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BENIFICIAL EFFECTS OF PROBIOTIC ON GROWTH PERFORMANCE AND HEMATO-BIOCHEMICAL PARAMETERS IN BROILERS DURING HEAT STRESS

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ABSTRACT: The experiment was carried out to investigate the effects of probiotic 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 5 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 probiotic group fed the normal diet with 0.2g probiotic (Protexin® Boost). The results revealed that supplementation of probiotic 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 probiotic group (1660.00b ± 6.124 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 probiotic. Therefore, it is concluded that probiotic is essential for the maintenance of broilers performance under heat stress condition.

KEYWORDS: Probiotics, Growth performance, 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. Moreover, cross-resistance to antibiotics used in the therapy of humans and other animals could also result [1], [2], [3]. In the modern intensive poultry production, newly hatched chicks have little chance of contact with their mothers and consequently normal microflora is slow in colonizing the intestine (Fuller, 1989). It is during this early period, when a stable gut microflora has not yet been established that the chick is most vulnerable to colonization by pathogens. Eden's mentioned that with increasing concerns about antibiotic resistance, and the ban on sub-therapeutic antibiotic usage in Europe and the potential for a ban in the United States, there is increasing interest in finding

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alternatives to antibiotics for poultry production. The so called probiotics can be listed among these products. 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. In large-scale rearing facilities where poultry are exposed to stressful conditions there problems related to diseases and deterioration of environmental conditions often occurs and results in serious economic losses. 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 [4]. Probiotics are live bacteria which are intended to colonize the large intestine and confer physiological health benefits to the host [5]. There are various beneficial effects of probiotics in terms of health and product. These areas - a) Production of lactic acid and hydrogen peroxide which are detrimental to many pathogens b) Lowered O-R potential in the gut inhibiting the aerobic pathogens c) Competitive antagonisms d) Prevention of the accumulation of toxic amines and ammonia e) Beneficial organisms entering a system prior to the establishment of a non-beneficial flora f) Production of essential digestive enzymes g) Production of B-vitamin h) Appetite stimulation and non-specific immunomodulators stimulant [6]. Probiotic supplementation in broilers reared during high environmental temperature significantly improved appetite for feed intake which could eventually increase body weight growth and feed efficiency [7]. The subjecting broilers to high environmental temperature significantly suppressed growth performance whereas, feeding probiotic can improve body weight gain and lower feed conversion ratio [8]. The effects of a dietary treatment with a probiotic product on stress broiler chickens. The body weight, average daily weight gain, carcass yield percentage and feed conversion rate were significantly increased compared with the control [9]. The probiotic supplementation caused statistically significant increase in the erythrocyte count, hemoglobin concentration and haematocrit values of broilers during high environmental temperature [10].

2 METHODS

2.1 STATEMENT OF THE EXPERIMENT

The experiment on effects of probiotic on growth performance and hemato-biochemical parameters in broilers during high environmental temperature condition 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 probiotic group (HS-B)** - Normal feeding & 0.2g Protexin® Boost in per liter of drinking water as probiotic 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 probiotic 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 weekly. 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 RESULT

3.1 EFFECTS OF PROBIOTIC ON GROWTH PERFORMANCE

Table 1. Effects of probiotic 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 (Probiotic)	420.00a ± 3.54^{NS}	725.00b ± 5.00**	1081.00b ± 5.34**	1489.00b ± 3.317**	1660.00b ± 6.124**

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

3.2 EFFECTS OF PROBIOTIC ON BLOOD PARAMETERS

Table 2. Effects of probiotic 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 (Probiotic)	2.62b ± 0.058**	8.42a ± 0.066**	26.70ab ± 0.539**	3.40c ± 0.141**

*** indicates p<0.01*

3.3 EFFECTS OF PROBIOTIC ON BIOCHEMICAL PARAMETERS

Table 3. Effects of probiotic 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 (Probiotic group)	6.46a b± 0.163*	137.00a ± 3.924^{NS}

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

4 DISCUSSION

4.1 EFFECTS OF PROBIOTIC ON GROWTH PERFORMANCE

The present findings showed that when supplementation of probiotic 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 probiotic mixture increased body weight gain in broilers when they are exposed to high environmental temperature or stressful condition [11]. 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 [12], [13], [14]. 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. It may be defined as the probiotics are live bacteria which are intended to colonize the large intestine and confer physiological health benefits to the host. Probiotic bacteria may colonize the upper part of the intestine to avoid the adhering of pathogens to the intestinal tract and may help in digestion which is agreed to the present study. So the present study states that probiotic 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 PROBIOTIC ON BLOOD PARAMETERS

The present findings showed that when supplementation of probiotic in broilers during high environmental temperature the hematological parameters (TEC, Hb, PCV, ESR) significantly (p<0.01) differ compared to both control groups. 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 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 [15] 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. The present findings suggested that supplementation of probiotic 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 PROBIOTIC ON BIOCHEMICAL PARAMETERS

The present findings showed that when supplementation of probiotic 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 probiotic. Increased uric acid in the treated group resembles Swain and Johri who detected the uric acid level increased significantly (p<0.01) with probiotics supplementation. Moreover, it has been also reported that supplementation of probiotics increased uric acid and creatinine level which are support to the present study [16]. 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 probiotic on organs of urinary system. There are some probiotics which are essential for normal growth of the urinary organs and stimulate that enzyme which are responsible for uric acid formation [17]. 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 of probiotic 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 is stated the synthesis of bile acids from cholesterol in the liver is the most important way of cholesterol excretion and when probiotic supplementation in broilers during high environmental temperature the cholesterol level gradually decreased which is support to the present study [18]. 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 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 [19]. 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 probiotic 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 probiotic/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 probiotic under heat stress condition.

5 CONCLUSION

The research work was carried out to investigate the effect of probiotic 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 5 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, was treated with probiotic respectively. Supplementation of a probiotic 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 probiotics 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 probiotic. From the findings it could be suggested that probiotic is essential for the maintenance of broilers performance under heat stress condition. To establish probiotics 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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