): 99-115.

Emami, N. K.; Samie, A.; Rahmani, H. and Ruiz-Feria, C. 2012. The effect of peppermint essential oil and fructooligosaccharides, as alternatives to virginiamycin, on growth performance, digestibility, gut morphology and immune response of male broilers. Anim. Feed Sci. Technol., 175: 57-64

Gurbuz, Y., and I. A. Ismael. 2016. Effect of peppermint and basil as feed additive on broiler performance and carcass characteristics. Iran. J. Appl. Anim. Sci. 6:149–156

Hassan, H.M.S.; Ahmed, Ali, K.h.A.E-M. and Gouda, A.R.A.E-H. 2020. Effect of L-Carnitine and Yeast Chromium Supplementation on Productive Performance in Pekin and Sudani Duckling during Growth Period. *World Vet. J.,* 10 (4): 587-596.

Jahanian, R. and Rasouli, E. 2015. Dietary chromium methionine supplementation could alleviate immunosuppressive effects of heat stress in broiler chicks. J. Ani. Sci., 93(7): 3355-3363.

Jaiswal, S.K.; Tyagi, J.S.; Kolluri, G.; Marappan, G.; Dilliwar, L. & Ajay, C. 2017. Analysing the digestive function of the broiler exposed to heat stress both pre-hatch and post-hatch with or without protein synthesis modulator. Int. J. Livest. Res., 7: 41-47..

Lewicki, S.; Zdanowski, R.; Krzyżowska, M.; Lewicka, A.; Dębski, B.; Niemcewicz, M.2014. The role of chromium III in the organism and its possible use in diabetes and obesity treatment. *Ann Agric Environ Med* , 21(2):331–5. doi: 10.5604/1232-1966.1108599

Li R, Zhou Y, Li Y, Guo L, Zhang Y, 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, 226–234. doi:10.4067/S0717-95022018000100226

Norain, T.M.; Ismail, I.B.; Abdoun, K.A. and Al-Haidary, A.A. 2013. Dietary Inclusion of Chromium to Improve Growth Performance and Immune-Competence of Broilers Under Heat Stress, ITAL. J. ANIM. SCI., 12:4, e92

NRC, National Research Council, 1994. Nutrient requirements of poultry. 9th rev. edn. National academy press, Washington, DC., USA.

Rajkumar, U.; Vinoth, A.; Shanmugam, M.; Rajaravindra, K.S. & Rama rao, S.V. 2015. Effect of embryonic thermal exposure on heat shock proteins (HSPs) gene expression and serum T3 concentration in two broiler populations. Anim. Biotech., 26: 260-267.

Rao, S.V., M.V. Raju, A.K. Panda, N.S. Poonam, O.K. Murthy, and G.S. Sunder, 2012. Effect of dietary supplementation of organic chromium on performance, carcass traits, oxidative parameters, and immune responses in commercial broiler chickens. Biol. Trace Elem. Res., 147 (1-3), 135-41.

Ruff, J., G. Tellez, A. J. Forga, R.S. Cuesta, C.N. Vuong, E.S. Greene, X.H. Velasco, Á. J. Uribe, B.C.M., J.A. Angel-Isaza, S. Dridi, C.J. Maynard, C.M. Owens, B.M. Hargis and G. Tellez-Isaias, 2021. Evaluation of three formulations of essential oils in broiler chickens under cyclic heat stress. Animals, 11, 1084.

Sahin, K. and Sahin, N. 2002. Effects of chromium picolinate and ascorbic acid dietary supplementation on nitrogen and mineral excretion of laying hens reared in a low ambient temperature (7°C) *Acta Vet. Brno.* 71:183–189.

Sands, J.S. and Smith, M.O. 1999. Broilers in heat stress conditions: Effects of dietary manganese proteinate or chromium picolinate supplementation. J. Appl. Poultry Res. 8:280–287.

SAS, 2009. SAS® User's Guide: Statistics. Version 5th ed., SAS Institute Inc., Cary, NC, USA.

Yalcin, S., S. Yalcin, K. Uzunoglu, H.M. Duyum and O. Eltan, 2012. Effects of dietary yeast autolysate (*Saccharomyces cerevisiae*) and black cumin seed (*Nigella sativa L.*) on performance, egg traits, some blood characteristics and antibody production of laying hens. Livest. Sci., 145:13-20.

broiler, Chromium-l-methionine,peppermint oil, broiler performance, Serum biochemicals.

الملخص العربي

تأثير الكروميوم- مثيونين ، زيت النعناع على الأداء الانتاجي لدجاج اللحم تحت تأثير ظروف الإجهاد الحرارى

وليد محمد الدسوقي[١]، سليمان محمد زهران[١]، ساميه موسي غالب[٢]، محمد معوض خليفه[٢]
[١] قسم الانتاج الحيواني والسمكي-كليه الزراعه سابا باشا-جامعه الاسكندريه- ٢١٥٣١ -مصر
[٢] قسم تغذيه الدواجن-معهد بحوث الانتاج الحيواني-مركز البحوث الزراعيه-الدقي-الجيزه-١٢٦١٨-مصر

تم تقسيم إجمالي عدد مائتين وخمسة وعشرين كتكوت من دجاج اللحم روس ٣٠٨ عمر سبع أيام عشوائيا إلى تسع معاملات، في كل معاملة ٢٥ كتكوت وكل معاملة مقسمة إلى خمس مكررات (٥ كتكوت/مكررة) في تصميم عشوائي كامل - وكانت المعاملات التجريبية كما يلي :- المجموعة الاولى غذيت على علف بدون اضافات وكان يشكل مجموعة الكنترول، المجموعتين الثانية والثالثة غذيت علي العليقة الاساسيه مع اضافة مركب الكروميوم ميثيونين (Meth-Cr) بمعدل 0.3 و 0.4 جم /كجم علف و المجموعتين الرابعة والخامسة غذيت علي العليقة الاساسيه مع اضافة زيت النعناع (PO) بمعدل 0.6 و 0.8 جم /كجم من العلف المقدم . في حين تغذت المجموعات السادسة والسابعة والثامنة والتاسعة على العليقة الاساسيه مضاف خليط من (Meth – Cr) بمعدل 0.3 و 0.4 جم /كجم علف و (PO) بمعدل 0.6 و 0.8 جم /كجم من العلف المقدم التوالي . اظهرت النتائج ان افضل قيمه للوزن الحي ومعدل الزيادة في الوزن الحي والعلف الماكول ومعدل التحويل الغذائي سجلت في المجموعات T8,T3,T9,T7على التوالي . لم تتأثر الأوزان النسبية لكل من القونصة، الكبد، القلب والطحال بالمواد المختبرة وخليطها بإستثناء الوزن النسبي لغدة البرسا ودهون البطن التي تأثرت بشكل معنوي.

انخفضت مستويات الكولسترول الكلي والدهون الثالثية بشكل معنوي باضافة المواد المختبره او وخليطها. تعرض الطيور لظروف درجات الحرارة العالية ادي إلى زيادة في مركب المالون داى ألدهيد (MDA) في المجموعة الكنترول بينما إنخفض هذا المركب فى كل المعاملات التجريبية ، هذا بالإضافة إلى وجود زيادة عددية في القدرة التأكسدية الكلية للطائر (TAC) بسب الاضافات الغذائية المختلفة .

يستنتج مما سبق : إمكانية إستخدام كل من الكروميوم – مثيونين أو زيت النعناع أو مخلوطهما كمضادات للأكسدة فى علائق كتاكيت اللحم تحت ظروف الإجهاد الحرارى