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# Effect of Synbiotics Feeding in Egg Type Chick Diet with Varying Protein and Energy Levels during Hot-Dry Summer

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## ABSTRACT

*A study was conducted to evaluate the effects of dietary inclusion of synbiotics (mannan-oligosaccharides-MOS & probiotics- Bacillus subtilis and Bacillus amyloliquefaciens) at different energy and protein level on performance of egg-type chicks during hot-dry summer (April-May, Temperature - 28.0 ± 0.12$^0$C to 35.25 ± 0.37$^0$C, RH, %: 68.95±0.90 to 79.15±0.61). After feeding a standard diet from 0-21 days of age, the chicks were randomly distributed into four dietary treatment groups viz., $T_1$ with high energy 2800 kcal ME/kg and high protein 18% (HEHP), $T_2$ with HEHP diet with synbiotics (MOS @ 0.2% + probiotics premix Protimix @ 0.025 %), $T_3$ with low energy 2700 kcal ME/kg low protein 17.34% (LELP) and $T_4$ with LELP diet with synbiotics (MOS @0.2% + probiotics premix Protimix @0.025 %). Each treatment was fed to fifty birds divided in five replicates of ten each from 22-63 days of age. Feed intake and body weight changes were recorded at weekly interval. The yield of immune organs, blood biochemical profile and intestinal histomorphometry were measured at 42$^{nd}$ and 63$^{rd}$ day post-hatch. Feed intake and feed conversion ratio (feed; gain FCR) improved (P<0.05) in HEHP+ synbiotics group. H:L ratio reduced (P<0.05) in synbiotics fed group. The relative yields of immune organs like thymus, spleen & bursa were significantly (P<0.05) higher in synbiotics supplemented groups. Total protein (P<0.001), SGOT (P<0.001), SGPT (P<0.001), creatinine were significantly (P<0.05) improved, while cholesterol, uric acid & ALP values were significantly (P<0.001) reduced in birds fed synbiotics supplemented diets. Villus height & crypt depth improved significantly (P<0.001) in synbiotics supplemented group. Thus it was concluded that high energy (2800 kcal ME/kg) and high protein (18% CP) diet along with inclusion of synbiotics was beneficial for egg type starting chicks during dry summer.*

***Key words:*** *Egg Type Chicks, Heat Stress, Synbiotics, Nutritional Plane*

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## INTRODUCTION

As body weight at sexual maturity is an important criterion for sustainable egg production in laying hens. But in tropical countries, especially in India, high temperatures is an obstacle to achieve such body weight of summer hatched chicks due to reduced feed intake as a result egg production, egg weight and eggshell thickness are reduced resulting in deteriorating efficiency of egg production[36] . Antibiotics have been used to improve growth rate, feed conversion ratio (FCR) and gut health. However, world- wide rejection on use of antibiotics in poultry diets as growth promoter has resulted in search for alternatives for reducing entero-pathogens, antibiotics residues, balancing gut microflora and promoting growth of beneficial intestinal microflora.

Probiotics are "live microorganisms, which when befit on the host"[4] , while prebiotics are referred to non-digestible food ingredients that act as substrate for growth of beneficial bacteria in the gut of host. Synbiotics is referred to combination of probiotics and prebiotics in the form of synergism as prebiotics act food for probiotics favouring survivability of favourable organisms in the digestive system. Without the necessary food source for the probiotics, it will have a greater intolerance for oxygen, low pH, and temperature[5]. Several dietary strategies such as use of nutritional agents like MOS and probiotic (*Bacillus substalis* & *bacillus amyloliqufacies*) received considerable interest in poultry feeding as a novel feed additive to reduce thermal stress in broiler chickens[33,37]. Extremely high environmental temperatures occur during May to September in the subtropics zone of the world, and these temperatures induce devastating effects on performance, general health status, and nutrient utilization of birds. From this perspective, the present study was conducted to investigate the potential effect dietary incorporation of synbiotics as a means of ameliorative strategies against the adverse effects of seasonal heat stress on overall growth performance and specific immunity during starting stage besides nutritional plane considering compensation of decrease in feed intake.

## MATERIALS AND METHODS

A feeding trial was conducted during 0 to 63 days of age in layer starting chicks to study the efficacy of synbiotics (mannan-oligosaccharides- MOS & probiotics- *Bacillus subtillis*, *Bacillus amyloliquefaciens*) on performance during hot-dry summer (April-May, 28±0.12$^0$C to 35.25 ± 0.37$^0$C, Rh%: 68.95±0.90- to 79.15 ± 0.61) involving day-old CARI Sonali laying chicks (n=200). After feeding a standard diet for 0-21d of age, the chicks were randomly distributed into four dietary treatment groups viz., T1 with high energy 2800 kcal ME/kg and high protein 18% (HEHP), T2 with HEHP diet & synbiotics (MOS @0.2% + Probiotics @0.025 %), T3 with low energy 2700 kcal ME/kg low protein 17.34% (LELP) and T4 with LELP diet and synbiotics (MOS @0.2% + Probiotics @0.025 %). The probiotics premix supplied $10^6$ cfu/g of feed. Each treatment was subjected to fifty birds divided in five replicated groups of ten each. The ingredient and chemical composition of the diets are presented in Table 1.

Data on growth performance in the control and experimental groups were recorded every week from 22–63$^{rd}$ days of age. Lymphoid organ weights (bursa of Fabricius, spleen and thymus) were recorded on 42$^{nd}$ and 63$^{ed}$ days of age and expressed as percent (relative yield) of live weight. Blood samples (1ml) were collected from the wing vein using 24 gauge needles in $K_3$-EDTA tubes on 42$^{nd}$ and 63$^{rd}$ day of age. Haemoglobin concentration (g/dl) in the whole blood was estimated by cyanomethemoglobin method. Blood smears prepared from fresh blood smear were stained by Geimsa stain (1:9 Dilution for 45 min) to calculate Heterophil to lymphocyte (H:L) ratio. Serum samples were separated after blood collection and subjected to different blood biochemical tests like Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), total protein and total cholesterol using standard KIT. On 42nd and 63rd day after slaughter jejunum samples were collected and histomorphology of villas height depth and ratio was observed. The data were analyzed following 2 X 2 factorial design.

## RESULTS AND DISCUSSION

The body weight gain (Table 2) did not differ significantly at any growth phase due to plane of nutrition, inclusion of synbiotics or their interaction. However, feed intake differ (P<0.001) due to incorporation of synbiotics in diet in all the growth phases and plane of nutrition during 42nd and 63rd d of age, while interaction was not significant at any growth phase. The feed conversion ratio (FCR) differed (P<0.001) due to synbiotics as well as plane of nutrition in all the phases (22 to 42, 43 to 63 or 22 to 63d of age) but interaction of these two major effects did not influence FCR (Table 2). The birds with synbiotics fed diet had lower feed intake in all the growth phases. Similar to the present findings, Sohail *et al.*[15] reported that in hot humid environment supplementation the probiotic along with MOS helped in reduction of heat stress and improvement of FI, FCR and BWG of the birds. The significant improvement in the body weight during the finisher phase in probiotic and prebiotic supplemented birds may be attributed to a better microbial environment in the gut and higher enzymatic activity which in turn have enhanced digestion, absorption and utilization of feed[27]. The rise in BW gain in supplemented broilers is believed to be a cumulative effect of prebiotic and probiotic, which serve to promote beneficial bacteria, intestinal function, and disease resistance[7]. Moreover, oligosaccharides improved appetite and feed consumption in broilers, which eventually increased body weight gain and feed efficiency[6]. It is reasonable to assume that improved beneficial microbial environment in the gastrointestinal tract might have translated into decreased overall stress.

Though body weight gain did not differ due to dietary plane but the values were apparently higher in HEHP diet. In contrary, body weight increased by increasing protein level from 18% to 20% CP[42]. In the present study increment of protein was much less and the ratio of energy to protein remained similar, which might be the possible reasons for similar gain in body weight. Feed intake increased in low energy low protein diet, which may be attributed to dietary energy concentration. The feed intake increased significantly with low energy diet (2600 vs. 2800 kcal ME /kg) but there was no change in total feed intake by increasing crude protein levels from 18 to 22 % at any energy level[42]. Feed conversion ratio was significantly (P<0.05) poorer in low energy low protein diet as in earlier experiment FCR remained poorer than in high energy level in Cari Sonali chicks, and feed conversion ratio tended to be higher at low protein (18%) diet[42].

Supplementation of synbiotics caused significant improvement in relative weights of spleen, thymus and bursa during 42nd and 63rd d post-hatch during hot humid climate (Table 2). There was no interaction and different energy protein level effect. Awad *et al.*[24], found similar results in broilers supplemented with synbiotics having higher immune organ weight. In accordance, Kabir *et al.*[31] reported that probiotic and prebiotic supplementation showed higher (P<0.01) bursa yield as compared to control. Bursa and thymus are central lymphoid organs in the chicken essential to the development of adaptive immunity in the chicken and the relative higher weight correlates wide spread lymphoid population. During heat stress the relative organ weight of the bursa of Fabricius, spleen, and thymus decreases[8]. A glucocorticoid-dependent mechanism during stress was reported to induce lymphoid organ involution[9]. In the present study, the increase in immune organ yield indicated that supplementation of probiotics reduced the adverse effect of heat stress. Plane of nutrition did not influence immune organs as protein or energy was not deficient in the diet. Moreover, the ratio of energy to protein remained similar.

In the present study, lower (P<0.001) H:L ratio was observed in synbiotics fed bird as compared to control birds in HEHP and

LELP feed during 42nd and 63rd d of age (Table 4 and Table 5). Rahimi and Khaksefidi[10] also observed similar results that supplementation of *Bacillus Subtilis* CH201 and *Bacillus linchioformis* CH200 during heat stress lowered H: L ratio in comparison to un-supplemented group. Probiotic administration has been found to enhance antibody responses[12] as well as leukocytes count in birds reared under hot temperature. In summer the probiotic supplementation was found effective in reducing the H: L ratio[11]. During stresses the H: L ratio increases because of increase in the stimulation of adrenal gland to produce some hormones such as estrone that increases H: L ratio. The present results were in concurrence with the observation of Hanamanta *et al.*[30] who reported an increase in total leukocyte count on supplementation with a viable lactic acid bacteria in diet.

The serum total protein was significantly (P<0.001) higher in synbiotics supplemented birds as compared to control in both HEHP and LELP birds at 42nd and 63rd d of age during hot dry summer (Table 4 and 5). In accordance with the present report, Mashaly *et al.*[36] observed that exposure to high temperature decreased plasma protein concentration; this serum protein level was increased by supplementation of antioxidant or probiotics. Also Haldar *et al.*[13] observed that yeast (*Saccharomyces cerevisiae*) and yeast protein concentrated supplement increase the serum protein concentration in heat stressed birds. It has been reported that exposure to high temperature decreased plasma protein concentration[14]. The increase in serum protein in present study may be due to dietary supplementation of synbiotics improved the whole body protein anabolism and reduced stress.

Synbiotics supplementation reduced (P<0.001) the serum cholesterol concentration at 42nd and 63rd of age as compared to control birds in both HEHP and LELP during hot-dry summer. Sohail *et al*.[15] observed that lower serum cholesterol concentration was observed in the lactobacillus based probiotic along with MOS supplemented groups compared with the unsupplemented counterpart. Similar findings have also been reported by Abdulrahim *et al*[16]. in layers supplemented with probiotics. Probiotics (Protexin® Boost) might have stimulated the disintegration of bile salts and de-conjugate production of enzymes by their activity as well as reduction of the pH in the intestinal tract, which could be effective in reducing the cholesterol concentration during high environmental temperature[21]. The low serum cholesterol concentration in the supplemented groups might be due to cholesterol digestion by probiotic bacteria[17].

During 42nd and 63rd d of age, aspartate aminotransferase **(**AST) and alanine aminotransferase (ALT) levels increased significantly (P<0.001) with higher concentration in synbiotics fed birds as compared to control birds in both HEHP and LELP feed. Sohail *et al.*[15] found that supplementation of *Lactobacillus* based probiotic and mannan-oligosaccharides during heat stress in broilers resulted into significant increase in AST as well as ALT serum values. Similar to the present study, Rokade *et al.*[37] reported significant increase in AST as well as ALT serum values due to MOS supplementation in heat stressed birds. In present study, increase in AST and ALT is associated with reducing the deleterious effect of heat stress and promoting protein synthesis.

Synbiotics supplementation significantly (P<0.001) reduced the serum alkaline Phosphates concentration during 42nd and 63rd d of age as compared to un-supplemented control birds in both HEHP and LELP during hot summer. The decrease in serum alkaline phosphatase (ALP) activity obtained in the present study was in agreement with Hatab *et al.*[18], who reported that significant decrease in the activities of serum ALP of the layer in *Bacillus subtilis* and *Enterococcus faecium* supplemented group when compare to control. Aluwong *et al.*[26], reported a significant decrease in the activities of serum alkaline phosphatase of the broiler chickens in all the yeast supplemented groups, compared with the control. Vahdatpour *et al*[20]., also reported depressed ALP activity in quails fed probiotic supplemented diet as compared to control.

Synbiotics supplementation significantly (P<0.001) reduced the serum uric acid concentration at 42nd and 63rd day of age as compared to un-supplemented (control) birds in both HEHP and LELP during hot-dry summer. During of 42nd and 63rd d age, creatinine levels increased significantly (P<0.001) with supplementation of synbiotics fed birds as compared to control birds in both HEHP and LELP. Kamgar[32] also observed significant decrease in uric acid level in the synbiotics treated groups than in control. The significant decrease in uric acid level in the present study indicated beneficial effect of the synbiotic on the kidney function. Moreover, certain probiotic microorganisms can utilize urea, uric acid and creatinine and other toxins as its nutrients for growth[38]. Any abnormal increase in serum levels of uric acid and creatinine may imply kidney damage[44]. Therefore, the relatively lower serum levels of uric acid and creatinine may be associated with renal protective effects of the synbiotic.

During 42nd and 63rd d of age, villus height increased (P<0.001) with higher value in synbiotics fed birds as compared to control birds in both HEHP and LELP feed. Synbiotics supplementation significantly (P<0.001) reduced the crypt depth during 42nd and 63rd d of age as compared to control birds in both HEHP and LELP feed during hot-dry summer. Similarly, Awad *et al.*[24], found that supplementation of diet with synbiotics increased the villus height and villus height: crypt depth ratio in broiler chickens. A shortening of the villi and deeper crypts may lead to poor nutrient absorption, increased secretion in the gastrointestinal tract, and lower performance[23]. Therefore, higher villus height might have fovoured nutrient utilization and thus feed conversion efficiency. Moreover, fermentation products of probiotic bacteria consists of several short-chain fatty acids, believed to exert effects on the intestinal microarchitecture[43], Therefore, the improvement in histology of intestine could possibly be the total effect of synbiotics supplementation during heat stress.

**Table 1: Ingredients and nutrient composition of basal diet used HEHP and LELP for hot and hot-humid summer**

| Ingredients (kg/100kg) | HEHP | LELP |
|---|---|---|
| Yellow maize | 55.8 | 50.7 |
| DORB | 12.935 | 21.475 |
| Soybean meal | 18.7 | 15.3 |
| Rapeseed meal | 5 | 5 |
| Roasted gure | 5 | 5 |
| Limestone powder | 1 | 1.1 |
| Dicalcium phosphate | 0.95 | 0.75 |
| Common salt | 0.3 | 0.3 |
| Lysine | 0 | 0.06 |
| TM premix 1 | 0.1 | 0.1 |
| Vit premix 2 | 0.15 | 0.15 |
| B comp | 0.015 | 0.015 |
| Ch Chloride | 0.05 | 0.05 |
| Total | 100 | 100.0 |
| Nutrient composition (As fed basis) | | |
| ME, kcal/kg*** | 2800.41 | 2700.32 |
| Crude Protein, %** | 17.99 | 17.33 |
| Lysine,%*** | 0.85 | 0.85 |
| Methionine,%*** | 0.33 | 0.33 |
| Threonine | 0.83 | 0.77 |
| Calcium,%** | 1.02 | 1.01 |
| Total Phosphorus,%** | 0.75 | 0.75 |
| Available Phosphorus, %*** | 0.45 | 0.45 |

Trace mineral premix includes 0.1, vitamin premixes 0.15. Trace mineral premix supplied Mg- 300, Mn- 55, I- 0.4, Fe- 56, Zn-30 and Cu- 4 mg/kg diet. The vitamin premixes supplied vitamin A 8250 IU, vitamin $D_3$ 1200 ICU; vitamin K 1 mg; vitamin E 40 IU, vitamin $B_1$ 2 mg, vitamin $B_2$ 4 mg, vitamin $B_{12}$ 10 mcg; niacin 60 mg; pantothenic acid 10 mg and choline chloride 500 mg/kg diet.

Representative samples of practical feed ingredients and test diets used in the study were analyzed (AOAC 1990).

**Table 2: Body weight gain, feed intake and feed conversion ratio in different treatments**

| EP | Synbiotics | BWG (3-6wk) | BWG (6-9wk) | BWG (3-9wk) | FI (3-6wk) | FI (6-9wk) | FI (3-9wk) | FCR (3-6wk) | FCR (6-9wk) | FCR (3-9wk) |
|---|---|---|---|---|---|---|---|---|---|---|
| HEHP | 0 | 233.1 | 363.1 | 595.6 | 773 | 1276 | 2024 | 3.35 | 3.58 | 3.46 |
| HEHP | 0.225 | 242.4 | 400.1 | 641.2 | 737 | 1151 | 1825 | 3.08 | 2.89 | 2.90 |
| LELP | 0 | 226.9 | 365.9 | 593.0 | 837 | 1393 | 2186 | 3.39 | 3.56 | 3.45 |
| LELP | 0.225 | 241.3 | 367.7 | 611.8 | 739 | 1163 | 1889 | 3.18 | 3.10 | 3.05 |
| SEM | | 2.85 | 7.82 | 9.83 | 7.18 | 31.37 | 33.29 | 0.05 | 0.05 | 0.02 |
| HEHP | | 237.7 | 381.6 | 618.4 | $755^{b}$ | $1213.5^{b}$ | $1924^{b}$ | $3.21^{b}$ | $3.23^{b}$ | $3.18^{b}$ |
| LELP | | 234.1 | 366.8 | 602.4 | $788^{a}$ | $1278^{a}$ | $2037^{a}$ | $3.28^{a}$ | $3.33^{a}$ | $3.25^{a}$ |
| Synbiotics | 0 | 230.0 | 364.5 | 594.3 | $805^{x}$ | $1334^{x}$ | $2105^{x}$ | $3.37^{x}$ | $3.57^{x}$ | $3.45^{x}$ |
| Synbiotics | 0.225 | 241.8 | 332.59 | 626.5 | $738^{y}$ | $1157^{y}$ | $1857^{y}$ | $3.13^{y}$ | $2.99^{y}$ | $2.97^{y}$ |
| Probability | | | | | | | | | | |
| EP | | NS | NS | NS | P<0.03 | P<0.03 | P<0.03 | P<0.03 | P<0.03 | P<0.02 |
| Synbiotics | | NS | NS | NS | P<0.001 | P<0.001 | P<0.003 | P<0.02 | P<0.001 | P<0.001 |
| EP X Synbiotics | | **NS** | NS | NS | NS | NS | NS | NS | NS | NS |

[abxy]Values bearing different superscript differed significantly (P<0.01); NS, Non significant.

**Table 3: Yield of immune organs (Percent of body weight) in different treatments**

| EP | Synbiotics (%) | 6 week | | | 9 week | | |
|---|---|---|---|---|---|---|---|
| | | Thymus | Bursa | Spleen | Thymus | Bursa | Spleen |
| HEHP | 0 | 0.268 | 0.123 | 0.205 | 0.379 | 0.108 | 0.187 |
| | 0.225 | 0.355 | 0.158 | 0.272 | 0.457 | 0.170 | 0.252 |
| LELP | 0 | 0.278 | 0.126 | 0.225 | 0.529 | 0.109 | 0.247 |
| | 0.225 | 0.362 | 0.134 | 0.247 | 0.421 | 0.165 | 0.276 |
| SEm | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 |
| HEHP | | 0.311 | 0.140 | 0.238 | 0.418 | 0.139 | 0..219 |
| LELP | | 0.320 | 0.130 | 0.236 | 0.475 | 0.137 | 0.261 |
| Synbiotics | 0 | $0.273^{x}$ | $0.124^{x}$ | $0.215^{x}$ | $0.454^{x}$ | $0.108^{x}$ | $0.217^{x}$ |
| Synbiotics | 0.225 | $0.358^{y}$ | $0.146^{y}$ | $0.259^{y}$ | $0.339^{y}$ | $0.137^{y}$ | $0.264^{y}$ |
| Probability | | | | | | | |
| EP | | NS | NS | NS | NS | NS | NS |
| Synbiotics | | P>0.001 | P>0.001 | P>0.001 | P>0.003 | P>0.003 | P>0.000 |
| EP X Synbiotics | | NS | NS | NS | NS | NS | NS |

[abxy]Values bearing different superscript differed significantly (P<0.01); NS, Non significant.

**Table 4: Blood biochemical parameter and H:L ratio at 6 weeks of age in different treatments**

| EP | Synbiotics | Protein | SGOT | SGPT | Cholesterol | Uric acid | Alkaline P | Creatine | H:L ratio |
|---|---|---|---|---|---|---|---|---|---|
| HEHP | 0 | 3.09 | 71.34 | 2.87 | 167.30 | 5.40 | 42.87 | 0.72 | 0.45 |
| | 0.225 | 4.19 | 102.52 | 3.67 | 129.23 | 3.55 | 31.03 | 0.79 | 0.37 |
| LELP | 0 | 2.95 | 73.29 | 2.43 | 171.21 | 5.49 | 43.12 | 0.70 | 0.46 |
| | 0.225 | 3.86 | 102.34 | 3.65 | 138.23 | 3.79 | 34.98 | 0.78 | 0.41 |
| Sem | | 0.04 | 0.61 | 0.07 | 0.81 | 0.07 | 0.74 | 0.01 | 0.01 |
| HEHP | | 3.64[a] | 86.93 | 3.27 | 148.26 | 4.47 | 36.95 | 0.75 | 0.41 |
| LELP | | 3.40[b] | 87.81 | 3.04 | 154.72 | 4.64 | 39.05 | 0.74 | 0.43 |
| Synbiotics | 0 | 3.02[x] | 72.31[x] | 2.65[x] | 169.25[x] | 5.44[x] | 42.99[x] | 0.71[x] | 0.45[x] |
| Synbiotics | 0.225 | 4.02[y] | 102.43[y] | 3.66[y] | 133.73[y] | 3.67[y] | 33.99[y] | 0.78[y] | 0.39[y] |
| Probability | | | | | | | | | |
| EP | | NS | NS | NS | NS | NS | NS | NS | NS |
| Synbiotics | | P>0.000 | P>0.000 | P>0.000 | P>0.000 | P>0.000 | P>0.00 | P>0.00 | P>0.003 |
| EP X Synbiotics | | NS | NS | NS | NS | NS | NS | NS | NS |

[abxy]Values bearing different superscript differed significantly (P<0.01); NS, Non significant

**Table 5: Blood biochemical parameter and H: L ratio at 9weeks of age in different treatments**

| EP | Synbiotics | Protein | SGOT | SGPT | Cholesterol | Uric acid | Alkaline P | Creatine | H:L ratio |
|---|---|---|---|---|---|---|---|---|---|
| HEHP | 0 | 3.76 | 71.97 | 2.82 | 173.40 | 5.49 | 52.52 | 0.76 | 0.40 |
| | 0.225 | 5.50 | 104.32 | 3.58 | 130.81 | 3.86 | 34.49 | 0.71 | 0.35 |
| LELP | 0 | 3.72 | 75.37 | 2.98 | 175.13 | 5.67 | 52.63 | 0.75 | 0.39 |
| | 0.225 | 5.60 | 106.71 | 3.72 | 132.94 | 3.72 | 36.75 | 0.70 | 0.36 |
| SEm | | 0.08 | 0.98 | 0.09 | 1.51 | 0.08 | 0.79 | 0.01 | 0.01 |
| HEHP | | 4.63 | 88.14 | 3.20 | 151.10 | 4.67 | 43.50 | 0.73 | 0.37 |
| LELP | | 4.66 | 91.04 | 3.35 | 154.03 | 4.69 | 44.69 | 0.72 | 0.37 |
| Synbiotics | 0 | 3.74[x] | 73.67[x] | 2.90[x] | 174.26[x] | 5.58[x] | 55.57[x] | 0.75 [x] | 0.39[x] |
| Synbiotics | 0.225 | 5.55[y] | 105.5[y] | 3.65[y] | 131.87[y] | 3.79[y] | 35.62[y] | 0.70 [y] | 0.35[y] |
| Probability | | | | | | | | | |
| EP | | NS | NS | NS | NS | NS | NS | NS | NS |
| Synbiotics | | P>0.00 | P>0.00 | P>0.00 | P>0.00 | P>0.00 | P>0.00 | P>0.04 | P>0.01 |
| EP X Synbiotics | | NS | NS | NS | NS | NS | NS | NS | NS |

[abxy] Values bearing different superscript differed significantly (P<0.01); NS, Non significant

**Table 6: Intestinal histomorphology at 6th and 9th weeks of age in different treatments**

| EP | Synbiotics | 6 week | | | 9 week | | |
|---|---|---|---|---|---|---|---|
| | | Height | Depth | Ratio | Height | Depth | Ratio |
| HEHP | 0 | 956.9 | 172.8 | 5.53 | 2195.3 | 285.9 | 7.67 |
| | 0.225 | 997.7 | 163.4 | 6.10 | 2167.8 | 259.9 | 8.34 |
| LELP | 0 | 946.5 | 176.8 | 5.35 | 2153.4 | 287.7 | 7.48 |
| | 0.225 | 987.6 | 149.9 | 6.58 | 2179.5 | 261.0 | 8.35 |
| Sem | | 1.50 | 0.32 | 0.01 | 1.92 | 2.12 | 0.07 |
| HEHP | | 977.3 | 168.1 | 5.81 | 2181.5 | 272.9 | 8.00 |
| LELP | | 967.0 | 163.3 | 5.96 | 2166.4 | 274.3 | 7.91 |
| Synbiotics | 0 | 951.7$^{x}$ | 174.8$^{x}$ | 5.44$^{x}$ | 2174.3$^{x}$ | 286.8$^{x}$ | 7.57$^{x}$ |
| Synbiotics | 0.225 | 992.6$^{y}$ | 156.6$^{y}$ | 6.34$^{y}$ | 2173.6$^{y}$ | 260.4$^{y}$ | 8.34$^{y}$ |
| Probability | | | | | | | |
| EP | | NS | NS | NS | NS | NS | NS |
| Synbiotics | | P>0.00 | P>0.00 | P>0.00 | P>0.00 | P>0.00 | P>0.00 |
| EP X Synbiotics | | NS | NS | NS | NS | NS | NS |

$^{abxy}$ Values bearing different superscript differed significantly (P<0.01); NS, Non significant

## CONCLUSIONS

Based on the results, it was concluded that high energy (2800 kcal ME/kg) and high protein (18% CP) diet was beneficial for egg type starting chicks during dry summer. Moreover, inclusion of synbiotics @ 0.225% gave further advantage to improve performance and reduce thermal stress as evidenced through zoo-technical indices and blood biochemicals.

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