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Research Article

Evaluating the Effects of Dietary Inclusion of a Synbiotic Combined with Phytoactives on Egg Production, Feed Efficiency, and Profitability of BV-300 Layer Hens under Commercial Farm Conditions

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Abstract

Probiotics are being studied as performance enhancers and appropriate choices to antibiotics for poultry worldwide. The study evaluates the benefits of Synbiotic with Phytoactives Blend (SPB) on BV-300 layer bird egg production and costs. A flock size of 3400-layer birds was selected and maintained as the control group (G1), and a flock size of 9600-layer birds in the same poultry farm was selected as the SPB-supplemented group (G2). G1 and G2 were given common commercial feed, and parallel supplemented with SPB at 150 g/ton. Results revealed that Hen Housed Egg Production (HHEP) and Hen Day Egg Production (HDEP) were improved by 2.47% and 2.18% in the SPB-added group (G2) and the control group (G1), respectively. Feed conversion ratio results depicted that layer birds consumed 5 g less feed per dozen egg production in G2 as compared to G1. Furthermore, the mortality (%) was reduced by 0.50% in G2 as compared to G1. The average egg/feed and income (egg/feed) were found to be improved by Rs. 0.06 and Rs. 0.09, respectively; therefore, the client had made a total income of INR 31,772 due to SPB supplementation in a commercial layer diet of BV-300 layer birds. SPB consisting of a blend of probiotics and phytoactives at the inclusion level of 150 g/ton could be recommended for supplementation along with a commercial layer diet for the augmentation of egg production performance and the enhancement of feed efficiency in BV-300-layer birds. Furthermore, SPB was economically viable for poultry farmers.

Keywords: Egg Production; Feed Efficiency; HDEP; HHEP; Phytoactives; SPB

Introduction

The output of the chicken business has expanded greatly over the world owing to the usage of antibiotics as a growth enhancer [1]. Dietary supplementation of antibiotics in poultry birds has an impact on chicken's intestinal flora and their immunity to contain diseases [2,3]. However, unregulated or irregular utilization of antibiotics led to an increase in antibiotic resistance in bacteria, raising the susceptibility of the host to diseases. Moreover, antibiotic misuse increases the incidence of antibiotic residues in animal products, which have unfavorable effects on the animals and human health [3,4]. As a result, the use of antibiotics in animal feed has been restricted in Europe and other wealthy nations. Hence, there has been a robust quest for safer antibiotic alternatives that have the same or better impact on animal production [5].

In recent years, to enhance livestock production, the usage of synbiotics, and postbiotics to replace antibiotics extensively explored [6,7]. Probiotics are defined as supplemental live microorganisms that are sufficiently concentrated to enter the intestines in an active state and have a favorable impact on an animal's health [8]. Probiotics are usually made of natural microbes with beneficial antimicrobial activity to the host [9]. They improve digestive system balance, gut maturation, immune function, and inflammation, and enhance feed intake and digestion by balancing bacterial enzymes and neutralizing enterotoxins. Probiotics benefit poultry of all ages and classes [10,11]. They enhance the health and productivity of animals and do not leave residues in animal products (milk, meat, and eggs) [12].

Intestinal health, gut flora stability, and pathogen colonization are all demonstrated to be improved by probiotics, which have been recommended as an appealing antibiotic alternative [13,14]. Previous research has shown that adding probiotics to the diet can increase egg production while also enhancing feed conversion efficiency, enhancing hen performance, and enhancing eggshell quality [15,16]. Probiotics have also been shown to promote intestinal T-cell immunity, regulate synbiotic bacterial colonization, and increase the number of intestinal goblet cells [17,18]. SPB, is a supplement containing probiotics, prebiotics, and botanicals, to improve layer bird production. The study assessed egg production and cost implications of SPB feeding in commercial farm situations.

Material and Methods

Synbiotic with phytoactives blend (SPB)

SPB is a proprietary polyherbal preparation of HimFlora developed by M/s. Himalaya Wellness Company, Bengaluru, Karnataka, India. HimFlora contains prebiotic polysaccharides from ginger and yeast -glucan, as well as probiotics such as *Bacillus subtilis*, *Bacillus coagulans*, *Bacillus pumilus*, and *Bacillus polymyxa*, herbal actives such as *Zingiber officinale*, and extract of *Curcuma longa*.

Approval from animal ethics

The current study was carried out in congruity with the guidelines for animal care and use, and protocol approval was obtained by the Institutional Animal Ethics Committee protocol no: AHP/ P/12/22.

Experimental birds and diets

The study was conducted at Barwala Poultry Farm, Chandigarh. A flock size of 3400 layer birds was selected and maintained as the control group (G1), and another flock size of 9600 layer birds in the same poultry farm was selected as the SPB supplemented group (G2). G1 and G2 were fed standard commercial feed, and G2 was supplemented with SPB at a rate of 150 g/ton (Table 1). The experimental meal was prepared using the current nutritional criteria for BV-300-layer birds (Table 2).

General husbandry practices for layer birds

The standard BV-300-layer bird management practices were followed during the experimental course. Experimental birds were reared in the cage system, i.e., the stair step cage system with each cage consisting of four birds. The approximate size of each cage is 18” × 12” × 15” (length × width × height). Feeders and nipple drinkers were fitted with each cage. Throughout the study period, layer birds were given free access to chlorine drinking water. The birds were fed layer mash on an ad libitum basis. The normal immunization protocol for BV-300-layer birds was followed.

Group	Supplementation	Supplementation duration	Number of birds/groups
G1: Control	Normal commercial feed	74 days	3400
G2: SPB	Normal commercial feed + SPB @ 150 g/ton feed	74 days	9600

Table 1: Study design.

Parameters Composition	
Metabolizable energy (kcal/kg)	2500.00
Crude protein (%)	17.570
SID amino acids (%)	
Methionine	0.41
Lysine	0.76
Met + cyst	0.65
Threonine	0.53
Tryptophan	0.17
Arginine	1.02
Calcium (%)	4.00
Available Phosphorus (%)	0.40
Potassium (%)	0.68
Sodium (%)	0.18
Chloride (%)	0.20
Choline (ppm)	1340
Linolenic acid (%)	1.86

Table 2: Nutrient composition of the BV-300 layer diet.

Assessment parameters

- **Production performance parameters:** In the control and supplemental groups, hen day egg production (HDEP), hen housed egg production (HHEP), feed conversion ratio (FCR)/dozen eggs, and mortality rate (%) were assessed weekly, and cumulative production performance results were collected to evaluate the effects of adding SPB to the BV-300 commercial layer bird’s diet on production performance parameters.
- **Cost-Effectiveness parameters:** The average egg per feed income (avg. egg/feed income) and average income egg per feed (avg. income egg/feed) were calculated to assess the cost-effectiveness of feeding BV-300 layer birds with SPB.

Results and Discussion

The effects of SPB on cumulative performance parameters and cost implications in BV-300 layer birds are represented in table 3.

Groups	T1 Control	T2 SPB (150 g/ton)	Difference	% Increase
Production performances				
HHEP	63.13	65.55	2.42	3.83
HDEP	66.23	68.41	2.18	3.29
FCR/doz. eggs	1.47	1.42	−0.05	-
Mortality %	4.74	4.24	−0.50	-
Cost implications				
Average egg/feed	1.17	1.23	0.06	-
Average income (egg/feed)	1.00	1.09	0.09	-
Total income, INR (from egg sale)	8, 36, 959	8,68, 731	31772	-

Table 3: Effects of SPB on cumulative performance parameters and cost implications of BV-300 layer birds.

Values are expressed as means.

Results inferred that performance parameters, *viz.* HHEP, HDEP, and FCR/dozen eggs of BV-300 layer birds, were found to be improved following an SPB supplementation at 150 g/ton. HHEP and HDEP improved by 2.42% and 2.18%, respectively, in the SPB-supplemented (G2) and control (G1) groups. The results of FCR depicted that layer birds consumed 5g lesser feed per dozen egg production in G2 as compared to G1. Furthermore, the mortality (%) was reduced by 0.50% in G2 as compared to G1 (4.74%). The average egg/feed and income (egg/feed) were found to be improved by Rs. 0.06 and Rs. 0.09, respectively, and as a result, the client had made a total income of INR 31, 772/- due to SPB supplementation in the commercial layer diet of BV-300-layer birds.

The overuse of antibiotics in poultry farms has increased safety risks and decreased egg quality. Antibiotic resistance is a major global health threat [19]. Therefore, there is a critical need for antibiotic alternatives like probiotics. This study aims to evaluate how feeding SPB affects egg production in BV-300-layer birds on commercial farms and assess the cost implications.

The results of the current study showed that performance parameters, *viz.* HHEP, HDEP, FCR/dozen eggs of BV-300 layer birds, were found to be improved following SPB supplementation at 150 g/ton. The results could be mainly ascribed to the probiotics, *viz. Bacillus subtilis, Bacillus coagulans, Bacillus pumilus,* and *Bacillus polymyxa,* herbal actives, *Curcuma longa* extracts, *Zingiber officinale*, and prebiotics yeast β-glucan.

Ribeiro., *et al.* 2014, and Peralta-Sánchez., *et al.* 2019 [20,21], reported the use of probiotics in layer diets augments egg production performances. In comparison to the control, Abdelqader., *et al.* 2013 [22]. found that B. subtilis feeding (maximum 2.3 108 cfu/g) considerably increased egg production. A review of the literature findings, B. pumilus, and B. subtilis improved gut health by positively impacting intestinal shape and gut flora, which enhances production capabilities [23,24]. According to several investigators who published their findings in the literature, B. coagulans supplementation increased the FCR by promoting the production of endogenous enzymes including amylase, protease, and lipase, which in turn improves feed availability, digestibility, and intestinal peristalsis [25-28]. Additionally, a recent study by Ebtihal., *et al.* 2023 [29], showed that the inclusion of probiotics of various Bacillus strains to broiler diets boosted the profitability of production by promoting bird growth, improving feed intake, and improving the health of gut mucosa and immune organs. In addition, Raka., *et al.* 2014 [30] showed that *Lactobacillus* spp. and Bacillus spp. as a mixed culture liquid probiotic fed to ISA brown layers showed an increase in egg production. In summary, previous studies have reported that the addition of probiotics to the diet of laying hens promotes egg production either by increasing the number of eggs or by maintaining production. Thus, the effects of improving egg production efficiency observed in our study after the addition of SPB at 150 g/ton BV-300 birds can be largely attributed to probiotics, e.g., B. subtilis, B. coagulans, B. pumilus and B. polymyxa found in SPB.

Zingiberaceae plants, particularly *Zingiber officinale* Rosc, have been used in dietary cuisines and traditional oriental medications for over 2000 years [31,32]. Turmeric rhizome powder is used for color, flavor, and treatment of inflammatory conditions and diseases [33]. Malekizadeh., *et al.* 2012 reported that *Zingiber officinale* and C. longa rhizome powders as herbal additives have some positive effects on the production of laying hens. *Zingiber officinale* rhizome powders at a dose of 1% increased egg production and significantly reduced FCR.

Moreover, Van Phuoc and others, 2019 [34], that the addition of C. longa extracts improved the production of Ac "Black bone" chickens [34]. Park., *et al.* 2012 [35]. stated that egg production improved by 0.5% in eggs supplemented with C. longa as compared to the control group. Even with the literature findings, our research results also described that the addition of SPB and *Z. officinale,* and *C. longa* resulted in the augmentation of egg production performances and feed efficiency.

Furthermore, Wang *et al*., recently characterized two heteropolysaccharides from the rhizomes of *Z. officinale* [36]. Similarly, the augmentation of egg production performances in BV-300-layer birds observed in our study would be attributable to these heteropolysaccharides. Moreover, improvement in egg production of BV-300-layer birds observed in this study even at high ambient temperatures following SPB supplementation could be solely accredited synergetic effects of synbiotic and phytoactives present in SPB.

Conclusions

It was proven from this feeding trial that dietary inclusion of SPB at the level of 150 g/ton in commercial layers as a blend of probiotics, *viz.* B. subtilis, B. pumilus, B. coagulans, B. polymyxa, herbal actives, Z. officinale, and C. longa, causes augmentation of the egg production performance and enhancement of feed efficiency, and thereby SPB was economically viable for poultry farmers. This study shows SPB improves egg production in BV-300-layer birds.

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Conflicts of Interest

There is nothing to declare.

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