Egypt.Poult.Sci.Vol (38)(II): (593-605)(2018) **(1803-1011)**

Egyptian Poultry Science Journal

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

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

EFFECTS OF YEAST AND VITAMIN C SUPPLEMENTATION ON EGG PRODUCTION, EGG QUALITY, ANTIBODY TITER AND INTESTINE MICROBIAL BURDEN OF HY-LINE BROWN HENS UNDER SUMMER CONDITIONS

A. A. Desoky[1] and Nancy N. Kamel[2]

[1]Dep. of Anim. Prod., Fac. of Agric.e, Cairo Uni., Egypt.

[2]Dep. of Anim. Prod., Nation. Res. Center, Dokki, Giza, Egypt.

Corresponding author: A. A. Desoky Email **:** adeldesoky66@yahoo.com

Received: 22/04/2018 Accepted: 29/05/2018

ABSTRACT: The high ambient temperature during summer causes various negative effects compromising laying hen performance. The present study aimed at studying the possible effects of yeast culture and/or vitamin C dietary supplementations to laying hens on alleviating the negative effects imposed by high ambient temperature during summer. A total of 200 Hy-Line Brown hens 32 weeks old, were randomly allocated to four groups with 50 hens divided at five replicate each. The first group received basal diet without any supplementation and served as control group (C). The groups 2, 3, and 4 received basal diet supplemented with 0.2% dried yeast (Yeast), 250 mg of vitamin C (Vit-C), and 0.1 % dried yeast + 125 mg vitamin C (Yeast+Vit-C) respectively. Hens were raised in wired cages in an open house. The experiment was carried out during summer, and the averages ambient temperature and relative humidity were 30.9±1.3℃ and 48.8±0.1%, respectively. Feed intake, feed conversion, egg production were recorded and egg quality parameters were measured. Yolk cholesterol, total lipid and plasma biochemical contents were determined. Antibody titer of Newcastle (NDV), Infectious Bronchitis (IBDV) and Avian Influenza (AIDV) disease virus were quantified after 30 days of immunization. Ileum Salmonella, E-coli and total bacterial count (TBC) were also quantified. Yeast supplementation with or without vitamin C showed a positive effect on feed intake, feed conversion, egg production and egg quality. Improvement in both external and internal egg quality parameters were observed for dietary supplemented groups compared to the control group. Yolk cholesterol and total lipid decreased significantly with all supplementations. The antibody titer for the immunized viral diseases NDV, IBDV and AIDV significantly increased with yeast supplementation. Ileum E-coli and TBC were significantly decreased by yeast supplementation. It can be concluded that yeast culture is a powerful dietary supplement during hot season, since they can alleviate the negative effects of heat stress on laying hen performance and egg quality. Also, they can be used as an immunomodulation of pathogen challenged animals or pre-immunization. Moreover, vitamin C can also be used as anti-stress but with less pronounce positive effect.

Keywords: laying hen – yeast - vitamin C - antibody titer - intestine microbes

INTRODUCTION

Low egg production performance, low egg quality and high susceptibility of infectious diseases are the most common negative effects of high ambient temperature on laying hens (Lara and Rostagno, 2013). The highest mortality rate found in commercial egg type chickens during summer is primarily caused by bacterial diseases followed by viral diseases even with vaccination (Uddin et al., 2011). Mashaly et al. (2004) subjected layers to cyclic (daily cyclic temperature and humidity) or continuous heat stress conditions. It was reported that heat stress does not only adversely affect production performance (feed intake, egg weight, shell weight, shell thickness and albumin height), but it also inhibits the immune function (antibody titer and H/L ratio). Kilic and Simsek (2013) reported a 25% reduction in egg production when temperature-humidity index (THI) increased from 25 to 29. Bozkurt et al. (2012) stated that high environmental temperatures negatively influenced the laying hen performance. The effects on egg quality were variable, where it did not influence feed conversion, eggshell breaking strength and egg yolk weight. Franco-Jimenez et al. (2007) studied the effects of heat stress on three different strains and reported the highest mortality rate on Hy-Line Brown strain. Short and long heat exposure caused significant hyperthermia and reduction in egg production, egg weight, ovarian weight and the number of large follicles with a significant reduction in both progesterone and 17β-estradiol (Rozenboim et al., 2007). Kamel et al. (2017) reported that heat stress caused depression in leukocyte protein synthesis that compromises the immune response of broiler raised under high environmental temperature. The above mentioned negative effects of heat stress imposed a necessity in finding applicable solution to sustain high production performance.

Ascorbic acid, also called vitamin C, is a water soluble vitamin that is considered one of the potent natural antioxidant. Attia et al. (2016) found that vitamin C supplementation at 200mg/kg to heat stressed layers alleviated the negative effects on production performance, digestibility and plasma hormones. Vitamin C can ameliorates heat stress induced problems such as poor immunity, feed intake, weight gain, oxidative stress, rectal and body temperature and mortality in birds (Abidin and Khatoon, 2013). Ahmadu et al. (2016) reported that vitamin C supplemented at 100 to 200 mg/kg is capable of converting the negative effects of different stress factors imposed on poultry and thereby improving its productivity. Mortality of Leghorn-type chickens was remarkably decreased when vitamin C was supplemented to the diet (Gross, 1988). Feed conversion was improved significantly when broiler chickens were fed vitamin C at 200mg/kg (Njoku, 1986).

Probiotic was firstly introduced as a “live microbial feed supplement which beneficially affects the host animal by improving intestinal microbial balance” (Fuller, 1989). The different immunomodulation effect of probiotic was reviewed by Cross (2002). Enhancement of leucocyte phagocytosis responses and gastrointestinal tract antibody responses was stated as a potential mode of action of probiotic supplementation. Callaway et al. (2008) mentioned that probiotic, such as yeast culture, can be used effectively to reduce the number of pathogenic bacteria in the gastrointestinal tract in poultry and other farm animals. Zhang et al. (2017) demonstrated a positive effect of probiotic on maintaining productive performance of heat stressed laying hen. Probiotics were contributed to the maintenance of gut microbiota and improving intestinal integrity. Probiotics could be responsible for inhibiting the invasion of pathogenic bacteria. The present study aimed at the investigation of the possible effects of dietary supplemented yeast culture and/or vitamin C on alleviating the negative effects imposed by high ambient temperature during summer on egg production, egg quality, immune response and ileum pathogenies counts.

MATERIALS AND METHODS

Management, Diets and Design

A total of 200 Hy-Line Brown laying hens at 32 weeks old were randomly divided into four symmetric equal groups. The groups were randomly assigned to four dietary treatments, each of 50 hens with five replicates of 10 hens. Hens were housed in laying cages with 3 hens per cage in an open poultry house The basal diet was formulated to meet the recommendations of the NRC (1994), with a 17.5% CP and 2750 Kcal ME/kg diet (Table 1).

The first group received basal diet without any supplementation and served as control group (C). The groups 2, 3, and 4 received basal diet supplemented with 0.2% dried yeast (Yeast), 250 mg of vitamin C (Vit-C), and 0.1 % dried yeast + 125 mg vitamin C (Yeast+Vit-C) respectively. The diet supplementation continued for 12 weeks. All birds were reared under the same environmental, managerial and hygienic condition. The average ambient temperature and relative humidity were 30.9±1.32°C and 48.8±0.06%, respectively. Light regime was 16h light and 8h dark throughout the experimental period. Feed and water were provided ad libitum during the experimental period.

Production Performance and Egg Quality

Body weights (g) were individually recorded at 32, 35, 39 and 43 weeks of age. Feed intake was recorded biweekly and calculated as g/hen/day and feed conversion was calculated. The average daily egg production was recorded and egg weight was measured to the nearest 1g. Egg mass was calculated per hen according to the following equation: Egg mass = egg number × egg weight (g).

Twenty five eggs were taken randomly from each treatment at the end of the experiment (43 wks. of age) to examine their quality. Shape index was determined according to Romanoff and Romanoff (1949). Egg width and length were measured in centimeters, using a Veriex–Caliper and shape index % was obtained as [egg width (cm) / egg length (cm) × 100]. Shell with membranes of the broken eggs were rinsed with clean water, air dried at room temperature for one day and then weighted to the nearest 0.1 g. Shell thickness was determined with membranes included in the middle region using Ames anvil-Jawed micron according to Brant and Shrader (1952).

Yolk was separated from the albumin and was weighted. Yolk index was calculated according to Funk (1948) as [Yolk index = yolk height/yolk diameter × 100]. The height was measured to the nearest 0.01 cm using tripod micrometer reading, and yolk diameter was measured to the nearest 0.1 mm by vernier caliber. Albumin weight was calculated according to the following equation: [Albumin weight = egg weight – (yolk weight + shell weight)].

Yolk Parameters

Twenty five eggs from each treatment were taken randomly at the end of the experiment, and every five eggs yolk were mixed to make one homogenized sample to test their yolk parameters. Yolk cholesterol and total lipids were determined according to Folch et al. (1973).

Blood Parameters

Blood samples were collected from 10 birds per treatment at the end of the experiment (43 wks. of age). For each sample, 3 ml blood was collected during slaughtering in heparinized tubes. The blood samples were centrifuged at 3000 ×g for 15 min, clear plasma was separated and stored at -20°C until further biochemical analysis. Total protein level was determined according to Gornall et al. (1949). Albumin was determined according to Doumas et al. (1971) and globulin was determined by the difference between total protein and albumin. Calcium was determined according to Gindler and King (1972). Inorganic phosphorus was determined according to Amador and Urban (1972). Triglycerides were determined according to Friedewald et al. (1972). Cholesterol level was determined according to Flegg (1973). Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined according to Reitman and Frankel (1957).

Also, blood samples were collected at slaughtering in tubes containing EDTA as anti-coagulation. Total WBCs was counted as described by Haddad and Mashaly (1990). Briefly, 490µl of brilliant crassly blue dye leukocytes were counted under a microscope at a magnification of 200× using a hemocytometer. One drop blood was smeared on the glass slide. The smears were fixed and stained using Hema-3 (cat# 22-122911, Fisher scientific, USA). One hundred leukocytes were counted on one slide for each bird and heterophil to lymphocyte ratio was calculated according to Zhang et al., (2009).

Immune Response

At 35 weeks of age, birds were immunized by vaccines against Newcastle Disease Virus (NDV), Infectious Bronchitis Disease Virus (IBDV) and Avian Influenza Disease Virus (AIDV). Ten blood samples were collected from each group after 30 days of immunization. Commercial ELISA kits were used for detection of antibodies against nucleoprotein and matrix antigen of IBDV. The other two antibody titers of NDV and AIDV were determined by hemagglutination-inhibition (HI) test titers regarded as positive if these is inhibition at a serum dilution of 1/16 (4 $\log^2$) according to OIE (2008).

Salmonella, E-coli and Total bacterial count

Ten samples from intestine (Ileum) were collected from each experimental group to examine, define and count the salmonella, E-coli and the total bacterial count content using the procedure of A.O.A.C. (1995).

Statistical Analysis

The experimental design was completely randomized with four treatments each with 5 replicates (10 hens per replicate). Samples used for egg quality were 25 eggs per treatment. For blood, yolk, ileum microbial count and humeral response parameters, the experimental unite was consisted of ten birds randomly chosen from each treatment. Data were statistically analyzed by one-way analysis of variance for treatment effect, using the general linear model (GLM) procedure of SAS (2006). When the model was significant, Duncan's test was used to separate treatment means. Differences between treatment means were considered significant at P<0.05.

RESULTS AND DISCUSSION

Production parameters

Significant increase in feed intake and improvement in feed conversion were found when yeast and/or vitamin C were supplemented to layers diet (Table 2). Egg number and egg weight were also increased due to yeast supplementation to the diet with or without vitamin C. Egg mass was significantly increased with diet supplementation compared to the control group but with higher level for Yeast and Yeast +Vit-C groups followed by Vit-C group.

The enhancement in egg production of laying hens due to the yeast culture supplementation was also reported by Abou El-Ella et al. (1996) and Liu et al. (2002). Furthermore, Hassanein and Soliman (2010) reported that 0.4 and 0.8% probiotic addition had beneficial effects on egg production. On the other hand, Yalçın et al. (2008) revealed that the supplementation of feed with commercial yeast culture up to 2g/kg did not significantly influence feed intake or feed efficiency. The significant negative effects of high ambient temperature on egg production can be contributed to the changes in sexual hormone (Novero et al., 1991), and yeast supplementation could alleviate such negative effects. Saki et al. (2010) found no effect of supplemented vitamin C at the level of 250mg/kg on feed intake, feed conversion, egg production and egg quality of laying hens reared under ambient temperature of 19°C indicating that vitamin C is efficient when used as anti-stress.

Egg quality

The internal and external egg quality parameters and yolk lipid profile are presented in Table (3). Egg weight, shell weight, shell thickness, shell percentage, yolk percentage and yolk index were significantly increased in all treated groups compared to the control group. Results showed also that yolk cholesterol and total lipid content were significantly (P<0.05) decreased with different diet supplementations compared to the control group. The group fed yeast+ Vit-C had lower value of yolk cholesterol and total lipid content followed by the group fed yeast and Vit-C. Yalçın et al. (2008, 2010 and 2014) and Yousefi and Karkoodi (2007) fed laying hens diet supplemented with yeast cell wall, yeast culture or probiotic and reported significant reduction in yolk cholesterol. However, Shell weight, shell thickness, yolk weight significantly increased when yeast was fed to the diet of laying hens.

Blood biochemical and immunological parameters

Plasma biochemical content and immunological parameters are presented in Table (4). Total protein and albumin levels significantly increased with yeast supplementation in the groups fed yeast and yeast+Vit-C. Also, plasma calcium and phosphorus levels significantly increased with yeast supplementation. Meanwhile, vitamin C supplementation resulted in significant increases in those parameters, but with less extents compared to the results of yeast supplementation.

Plasma triglycerides significantly decreased in all treated groups, and reached to 165.1, 180.3 and 162.7 mg/dl in the Yeast, Vit-C and Yeast+Vit-C groups, respectively, compared to 209.6 mg/dl for the control. Cholesterol level decrease significantly as a result of yeast supplementation groups by 18%. It has been reported that serum cholesterol and triglyceride levels decreased in Hy-line Brown laying hens dietary supplemented with yeast autolysate at 2, 3 and 4 g/kg or supplemented with yeast cell wall at 1 and 2 g/kg had lower serum cholesterol and triglyceride levels (Yalçın et al., 2010 and 2014). Liver enzymes ALT and AST activity decreased significantly due to different supplementations compared to the control group.

Total WBCs significantly increased when yeast and vitamin C supplemented together compared to the control group. The yeast supplemented groups have significantly lower H/L ratio followed by the Vit-C supplemented group compared to the control group by 25 and 19%, respectively. Czech et al. (2014) reported a reduction in ALT, cholesterol, triglycerides and H/L ratio when yeast (Yarrowia lipolytica) was provided to 16 weeks old turkey hens.

Antibody titer of immunized viral diseases

The antibody titer of Newcastle and Avian Flu diseases increased significantly for layers fed yeast and/or vitamin C (Fig. 1). Infectious Bronchitis virus antibody titer significantly increased with Yeast and Yeast+Vit-C supplementations. The increase in the immune response in poultry subjected to different stressors due to dietary yeast and yeast extraction has been reported by Świątkiewicz et al. (2014). Yalçın et al. (2012) reported a positive effect of dietary yeast autolysate fed to laying hens on antibody titer for SRBC. Yalçin et al. (2014) reported the same positive effect on SRBC antibody titer in laying hen fed diet supplemented with yeast cell wall. Laying hen antibody titer against SRBC was significantly increased by yeast supplementation while vitamin C showed no effect (Asli et al., 2007). Lin et al. (2002) found a significant increase in antibody titer to NDV exposed to high temperature (31.5 ˚C) when vitamin A was supplemented.

Intestinal microbial count

Ileum total bacterial count (TBC) showed a significant reduction when yeast was fed to the laying hens (Fig. 2). Also, all dietary supplementation showed significant reductions of E-coli count. Nevertheless, ileum salmonella count was not affected by any of the diet supplementation. These results imply a potential positive effect of yeast on changing the intestinal microbial composition in favor to non-pathogenic bacteria.

CONCLUSION

It can be concluded that yeast culture is a powerful dietary strategy during hot season because it alleviates the negative effects of heat stress on laying hen performance, egg quality and immune response. Yeast and vitamin C supplementation can be used pre-immunization to obtain the maximal level of antibody production, or as an immunomodulation of pathogen challenged for birds under high environmental temperature. Moreover, vitamin C can also be used as anti-stress but with less prominent positive effects.

Table (1): Composition and calculated analysis of the basal diet.

Ingredients	**%**
Yellow corn	63.2
Soybean meal, 44%	26.4
Wheat bran	1.5
Layer premix*	0.3
Di calcium phosphate	1.6
Limestone	6.6
Sodium chloride	0.3
DL-Methionine	0.1
Calculated analysis	
ME, Kcal/kg	2750
Crude protein %	17.50
Crude fiber, %	2.81
Ether extract, %	2.86
Calcium %	3.24
Available phosphorus, %	0.53
Lysine, %	0.76
Methionine, %	0.42
Methionine+Cystine, %	0.67

*Each 3kg of layer premix contained: Vit. A 10,000,000 I.U., Vit. D_3 2,250,000 I.U., Vit. E 10g; Vit. K_2 1g; Vit. B_1 1g; Vit. B_6 1.5g; Vit. B_{12} 10mg; Pantothenic acid 10g; Niacin 20g; Folic acid 1g; Vit. B_2 50mg; Choline chloride 500g; Fe 30g; Mg 40g; Zn 45g; Co 100mg; I 300mg; Se 100mg and CaCO3 to 3000g.

Table (2): Production parameters of laying hen reared under summer condition and fed yeast and/or vitamin C.

Parameter	**Control**	**Yeast**	**Vit-C**	**Yeast+Vit-C**
Feed intake,g/bird/d	108.20 ± 0.15^{c}	111.19 ± 0.48^{a}	109.79 ± 0.20^{b}	110.79 ± 0.14^{a}
Feed conversion	2.33 ± 0.03^{a}	2.14 ± 0.02^{bc}	2.23 ± 0.05^{b}	2.12 ± 0.01^{c}
Egg number, bird/d	0.83 ± 0.01^{b}	0.89 ± 0.02^{a}	0.87 ± 0.01^{ab}	0.89 ± 0.01^{a}
Egg weight, g	56.35 ± 0.61^{b}	58.46 ± 0.29^{a}	57.14 ± 0.31^{b}	58.56 ± 0.21^{a}
Egg mass	46.36 ± 0.71^{c}	51.86 ± 0.56^{a}	49.36 ± 1.12^{b}	52.39 ± 0.24^{a}

Means within the same row with different superscripts differ significantly ($P<0.05$).

Table (3): Egg quality parameters and yolk lipid profile of laying hen reared under summer condition and fed yeast and/or vitamin C.

Parameter	Control	Yeast	Vit-C	Yeast+Vit-C
Egg weight, g	56.20±0.13^{c}	58.60±0.15^{a}	57.32±0.15^{b}	58.80±0.15^{a}
Shell weight, g	6.36±0.13^{c}	7.15±0.06^{a}	6.76±0.07^{b}	7.23±0.06^{a}
Shell thickness, mm	0.32±0.003^{d}	0.36±0.003^{b}	0.35±0.002^{c}	0.37±0.002^{a}
Shell, %	11.31±0.21^{c}	12.20±0.09^{a}	11.80±0.13^{b}	12.30±0.10^{a}
Yolk weight, g	13.38±0.08^{d}	14.89±0.12^{b}	14.09±0.11^{c}	15.17±0.06^{a}
Yolk, %	23.81±0.16^{c}	25.41±0.22^{a}	24.58±0.21^{b}	25.80±0.11^{a}
Yolk index	41.78±0.47^{c}	45.15±0.21^{a}	43.90±0.16^{b}	44.74±0.13^{a}
Yolk cholesterol, mg/g	13.86±0.56^{a}	10.62±0.34^{b}	11.2±0.47^{b}	10.40±0.36^{b}
Yolk total lipid, mg/g	269±4.76^{a}	224±4.84^{c}	242±5.02^{b}	220±6.01^{c}

Means within the same row with different superscripts differ significantly (P<0.05).

Table (4): Blood biochemical and immunological parameters of laying hen reared under summer condition and fed yeast and/or vitamin C.

Parameter	Control	Yeast	Vit-C	Yeast+Vit-C
Total protein, g/dl	4.31±0.21^{b}	5.26±0.20^{a}	4.80±0.26^{ab}	5.44±0.21^{a}
Albumin, g/dl	2.20±0.09^{b}	2.85±0.12^{a}	2.49±0.13^{b}	2.94±0.11^{a}
Globulin, g/dl	2.11±0.23	2.41±0.13	2.31±0.28	2.49±0.18
Calcium, mg/dl	10.91±0.25^{c}	12.91±0.26^{a}	12.12±0.27^{b}	13.42±0.15^{a}
Phosphorus, mg/dl	6.83±0.18^{c}	9.15±0.26^{a}	8.27±0.22^{b}	9.33±0.20^{a}
Triglycerides, mg/dl	209.6±7.58^{a}	165.1±10.00^{b}	180.3±6.76^{b}	162.7±6.71^{b}
Cholesterol, mg/dl	150.3±6.70^{a}	121.8±6.16^{b}	133.2±5.98^{ab}	124.3±6.86^{b}
ALT,U/l	10.34±0.86^{a}	7.85±0.53^{b}	8.20±0.38^{b}	7.52±0.57^{b}
AST, U/l	26.42±0.55^{a}	21.26±0.64^{b}	22.82±1.24^{b}	21.14±0.79^{b}
WBCs, $\times 10^3$/mm^3	42.49±2.55^{b}	56.18±4.85^{ab}	51.65±5.4^{ab}	58.22±5.16^{a}
H/L ratio	0.59±0.01^{a}	0.45±0.01b^{c}	0.48±0.02^{b}	0.43±0.02^{c}

Means within the same row with different superscripts differ significantly (P<0.05).

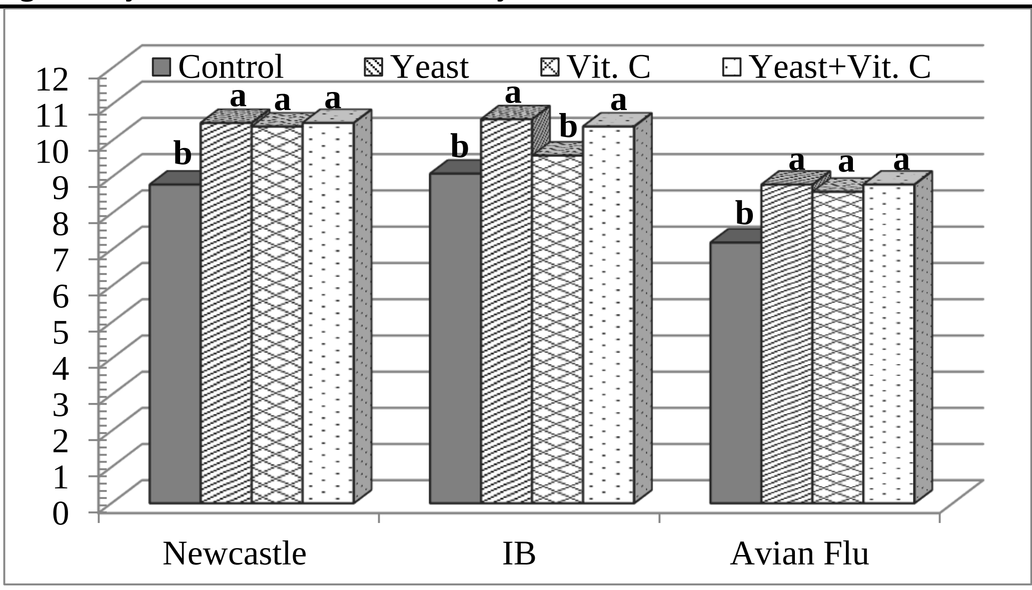

Fig. (1) Blood antibody titer of Newcastle Disease Virus, Infectious Bronchitis Disease Virus (IB) and Avian Influenza Disease Virus (Avian Flu) for laying hen reared under summer condition and fed yeast and/or vitamin C.

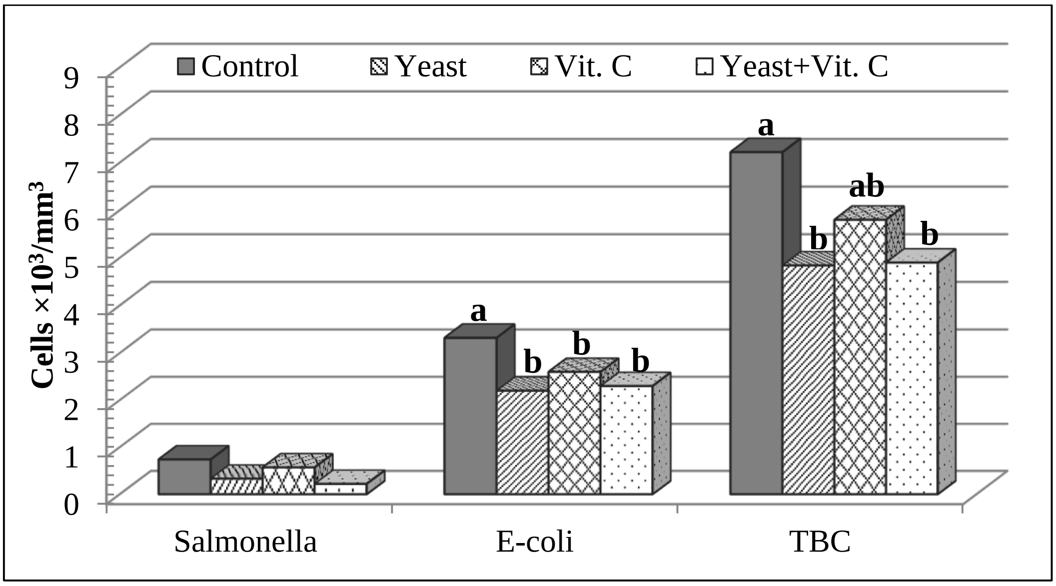

Fig. (2): Ileum salmonella, E-coli and total bacterial count (TBC) for laying hen reared under summer condition and fed yeast and/or vitamin C.

REFERENCES.

Abou El-Ella, M.A.; Attia M.Y.; El-Nagmy, K.Y. and Radwan, M.A.H. 1996. The productive performance of layers fed diets supplemented with some commercial feed additives. Egypt J. Anim. Prod. 33:423-430.

A.O.A.C. 1995. Association of Official Analytical Chemists. Official Methods of Analysis, 16^{th} ed. Washington, DC, J. AOAC. Int., 78:724-729.

Abidin, Z. and Khatoon, A. 2013. Heat stress in poultry and the beneficial effects of ascorbic acid (vitamin C) supplementation during periods of heat stress. World's Poult. Sci. J., 69(1):135–152.

Ahmadu, S.; Mohammed, A.A.; Buhari, H. and Auwal, A. 2016. An overview of vitamin C as an antistress in poultry. Malaysian J. Vet. Res., 7(2):9-22.

Amador, E. and Urban, J. 1972. Simplified serum phosphorus analyses by continuous-flow ultraviolet spectrophotometry. Clin. Chem., 18(7):601-604.

Asli, M.M.; Hosseini, S.A.; Lotfollahian, H. and Shariatmadari, F. 2007. Effect of probiotics, yeast, vitamin E and vitamin C supplements on performance and immune response of laying hen during high environmental temperature. International J. Poult. Sci., 6(12):895-900.

Attia, Y.A.; Abd El-Hamid, A.E.-H.E.; Abedalla, A.A.; Berika, M.A.; Al-Harthi, M.A.; Kucuk, O.; Sahin, K. and Abou-Shehema, B.M. 2016. Laying performance, digestibility and plasma hormones in laying hens exposed to chronic heat stress as affected by betaine, vitamin C, and/or vitamin E supplementation. Springerplus, 5(1):1619.

Bozkurt, M.; Küçükyilmaz, K.; Çatli, A.U.; Çınar, M.; Bintaş, E. and Çöven, F. 2012. Performance, egg quality, and immune response of laying hens fed diets supplemented with mannan-oligosaccharide or an essential oil mixture under moderate and hot environmental conditions. Poult. Sci., 91(6):1379-1386.

Brant, A.W. and Shrader, A.A. 1952. Shell quality and bacterial infection of shell eggs. Poult. Sci., 57:638-640.

Callaway, T.R.; Edrington, T.S.; Anderson, R.C.; Harvey, R.B.; Genovese, K.J.; Kennedy, C.N.; Venn, D.W. and Nisbet, D.J. 2008. Probiotics, prebiotics and competitive exclusion for prophylaxis against bacterial disease. Anim. Health Res. Rev., 9(2):217-225.

Cross, M.L. (2002). Microbes versus microbes: immune signals generated by probiotic lactobacilli and their role in protection against microbial pathogens. FEMS Immunol. Med. Microbiol., 34:245-253.

Czech, A.; Merska, M. and Ognik, K. 2014). Blood immunological and biochemical indicators in turkey hens fed diets with a different content of the yeast Yarrowia lipolytica. Ann. Anim. Sci., 14(4):935-946.

Doumas, B.T.; Watson, W. and Biggs, H.G. 1971. Albumin standard and the measurement of serum albumin with bromocresol green. Clinica Chimica Acta, 31(1):87–96.

Flegg, H.M. 1973. An investigation of the determination of serum cholesterol by an enzymatic method. Ann. Clin. Biochem., 10:79–86.

Folch, J.; Lees, M. and G.H. Sloane Stanley 1973. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem., 226:497–509.

Franco-Jimenez, D.J.; Scheideler, S.E.; Kittok, R.J.; Brown-Brandl, T.M.; Robeson, L.R.; Taira, H. and Beck, M.M. 2007. Differential effects of heat stress in three strains of laying hens. J. Appl. Poult. Res., 16(4):628–634.

Friedewald, W.T.; Levy, R.; Friedewald, W.T.; Levy, R.I. and Fredrickson, D.S. 1972. Estimation of concentration of low density lipoprotein cholesterol in plasma without use of the ultra-centrifuge. Clin. Chem., 18:449–502.

Fuller, R. 1989. Probiotics in man and animals. J. Appl. Microbiol., 66:365–378.

Funk, E. M. 1948. The relationship of the yolk index determined in natural position to the yolk as determined after separating the yolk from the albumin. Poult. Sci., 27:367–378.

Gindler, E.M. and King, J.K. 1972. Rapid colorimetric determination of calcium in biologic fluids with methylthymol blue. Am. J. Clin. Pathol., 58:376-382.

Gornall, A.G.; Bardawill, G.J. and Divid, M.M. 1949. Determination of serum proteins by means of the biuret reaction. J. Biol. Chem., 177:751-766.

Gross, W.B. 1988. Effects of ascorbic acid on the mortality of leghorn-type chickens due to overheating. Avian Dis., 32:561–562.

Haddad, E.F. and Mashaly, M.M. 1990. Effect of thyrotropin releasing hormone, triiodothyronine and chicken growth hormone on plasma concentration of thyroxine, triiodothyronine, growth hormone and growth of lymphoid organs and leukocyte populations in immature male chicken. Poult. Sci., 69:1094–1102.

Hassanein, S.M.; Soliman, N.K. 2010. Effect of probiotic (Saccharomyces cerevisiae) adding to diets on intestinal microflora and performance of Hy-line layers hens. J. Am. Sci.. 6(11):159-169.

Kamel, N.N.; Ahmed, A.M.H.; Mehaisen, G.M.K.; Mashaly, M.M. and Abass, A.O. 2017. Depression of leukocyte protein synthesis, immune function and growth performance induced by high environmental temperature in broiler chickens. Int. J. Biometeorol., 61(9):1637-1645.

Kilic, I. and Simsek, E. 2013. The effects of heat stress on egg production and quality of laying hens. J. Anim. Vet. Advances, 12(1):42-47.

Lara, L.J. and Rostagno, M.H. 2013. Impact of Heat Stress on Poultry Production. Animals, 3(2):356–369.

Lin, H.; Wang, L.F.; Song, J.L.; Xie, Y.M. and Yang, Q.M. 2002. Effect of dietary supplemental levels of vitamin A on the egg production and immune responses of heat-stressed laying hens. Poult. Sci., 81(4):458-465.

Liu, Z.; Qi, G. and Yoon, I. 2002. Effect of yeast culture on production parameters and intestinal microflora in laying hens. Page 89 in Poultry Science Association 91st Annual Meeting Abstracts. August 11–14. Newark, DE. Abstract No: 381.

Mashaly, M.M.; Hendricks, G.L.; Kalama, M.A.; Gehad, A.E.; Abbas, A.O. and Patterson, P.H. 2004. Effect of Heat Stress on Production Parameters and Immune Responses of Commercial Laying Hens. Poult. Sci., 83(6):889-894.

Njoku, P.C. 1986. Effect of dietary ascorbic acid (vitamin C) supplementation on the performance of broiler chickens in a tropical environment. Anim. Feed Sci. Tech., 16(1):17-24.

Novero, R.P.; Beck, M.M.; Gleaves, E.W.; Johnson, A.L. and Deshazer, J.A. 1991. Plasma progesterone, luteinizing hormone concentrations, and granulosa cell responsiveness in heat-stressed hens. Poult. Sci., 70(11):2335-2339.

NRC 1994. Nutrient Requirements of Poultry. 9th rev. ed. National Academies Press, Washington, DC, USA.

OIE, World Organisation for Animal Health 2008. Manual of Diagnostic Tests and Vaccines for Terrestrial Animal. 6th ed. http://www.oie.int/manual-of-diagnostic-tests-and-vaccines-for-terrestrial-animals/.

Reitman, S. and Frankel, S. 1957. A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol., 28(1):56-63.

Romanoff, A. L. and A. J., Romanoff 1949. The avian egg. John Wiley and sons Inc., New York. USA. pp.1-918.

Rozenboim, I.; Tako, E.; Gal-Garber, O.; Proudman, J.A. and Uni, Z. 2007. The effect of heat stress on ovarian function of laying hens. Poult. Sci., 86(8):1760-1765.

Saki, A.A.; Rahmati, M.M.H.; Zamani, P.; Zaboli, K. and Matin, H.R.H. 2010. Can vitamin C elevate laying hen performance, egg and plasma characteristics under normal environmental temperature? Ital. J. Anim. Sci., 9(3):e60.

SAS 2006. SAS/STAT® 9.1 User's Guide. SAS Institute Inc., Cary, NC, USA. 5136 pp.

Świątkiewicz, S.; A. Arczewska-Włosek, and D. Józefiak 2014. Immunomodulatory efficacy of yeast cell products in poultry: a current review. World's Poult. Sci. J., 70(1):57-68.

Uddin, M.Z.; Samad, M.A. and Kabir, S.M.L. 2011. Mortality and disease status in Hy-line and ISA-Brown strains of layer chickens reared in cage system in Bangladesh. Bangladesh J. Vet. Med., 9(1):1-16.

Yalçın, S.; Özsoy, B.; Erol, H. and Yalçın, S. 2008. Yeast culture supplementation to laying hen diets containing soybean meal or sunflower seed meal and its effect on performance, egg quality traits, and blood chemistry. J. Appl. Poult. Res., 17(2):229-236.

Yalçın, S.; Yalçın, S.; Çakin, K.; Eltan, Ö. and Dağaşan, L. 2010. Effects of dietary yeast autolysate (Saccharomyces cerevisiae) on performance, egg traits, egg cholesterol content, egg yolk fatty acid composition and humoral immune response of laying hens. J. Sci. Food Agric., 90(10):1695-1701.

Yalçın, S.; Yalçın, S.; Uzunoğlu, K.; Duyum, H.M. and Eltan, Ö. 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(1):13-20.

Yalçin, S.; Yalçin, S.; Onbaşilar, İ.; Eser, H.; Şahin, A. 2014. Effects of dietary yeast cell wall on performance, egg quality and humoral immune response in laying hens. Ankara Üniv. Vet. Fak. Derg., 61:289-294.

Yousefi, M. and K. Karkoodi 2007. Effect of probiotic Thepax® and Saccharomyces cerevisiae supplementation on performance and egg quality of laying hens. Int. J. Poult. Sci., 6:52-54.

Zhang, L.; Yue, H.Y.; Xu, L.; Wu, S.G.; Yan, H.J. 2009. Transport stress in broilers: I. blood metabolism, glycolytic potential, and meat quality. Poult. Sci., 88:2033-3041.

Zhang, P., T. Yan, X. Wang, S. Kuang, Y. Xiao, W. Lu, and D. Bi 2017. Probiotic mixture ameliorates heat stress of laying hens by enhancing intestinal barrier function and improving gut microbiota. Ital. J. Anim. Sci, 16(2):292-300.

الملخص العربى

تأثير إضافة الخميرة و فيتامين سى على إنتاج البيض وجودة البيض وعدد الأجسام المناعية خلال فصل الصيف وميكروبات الأمعاء فى دجاج الهاى لاين البنى

عادل عبد المنعم دسوقى[1] و نانسى نبيل كامل[2]

[1] قسم الإنتاج الحيوانى، كلية الزراعة، جامعة القاهرة، مصر

[2]قسم الإنتاج الحيوانى، المركز القومى للبحوث، الدقى، الجيزة، مصر

يسبب ارتفاع درجات الحرارة أثناء فصل الصيف العديد من التغيرات السلبية التى تؤثر على إنتاج الدجاج البياض. تهدف الدراسة الحالية إلى دراسة تأثير أضافة الخميرة وفيتامين سى فى علائق الدجاج البياض على تخفيف التأثيرات السلبية التى يفرضها ارتفاع درجات الحرارة أثناء فصل الصيف. تم استخدام عدد 200 دجاجة هاى لاين بنى عمر 32 اسبوع تم تقسيمهم بشكل عشوائى إلى أربعة مجموعات 50 طائر فى كل معاملة مقسمه على خمس مكررات. المجموعة الأولى غذيت على العليقة الأساسية بدون أى إضافة (مجموعة الكنترول). المجموعات الثانية والثالثة والرابعة غذيت على العليقة الأساسية مضاف إليها 0.2% خميرة جافة أو 250 ملجم فيتامين سى أو 0.1% خميرة جافة + 125 ملجم فيتامين سى، على التوالى. تم تربية الدجاج فى اقفاص من السلك فى مسكن مفتوح وكان متوسط درجات الحرارة خلال فترة التجربة 30.9±1.3 درجة مئوية والرطوبة النسبية 48.8±0.1%. تم تسجيل كمية الغذاء المأكول وإنتاج البيض وحساب كفاءة تحويل الغذاء وتم أخذ بعض القياسات على جودة البيض المنتج، كما تم قياس نسبة الكوليستيرول والدهون الكلية فى صفار البيض وتقدير بعض قياسات كيمياء الدم. تم قياس الأجسام المناعية الخاصة بمرض النيوكاسل والتهاب الشعب الهوائية المعدى وأنفلونزا الطيور وذلك بعد 30 يوم من التحصين. كما تم عمل عد لبكتريا السالمونيلا والإيكولاي والعدد الكلى للبكتريا الموجودة فى منطقة الأمعاء الغليظة. أظهرت النتائج تحسن فى كمية المأكول وكفاءة تحويل الغذاء وإنتاج البيض وجودة البيض المنتج بإضافة الخميرة مع أو بدون فيتامين سى. كما حدث تحسن فى خواص البيضة الداخلية والخارجية ولوحظ أيضاً إنخفاض معنوى فى نسبة الكوليستيرول والدهون الكلية بصفار البيض فى المجموعات التجريبية المختلفة مقارنة بمجموعة المقارنة. زيادة معنوية فى الأجسام المناعية لكل من النيوكاسل و التهاب الشعب الهوائية المعدى وأنفلونزا الطيور قد لوحظ كنتيجة لإضافة الخميرة. من ناحية أخرى إنخفاض معنوى فى عدد بكتريا الإيكولاي والعد البكتيرى الكلى قد لوحظ بأضافة الخميرة. ومن هذا يمكن أستخلاص أن الخميرة تعتبر إضافة غذائية ذات تأثيرات إيجابية متعددة أثناء المواسم الحارة حيث يمكنها التخفيف من التأثيرات السلبية التى تظهر نتيجة للعبئ الحرارى على الأداء الإنتاجى للدجاج البياض وكذلك جودة البيض المنتج. كما يمكن أستخدام الخميرة كمحفز مناعى للطيور المعرضة للأمراض أو قبل عمليات التحصين. وعلاوة على ذلك يمكن أيضاً إستخدام فيتامين سى لتخفيف التأثير السلبى للحرارة ولكن بشكل أقل قوة نسبياً إذا ما قورن بالخميرة.