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

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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°C and 48.8±0.1%, respectively. Feed intake, feed conversion, egg production 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). Ahmadi 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...
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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: \[
\text{Shape index} = \left( \frac{\text{egg width (cm)}}{\text{egg length (cm)}} \right) \times 100
\]

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: \[
\text{Yolk index} = \frac{\text{yolk height}}{\text{yolk diameter}} \times 100
\]

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
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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 log²) 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
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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. Yalçın 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.
laying hen – yeast - vitamin C - antibody titer - intestine microbes

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

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>63.2</td>
</tr>
<tr>
<td>Soybean meal, 44%</td>
<td>26.4</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>1.5</td>
</tr>
<tr>
<td>Layer premix*</td>
<td>0.3</td>
</tr>
<tr>
<td>Di calcium phosphate</td>
<td>1.6</td>
</tr>
<tr>
<td>Limestone</td>
<td>6.6</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>0.3</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>0.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculated analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME, Kcal/kg</td>
<td>2750</td>
</tr>
<tr>
<td>Crude protein %</td>
<td>17.50</td>
</tr>
<tr>
<td>Crude fiber, %</td>
<td>2.81</td>
</tr>
<tr>
<td>Ether extract, %</td>
<td>2.86</td>
</tr>
<tr>
<td>Calcium %</td>
<td>3.24</td>
</tr>
<tr>
<td>Available phosphorus, %</td>
<td>0.53</td>
</tr>
<tr>
<td>Lysine, %</td>
<td>0.76</td>
</tr>
<tr>
<td>Methionine, %</td>
<td>0.42</td>
</tr>
<tr>
<td>Methionine+Cystine, %</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*Each 3kg of layer premix contained: Vit. A 10,000,000 I.U., Vit. D₃ 2,250,000 I.U., Vit. E 10g; Vit. K₂ 1g; Vit. B₁ 1g; Vit. B₆ 1.5g; Vit. B₁₂ 10mg; Pantothenic acid 10g; Niacin 20g; Folic acid 1g; Vit. B₂ 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.

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

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.

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

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Yeast</th>
<th>Vit-C</th>
<th>Yeast+Vit-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein, g/dl</td>
<td>4.31±0.21b</td>
<td>5.26±0.20a</td>
<td>4.80±0.26ab</td>
<td>5.44±0.21a</td>
</tr>
<tr>
<td>Albumin, g/dl</td>
<td>2.20±0.09b</td>
<td>2.85±0.12a</td>
<td>2.49±0.13b</td>
<td>2.94±0.11a</td>
</tr>
<tr>
<td>Globulin, g/dl</td>
<td>2.11±0.23</td>
<td>2.41±0.13</td>
<td>2.31±0.28</td>
<td>2.49±0.18</td>
</tr>
<tr>
<td>Calcium, mg/dl</td>
<td>10.91±0.25c</td>
<td>12.91±0.26a</td>
<td>12.12±0.27b</td>
<td>13.42±0.15a</td>
</tr>
<tr>
<td>Phosphorus, mg/dl</td>
<td>6.83±0.18c</td>
<td>9.15±0.26a</td>
<td>8.27±0.22b</td>
<td>9.33±0.20a</td>
</tr>
<tr>
<td>Triglycerides, mg/dl</td>
<td>209.6±7.58a</td>
<td>165.1±10.00b</td>
<td>180.3±6.76b</td>
<td>162.7±6.71b</td>
</tr>
<tr>
<td>Cholesterol, mg/dl</td>
<td>150.3±6.70a</td>
<td>121.8±6.16b</td>
<td>133.2±5.98b</td>
<td>124.3±6.86b</td>
</tr>
<tr>
<td>ALT, U/l</td>
<td>10.34±0.86a</td>
<td>7.85±0.53b</td>
<td>8.20±0.38b</td>
<td>7.52±0.57b</td>
</tr>
<tr>
<td>AST, U/l</td>
<td>26.42±0.55a</td>
<td>21.26±0.64b</td>
<td>22.82±1.24b</td>
<td>21.14±0.79b</td>
</tr>
<tr>
<td>WBCs, ×10³/mm³</td>
<td>42.49±2.55b</td>
<td>56.18±4.85ab</td>
<td>51.65±5.4ab</td>
<td>58.22±5.16a</td>
</tr>
<tr>
<td>H/L ratio</td>
<td>0.59±0.01a</td>
<td>0.45±0.01bc</td>
<td>0.48±0.02ab</td>
<td>0.43±0.02c</td>
</tr>
</tbody>
</table>

Means within the same row with different superscripts differ significantly (P<0.05).
laying hen – yeast - vitamin C - antibody titer - intestine microbes

**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.
laying hen – yeast - vitamin C - antibody titer - intestine microbes

REFERENCES.


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


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الملخص العربي
تأثير إضافة الخميرة والفيتامين C على إنتاج البيض ووجودة البيض وعدد الأجسام المناعية خلال فصل الصيف وميكروبات الأمعاء في دجاج الهاين المبني
عادل عبد المنعم دسوقى و نانسي نبيل كامل
قسم الإنتاج الحيواني، كلية الزراعة، جامعة القاهرة، مصر
قسم الإنتاج الحيواني، المركز القومي للبحوث، الدقى، الجيزة، مصر

يسبب ارتفاع درجات الحرارة أثناء فصل الصيف العديد من التغيرات السلبية والتي تؤثر على إنتاج الدجاج البياض. تهدف الدراسة الحالية إلى دراسة تأثير إضافة الخميرة والفيتامين C على النتائج البياضية عند فصل الصيف. تم استخدام عدد 200 دجاجة بانا لإن بني عمر 32 أسبوع تم تقسيمهم بشكل عشوائي إلى أربعة مجموعات 50 طائر في كل مجموعه على حسب مكررات. المجموعة الأولى غذت على العليقة الأساسية دون أي إضافة (مجموعة الكنترول). المجموعات الثانية والثالثة والرابعة غذت على العليقة الأساسية مضاد إلها 0.2% خميرة جافة أو 250 مليم فيتامين C أو 0.1% خميرة جافة + 125 مليم فيتامين C. تم تربية الدجاج في أقفاص من السلك في مسكن مفتوح وكان متوسط درجات الحرارة خلال فترة التجربة 13.5 درجة مئوية والرطوبة النسبية 48.8±0.1%. تم تسجيل كمية الغذاء المأكول وإنتاج البيض وحساب كفاءة تحويل الغذاء والفئات على جودة البيض المنتج. كما تم قياس نسبة الكوليسترول والدهون الكلية في صفار البيض وحساب 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 عدد كوليرا السالمونيلا والإيكولاي والعد بالكوليرا الموجدة في منطقة الأمعاء الغليظة. أظهرت النتائج تحسن في كمية الحركة و威廉ования التحول الغذاء ونتاج البيض ووجودة البيض المنتج بإضافة الخميرة مع أو بدون فيتامين C. كما حدث تحسن في خواص البيضة الداخلية والخارجية ولاحظ أيضاً انخفاض خميرة في نسبة الكوليسترول والدهون الكلية مقارنة مع مجموعة الكنترول. زيادة مزدوجة ماء في الأمعاء المناعية لكل من النيوكاسل والتهاب الشعب الهوائي المعدى، وأيضًا الطيور قد لوحظ نتائج إضافة الخميرة. من جهة أخرى، أن الفئات مع تحسن في نسب الكوليرا والإيكولاي والعد البكتيري الكلي. قد لوحظ أيضاً انخفاض خميرة في نسبة الجهاز المناعي. ومن هذا يمكن استخلاص أن الخميرة تعتبر إضافة غذائية ذات تأثيرات إيجابية متعددة أثناء المواسم الحارة حيث يمكنها تخفيف من التأثيرات السلبية التي تظهر نتيجة للحرارة على الأداء الإنتاجي للدجاج البياض وكذلك جودة البيض المنتج. كما يمكن استخدام الخميرة كمحفز مغذي لعلاج التمزقات المكشوفات المرضية للأراض أو قبل عمليات التحصين. عملاً على ذلك يمكن أيضاً استخدام فيتامين C لتخفيف التأثير السلبي للحرارة ولكن بشكل أقل قوة نسبياً إذا ما قورن بالخميرة.