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GROWTH PERFORMANCE AND HEMATO-BIOCHEMICAL PARAMETERS IN BROILER DURING HIGH ENVIRONMENTAL TEMPERATURE BY THE APPLICATION OF SYNBIOTIC

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ABSTRACT: The experiment was carried out to investigate the effect of synbiotic on growth performance, hematological (TEC, Hb, PCV, ESR) and biochemical (Cholesterol, Uric acid) parameters in broilers during high environmental temperature. A total of 30, at 7 days old (Cobb-500) broilers were randomly divided into 3 groups (n=6). Heat stress broilers were held at 35 ± 2°C temperature and 70±5% relative humidity respectively where as normal temperature was 25 ± 2°C and relative humidity was 60 ± 5%. Normal control group (NE-T) fed the normal diet with normal environmental temperature. Heat stress groups consisted of HS-A as heat stress control group fed the normal diet; HS-B as synbiotics group fed 0.1g prebiotic and 0.1g probiotic with normal diet. The results revealed that supplementation of synbiotic produced a significantly (p<0.01) increased of the live body weight as compared to normal and heat stress control group. The highest weight gain was recorded in HS-B as synbiotic group (1710.00a ± 3.54 gm) and the lowest weight gain was recorded in HS-A as heat stress group (1303.00e ± 4.899 gm). The hematological parameters (TEC, Hb, PCV, ESR) also significantly (p<0.01) differ compared to the both control. The biochemical parameters in uric acid was a significant (p<0.05) difference among groups and there was no significant (p>0.05) difference among the groups in serum cholesterol after treating with synbiotic. Therefore, it is concluded that synbiotic is essential for the maintainance of broilers performance under heat stress condition.

KEYWORDS: Prebiotics, Probiotics, Synbiotics, Blood parameters, Heat stress, Broilers.

1 INTRODUCTION

The poultry industry during the past two decades has been one of the most dynamic and ever expanding sectors in the world. It helps to fill the gap between requirement and availability of high quality protein for human consumption. The demand for a higher and safer protein source, free of infectious agents, is getting increased. However, during intensive growth, poultry industry has always been confronted with challenges in the form of various diseases. Among these conditions, the major economic losses are due to infectious diseases which could be caused by viruses, bacteria, fungi, protozoa, and the cost of preventive medication. This led to increased use of antibiotics in the poultry industry for therapeutic, prophylactic and growth promotion purposes. The presence of antibiotic residues in poultry meat and eggs may have deleterious effects on human consumers. The residues of antibiotics can cause resistance of human flora and pathogenic microbes to those groups of antibiotics. Bangladesh is an agro-based country where 80 percent of the population depends on agriculture. Poultry plays a vital role in the income generating framework of the rural people of Bangladesh. It is therefore the fact that its contribution towards promoting resources for improving the life style and livelihood of landless and marginal farmers is noted worthy. Heat stress **(**HS**)** is one of the most serious climate problems of tropical and subtropical regions of world negatively affects the production performance of poultry. A synbiotic is a combination of prebiotics and probiotics [1]. Probiotics are live bacteria which are intended to colonize the large intestine and confer physiological health benefits to the host [2]. A prebiotic is a food or dietary supplement product that confers a health benefit on the host associated with modulating the microbiota [3]. Synbiotic plays a vital role in the poultry feed industry. A well-balanced ration sufficient in energy and nutrients is also of great importance in maintaining a healthy gut [4]. Use of synbiotic

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for prevention of bacterial diseases in poultry as well as demonstrating the potential growth performance and immune response of poultry during high environmental temperature was not available in the world [5]. Antibiotics as a growth promoter have been widely used extensively in poultry feed for more than 50 years but it band on in some parts of the world legislations has promoted to the search for alternatives. Therefore, prebiotics and probiotics are considered to be the alternatives as non-antibiotic growth promoters are being more popular in poultry industry. But recently, the prebiotic and probiotic which are combinedly known as synbiotic used in the poultry industry are new concept [6].

2 MATERIALS AND METHODS

2.1 STATEMENT OF THE EXPERIMENT

The experiment on effects of synbiotic on growth performance and hemato-biochemical parameters in broilers during high environmental temperature was carried out in poultry farm, BAU and laboratory of the Department of Physiology, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, during summer season. The research work was carried out during the period from 28th July, 2013 to 31th August, 2013 for 35 days to study the hemato-biochemical effects and growth performance in broilers.

2.2 EXPERIMENTAL DESIGN

A total of 30, at day old broiler chicks were collected from Renata Hatchery. Broiler chicks were randomly selected for the experiment and were divided into following groups:

- **Normal control group (NE-T)** - Normal feeding & watering with normal environmental temperature (T= 25 ± 2°C, RH=60 ± 5%) daily up to 5 weeks under normal condition.
- **Heat stress control group (HS-A)** - Normal feeding & watering daily up to 5 weeks during high environmental temperature (T= 35 ± 2°C, RH= 70 ± 5%).
- **Heat stress synbiotic group (HS-B)** - Normal feeding & 0.1g prebiotics with 0.1g probiotics in per liter of drinking water as synbiotic daily up to 5 weeks during high environmental temperature (T= 35 ± 2°C, RH= 70 ± 5%).

2.3 EXPERIMENTAL BIRDS

A total of 30, at day old Cob-500 strains were collected from Renata Hatchery. At day 7, broiler chicks were randomly divided into 3 treatment groups. Each group contains 6 birds. Birds were housed in 3ft x 2ft floor pens on fresh rice husk litter with a 24-h lighting plan. The height of litter was 3 cm. Before being used in the experiment, birds were adapted for 7 days in order to acclimatize in the environment. The collected birds have neither developmental disorders, detectable genital diseases nor other diseases that may cause any problem in the experiment or affect the result of the experiment.

2.4 BLOOD COLLECTION

After 5 weeks, blood sample was collected from wing vein to test of effects of synbiotic on RBC, Hb, PCV, and ESR from 3 birds in each group (9 birds) by JMI syringe. Three (3) ml blood collected from each bird at a time within a series of sterile test tube containing anticoagulant 4% sodium citrate at a ratio of 1: 10. The hematological studies were performed within two hours of blood collection.

2.5 STATISTICAL ANALYSIS

During the study period we were regularly collect the data of daily feed intake and body weight weakly. After study period we were analyzed hemato-biochemical and physiological data. All the collected data were analyzed with the help of computer package MSTAT. The mean differences among the treatments were determined as per Duncan's Multiple Range Test.

3 RESULTS

3.1 EFFECT OF SYNBIOTIC ON GROWTH PERFORMANCE

Table 1. Effects of synbiotic on body weight (Mean ±SE) gain in broilers during heat stress

Groups	Pretreated body weight (gm)	Post treated body weight (gm)			
	Day 7	Day 14	Day 21	Day 28	Day 35
NE-T (Normal control)	424.00a ± 2.92	659.00c ± 4.30	1050.00c ± 3.54	1407.00c ± 3.742	1623.00c ± 7.176
HS-A (Heat stress control)	427.00a ± 2.55	540.00e ± 7.07	830.00e ± 6.52	1121.00e ± 5.788	1303.00e ± 4.899
HS-B (Synbiotic)	425.00a ± 3.54^{NS}	752.00a ± 4.64**	1141.00a ± 6.78**	1512.00a ± 8.60**	1710.00a ± 3.54**

*** indicates p<0.01 and NS indicates non significant*

3.2 EFFECTS OF SYNBIOTIC ON BLOOD PARAMETERS

Table 2. Effects of synbiotic on hematological parameters in broilers during heat stress

Groups	TEC (Millions/mm^3)	Hb (gm/dl)	PCV (%)	ESR (mm in 1st hour)
NE-T (Normal control)	2.22bc ± 0.073	7.40c ± 0.071	23.80c ± 0.860	3.86b ± 0.186
HS-A (Heat stress control)	2.12c ± 0.097	7.18c ± 0.066	21.00d ± 0.707	4.62a ± 0.058
HS-B (Synbiotic)	2.76a ± 0.051**	8.62a ± 0.107**	28.80a ± 0.860**	3.90b ± 0.158**

*** indicates p<0.01*

3.3 EFFECTS OF SYNBIOTIC ON BIOCHEMICAL PARAMETERS

Table 3. Effects of synbiotic on biochemical parameters in broilers during heat stress

Treatment groups	Uric acid (mg/dl)	Cholesterol (mg/dl)
NE-T (Normal control)	5.88b ± 0.177	138.20a ± 2.417
HS-A (Heat stress control)	6.10b ± 0.333	132.80a ± 2.437
HS-B (Synbiotic group)	7.14a ± 0.331*	135.00a ± 4.183^{NS}

** indicates p<0.05 and NS indicates non significant*

4 DISCUSSION

4.1 EFFECT OF SYNBIOTIC ON GROWTH PERFORMANCE

The present findings showed that when supplementation of synbiotic in broilers during high environmental temperature the body weight increased significantly (p<0.01) among the treated groups and suppress the stressful condition. It was stated that appropriate administration of the prebiotic and probiotic mixture which are considered as synbiotic increased body weight gain in broilers when they are exposed to high environmental temperature or stressful condition [7]. Normally, heat stress suppresses body weight gain in broilers due to less feed intake, less metabolic activity and intestinal microbial dysbiosis. Heat stress is one of the most serious climate problems of tropical and subtropical regions of world, negatively affects the production performance of poultry and livestock as heat stress is characterized by endocrine disorders, reduced metabolic rate, lipid peroxidation, decreased feed consumption, decreased body weight gain, higher feed conversion ratio **(**FCR**),** immunosuppression and intestinal microbial dysbiosis [8],[9],[10],[11]. Our experiment stated that prebiotic (MOS) may be stimulated and modulated the beneficial micro-organisms which are present in intestinal tract results increase appetite, intestinal digestion and absorption ultimately, increased growth performance. Gibson and Roberfroid, 1995

observed a prebiotic is a food or dietary supplement product that confers a health benefit on the host associated with modulating the microbiota. Probiotic (Protexin® Boost) also plays an important role to increased body weight gain during high environmental temperature because probiotic may colonized in upper part of intestinal mucosa to prevent adhering the harmful bacteria results increased intestinal villus width. Thus, probiotic may helps to stimulate more feed intake, more nutrient absorption, more metabolic activity results body weight gradually (p<0.01) increased. Probiotics are live bacteria which are intended to colonize the large intestine and confer physiological health benefits to the host Fuller (1989). Probiotic bacteria may colonise the upper part of the intestine to avoid the adhering of pathogens to the intestinal tract and may help in digestion which are agreed to the present study.But when preboitic and probiotic are combinedly used as synbiotic in broilers the body weight significantly (p<0.01) increased than all others treated and control groups due to combined action of preboitic and probiotic during high environmental temperature. The rise in body weight gain in supplemented broilers is believed to be a cumulative effects of prebiotic and probiotic foods which serve to promote beneficial bacteria, intestinal function and disease resistance [12, 13]. Moreover, reported that synbiotics have a good impact on the poultry performance improve microbial balance, synthesize vitamins, decrease p^H, and improve feed consumption in broilers during high environmental temperature [14, 15] which are agreed to the present study. So the present study states that synbiotic influences the higher growth performance in broilers under heat stress condition than other experimental and control groups. All the treatment groups of broilers showed numerically (p<0.01) higher body weight gain as compared to control group.

4.2 EFFECTS OF SYNBIOTIC ON BLOOD PARAMETERS

The present findings showed that when supplementation of synbiotic in broilers during high environmental temperature the hematological parameters (TEC, Hb, PCV, ESR) significantly (p<0.01) differ compared to both control groups. The synbiotic supplementation caused statistically significant increase in the erythrocyte count, hemoglobin concentration and haematocrit values of broilers under chronic heat stress condition [16]. Moreover, it has been also observed synbiotic supplementation in broilers reared under heat stress significantly improved hematological activity and appetite for feed intake, which could eventually increase body weight growth and feed efficiency[17] which are support to the present study. The significantly increases (p<0.01) hematological parameters (TEC, Hb, PCV, ESR) of broilers under heat stress condition in experimental and control groups may due to the initiative effects of prebiotic and probiotic on hemopoitic organs. There are some probiotics which are essential for normal growth of the hemopoitic organs and erythropoiesis. The given probiotics (Protexin® Boost) may stimulate the hemopoitic organs and causes erythropoiesis results increase the hematological parameters during high environmental temperature. The hematological parameters of present finding resembles to that of Dukes[18] who reported that the number of erythrocytes and other components of blood varied due to the influence of age, sex, environment, exercise, nutritional status and climate. The hematological indices are affected by multiple environmental stresses and conditions. These effects differed according to age, period of exposure, single or concurrent stresses, the intensity and the environmental management programs. But synbiotic supplementation caused statistically significant increase in the erythrocyte count, hemoglobin concentration and haematocrit values of broilers during high environmental temperature. The present findings suggested that supplementation of synbiotic in broilers ration of treatment groups caused significantly (p<0.01) increase in most hematological parameters as compared to that of control group of broilers under heat stress condition.

4.3 EFFECTS OF SYNBIOTIC ON BIOCHEMICAL PARAMETERS

The present findings showed that when supplementation of synbiotic in broilers during high environmental temperature, the biochemical parameters in uric acid was a significantly (p<0.05) increases in treated groups than control groups and there was no significant (p>0.05) difference among groups in serum cholesterol after treating with synbiotic. Increased uric acid in the treated group resembles [19] who detected the uric acid level increased significantly (p<0.01) with synbiotics supplementation. Moreover, it has been also reported that supplementation of synbiotics increased uric acid and creatinine level[20] which are support to the present study.

The significantly increases (p<0.05) uric acid level in broilers under heat stress condition than other experimental and control groups may due to the initiative effects of prebiotic and probiotic on organs of urinary system. There are some prebiotics and probiotics which are essential for normal growth of the of urinary organs and stimulate that enzyme which are responsible for uric acid formation[21]. The given probiotics may (Protexin® Boost) stimulate the renal enzyme which is responsible for uric acid formation results increase the uric acid level in broilers during high environmental temperature. On the other hand, the present findings showed that when supplementation synbiotic in broilers during high environmental

temperature, the biochemical parameters in cholesterol concentration was a significantly (p<0.05) decreases in treated groups than control groups. It was stated the synthesis of bile acids from cholesterol in the liver is the most important way of cholesterol excretion and when synbiotic supplementation in broilers during high environmental temperature the cholesterol level gradually decreased[22] which is support to the present study. The given probiotics (Protexin® Boost) may stimulate the disintegrating bile salts and de-conjugate production of enzymes by their activity as well as reduction of the pH in the intestinal tract can be effective in reducing the cholesterol concentration during high environmental temperature. The use of probiotics and prebiotics can disintegrating bile salts and de-conjugate production of enzymes by the activity of lactic acid bacteria, as well as reduction of the pH in the intestinal tract can be effective in reducing the cholesterol concentration[23]. Solvability of non-conjugate bile acids is lowered at a low pH and consequently, they are absorbed less from the intestine and are excreted more in the faces and these are applicable when prebiotic, probiotic and synbiotic supplementation in broilers during high environmental temperature and/or others which are support to the present study. It is concluded that supplementation of 0.2 gm synbiotic/litre drinking water of treatment groups caused significantly (p<0.01) increase in live body weight and hematological parameters. The biochemical parameters in uric acid was a significant (p<0.05) difference among groups and there was no significant (p>0.05) difference among groups in serum cholesterol after treating with under heat stress condition.

5 CONCLUSION

The research work was carried out to investigate the effect of synbiotic on growth performance, hematological (TEC, Hb, PCV, ESR) and biochemical (Cholesterol, Uric acid) parameters in broilers during high environmental temperature. A total of 30, at 7 days old (Cobb-500) broilers were randomly divided into 3 treatment groups (n=6). Heat stress broilers were held at 35 ± 2°C temperature and 70 ± 5% RH respectively where as normal temperatures was 25 ± 2°C and RH was 60 ± 5%. Normal control group NE-T fed the normal diet with normal environmental temperature. Heat stress groups considered as HS-A was control group fed the normal diet, HS-B as synbiotic group respectively. Supplementation of synbiotic produced a significantly (p<0.01) increased of the live body weight as compared to control group and highest weight gain was recorded in HS-B as synbiotics group. The hematological parameters (TEC, Hb, PCV, ESR) also significantly (p<0.01) differ compared to control. The biochemical parameters in uric acid was a significant (p<0.05) difference among groups and there was no significant (p>0.05) difference among groups in serum cholesterol after treating with synbiotic. From the findings it could be suggested that synbiotic is essential for the maintainnce of broilers performance under heat stress condition. To establish synbiotics as a growth promoter, further study needed to see any adverse effect in relation to histopathology and biochemistry before making any conclusion regarding the beneficial effect in broilers.

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REFERENCES

[1] M. D. Collins and G. R. Gibson, Probiotics, prebiotics, and synbiotics Approaches for modulating the microbial ecology of the gut, Poultry Science, 79:147–245, 1999

[2] R. Fuller, Probiotics in man and animals, Journal Applied Bacteriology, 66:365–378, 1989.

[3] G. R. Gibson and M. B. Roberfroid, Dietary modulation of the human colonic microflora: Introducing the concept of prebiotics, International Journal of Nutrtion, 125:1401–1412, 1995.

[4] E. Samik, A. Maiorka, M. Macari, M. Grecco, T. M. Okada, A. M. Myasaka, Performance and intestinal mucosa development of broiler chickens fed diet containing Sccharomyces cerevisiae cell wall, Journal of Applied Poultry. Research, 10: 236-244, 2007.

[5] Dhawale, A. L. D'souza, C. Rajkumar, J. Cooke, C.J. Bulpitt, Probiotics in prevention of antibiotic associated diarrhea: meta-analysis" ,BMJ324 (7350): 1361, 2005.

[6] B. P. Singh, R. S. Chauhan, Single or combined effects of mannan-oligosaccharides and probiotic supplements on the total oxidants, total antioxidants, enzymatic antioxidants, liver enzymes, and serum trace minerals in cyclic heat-stressed broilers, Poultry Science, 90:2573–2577, 2011.

[7] W. A. Vicente, E.R.L Pelicano, A. Oba, E. A. Norkus, L. M. Kodawara, Effect of different probiotics on broiler carcass and meat quality, British Journal of Poultry Science, 5:207 214, 2007.

[8] J. D. May, J. W. Deaton, F. N Reece, S. L. Branton , Effect of acclimation and heat stress on thyroid hormone concentration, Poultry Science, 65:1211–1213, 1986.
[9] P. T. N. Lan, L. T. Binh, Y. Benno, Impact of two probiotic Lactobacillus strains feeding on fecal lactobacilli and weight gains in chicken, Journal of General Applied Microbiol.ogy, 49:29–36, 2003.
[10] P.J. Sansonetti, War and peace at mucosal surface, Natural Review of Immunology. 4:953–964, 2004.
[11] M.U. Sohail , A. Ijaz ,M.S. Yousaf, K.Z. Ashraf ,H. Aneb, M. Aleem, H. Rehman, Dietary Supplementation of mannan-oligosaccharide and Lactobacillus-based probiotic: Dynamics of cortisol,thyroid hormones, cholesterol, C-reactive protein, and humoral immunity. Poultry Science, 89:1934–1938, 2010.
[12] W. Awad, K.Ghareeb, J. Böhm, Intestinal structure and function of broiler Chickens on diets supplemented with a probiotic containing Enterococcus faecium nd Oligosaccharide, International Journal of Molecular Science, 9:2205–2216, 2009.
[13] Y. Yang, P. A. Iji, A. Kocher, E. Thomson, L.L Mikkelsen, M. Choct, Effects of mannanoligosaccharide in broiler chicken diets on growth performance, energy utilization, nutrient digestibility and intestinal micro flora, British Poultry Science, 49:186–194, 2008.
[14] K. C. Mountzouris, P. Tsirtsikos, E. Kalamara, G. K. Schatzmayr, K. Fegeros, Evaluation of the efficacy of probiotic containing Lactobacillus, Bifidobacterium, Enterococcus, and Pediococcus strains in promoting broiler performance and modulating cecal microflora composition and metabolic activities, Poultry Science, 86:309–317, 2007.
[15] M. E. Koenen, J. Kramer, R. van der Hulst, S. H. M. Jeurissen, W. J. A. Boersma, Immunomodulation by probiotic lactobacilli in layer- and meat-type chickens, British Poultry Science, 45:355–366, 2004.
[16] N. Cetin, A. Khaksefid, T. Ghoorchi 1995, Effect of probiotic on some hematological and immunocompetence in broiler chicks, Journal Poultry Science, 43:296–300, 1995.
[17] Haldar, T .K. Ghosh, Toshiwati, M. R. Bedford, Effects of yeast (Saccharomyces cerevisiae) and yeast protein concentrate on production performance of broiler chickens exposed to heat stress and challenged with Salmonella enteritidis, Animal Feed Science Technology, 168:61–71, 2011.
[18] H. H. Dukes, The physiology of domestic animals ,7th edition, Baillers Tindal andn Co. London, 96-98, 1955.
[19] Swain and Johri 2000, Comparative evaluation of probiotic culture, mannanoligosaccharide and an antibiotic on urea level of broilers, Poultry Science, 79:117, 2000.
[20] M. L. Huff, H. S. Nakaue, L. W. Mirosh , Effect of probiotic on performance and Biochemical parameters in pullets, Poultry Science, 43, 296-300, 1992.
[21] Kumar and Rawat, Effects of direct fed microbials on nutrient retention and parameyers of Single White Leghorn pullets, Poultry science 62 (suppl2): 71, 1976.
[22] T. A. Wilson, R. J. Nicolosi, E. J. Rogers, R. Sacchiero, D. J. Goldberg, Studies of Cholesterol and bile acid metabolism and early atherogenesis in hamsters fed GT16 239, a novel bile acid sequestrant (BAS), Atherosclerosis. 40: 315-324, 1998.
[23] F. A. M. Klaver and R.Van Der Meer, The assumed assimilation of cholesterol by lactobacilli and Bifidobacterium bifidum is due to their bile salt-deconjugating activity, Applied Environmental Microbiology, 59: 1120-1124, 1993.