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COMPARATIVE STUDY ON EFFECT OF TURMERIC POWDER, PROBIOTIC AND PREBIOTIC SUPPLEMENTATION ON BROILER PERFORMANCE AND IMMUNITY

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Received: 30 September 2019; **Accepted:** 31 October 2019

ABSTRACT

Emerging role of Probiotic, Prebiotic and herbal additives in poultry industry should be considered to overcome abuse of antibiotics. The present research accomplished to scrutinize effectiveness of Curcumin, Probiotic and Prebiotic in broilers productivity. Body weight/gain, feed intake, conversion efficacy, hematological analysis and immune-assay were evaluated. 150 chicks were divided into 5 groups, 3 supplemented separately with the mentioned additives in the feed for 5 weeks and the left were fed on basal diet without additives, 4 groups were vaccinated against avian influenza and infectious bursitis. Results exhibited that Curcumin Probiotic and Prebiotic boosted body gain significantly ($p<0.05$), at the end of the study 1948.83g, 1950.83g and 1914.03g, respectively, comparing with control 1750.60g and 1772.20g for vaccinated group. Curcumin and Probiotic supplemented groups presented higher packed cell volume (34.09%, 34.08%), red blood cells count (2.49 10^6/µl, 2.50 10^6/µl), white blood cells count (31.95 10^3/µl, 31.91 10^3/µl) and hemoglobin (8.78g/dl, 8.78g/dl) than Prebiotic (32.69%, 2.40 10^6/µl, 31.45 10^3/µl, 8.48dl) and other groups at 3 weeks old. Moreover, ELISA showed that both Curcumin and Probiotic statistically had highest antibody titer for avian influenza (1606.30 and 1592.83), while probiotic had the highest titer 2374.73 for infectious bursitis. Results of current study concluded that the inclusion of Curcumin, Probiotic and Prebiotic not only advanced performance parameters but also improved hematological indices and immunological reaction of broilers. It is advisable to evaluate the cost efficacy to compromise these results.

Key words: *Curcumin, Probiotics, Prebiotics, Performance, Hematology, Immunity*.

INTRODUCTION

Gibson and Roberfroid (1995) described Prebiotics as non-digestible polysaccharides and oligosaccharides which boost the growth of beneficial lactic acid bacteria in the colon responsible for suppressing of Salmonella sp. or Escherichia coli multiplication. It is revised and categorized by Stowell (2007) to established prebiotics (Inulin, fructooligosaccharides (FOS), galactooligosaccharides (GOS), lactulose and polydextose) and emerging prebiotics (isomaltooligosaccharides (IMO), xylooligosaccahrides (XOS), and lactitol). Sabater-Molina *et al.* (2009); Xu *et al.* (2009) and Femia *et al.* (2010) reported that established prebiotic such as FOS (chicory root) and XOS (wheat bran) have enormous usages. Moreover Yeo and Liong (2010); Vamanu and Vamanu (2010) and Mandal *et al.* (2009) mentioned that mannitol, maltodextrin, raffinose, lactulose and sorbitol are prebiotics of wide health applications. Avian gastrointestinal tract contains different and dynamic population of microorganisms of cooperative relationship with its host nutrition, metabolism and immunity (Sohail *et al.,* 2012). Probiotics described by FAO/WHO, (2001) as live microorganisms which deliberate health advantage when administered sufficiently by the host. Also known as direct-fed microbials, which classified as live nonpathogenic microorganisms that are capable of maintaining a normal gut microbial population by Patterson and Burkholder (2003) and Ohimain and Ofongo (2012). It include strains of Lactobacillus, Bifidobacterium, and yeast, indigenous in the colon of chicken, which enhance the levels of health by producing bacteriocins that suppress the growth of pathogenic bacteria as reported by Alavi *et al.* (2012). Probiotics can help in keeping a healthy balance of microorganisms via several mode of actions comprising competitive exclusion, pathogen antagonism, altering metabolism by increasing digestive enzyme activity and stimulation of the immune system, noted by Dierck (1989) and Cox and Dalloul (2015). Moreover Kaiber *et al.* (2004) and Pender *et al.* (2016) mentioned that probiotic may provide a potential alternative to the prophylactic use of drugs in food animals due to their studied abilities

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to reduce severity of enteric diseases and enhance performance in poultry. Amalraj *et al.* (2017) described Curcumin as yellowish powder derived from herbal medicinal plant turmeric (*Curcuma longa*) of numerous pharmacological uses antioxidant, antiprotozoal, antivenom, antimicrobial, anti-inflammatory, antiproliferative, antiangiogenic, antitumor and antiaging. Al Sultan (2003) reported that usage of *Curcuma longa*, turmeric, as feed additive at level of 0.5% boosted overall performance of broiler chickens with recommendation of cost effectiveness study.

The research aimed to investigate the influences of Prebiotics, Probiotics and Curcumin supplementation to broilers diet on their body gain, feed intake, feed conversion rate, hematological parameters and immune response.

MATERIALS AND METHODS

Ethical approval: This study was carried out under the authorization of the Animal Welfare and Research Ethics Committee, Faculty of Veterinary Medicine, Zagazig University, Egypt.

Birds: 150 of day old chicks (Arbor acer) were sourced from local hatchery, reared on floor pens and fed on commercial grower ration contain 22% protein and yield 3150 Kcal/kg (Table1).

Probiotic: *Bacillus licheniformis* 8 x 10^9 CFU (Gallipro Tect®) added to the feed as 100gm per ton according to the producer recommendation along the research period starting with the first day.

Prebiotic: Inactivated *saccharomyces cerevisiae var. ellipoideus* 1x10^{10} CFU (Thepax®) supplemented as 100gm per 100kg feed according to the producer recommendation for the whole period started from the first day.

Turmeric powder: Curcumin was purchased from local market and mixed in the feed 7.5gm/kg according to Shohe *et al.* (2019).

Vaccines: Avian Influenza (AI) type A H9N2 (Cevac Flu H9K) inactivated oil adjuvant vaccine deployed for immunization of broilers at day old subcutaneous at the back of the neck with 0.2ml. Infectious Bursal Disease (IBD) strain MB5 10^2 EID_{50} lyophilized live vaccine used for immunization of broilers at 8 days old via drinking water according to the manufacturer guidelines.

Samples: Blood were collected from wing vein with vacutainers needle from all groups at 3 and 5weeks old for hematological analysis by using heparinized vacutainer and normal vacutainer for immunological assay.

Experimental birds and design: Chicks randomly were divided equally to 5 groups (A negative control, B positive vaccinated, C vaccinated with Curcumin supplement, D vaccinated with probiotic supplement and E vaccinated with prebiotic supplement) and subjected to weighing and blood sampling at 3and5 weeks of age. Groups A, B, C and E were vaccinated with against AI and IBD

Performance assessment: Body weight (BW) of chicks was recorded individually at recipient day as well as feed supplement for each group to calculate feed intake (FI) thereafter BW and FI were logged at 3 and 5 weeks of age. Weight gain (WG) was calculated by the difference between BW of 35, 21 and 0day old while feed conversion rate (FCR) was calculated by dividing the amount of FI for a period by the BG of the same period.

Immuno-assay: Commercial kits were used for determination of IBD antibody titer (IDEXX) and (Bio Check) for AI. According to the manufacturer instructions, harvested serum was diluted and procedure was followed. Sample to positive (S/P) ratio was calculated as the difference between sample and negative control values divided by the difference between positive control and negative control values. At 1:500 dilution (Log_{10}) titer = 1.09 (log_{10} S/P) + 3.36 for IBD while = 1.1 * Log (SP) + 3.156 for AI.

Hematological analysis: Hematology indicators such as erythrocyte count (RBCs), packed cell volume (PCV), white blood cell (WBCs), WBC differentials and mean corpuscular hemoglobin (Hb) were investigated. Hb concentration was measured using Van Slyke Apparatus, and PCV – Hacksley Hematocrit Centrifuge (UK). WBC and its differentials were determined using the Neubaer count chamber following procedure described by Fudge (2000) and Cray and Zaias (2004).

Statistical assay: Data were compiled and analyzed using one-way analysis of variance (ANOVA) through the general linear models (GLM) procedure of the statistical Package for Social Science version 20.0 (SPSS for windows 20.0 Inc., Chicago, IL,USA). Duncan multiple range test used to separate means at $P<0.05$.

RESULTS

Growth performance parameters were summarized in Table 2. Addition of Curcumin, Probiotic and Prebiotic resulted in upsurge of BW than control and vaccinated groups. At 21days old, the recorded BW were 868.83 ± 8.53^{a}, 843.67 ± 12.03^{ab}, 832 ± 11.7^{b}, 817.37 ± 12.36^{bc} and 796.27 ± 8.56^{c} for Curcumin, Probiotic Prebiotic, vaccinated and control respectively. Statistically BW difference was insignificant between Curcumin and Probiotic, between Probiotic and Prebiotic, Prebiotic and

vaccinated and between vaccinated and control groups, while significant differences were recorded between Curcumin, Prebiotic and control. At 35 days old, there was no significant difference between Curcumin, Probiotic and Prebiotic in BW 1999.4±22.74[a], 1999.4±22.74[a] and 1959.73±24.08[a], respectively, but significant different with vaccinated and control group 1820.67±24.22[b] and 1789.03±17.01[b], respectively. Overall FI was significantly lower for Prebiotic group 3371.77±30.70[b] comparing with Curcumin 3452.53±18.56[a] and vaccinated 3455.47±17.47[a] while overall WG was not significantly varied within Curcumin, Probiotic and Prebiotic groups 1948.83±22.86[a], 1950.83±22.67[a] and 1914.03±23.80[a], respectively but significantly higher than control and vaccinated 1750.60±16.47[b] and 1772.20±24.75[b] respectively (Fig1). Similarly overall FCR was 78±0.020[b], 1.76±0.025[b] and 1.77±0.026[b] respectively, but significantly better than control and vaccinated group (Table2) (Fig.2).

Hematological indices revealed that Curcumin and Probiotic at 21 and 35 days old improved significantly PCV, RBCs count and WBCs count than other groups (Table3). At 3 weeks old PCV values were 34.09±0.24[a], 34.08±0.24[a], 32.69±0.26[b], 32.03±0.26[b] and 30.45±0.26[c], RBCs count were 2.49±0.017[a], 2.50±0.017[a], 2.40±0.017[b], 2.32±0.016[c] and 2.20±0.014[d] 10^6/µl, WBCs count were 31.95±0.28[a], 31.91±0.28[a], 31.45±0.29[ab], 31.05±0.24[b] and 23.49±0.25[c] 10^3/µl for Curcumin, Probiotic, Prebiotic, vaccinated and control group, respectively. Prebiotic had no significant effect on Hb concentration, but increased significantly RBCs and WBCs count than vaccinated and control group. Moreover at 35 days old all additives had no influence on Hb 8.99±0.104[a], 8.96±0.103[a], 8.64±0.096[a], 8.42±0.095[a] and 8.31±0.097[a], respectively, but had significant effect PCV, RBCs and WBCs count.

Differential leucocytes showed significant higher count of lymphocyte 22.45±0.23[a], 22.42±0.23[a] and 20.74±0.22[a], 20.71±0.22[a] at 3 and 5 weeks of age in Curcumin and Probiotic respectively, (Table4). ELISA IBD antibody titer at 21 day old exhibited higher titer in groups supplemented with Probiotic (Fig.3) where it was 2374.73±19.44[a] compared with Curcumin 2317.63±18.80[b], Prebiotic 2297.63±17.88[b], vaccinated 2243.77±20.42[c]and control which showed negative titer. While Curcumin and Probiotic not only induced higher AI titer 1606.30±10.36[a], 1592.83±15.75[a], respectively, at 21 day old (Fig.4) but also at 35 days old (Fig.5).

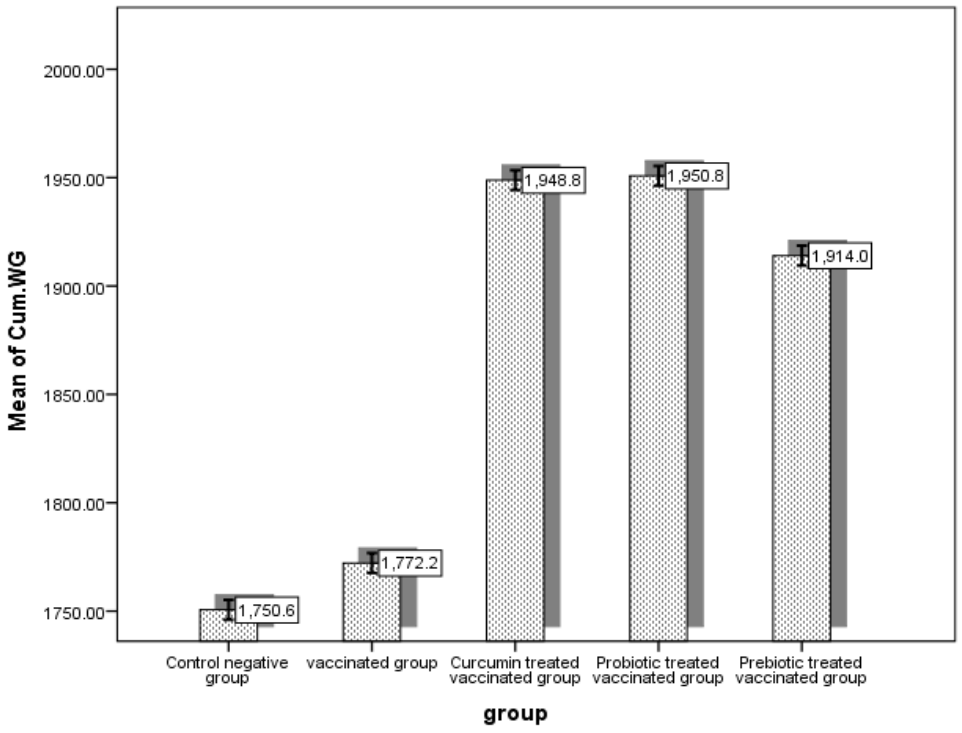

Fig. 1: Influence of Turmeric, Probiotic and Prebiotic on overall Weight Gain

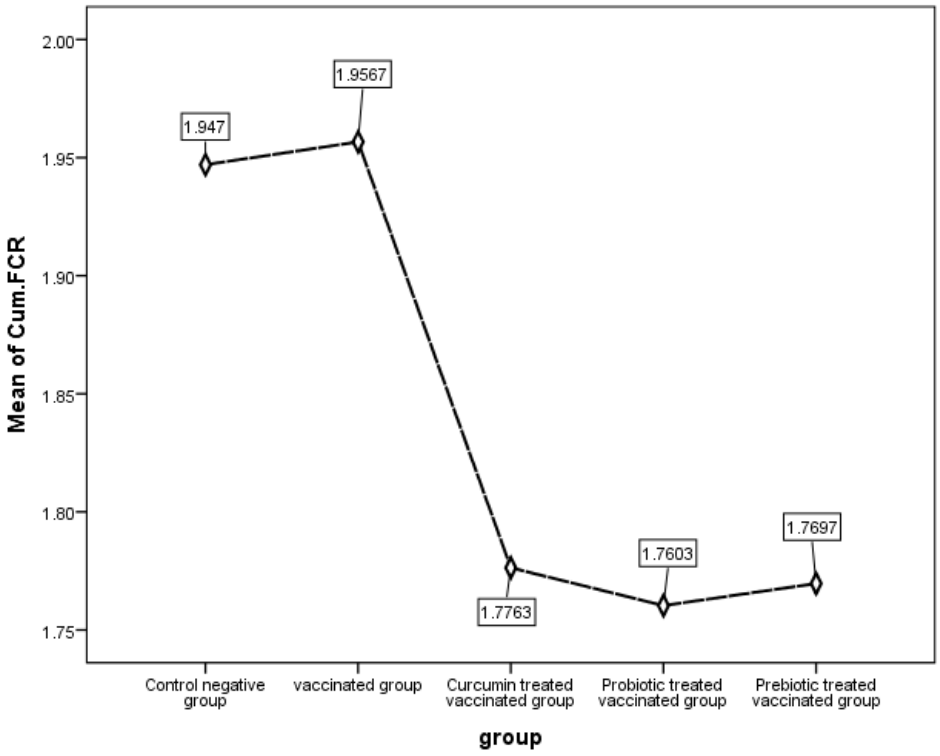

Fig. 2: Effectiveness of feed additives on overall Feed Conversion Ratio

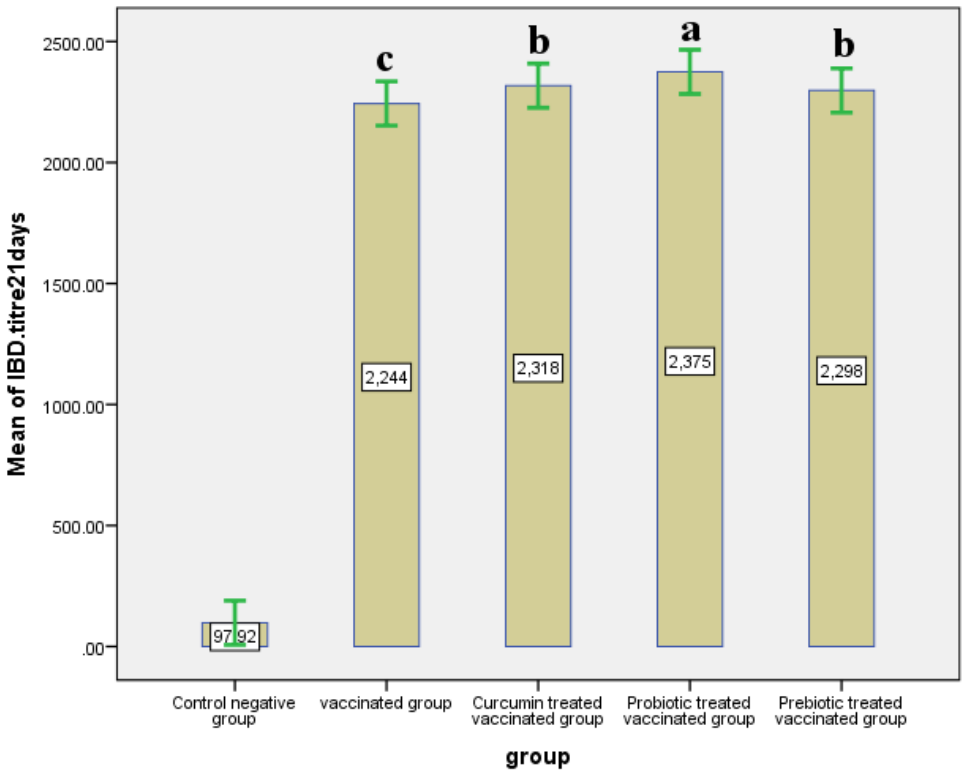

Fig. 3: Post vaccinal reaction against Infectious bursitis

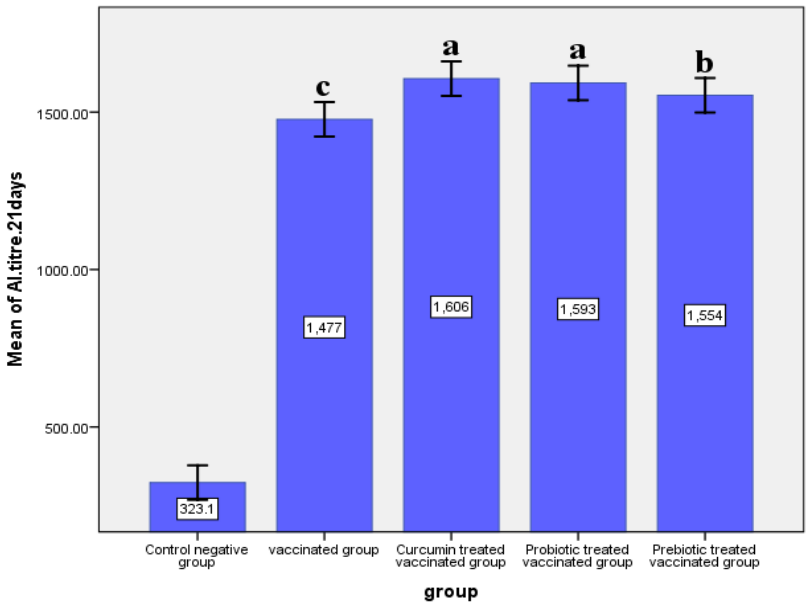

Fig. 4: Post vaccinal reaction against Avian Influenza at 3weeks of age

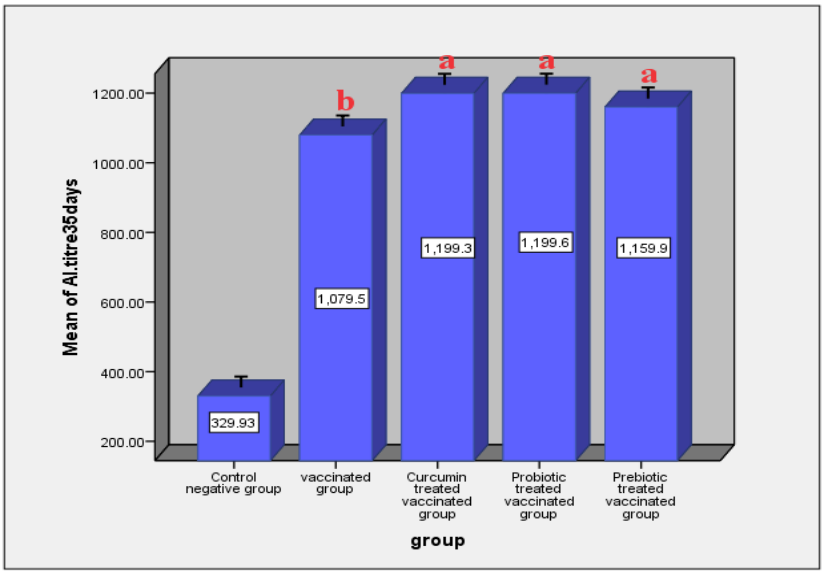

Fig. 5: Post vaccinal reaction against Avian Influenza at 5weeks of age

Table 1: Composition of grower basal diet

Ingredients	Grower
Maize	540
Soybean meal 44%	299
Corn gluten meal 60%	70
Oil	48
Di-calcium phosphate	18
Lime stone	13
D.L. Methionine	2.5
Lysine hydrochloride	2.5
Sodium chloride	4
Mineral and vitamin premix	3
Total	1000
Calculated analysis:	
Crude protein%	22.0
Metabolized energy (Kcal/Kg)	3150

Table 2: Growth performance parameters of broilers at different experimental intervals.

Group / Parameter	A	B	C	D	E
0 - 21 days old					
BW	796.27±8.56^{c}	817.37±12.36^{bc}	868.83±8.53^{a}	843.67±12.03^{ab}	832±11.7^{b}
FI	1137.17±10.1^{d}	1083.77±12.22^{e}	1293.97±8.53^{a}	1263.97±9.19^{b}	1214.3±12.80^{c}
WG	757.83±9.14^{b}	768.9±12.44^{b}	818.17±8.89^{a}	777.7±13.83^{b}	786.3±11.02^{b}
FCR	1.5±0.014^{c}	1.43±0.024^{d}	1.59±0.015^{ab}	1.64±0.031^{a}	1.55±0.026^{bc}
22 – 35 days old					
BW	1789.03±17.01^{b}	1820.67±24.22^{b}	1999.4±22.74^{a}	1999.4±22.74^{a}	1959.73±24.08^{a}
FI	2264.2±13.02^{b}	2371.7±16.32^{a}	2158.57±17.95^{c}	2157.47±18.70^{c}	2157.47±28.67^{c}
WG	992.77±15.44^{b}	1003.3±27.15^{b}	1130.67±25.85^{a}	1173.13±27.34^{a}	1127.73±24.05^{a}
FCR	2.29±0.036^{a}	2.42±0.07^{a}	1.93±0.04^{b}	1.87±0.048^{b}	1.93±0.044^{b}
Overall period 0 – 35 days old					
FI	3401.37±14.06^{ab}	3455.47±17.47^{a}	3452.53±18.56^{a}	3420.70±21.65^{ab}	3371.77±30.70^{b}
WG	1750.60±16.47^{b}	1772.20±24.75^{b}	1948.83±22.86^{a}	1950.83±22.67^{a}	1914.03±23.80^{a}
FCR	1.95±0.016^{a}	1.96±0.029^{a}	1.78±0.020^{b}	1.76±0.025^{b}	1.77±0.026^{b}

A: control. B: vaccinated. C: vaccinated with Curcumin. D: vaccinated with Probiotic. E: vaccinated with Prebiotic.
BW: body weight. FI: feed intake. WG: weight gain. FCR: feed conversion rate.
* Means ±standard error within the same row carrying different superscript are significantly different at P value<0.05.

Table 3: Hematological analysis of broilers supplemented with feed additives.

Group / Parameter	A	B	C	D	E
21 days old					
PCV %	30.45±0.26^{c}	32.03±0.26^{b}	34.09±0.24^{a}	34.08±0.24^{a}	32.69±0.26^{b}
WBCs 10^3/µl	23.49±0.25^{c}	31.05±0.24^{b}	31.95±0.28^{a}	31.91±0.28^{a}	31.45±0.29^{ab}
RBCs 10^6/µl	2.20±0.014^{d}	2.32±0.016^{c}	2.49±0.017^{a}	2.50±0.017^{a}	2.40±0.017^{b}
Hemoglobin g/dl	8.20±0.097^{b}	8.25±0.097^{b}	8.78±0.100^{a}	8.78±0.101^{a}	8.48±0.096^{b}
35 days old					
PCV %	23.19±0.27^{d}	27.49±0.26^{c}	29.37±0.22^{a}	29.36±0.22^{a}	28.49±0.21^{b}
WBCs 10^3/µl	22.98±0.25^{d}	27.56±0.26^{c}	29.37±0.22^{a}	29.36±0.22^{a}	28.59±0.22^{b}
RBCs 10^6/µl	2.20±0.016^{d}	2.41±0.032^{c}	2.63±0.021^{a}	2.62±0.017^{a}	2.51±0.015^{b}
Hemoglobin g/dl	8.31±0.097^{a}	8.42±0.095^{a}	8.99±0.104^{a}	8.96±0.103^{a}	8.64±0.096^{a}

A: control. B: vaccinated. C: vaccinated with Curcumin. D: vaccinated with Probiotic. E: vaccinated with Prebiotic.
PCV: packed cell volume. WBCs: white blood cells. RBCs: red blood cells.
* Means ±standard error within the same row carrying different superscript are significantly different at P value<0.05.

Table 4: Immuno-assay of broilers supplemented with feed additives.

Group / Parameter	A	B	C	D	E
21 days old					
AI titer	323.10±10.36^{d}	1477.20±10.20^{c}	1606.30±10.36^{a}	1592.83±15.75^{a}	1553.57±15.23^{b}
IBD titer	97.92±1.30^{d}	2243.77±20.42^{c}	2317.63±18.80^{b}	2374.73±19.44^{a}	2297.63±17.88^{b}
Hetero(10^3/µl)	7.29±0.20^{b}	9.69±0.21^{a}	9.88±0.21^{a}	9.89±0.21^{a}	10.29±0.21^{a}
Lympho(10^3/µl)	14.32±0.23^{d}	19.62±0.23^{c}	22.45±0.23^{a}	22.42±0.23^{a}	20.97±0.23^{b}
35 days old					
AI titre	329.93±19.77^{c}	1079.47±9.98^{b}	1199.30±10.99^{a}	1199.57±14.88^{a}	1159.93±14.45^{a}
IBD titre	101.16±1.35^{b}	368.10±7.15^{a}	371.43±7.29^{a}	369.93±7.30^{a}	371.43±7.29^{a}
Hetero(10^3/µl)	5.51±0.21^{c}	7.21±0.21^{b}	8.01±0.28^{a}	7.99±0.27^{a}	7.41±0.20^{ab}
Lympho(10^3/µl)	15.09±0.23^{d}	18.65±0.25^{c}	20.74±0.22^{a}	20.71±0.22^{a}	19.64±0.23^{b}

A: control. B: vaccinated. C: vaccinated with Curcumin. D: vaccinated with Probiotic. E: vaccinated with Prebiotic.
AI: avain influenza antibody. IBD: infectious bursal disease antibody. Hetero: heterophil count. Lympho: lymphocytic count.
* Means ±standard error within the same row carrying different superscript are significantly different at P value<0.05.
AI titer < 600 consider negative. IBD titer < 200 consider negative.

DISCUSSION

Excessive usage of antibiotics in poultry industry, subsidized the importance of herbal plant, Prebiotics and Probiotics convention. Therefore this study was conducted to investigate its effect on broiler production. Although addition of Curcumin, Probiotic and Prebiotic to basal diet had slightly affected overall FI, performance parameters as BW, overall WG and FCR of broilers had significantly improved ($p < 0.05$) on matching with the control and vaccinated groups. However, Curcumin had highest BW, WG and FI at 21 days old, there was no significant favor to any of these additives at the end study except Prebiotic had the lowest overall FI. Clockwise, Abdel-Hafeez *et al.* (2017) pointed that chicks fed diets supplemented with Probiotic, Prebiotic and Synbiotic (with and without feed restriction) showed higher BW and FCR than chicks fed the control diets. Moreover PCV was increased in additive treatments with restricted feeding at the end of the experiment. Alimohamadi *et al.* (2014) resulted that at 28 days old, diets mixed with Black seed, Cumin seed and Probiotic increased body weight ($p = 0.027$) with no significant differences in final body weight and average daily feed intake among any dietary treatments ($p > 0.05$). Though the chicks fed diets mixed black seed, Probiotic and Prebiotic exhibited significantly better FCR than chicks fed the control diet during the entire experimental period ($p = 0.048$). Tayeri *et al.* (2018) noted that there was no effect of Synbiotic, Probiotic, Prebiotic and antibiotic treatment on FI. Yet, weight gain was greater for broilers ($p = 0.001$) fed Synbiotic (73.6 g/d), Probiotic (72.8 g/d) and prebiotic treatments (69.8 g/d), when compared with broilers fed the antibiotic (66.3 g/d) or no supplement (64.2 g/d). In the same line, Rajput *et al.* (2013) documented that, at 42 days old (finisher phase) live body weight ($P < 0.0003$) and FCR ($P < 0.0172$) were significantly enhanced in group that received 200mg/kg diet Curcumin, as compared to control and other groups. Also, these findings agreed with Kafi *et al.* (2017), Ahlawat *et al.* (2018) and Shohe *et al.* (2019) who recorded that not only the average BW and BG was significantly ($P <0.05$) the highest in group which supplemented with turmeric powder at the rate 7.5g/kg feed but also the value of FCR was the lowest. Improvement of growth and feed conversion efficacy may be explained by indorsement of a well-balanced gut microflora in early life which can be established by feeding of Probiotic/Prebiotic in the starter diet (Salim *et al.*, 2013) and/or modulation of microbial population by phytogenetic products (Windisch *et al.*, 2008). Also stimulation of gastric and pancreatic digestive enzymes can be accredited by spices and their derivatives (Srinivasan, 2005) that finally lead to more absorption of essential nutrients.

Hematology indices reflected highest influences ($p < 0.05$) of Curcumin and Probiotic supplementation on PCV, RBCs and WBCs values at 3 and 7 weeks old as well as Hb concentration at 3weeks old. This positive effect may attributed to anti-inflammatory, antioxidant properties of Curcumin and digestive enzyme intensifying of Probiotic that enhance metabolism consequently improve iron absorption and utilization leading to enhancement of RBCs production and Hb concentration consequently PCV. Similarly, Beski and Al-Sardary (2015) who noted that Probiotics and Synbiotics resulted in a significant increase in the concentration of Hb, as well as, Alimohamadi *et al.* (2014) who declared that RBC counts, hemoglobin concentration and hematocrit percentage were significantly higher in the chicks fed diets contain Black seed compared with those fed the control diet ($p < 0.05$). Furthermore, Salim *et al.* (2013) recorded that WBC count was significantly higher in chicken fed on diet contain 0.1% mixture of Probiotic and Prebiotic (DFM2) compared with the other contain 0.1% virginiamycin and control-fed birds, likewise monocyte level was higher in DFM 2. Contrarily, Kafi *et al.* (2017) and Shohe *et al.* (2019) found that no significant difference in Hb and PCV values of broiler birds when supplemented with turmeric powder irrespective of levels. Moreover Abdel-Hafez *et al.* (2017) noted that there were no statistical differences ($p>0.05$) in Hb and PCV% between the control and the other groups which received Synbiotic, Probiotic, Prebiotic and Adegoke *et al.* (2018) mentioned that broilers received basal diet with Curcumin at level of 400g/100kg in ad libitum feeding, had no significant alternation on PCV, RBCs and Hb except WBCs.

Immune response analysis exhibited boosting of Curcumin, Probiotic and Prebiotic to vaccines reaction for both AV and IBD. Likewise, Hong *et al.* (2005) reported that *Bacillus*-based direct fed microbals (DFM) enhances immune function and promotes the synthesis of endogenous antimicrobial peptides in the gut. In addition Janardhana *et al.* (2009) highlighted that Prebiotic fructooligosaccharide supplement increased IgG and IgM in broilers. Present findings provoked highest ELISA antibody titer at 3weeks old for AV was recorded in Curcumin and Probiotic group but for IBD in Probiotic. This variation could be justified by the type of vaccine, age of vaccination and the route of administration.

Results could be concluded that addition of Curcumin, Probiotic and Prebiotic to the broiler's diet had performance enhancement and immune stimulant properties and improved overall body weight/gain and feed conversion of broilers. Curcumin and Probiotic increased PCV, RBCs, WBCs and lymphocytes count which reflected on broiler immune status consequently vaccinal reaction. Cost effectiveness study should be recommended.

REFERENCES

Abdel-Hafeez H.M.; Elham S.E. Saleh; Samar S. Tawfeek; Youssef, I.M.I. and Asmaa S.A. Abdel-Daim (2017): Effects of probiotic, prebiotic, and synbiotic with and without feed restriction on performance, hematological indices and carcass characteristics of broiler chickens. Asian-Australas J Anim Sci 30: 672-682.

Adegoke, A.V.; Abimbola, M.A.; Sanwo, K.A.; Egbeyale, L.T.; Abiona, J.A.; Oso, A.O. and Iposu, S.O. (2018): Performance and blood biochemistry profile of broiler chickens fed dietary turmeric (Curcuma longa) powder and cayenne pepper (Capsicum frutescens) powders as antioxidants. Veterinary and Animal Science 6: 95–102.

Ahlawat, P.K.; Rajesh, D.; Sonu Tewatia, B.S.; Panwar, V.S. and Nancy, S. (2018): Antimicrobial effect of dietary supplementation of turmeric powder in intestine of broilers. International Journal of Current Microbiology and Applied Science, 7(4): 2244-2251.

Alavi, S.A.N.; Zakeri, A.; Kamrani, B. and Pourakbari, Y. (2012): Effect of prebiotics, probiotics, acidifier, growth promoter antibiotics and symbiotic on humoral immunity of broiler chickens. Global veterinaria, 8: 612-617.

Alimohamadi, K.; Taherpour, K.; Ghasemi, H.A. and Fatahnia, F. (2014): Comparative effects of using black seed (Nigella sativa), cumin seed (Cuminum cyminum), probiotic or prebiotic on growth performance, blood haematology and serum biochemistry of broiler chicks. Journal of Animal Physiology and Animal Nutrition 98: 538–546.

Amalraj, A.; Pius, A.; Gopi, S. and Gopi, S. (2017): Biological activities of curcuminoids, other biomolecules from turmeric and their derivatives – a review. J. Tradit. Complement. Med. 7, 205–233, https://doi.org/10.1016/j.jtcme.2016.05.005.

Al-Sultan, SI. (2003): The Effect of Curcuma longa (Tumeric) on Overall Performance of Broiler Chickens. Int. J. Poult Sci 2(5): 351-353.

Beski, S.S. and Al-Sardary, S.Y. (2015): Broiler chickens hematology and intestinal integrity. Int J Poult Sci 14: 31-6.

Cox, C.M. and Dalloul, R.A. (2015): Immunomodulatory role of probiotics in poultry and potential in ovo application. Benef Microbes 6: 45–52.

Cray, C. and Zaias, J. (2004): Laboratory procedures. Veterinary Clinical Exotic Animal 7:487–518.

Dierck, N.A. (1989): Biotechnology aids to improve feed and feed digestion: Enzymes and fermentation. Arch. Anim. Nutr. Berl., 39, 241-261.

FAO/WHO (2001): Health and nutritional properties of probiotics in food including powder milk with live lactic acid bacteria. Food and Agriculture Organization of the United Nation.

Femia, A.P.; Salvadori, M.; Broekaert, W.F.; Francois, I.E.J.A.; Delcour, J.A. (2010): Arabinoxylan-oligosaccharides (AXOS) reduce preneoplastic lesions in the colon of rats treated with 1,2- dimethylhydrazine (DMH). Eur. J. Nutr. 49: 127–132.

Fudge, A.M. (2000): Avian complete blood count. In A.M. Fudge (Ed.). Laboratory medicine-avian and exotic pets (pp. 9–18). Philadelphia: W. B Saunders company Clinical Chemistry and Clinical Biochemistry 24: 481-495.

Gibson, G.R. and Roberfroid, M.B. (1995): Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. J. Nutr. 125: 1401–1412.

Hong, H.A.; Ducle, H. and. Cutting, S.M. (2005): The use of bacterial spore formers as probiotics. FEMS Microbiol. Rev. 29: 813–835

Janardhana, V.; Broadway, M.M.; Bruce, M.P.; Lowenthal, J.W.; Geier, M.S.; Hughes, R.J. and Bean, A.G. (2009): Prebiotics modulate immune responses in the gut-associated lymphoid tissue of chickens. Journal of Nutrition 139, 1404–1409

Kabir, S.M.L.; Rahman, M.M.; Rahman, M.B.; Rahman, M.M. and Ahmed, S.U. (2004): The dynamics of probiotics on growth performance and immune response in broilers. Int. J. Poult. Sci. 3: 361–364.

Kafi, A.; Uddin, M.N.; Uddin, M.J.; Khan, M.M.H. and Haque, M.E. (2017): Effect of dietary supplementation of turmeric (Curcuma longa), ginger (Zingiber officinale) and their combination as feed additives on feed intake, growth performance and economics of broiler. International Journal of Poultry Science, 16: 257-265.

Mandal, V.; Sen, S.K. and Mandal, N.C. (2009): Effect of prebiotics on bacteriocin production and cholesterol lowering activity of Pediococcus acidilactici LAB 5. World J Microbiol Biotechnol 25:1837–1841.

Ohimain, E.I. and Ofongo, R.T.S. (2012): The effect of probiotic and prebiotic feed supplementation on chicken health and gut microflora: a review. Int J Anim Vet Adv 4: 135–143

Patterson, J.A. and Burkholder, K.M. (2003): Application of prebiotics and probiotics in poultry production. Poult Sci 82: 627–631 6.

Pender, C.M.; Kim, S.; Potter, T.D.; Ritzi, M.M.; Young, M. and Dalloul, RA. (2016): Effects of in ovo supplementation of probiotics on performance and immuno- competence of broiler chicks to an Eimeria challenge. Benef Microbes. doi:10.3920/BM2016.0080

Rajput, N.; Muhammad, N.; Yan, R.; Zhong, X. and Wang, T. (2013): Effect of Dietary Supplementation of Curcumin on Growth Performance, Intestinal Morphology and Nutrients Utilization of Broiler Chicks J. Poult. Sci. 50: 44-52.

Sabater-Molina, M.; Larque, E.; Torrella, F.; Zamora, S. (2009): Dietary fructooligosaccharides and potential benefits on health. J Physiol Biochem 65: 315–328.

Salim, H.M.; Kang, H.K.; Akter, N.; Kim, D.W.; Kim, J.H.; Kim, M.J.; Na, J.C.; Jong, H.B.; Choi, H.C.; Suh, O.S. and Kim, W.K. (2013): Supplementation of direct-fed microbials as an alternative to antibiotic on growth performance, immune response, cecal microbial population and ileal morphology of broiler chickens. Poultry Science 92:2084–2090.

Shohe, A.; Vidyarthi, V.K and Zuyie, R. (2019): Performance of Broiler Chicken on Diet Supplemented with Turmeric Powder (Curcuma longa). Livestock Research International 7(2): 77-82.

Sohail, M.U.; Hume, M.E.; Byrd, J.A.; Nisbet, D.J.; Ijaz, A., Sohail, A.; Shabbir, M.Z. and Rehman, H. (2012): Effect of supplementation of prebiotic mannan-oligosaccharides and probiotic mixture on growth performance of broilers subjected to chronic heat stress. Poult. Sci. 91: 2235–2240.

Srinivasan, K. (2005): Spices as influencers of body metabolism: an overview of three decades of research. Food Research International 38, 77–86.

Stowell, J. (2007): Chapter 4. Calorie control and weight management. In: Mitchell H (ed) Sweeteners and sugar alternatives in food technology. Blackwell Publishing Ltd. doi:10.1002/978047099 6003.ch4

Tayeri, V.; Seidavi, A.; Leila, A. and Phillips, C.J.C. (2018): A comparison of the effects of antibiotics, probiotics, synbiotics and prebiotics on the performance and carcass characteristics of broilers. Vet Res Communications. 42: 195–207.

Vamanu, E. and Vamanu, A. (2010): The influence of prebiotics on bacteriocin synthesis using the strain Lactobacillus paracasei CMGB16. Afr J Microbiol Res 4: 534–537.

Windisch, W.; Schedle, K.; Plitzner, C. and Kroismayr, A. (2008): Use of phytogenic products as feed additives for swine and poultry. Journal of Animal Science 86:E140–E14.

Xu, B.; Wang, Y.; Li, J. and Lin, Q. (2009): Effect of prebiotic xylooligosaccharides on growth performances and digestive enzyme activities of allogynogenetic crucian carp (Carassius auratus gibelio). Fish Physiol Biochem 35:351–357.

Yeo, S.K. and Liong, M.T. (2010): Effect of prebiotics on viability and growth characteristics of probiotics in soymilk. J Sci Food Agric 90: 267–275.

دراسة مقارنة عن تأثير اضافة الكركوم والبروبيوتك والبربيوتك على نمو ومناعة دجاج انتاج اللحم

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يجب التفكير والنظر باهتمام لدور استخدامات الكركوم والبروبيوتك والبربيوتك المتنامى فى صناعة الدواجن للتغلب على سوء استخدام المضادات الحيوية. فقد تم عمل هذه الدراسة لاستكشاف فاعلية الكركوم البروبيوتك والبربيوتك فى انتاجية دجاج انتاج اللحم وقد استخدم زيادة اوزان الدجاج ومعدل تحويلها وتحليل مكونات دمائها ونتائج قياس المناعات بعد التحصين كمعايير لها. استخدم فى هذه الدراسة ١٥٠ كتكوت عمر يوم وقسموا عشوائيا لخمس مجموعات منفصلة ٤ منهم حصنوا ضد مرض انفلونزا الطيور والجامبور وتركت مجموعة بدون تحصين. تم اضافة كركوم للعلف النامى لمجموعة والبروبيوتك لاخرى والبربيوتك للثالثة مع ترك مجموعتان دون اضافات. واثبتت النتائج ان هذه الأضافات قد اثرت معنويا فى زيادة معدلات الاوزان ونسب التحويل وعدد كرات الدم الحمراء والبيضاء ونسب الهيموجلوبين وكذلك عدد الاجسام المناعية المترتبة عن التحصين مقارنة بالمجموعتين الاخرتين ولكن لم تكن الزيادة بفوارق معنوية بين الثلاثة مجموعات. حيث سجلت الكركوم ١٩٤٨.٨٣جم والبروبيوتك ١٩٥٠.٨٣جم والبربيوتك ١٩١٤.٠٣جم بفارق معنوى عن المجموعة المحصنة ١٧٧٢.٢٠جم ومجموعة الضوابط ١٧٥٠.٦٠جم. بينما كان متوسط القياسات المناعية عند عمر ٣ اسابيع الأعلى فى مجموعة الكركوم والبروبيوتك ١٦٠٦.٣٠ و١٥٩٢.٨٣ على التوالى لتحصين انفلونزا الطيور ولكنه كان الأعلى فى البربيوتك لتحصين الجامبورو ٢٣٧٤.٧٣. وقد اثبتت الدراسة فاعلية استخدام هذه الاضافات فى انتاجية الدجاج حتى ٥ اسابيع من العمر مع النصح بعمل حساب تكاليف مادى لاتمام نتائج الدراسة.