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Effect of some biological supplementation on productive performance, physiological and immunological response of layer chicks

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ABSTRACT

The present study was carried out to evaluate the effects of biological (*Bacillus subtilis and Enterococcus faecium*) supplementation on productive performance, physiological and immunological response of Hy-line layer chicks. Total of 300 one-day old of Hy-line layer chicks, were randomly divided into three groups. The first group was fed a basal diet and served as a control. While the second and third groups were fed the basal diet that supplemented with the probiotic mixture at the rate of 1 and 2 gm/kg of diet, respectively, until 10 weeks of age.

Results indicated that treated groups with helpful bacteria (*B. subtilis* and *E. faecium*) showed significant effect on final body weight gain, feed conversion ratio and higher antibody levels against Newcastle disease virus as compared to the control one. Moreover, significant increase was recorded in the relative weight of carcass, liver, heart, kidney, proventiculus, small intestine, thymus, spleen, bursa of Fabricius and small intestine length (cm) in all supplemented groups as compared to the control group. On the other hand, there were no significant effects on serum total protein, albumin, globulin and creatinine concentrations, while, serum ALP, ALT, AST activities, uric acid, triglycerides and cholesterol concentrations in all treated groups were significantly lower than in control group. Furthermore, serum glucose, calcium, phosphorus concentrations and triiodothyronine hormone level were significantly higher in treated groups than the control. Red and white blood cell counts, hemoglobin level and hematocrit values were significantly increased in all treated groups as compared to control group.

In conclusion, biological (*B. subtilis* and *E. faecium*) supplementation can be used as one of important additive for enhancing the productive efficiency, and immunity of growing Hy-line chicks.

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1. Introduction

In Egypt, poultry farming is considered the most important way for solving the gap in meat production for human consumption. However, during intensive growth, this industry has always been confronted with challenges constraint to productivity that results in heavy economic loss to the poultry producers. Among these conditions, low growth performance and infectious diseases (Boirivant & Strober, 2007).

Biological supplementation to appropriate diets is highly helpful in the poultry industry for obtaining better productivity and health benefits (Hajati & Rezaei, 2010). The use of effective live microbes is recommended in the newly hatched chicks, to accelerate development of normal microflora and as safe alternatives to antibiotic growth promoters (Bansal, Singh, & Sachan, 2011). These could prevent diseases like early chick mortality, gastro-intestinal disturbances like scouring, loss of appetite, improper digestion, poor absorption of nutrients and infectious conditions by fighting against pathogenic microbes especially the enteric pathogens. Thus, these can alleviate reduced production performance and prevent heavy economic loss to the poultry producers (Dhama & Singh, 2010). In this regard, *Bacillus subtilis and Enterococcus faecium* are beneficial "live microbes", classified as probiotics (Mountzouris et al., 2007). A positive impact of probiotics supplementation in poultry has been well reported on production performance, (Awad, Ghareeb, Abdel-Raheem, & Bohm, 2009), feed intake, weight gain and feed conversion efficiency (Cavit, 2003), immune responses (Alkhalf, Alhaj, & Al-Homidan, 2010), and body's resistance to infectious diseases (Santos & Ferket, 2006) and help lowering of chick mortality (Dhama et al., 2008). The benefits of probiotics are based on improve the microbial environment of a bird's intestinal tract by displacing harmful bacteria. Thus, the use of defined probiotic cultures in the poultry industry has recently become more common for obtaining better digestion and absorption of carbohydrates, proteins and fats, which also increases the feed conversion efficiency and increases the body's resistance to infectious diseases by offering digestible proteins, vitamins, enzymes, various antibacterial substances and other important co-factors and by decreasing gut pH by production of lactic acids. As *'live enzyme factory'* (amylase, protease, lipase). Moreover, Probiotics help in metabolism of minerals and synthesis of vitamins (Biotin, Vitamin-B1, B2, B12 and K), which are responsible for proper growth and metabolism (Dhama & Singh, 2010). Unfortunately, little information is available concerning the effect of biological supplementation on layer chicks under Egyptian condition. Therefore, the present study was carried out to evaluate the effects of biological (*B. subtilis* and *E. faecium*) supplementation on productive performance, physiological and immunological response of Hy-line layer chicks from 1 to 10 weeks of age.

Table 1 – The ingredient composition and calculated chemical analysis of the basal diet.

Ingredients composition (kg)	Ingredient percentage
Yellow corn	54.25
soy bean meal (44%)	25.00
Glutin	6.00
Vegetable oil	3.50
Dicalcium. phosphate	2.00
Limestone	8.50
DL-methionine	0.10
Sodium chloride	0.30
Yeast	0.15
Amino vet.	0.05
Zinc pacitracin	0.015
Choline chloride	0.14
Lysine	0.20
Calcium carbonate	3.50
Vitamin and min. premix[a]	0.35
Calculated chemical analysis	
Crude protein, %	23
Metabolizable energy	3100 Kcal/kg

[a] Vitamin and mineral premix (contained per Kgm):- vit A, 1200 IU; vit D 1100 IU; vit E, 12 mg; vitB12, 0.02 mg; vit B1, 1 mg; choline chloride, 0.16 mg; copper, 3 mg; iron, 30 mg; manganese, 40 mg; zinc, 45 mg; and selenium, 3 mg.

2. Materials and methods

2.1. Experimental chicks and biological supplementation

A total number of 300 one-day old, Hy-line layer chicks with the average weight of 40 g, reared at the Poultry Experimental House, Nuclear Research Center, Egyptian Atomic Energy Authority were used in the present study. Hy-line layer chicks, with the average weight of 40 g were randomly divided into three equal groups. The first group was fed a basal diet and served as a control. While the second and third groups were fed the basal diet that supplemented with the probiotic mixture (*B. subtilis* and *E. faecium*) with 1 and 2 gm/kg, respectively, until 10 weeks of age. All groups were kept at the similar conditions of room temperature and under normal periods of light/dark. Feed and water supplemented were *ad libitum* throughout the experimental period. Body weight gain and feed consumption were recorded weekly during the experiment period. Feed conversion ratio (FCR) was calculated as the ratio between feed intake and body weight gain at the end of each week. The ingredients' composition and calculated chemical analysis of the basal diet are given in Table 1. The probiotics used in the experiment were white dried powders of double strain probiotic with the content of 3.0×10^{10} cfu/g. Probiotic containing (*B. subtilis* and *E. faecium*) was purchased from "Biopellet-S" and manufactured by Samu median Co., Ltd. (South Korea).

2.2. Carcass traits and blood analysis

At the end of experimental period (10 weeks of age), six chickens from each group, were randomly selected, weighed and slaughtered for carcass analysis. Head, feather, feet and viscera for each slaughter bird were handily removed. Carcass, liver, heart, kidney, proventiculus, small intestine, thymus, spleen, and bursa of Fabricius for each slaughter bird were calculated as a relative percentage of live body weight. In addition, small intestine length was determined. Blood samples were collected from slaughtered chicks and placed in two