Egypt.Poult.Sci.Vol (38)(II): (483-496)(2018) (1803-1007)

Egyptian Poultry Science Journal

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

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

PHYSIOLOGICAL RESPONSE OF GROWING GIMMIZAH CHICKS TO ZINC AND/ OR CREATINEMONOHYDRATE SUPPLEMENTATION IN DRINKING WATER

M.H. Hatab[1]; N.S. Ibrahim[1];E.M. Sabic[1;] and A.M. Badran[2]

[1]Biolog. Applic. Dep., Nuc. Res. Center, Atom.Ener. Auth., P.O. Box 13759,

[2]Anim. Prod. Res. Inst., Agric. Res. Center, Ministry of Agric. Dokki, Giza

Corresponding author: Aml Mohamed Badran, E-mail: aamel555@gmail.com

Received: 29/03/2018 Accepted: 20/05/2018

ABSTRACT: One hundred and twenty, 10-wk-old Gimmizah chickens, as a local balady strain were used in the current study to evaluate the physiological response to zinc (Zn) and/ or creatine monohydrate (CMH) supplementation in drinking water. All birds were weighed and randomly divided into four equal treatments. The first treatment fed the basal diet and served as control, while the second, third and fourth groups were given the basal diet and drinking water were supplemented with, 0.6 mg zinc sulphate/ml, 0.45 mg CMH /ml and 0.6 mg zinc sulphate /ml + 0.45 mg CMH /ml, respectively.

Body weight gain, feed consumption, feed conversion, and relative weight of carcass, abdominal fat, and sex organs were calculated. Serum concentrations of total proteins, total lipids, triglycerides, total cholesterol, alkaline phosphates, thyroxin, testosterone andestradiol (E2) hormones were measured.

The results indicated that the body weight gain, feed efficiency, and relative weight of carcass, abdominal fat, and sex organs were significantly ($P \leq 0.05$) increased in the fourth group as compared with the other treatments or the control groups. Moreover, plasma concentrations of total protein, total lipids, triglyceride, cholesterol, estradiol-17ß, testosterone, and thyroxin hormone levels in all supplemented groups were significantly ($P \leq 0.05$) higher than the control group. The highest values observed in the fourth group. Therefore, it could be recommended that supplementation of Zn + CMH might be involved in improving the physiological and productive performance of Gimmizah birds.

Key words: Zinc - creatine - Gimmizah birds- performance - blood biochemical-hormones.

INTRODUCTION

The overall economy of the poultry industry is assessed by its productivity and growth performance. In Egypt, one of the greatest challenges to efficient production of local chicken strains is reducing their performance (Aymen et al., 2012). In view of the fact that, improving growth and feed efficiency has always been a top priority in the poultry industry. Researchers have used nutritional supplements, in poultry production to enhance production performance and to achieve some positive effects on maximizing body weight (Sumei et al., 2010).

Some of these benefit supplements are zinc (Zn) and creatine monohydrate (CMH). Zn is an essential trace mineral in poultry feeding involved in many physiological, metabolic, and digestive processes in the body. Zn acts as a cofactor for more than 300 enzymes that are essential for the maintenance of optimal health, reproduction, growth, protein synthesis, fats and carbohydrate metabolism (Liu et al., 2015). In the same trend, Zhao et al.,(2014) and Refaie and Eisa (2014) reported that Zn supplementation improved growth rate, lipid metabolism, feed efficiency and reduced the percentage of fat in the broilers skin.

In addition, CMH is a nutritional supplement, which may be useful for enhancing performance. It is a compound based on the amino acids (arginine, glycine, and methionine), produced in the liver and a rich energy source for cellular energy and muscular activity (Guimaraes, 2014). It helps to maintain the energy balance in cells and tissues, improve muscle function and performance via improving ATP resynthesize as a result of increase the intracellular PCr in muscle (Casey (2011). It is believed to be one of the many causes of fatigue and muscular dystrophy if there is a decrease in phosphocreatine (PCr) in the muscles. Wang et al. (2015) reported the important of CMH for energy demand during exercise and physical activity in order to keep the body in a positive anabolic state by directly influencing protein synthesis and decreasing the catabolic effects (i.e., protein degradation) due to exercise. Experimental studies by Halle et al., (2006) showed that supplementing CMH up to 10g/kg diet elevated production efficiency and meat yield in broiler chickens. Carvalho et al.(2013) also, reported that inclusion of CMH in the diet resulted in improvement in body weight gain and feed conversion ratio to broiler chicks.

Because of not enough investigations on Zn and CMH supplements either alone or in combination on physiological responses, growth performance, lipid profile and fat accumulation of local chickens. Therefore, the present study designed to investigate the effects of Zn and or CMH on growth and feed performance, sex hormones, abdominal fat and physiological responses of growing Gimmizah local chicks from 10 to 15 weeks of age.

MATERIALS AND METHODS

Location, birds and experimental design:

This experiment was carried out at the Poultry Production Research Unit, Biological Application Department, Nuclear Research Center, Egyptian Atomic Energy Authority. One hundred and twenty, 10-wk-oldlocal Gimmizah chicks, as an Egyptian local strain used in the current study to evaluate the physiological response of growing Gimmizah chicks to Zn and/ or CMH supplementation in drinking water. Birds were kept under the same conditions of room temperature (25 ± 2^0C) and provided with 14:10 hrs Light: dark cycle. The diet was available ad libitum, along with water. The basal diet composition and calculated chemical analysis are shown in Table (1). All birds weighed and randomly divided into four equal treatments (30 birds for each group) with three replicates, each replicate contained 5 female and 5 cocks. Each replicates reared in a cage of dimension 80 cm width × 150 cm length × 50 cm height, to obtain stocking density of about 8 birds / m2. This cage was provided with an out of the cage feeder and nipple drinkers supplied water. The first treatment fed the basal diet and served as control, while the second, third and fourth groups were given the basal diet and supplemented drinking water with 0.6 mg Zn/ml; 0.45 mg CMH/ml and (0.6 mg Zn + 0.45 mg CMH /ml), respectively.

Measurements and collected data

Growth performance parameters

Growth performance parameters as the body weight gain (BWG) and feed consumption (FC) were measured weekly. Feed efficiency (FE)(g gain/g feed) and feed conversion ratio (FCR) (g feed/g gain) were calculated within each replicate at the end of each week. At end of the experimental period (after 5 weeks), 18 birds per treatment, (3 females, and 3 males per each replicate) were selected at random, weighed, and slaughtered. For each slaughtered bird, carcass, abdominal fat, and sex organs (Tests, ovary, and oviduct) were weighed and calculated as a relative percentage of live body weight.

Blood analysis

Blood samples were collected from slaughtered birds in tubes without anticoagulant and centrifuged at 3400 × g for 6 min to separate serum, then stored at −20°C until further analysis.

Serum concentrations of total proteins, total lipids, triglycerides, total cholesterol and the level of alkaline phosphates enzyme (ALP) were measured with a spectrophotometer (Shimadzu UV 1601) using commercial kits produced by Stan bio Company, USA.

The thyroxin (T_4), testosterone and estradiol (E2) hormones concentrations were determined using radioimmunoassay (RIA) Commercial Kit produced by IZOTOP Company (INSTITUTE OF ISOTOPES Ltd.) (http://www.izotop.hu), and samples were counted on Packard Gamma Counter.

Statistical analysis

To determine the effect of Zn and or CMH on the physiological responses of growing local Gimmizah birds, data were statistically analyzed by one-way analysis of variance using the General Linear Models procedure of the SAS software (Statistical Analysis System, 2008). The significance level was set at $P < 0.05$. Mean values were compared using Duncan's Multiple Range Test (Duncan 1955) in the case of significant differences.

The model used was:

$$X_{ij} = \mu + T_i + e_{ij}$$

Where:

X_{ij} = any value from the overall population.

μ = overall mean.

T_i = effect of the i^{th} treatment (i = group 1: control; group 2: 0.6 mg zinc sulphate /ml; group 3: 0.45 mg CMH /ml and group 4: (0.6 mg zinc sulphate + 0.45 mg CMH) /ml).

eij = random error associated with the j^{th} individual, within the i^{th} treatment.

RESULTS AND DISCUSSION

Effect of Zn and or CMH supplementation on some physiological performance:

Growth Performance

Effect of Zn and/or CMH supplementation on live body weight and feed performance parameters of Gimmizah chicks are present in the Table (2). It was observed that combination of Zn and CMH had better results for live body weight, daily weight gain, feed conversion ratio, and feed efficiency during the experimental period than CMH group. Moreover, CMH supplementation group had better results than the Zn group, while, both of them were significantly increased the previous parameters than the control group. Feed consumption for 35 days, daily feed intake, and feed conversion ratio were significantly reduced with Zn or CMH supplementation compared with the control one. Moreover, the combination of Zn and CMH showed the lowest values than the CMH or Zn supplementation each alone. The improvement occurred in the live body weight and feed performance parameters of supplemented groups may be attributed to biological functions such as the role of Zn in utilization of feed via participating in many metabolic pathways influencing the nutrient metabolism of carbohydrates, fats and proteins advantageously (Naz et al., 2016).

Moreover, Zn and/or CMH play central roles in energy metabolism. This concept is confirmed by that; feed conversion ratio was significantly improved in all treated groups especially in the combination of Zn and CMH group as compared to the control group. The significant reduction observed in feed intake of all treated groups of this study may be due to high efficiency of feed utilization and nutrient digestibility by helping the pancreas to secrete digestive enzymes, thus improving digestibility of nutrients and consequently, improved feed utilization and absorption (feed metabolism) (Zakariaet al.,2017).

These results are in agreement with several reports demonstrating that CMH supplemented up to 10g/kg diet of the broilers improved the body weight gains compared with the same diet without the use of the additive (Carvalho et al., 2013). Moreover, many investigators have added Zn in inorganic form or in organic form to diets of ducks and observed an improvement in carcass weight and growth performance (Attia et al., 2013). Similarly, Zakaria et al.,(2017) noted a significant decrease in feed intake with 50 or 150 mg supplemental Zn / Kg diet of chicken. Fawzy et al.,(2016) showed also that body weight gain of the birds fed diet supplemented with Zn (2 g /10 kg ration) were significantly higher than the control group and the feed conversion ratio was better. Consistent with these results, a number of researchers documented that growth rate and feed efficiency were improved by dietary Zn supplementation in broiler chicks (Zhao et al., 2014 and Fazilati, 2013).

Moreover, reduction of caloric consumption per kg of body weight gain by Zn and/or CMH supplementation may be due to their central roles in energy metabolism (Lemme et al., 2010). The beneficial effects of Zn and CMH supplementation on the intestinal growth through increasing serum Insulin-like growth factor-I levels (IGF-I) was demonstrated (Michiels et al., 2012 and Li et al., 2006). Also, Chen et al. (2011), attributed the anabolic effects of CMH supplementation (1.2 g / kg diet) in birds due to the up-regulation of muscle IGF-I expression. This might support muscle growth as well. In addition, Mousavi et al.(2013) showed that CMH supplementation decreased caloric intake per kilogram of body weight gain.

The main effects of CMH supplementation are likely to maximize the muscular creatine level or alleviating the muscle concentrations of creatine related metabolites, as reported by Dilger et al. (2013). In this way, PCr concentrations increase the overall potential for muscle energy homeostasis as illustrated by Guimaraes (2014), thereby allowing ATP to be consumed at a higher rate in support of the improved metabolic function. This phenomenon increases the rate of muscle protein synthesis, which might be beneficial for both skeletal muscle growth and for the contractile activity of supply organs, such as the heart. It seems reasonable because of the young fast-growing chicks require high supply of CREA to growing muscles for regeneration of ATP from the CREA and PCr system (Brosnan et al., 2009).

Carcass, abdominal fat and relative reproductive organ weights

The results of the carcass, abdominal fat and relative sex organ weights are shows in Table (3). The relative weight of carcass was significantly higher in the combined treatment (Zn and CMH) than all other treatment and the control. However, there were no significant differences in the relative weight of carcass between Zn and CMH treatments; however, they were both significantly higher than the control group. This significant higher carcass relative weight may be attributed to the role of Zn as essential micronutrient for the growth and as a cofactor for more than 300 enzymes, which are essential in many digestive, metabolic, and physiological processes in the body. This reflects on growth, protein and carbohydrate metabolism (Liu et al., 2015). Moreover, Zn plays a protective role in the pancreatic tissue against oxidative damage. It may help the pancreas to secrete digestive enzymes that improving digestibility of nutrients and consequently, growth performance (Naz et al., 2016).

In addition, CMH is a compound based on three amino acids; arginine, glycine, and methionine. It is a critical precursor in the production of muscle energy, may enhance muscle performance, growth and protein synthesis, due to an increase the amount of energy stored as PCr in muscles (Michiels et al., 2012).

Results in Table (3) demonstrate that the Zn & CMH group had the highest relative abdominal fat weight than the other treatment groups. However, there were no significantly differences between the second Zn and the CMH groups. Both of them had the lowest relative abdominal fat weight than the control group.

The results also indicated that Zn and CMH supplementation together in drinking water might promote excess glucose or energy supply to the muscles that led to increasing fat deposition in the body of Gimmizah birds. Fouad and El-Senousey (2014) attributed body fat deposition to changes in lipid profile such as increased serum triacylglycerol and total cholesterol levels, lower lipolysis, fatty acid oxidation and basal energy metabolism. Therefore, the excess energy produced is mainly stored in the body as fat (Naz et al., 2016). In this regard, Zn plays a role as an essential micronutrient responsible for the most important metabolic effect enhancing the basic metabolic rate and heat production. Thus affecting increases susceptibility of the body to fat accumulation (Mohamed et al., 2014). Moreover, creatine is heavily involved in energy metabolism, particularly muscle cells through the phosphocreatine (PCr) system (Guimaraes, 2014). In this way, phosphocreatine has been shown to increase cell ATP, which is the muscle cells' first source of energy for any action. Excess increase in cell ATP, may lead to increase abdominal fat (Dilger et al., 2013).

The relative weight of tests, ovary, and oviduct were significantly higher in the Zn &CMH group than the Zn, the CMH group, or the controls. However, there were no significant differences in the relative weights of tests, ovary, and oviduct between the Zn or the CMH treatments. All of the treated groups had a relative weight of tests, vary, and oviduct greater than the control. These results agree with the results of Amen and Al-Daraji (2011) who found significant improvement in the sex organs of broiler breeder chicken fed up to 100 mg Zn/kg of diet. Murakami et al. (2014) also showed a quadratic effect on tests weight of meat-type quail breeders by CMH supplementation up to 0.15 % / kg diet. Their findings helped to explain the effect of supplementary CMH and/or Zn on raising plasma sex hormones concentrations effectively.

Biochemical, hormonal and enzymatic parameters

Serum total protein

The effects of Zn and or CMH supplementation on some blood biochemical and hormonal concentrations are presented in Table (4). The data clearly showed that however, serum total protein was not significantly different between all the treatment groups (Zn, CMH, or Zn& CMH), serum total protein was significantly higher in all the supplemented groups as compared with the control group. These results are in agreement with Fawzy et al. (2016) who reported that Zn is necessary for many physiological functions including growth and protein synthesis, nucleic acid synthesis and activity of many enzymes. Its supplementation enhanced fat absorption, improved appetite, metabolism of carbohydrates, proteins, lipids, and many essential biochemical processes of chickens (Attia et al., 2013). Additionally, CMH serves as a stimulus of protein synthesis and muscle hypertrophy and reduced protein catabolism (Dilger et al., 2013). In addition, El-Slamony et al. (2015) reported that Zn and or CMH supplementation led to maximized protein synthesis (anabolic effects) and minimized protein catabolism (catabolic effects).

Serum concentration of lipids profile

Data from Table (4) represent serum lipids profile (total lipids, cholesterol, and triglycerides). All of them were significantly higher in the Zn& CMH group than the Zn or the CMH group. However, there were no significant differences in the serum lipids profile concentrations between the Zn or the CMH treatments. All of the treated groups had serum lipids profile concentrations greater than the control group. The results of this experiment indicated that Zn and CMH supplementation have a hypocholesterolemic effect by stimulating the synthesis of the total lipids, cholesterol and triglycerides (Wang et al., 2015). Zn supplementation is an extremely important mineral for insulin function; insulin stimulates fatty acids and triglycerides synthesis by increasing glucose. Moreover, a change of cholesterol levels in blood serum may be due to the Zn's role in enzyme action since the Zn forms an integral part of several enzymes (metalloenzymes) that are severed in lipid digestion and absorption (Zakaria et al., 2017).

Serum alkaline phosphates (ALP) enzyme activity

Serum alkaline phosphates (ALP) enzyme activity was significantly ($P \leq 0.05$) higher in the Zn&CMH group than the other experimental groups and the Control. While, there was no significant differences in serum alkaline phosphates (ALP) enzyme activity between the other experimental groups (Zn, CMH and Control), Table (4).

Any abnormal increase in serum level ALP activity may imply liver damage. Moreover, Fazilati (2013) reported that the activity of plasma ALP enzyme could be important in the diagnosis of diseases. Therefore, the relatively stable levels of these enzymes may be associated with hepatoprotective effects. This finding is in agreement with Fathi et al. (2016) who reported an increase in ALP activity of broilers with Zn supplementation compared with the control group.

Estradiol-17ß (E2)

Data from Table (4) indicated that serum Estradiol-17ß (E2) level was significantly higher in the Zn & CMH group than the Zn or the CMH groups. However, there were no significant differences between Zn or CMH treatments. Also all of the treated groups had a serum Estradiol-17ß concentration greater than the control group. These results agreed with Amen and Al-Draji (2011) who stated that adding Zn to diet at the level of 50, 75, and 100mg pure Zn/kg of diet resulted in significantly higher in blood plasma concentrations of estrogen and progesterone hormones during 54 and 66 weeks of age as compared with control group Also, Etches (2008) showed the role of Zn in sex and steroid hormones synthesis, activity of prostaglandin, gonad stimulating hormone, normal ovulation, fertilization, and normal functioning of the hypothalamic – pituitary gonadal-axis.

Male sex hormone

Serum Testosterone level was significantly higher ($P \leq 0.01$) higher in the group Zn group. This was followed by the reduced CMH group and then the Zn&CMH group then the control group. The control group had the lowest serum Testosterone level than all the treatment groups (Table 4). All the differences between groups were significant. Brown and Pentland (2007) reported that Zn is the most critical trace mineral for the synthesis of testicosteroid, spermatogenesis, successful fertilization, testosterone secretion, and male sexual health. In addition, CMH needed for sperm metabolism (Murakami et al., 2014). The results of the current study agree with Amen and Al-Daraji (2011) who found significant improvement in sex hormones (testosterone, estrogen, progesterone) of broiler breeder chicken fed up to 100mg Zn/kg of diet. These findings help to explain supplementary CMH and/or Zn is extremely effective for raising plasma testosterone and estrogens levels, energy and helping birds to improve their weight gain (Mohamed et al., 2014).

Serum concentration of thyroxin (T_4)

Data in Table (4) indicates that serum thyroxin (T_4) level was significantly ($P \leq 0.01$) higher than any of the other groups. Its concentrations were gradually lower in the CMH group and followed by the Zn group then the control. The control group had the lowest serum thyroxin (T_4) level than all the treatment groups. Zn is an important mineral for thyroid functions as well as an increase of oxygen utilization, enhancing the basic metabolic rate and heat production (thermogenic effect) (Mohamed et al., 2014). In addition, Michiels et al. (2012) showed a significant increase in plasma level of thyroid hormones with supplementing 0.6-1.2 CMH g/kg diet of broiler chickens There is an interaction between growth hormone (GH) and thyroid hormones (T_4), as the latter is required for GH secretion and action. Both hormones increase the production of muscle proteins and whole-body growth (Al-Daraji1 and Amen, 2011). Thyroid hormones are also responsible for the genetically determined growth, development, skeletal differentiation, development of the central nervous system and the reproductive organs; deficiency results in growth retardation (Stojevicet al., 2000). Thus, there is a positive correlation between thyroxin and body weight (Persky and Brazeau, 2001).

CONCLUSIONS

Supplementing Zn and or CMH to drinking water resulted in a significant improvement in body weight gain, fed performance, physiological responses, relative weights of carcass, abdominal fat, sex organs, and sex hormones concentration in both sexes of 15 weeks old Gimmizah birds. The best results obtained for the group supplemented with Zn and CMH in combination compared to the other experimental groups. Therefore, Zn and CMH supplementation in combination might have increased glucose or energy supply to the muscles and they can be used as a beneficial tool for improving the physiological and productive performance of Gimmizah birds.

Table (1): The composition and calculated chemical analysis of the grower diet.

Ingredients composition	%
Ground yellow corn 8.5%	62.5
Soybean meal (44%)	17
Wheat bran	15.5
Corn oil	1
Dicalcium. phosphate	1.7
Limestone	1.5
DL-methionine	0.05
Sodium chloride (NaCl)	0.40
L-Lysine-Hcl	0.05
Vitamin and Min. Mixture *	0.3
Total	100
Calculated chemical analysis	
Crude protein	15
Crude fiber	3.83
Crude fat	2.96
Calcium	0.97
Available phosphorous	0.47
Lysine	0.8
Methionine	0.33
Met+cystine	0.59
Metabolizable Energy	2900 Kcal /kg

*Supplied per kg diet: Vit A, 10000IU; Vit D3, 2000 IU; Vit E, 10 mg; Vit K3, 1 mg; Vit B1, 1 mg; Vit B2, 5mg; Vit B6, 1.5 mg; Vit B12, 10 mcg; Niacin, 30 mg; Pantothenic acid,10 mg; Folic acid, 1 mg; Biotin, 50mcg; Choline, 260 mg; Copper,4 mg; Iron, 30 mg; manganese, 60 mg; Zinc, 50 mg; Iodine, 1.3 mg; Selenium, 0.1mg; Cobalt,0.1mg

Table (2): Effect of Zn and/or CMH supplementation on live body weight and feed utilization parameters of 15-weeks Gimmizah chicks.

Growth performance	Experimental groups			
	Control	**Zn[1]**	**CMH[2]**	**Zn&CMH**
Live body weight (g)				
Initial body weight	686.1 ± 0.5^{a}	687.1 ± 0.4^{a}	686.5 ± 0.5^{a}	684.2 ± 0.5^{a}
1^{st} week	798 ± 2.49^{d}	810 ± 2.71^{c}	819 ± 2.76^{b}	831.5 ± 2.7^{a}
2^{nd} week	898 ± 2.2^{d}	912 ± 2.07^{c}	928.5 ± 2.04^{b}	965 ± 2.3^{a}
3^{rd} week	984 ± 2.5^{d}	1015.5 ± 2.1^{c}	1036.5 ± 2.8^{b}	1091 ± 2.4^{a}
4^{th} week	1069.5 ± 2.1^{d}	1111 ± 2.2^{c}	1139 ± 2.4^{b}	1203.5 ± 2.3^{a}
Final at 5^{th} week	1149.5 ± 4.1^{d}	1221 ± 3.1^{c}	1256 ± 2.9^{b}	1345 ± 2.2^{a}
Feed performance				
Daily weight gain (g)	13.24 ± 1.5^{d}	15.25 ± 1.4^{c}	16.3 ± 0.8^{b}	18.9 ± 0.8^{a}
Total weight gain (g)	463.4 ± 1.5^{d}	533.7 ± 1.4^{c}	570.5 ± 0.8^{b}	661.5 ± 0.8^{a}
Daily Feed intake (g/bird)	45.9 ± 1.2^{a}	44.0 ± 1.3^{b}	41.6 ± 0.9^{c}	39.5 ± 1.2^{d}
Feed consumption(g)/bird for 35 days	1606 ± 2.3^{a}	1540 ± 2.3^{b}	1456 ± 2.3^{c}	1382 ± 2.3^{d}
Feed conversion ratio(feed : gain)	3.46 ± 0.1^{a}	2.88 ± 0.1^{b}	2.55 ± 0.09^{c}	2.09 ± 0.09^{d}
Feed efficiency ratio(gain : feed)	0.29 ± 0.1^{d}	0.35 ± 0.1^{c}	0.39 ± 0.09^{b}	0.48 ± 0.09^{a}

*Values are means ± SE.

a, b, c, d, means with different superscripts within the same row are statistically different at ($P\leq0.05$).

Zn[1:] Zinc sulphate CMH[2]: creatine monohydrate

Table (3): Effect of Zn and/or CMH supplementation on relative weight of carcass, abdominal fat and sex organs of 15-weeks Gimmizah chickens.

Relative weight (%)	Experimental groups			
	Control	**Zn[1]**	**CMH[2]**	**Zn&CMH**
Carcass	60.15±0.6 [c]	64.2±0.3 [b]	64.15±0.5 [b]	69±0.5 [a]
Abdominal fat	0.95±0.03 [b]	0.62±0.01 [c]	0.61 ± 0.02 [c]	2.2 ± 0.01 [a]
tests	1.7±0.04 [c]	2.6±0.03 [b]	2.65 ± 0.02 [b]	3.09 ± 0.05 [a]
ovary	0.2±0.02 [c]	0.4±0.03[b]	0.4± 0.02 [b]	0.7 ± 0.02 [a]
oviduct	0.3±0.06 [c]	0.69±0.04 [b]	0.68 ± 0.08 [b]	0.85± 0.04[a]

***Values are means ± SE.
a, b, c, means with different superscripts within the same row are statistically different at (P≤0.05).
Zn[1:] Zinc sulphate   CMH[2]: creatine monohydrate

Table (4): Effect of Zn and/or CMH supplementation on some blood biochemicals and hormonal concentrations in 15-weeks old Gimmizah chickens serum.

Parameters	Experimental groups			
	Control	**Zn[1]**	**CMH[2]**	**Zn& CMH**
Total protein(g/dl)	4.2±0.05 [b]	4.4±0.04 [a]	4.5±0.01 [a]	4.6±0.01 [a]
Total lipids (mg/dl)	627.0±5.2[c]	653±5.0[b]	656.8±5.6[b]	755.7 ±5.3[a]
Triglyceride(mg/dl)	156.3±2.9 [c]	163.4±2.8[b]	163.5±3.1[b]	171±2.6[a]
Cholesterol(mg/dl)	150.5±1.8[c]	155.9±1.5[b]	155.3±1.9[b]	168.5±1.5[a]
Alkaline Phosphatase(IU/L)	96.7±0.3 [b]	99.5±0.5 [b]	98.4±0.5 [b]	106.3±0.4 [a]
Estradiol-17ß (E2) (pg/ml)	299.3± 1.9 [c]	320± 2.0 [b]	318.4± 1.8 [b]	350± 1.2 [a]
Testosterone (ng/ml)	3.84± 0.08 [d]	5.9 ± 0.03 [a]	5.2 ± 0.05[b]	4.4± 0.06 [c]
Thyroxine (nmol/L)	52.8± 0.64[d]	67.2 ± 0.65[c]	88.1 ± 1.7 [b]	97.5 ± 1.6 [a]

*Values are means ± SE.
a, b, c, d, means with different superscripts within the same row are statistically different at (P≤0.05).
Zn[1:] Zinc sulphate   CMH[2]: creatine monohydrate

REFERENCES

Al-Daraji, H.J.; and Amen, M.H. 2011. Effect of dietary zinc on certain blood traits of broiler breeder chickens. Int. J. Poult. Sci., 10: 807-813.

Amen, M.H.M. and Al-Daraji, H.J. 2011. Influence of Dietary Supplementation with Zinc on Sex Hormones Concentrations of Broiler Breeder Chickens. Pakistan J. of Nutr 10: 1089-1093.

Attia, Y.A.; Abd Al-Hamid, A.E.; Zeweil, H.S.; Qota, E.M.; Bovera, F.; Monastra, G.; and Sahledom M.D. 2013. Effect of dietary amounts of inorganic and organic zinc on productive and physiological traits of White Pekin ducks. Animal, 7: 895-900.

Ayman, E.; El-Edel, M.A.T.; El-Lakany, H.F.; and Shewita, R.S. 2012. Growth performance and immune response against Newcastle and avian influenza vaccines in Egyptian chicken strains. Global Veterinaria. 9: 434-440.

Brosnan, J.T.; Wijekoon, E.P.; Warford-Woolgar, L.; Trottier, N.L.; Brosnan, M.E.; Brunton, J.A.; and Bertolo, R.F.P. 2009. Creatine synthesis is a major metabolic process in neonatal piglets and has important implications for amino acid metabolism and methyl balance. J. Nutr., 139: 1292–1297.

Brown, L.; and Pentland, S. 2007. Health infertility organization: Male infertility - improving sperm quality. Acubalance Wellness. Centre Ltd. On west 8th Ave. in Vancouver Bc. Canada.

Carvalho, C.M.C.; Fernandes, E.A.; Carvalho, A.P.; Maciel, M.P.; Caires, R.M.; and Fagundes, N.S. 2013. Effect of creatine addition in feeds containing animal meals on the performance and carcass yield of broilers. Brazilian J. of Poult. Sci., 15 (3): 169-286.

Casey, S. 2011. Creatine adapted for broiler use. Poult. World, 165: 39.

Chen, J.; Tian, M.A.; Man, W.; Li, Y.K.; and Xiang, S.Z. 2011. Creatine Pyruvate Enhances Lipolysis and Protein Synthesis in Broiler Chicken. Agric. Sci. in China. 10: 1977–1985

Dilger, R.N.; Bryant-Angeoni, K.; Payne, R.L.; Lemme, A.; and Parsons, C.M. 2013. Dietary guanidino acetic acid is an efficacious replacement for arginine for young chicks. Poult Sci., 92:171-177.

Duncan, D.B. 1955. Multiple range and multiple F test. Biometrics, 11: 1 – 42.

El-Slamony, A.E.; Abdalla, E.A.; Faddle, A.A.; Hanan, S.M.; and Sabry, M.M. 2015. Effect of Supplementing Selenium And Zinc In Diet On Some Sex Hormones, Productive, Reproductive And Physiological Parameters Of Laying Golden Montazah Chicken During Summer Season. 1-The Effect on Females. Egypt. Poult. Sci. 35: 647-672.

Etches, R.J. 2008. Reproduction in Poultry. Printed and bound in the UK.

Fathi, M.; Haydari, M.; and Tanha, T. 2016. Effects of zinc oxide nanoparticles on antioxidant status, serum enzymes activities, biochemical parameters and performance in broiler chickens. J. of Livestock Sci. and Tech., 4 2: 7-13.

Fawzy, M.M.; El-Sadawi, H.A.; El-Dien, M.H.; and Mohamed, W.A.M. 2016. Hematological and Biochemical Performance of Poultry Following Zinc Oxide and Sodium Selenite

Supplementation as Food Additives. Ann. Clin. Pathol., 44: 1076.

Fazilati, M. 2013. Investigation toxicity properties of zinc oxide nanoparticles on liver enzymes in male rat. European J. of Exp. Biolog., 3: 97-100.

Fouad, A.M.; and El-Senousey, H. K. 2014. Nutritional Factors Affecting Abdominal Fat Deposition in Poultry: A Review . Asian Australas. J. Anim. Sci., 27: 1057-1068.

Guimarães, F.L. 2014. Role of the phosphocreatine system on energetic homeostasis in skeletal and cardiac muscles. Einstein (São Paulo), 12: 126-131.

Halle, I.; Henningm, M.; and Kohler, P. 2006. Studies of the effects of creatine on performance of laying hens, on growth and carcass quality of broilers. Landbauforschung Volkenrode, 56 : 11-18.

Lemme, A.; Gobbi, R.; Helmbrecht, A.; Van Der Klis, J.D.; Firman, J.; Jankowski, J.; and Kozlowsk, K. 2010. Use of guanidino acetic acid in all-vegetable diets for turkeys.Pages 57–61 in Proc. 4th Turkey Sci. Prod. Conf., Macclesfield, UK. Turkeytimes, Tarporley, Cheshire, UK.

Li, X.; Yin, J.; Li, D.; Chen, X.; Zang, J.; and Zhou, X. 2006. Dietary Supplementation with Zinc Oxide Increases IGF-I and IGF-I Receptor Gene Expression in the Small Intestine of Weanling Piglets. J. Nutr., 136: 1786-1791

Liu, Z.H.; Lu, L.; Wang, R.L.; Lei, H.L.; Li, S.F.; Zhang, L.Y.; and Luo, X.G. 2015. Effects of supplemental zinc source and level on antioxidant ability and fat metabolism-related enzymes of broilers. Poult. Sci., 94: 2686–2694.

Michiels, J.; Maertens, L.; Buyse, J.; Lemme, A.; Rademacher, M.; Dierick, N.A.; and De Smet, S. 2012. Supplementation of guanidinoacetic acid to broiler diets: Effects on performance, carcass characteristics, meat quality, and energy metabolism. Poult. Sci., 91: 402–412.

Mohamed, D.S.; Magdy, F.E.; Kamel, M.A.; Hassanin, K.; and Hashem, S. 2014. The ameliorative effects of L-carnitine and synbiotics on induced hyperlipidemia and oxidative stress in broilers. Inter. J. of Advanced Res., 2, (8): 378-390

Mousavi, S.; Afsar, A.; and Lotfollahian, H. 2013. Effects of guanidinoacetic acid supplementation to broiler diets with varying energy contents. J. Appl. Poult. Res., 22: 47-54.

Murakami, A.E.; Rodrigueiro, R.J.B.; Santos, T.C.; Ospina-Rojas, I.C.; and **Rademacher, M. 2014.**Effects of dietary supplementation of meat-type quail breeders with guanidinoacetic acid on their reproductive parameters and progeny performance Poult. Sci., 93: 2237-2244.

Naz, S.; Idris, M.; Khalique, M.; Alhidary, I.; Abdelrahman, M.; Khan, R.; Chand, N.; Farooq, U.; and Ahmad, S. 2016. The activity and use of zinc in poultry diets. World's Poult. Sci. J.,72: 159-167

Persky, A.M.; and Brazeau, G.A. 2001. Clinical pharmacology of the dietary supplement creatine monohydrate. Pharmacol Rev., 53: 161–176.

Refaie, A.M., and Eisa, W.H. 2014. A new approach of zinc supplementation in broiler diets: Effect on performance and lipid metabolism under summer season conditions. 4th mid. Poult.

Summit-Beirut, Lebanon, 2-5 September.

Statistical Analysis System. 2008. (Statistical Analysis System). SAS/STAT® 9.2. User's Guide. SAS Institute Inc. Cary, North Carolina

Stojevic, Z.; Milinkovic, T.S.; and Curcija, K. 2000. Changes in thyroid hormones concentrations in chicken blood plasma during fattening. Veterinarski Arhiv., 70: 31-37.

Sumei, Z.; Maa, H.; Huang, G.; and Zou, S. 2010. Hepatic lipolysis in broiler chickens with defferent fat deposition during embryonic development. Res. Vet. Sci. 88: 321-325.

Wang, X.F.; Zhu, X.D.; Li, Y.J.; Liu, Y.; Li, J.L.; Gao, F.; Zhou, G.H.; and Zhang, L. 2015. Effect of dietary creatine monohydrate supplementation on muscle lipid peroxidation and antioxidant capacity of transported broilers in summer, Poult. Sci., 94: 2797–2804.

Zakaria, H.A.; Jalal, M.; AL-Titi, H.H.; and Souad, A. 2017. Effect of Sources and Levels of Dietary Zinc on the Performance, Carcass Traits and Blood Parameters of Broilers. Brazilian J. of Poult. Sci., 19: 519-526.

Zhao, C.Y.; Tan, S.X.; Xiao, X.Y.; Qiu, S.X.; Pan, J.Q.; and Tang, Z.X. 2014. Effects of dietary zinc oxide nanoparticles on growth performance and antioxidative status in broilers. Bio. Trace Element Res., 160: 361–367.

الملخص العربى

التأثيرات الفسيولوجيه فى طيور الجميزة النامية نتيجة اضافة الزنك والكرياتين فى ماء الشرب

محمود حنفى محمود حطب[1] ـ نشأت سعيد إبراهيم عامر[1] ـ عصام محمد الهادي سابق[1]
امل محمد محمد بدران[2]
[1]قسم التطبيقات البيولوجية – مركز البحوث النووية – هيئة الطاقة الذرية
[2]معهد بحوث الانتاج الحيواني – مركز البحوث الزراعية – وزارة الزراعة

تماجراءالتجربةباستخدام120كتكوت من سلالة الجميزةالبلديعمر 10 أسبوعلدراسةالتأثيرات الفسيولوجيه فى طيور الجميزة النامية نتيجة اضافة الزنك والكرياتين فى ماء الشرب. تم وزن الكتاكيت و تم تقسيمها عشوائيا الي اربعة مجموعات متساوية. تم تغذية المجموعة الاولي (الكونترول) علي العليقة الاساسية و الماء دون اية اضافات. بينما تم اضافة كبريتات الزنك للمجموعة الثانية بمعدل 0.6 مجم / مل من ماء الشرب. و تم اضافة الكرياتين للمجموعة الثالثة بمعدل 0.45 مجم / مل من ماء الشرب. اما المجموعة الرابعة فتم اضافة خليط من كبريتات الزنك و الكرياتين بمعدل (0.6 + 0.45)/ مل من ماء الشرب.

تم قياس الزيادة في وزن الجسم و استهلاك العلائق و معدل التحويل الغذائي و حساب كل من دهن البطن ووزن الاعضاء الجنسية كنسبة من وزن الجسم. كما تم قياس مستوي سيرم الدم من كل من البروتين الكلي و الليبيدات الكلية و الدهون الثلاثية و الكوليستيرول الكلي و انزيم الالكالاين فوسفاتيز و هرمون الغدة الدرقية و هرمون الاستراديول.

و دلت النتائج علي التحسن المعنوي في كل من الزيادة في وزن الجسم و معدل التحويل الغذائي و وزن كل من دهن البطن و الاعضاء الجنسية كنسبة من وزن الجسم في المجموعة الرابعة مقارنة بالمجموعات المعاملة الاخري او بالكونترول. كما كان الارتفاع معنويا في مستوي سيرم الدم من كل من البروتين الكلي و الليبيدات الكلية و الدهون الثلاثية و الكوليستيرول الكلي و هرمون الغدة الدرقية و هرمون الاستراديول في كل المجموعات المعاملة خاصة المجموعة الرابعة مقارنة بالكونترول.

لذا فان الدراسة توصى باضافة الزنك و الكرياتين معا كمنشط لعمليات النمو و لتحسين الحالة الفسيولوجية و الانتاجية في طيور الجميزة.