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INFLUENCES OF PREBIOTIC ON GROWTH PERFORMANCE AND HEMATO-BIOCHEMICAL PARAMETERS IN BROILER DURING HEAT STRESS

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ABSTRACT

The study was carried out to investigate the effect of prebiotic 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=10). Broilers held at 35 ± 2°C temperature and 70±5% relative humidity were considered as heat stressed those kept at 25 ± 2°C and relative humidity 60 ± 5% were considered as normal. Normal control group (NE-T) was provided with the normal diet. Heat stressed groups consisted of HS-A as provided with normal diet; HS-B provided with the normal diet with 0.2g prebiotic (A-MOS). The results revealed that supplementation of prebiotic significantly ($p<0.01$) increased the live body weight as compared to heat stressed but without prebiotic supplement. The highest weight gain was recorded in normal control group (1623.00e±7.176 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) were also significantly ($p<0.01$) varied in comparison to the both control. The uric acid a biochemical parameter varied significantly ($p<0.05$) among groups. Therefore, it is may be concluded that prebiotic is helpful for the maintenance of broilers performance under heat stress condition.

Key words: Prebiotics, Growth performance, Blood parameters, Heat stress, Broilers

INTRODUCTION:

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. The contribution of this sector 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 may lead to diseases or decrease the production potentials which in turn results in serious economic losses. Heat stress (HS) is one of the most serious climate problems of tropical and subtropical regions of world which negatively affects the production performance of poultry (Sohail *et al.*, 2010). A prebiotic is a food or dietary supplement product that confers a health benefit on the host associated with modulating the microbiota (Gibson and Roberfroid, 1995). A prebiotic is a fiber such as fructose oligosaccharide, galactose oligosaccharide etc and is consumed that is intended to stimulate the microflora in the large intestine. A-MOS is a commercial prebiotic of the mannan-oligosaccharides family which is obtained by extraction from the outer cell wall of the yeast *Saccharomyces cerviciae* (Piray *et al.*, 2007). Mannanoligosaccharide in the ration of broiler chickens, significantly reduced the serum cholesterol level on day 35 as compared with the control ($p<0.05$) (Panda *et al.*, 2001). The addition of a prebiotic product on stressed broiler chickens has positive impact on average daily weight gain, carcass yield percentage and feed conversion rate in comparison to the control (Awad *et al.*, 2009). The prebiotic supplementations also significantly increase in the erythrocyte count, hemoglobin concentration and haematocrit values of broilers during high environmental temperature (Cetin *et al.*, 1995).

MATERIALS AND METHODS

The study on effects of prebiotic 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 the period from 28th July, 2013 to 31th August, 2013.

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Experimental design

A total of 30, 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 or 10 which is correct 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.

- **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 prebiotic group (HS-B)** - Normal feeding & 0.2g Active-mannan oligosaccharide in per liter of drinking water as prebiotic daily up to 5 weeks during high environmental temperature (T= 35 ± 2°C, RH= 70 ± 5%).

Blood collection

After 5 weeks, blood sample was collected aseptically from wing vein to test of effects of prebiotic on RBC, Hb, PCV, and ESR from 3 birds in each group (9 birds). Three (3) ml of blood was collected from each bird at a time and transferred to a labeled 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.

Statistical analysis

During the study period the data on daily feed intake and weekly body weight gain were recorded of each bird. The mean differences among the treatments were determined as per Duncan's Multiple Range Test using MSTAT.

RESULTS AND DISCUSSION

Effects of prebiotic on growth performance

The present findings showed that when supplementation of prebiotic in broilers during high environmental temperature the body weight increased significantly ($p<0.01$) among the treated groups and suppress the stressful condition. Vicente *et al.* (2007) 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.

Table 1. Effects of prebiotic 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)	424.00^{a}±2.92	659.00^{c}±4.30	1050.00^{c}±3.54	1407.00^{c}±3.742	1623.00^{c}±7.176
HS-A (Heat stress control)	427.00^{a}±2.55	540.00^{e}±7.07	830.00^{e}±6.52	1121.00^{e}±5.788	1303.00^{e}±4.899
HS-B (Prebiotic)	430.00^{a}±3.54	590.00^{d}±3.54	910.00^{d}±3.54	1360.00^{d}±7.071	1518.00^{d}±6.042
Level of significance	NS	**	**	**	**

Normally, heat stress suppresses body weight gain in broilers due to less feed intake, less metabolic activity and intestinal microbial dysbiosis. Heat stressis one of the most serious climatic problems of tropical and subtropical regions of world which negatively affects the production performance of poultry and livestock. It is because that heat stress leads to endocrine disorders, reduced metabolic rate, lipid peroxidation, decreased feed

consumption, decreased body weight gain, higher feed conversion ratio (FCR), immunosuppression and intestinal microbial dysbiosis (May *et al.*, 1986; Lan *et al.*, 2003; Sansonetti, 2004; Sohail *et al.*, 2010).

Values followed by different superscript letters in the same column differ significantly (P<0.01). Our experiment stated that prebiotic (MOS) may stimulate and modulate the beneficial micro-organisms which are present in intestinal tract resulting in increase appetite, intestinal digestion and absorption and ultimately; increased growth performance. Gibson and Roberfroid (1995) observed that a prebiotic is a food or dietary supplement product that confers a health benefit on the host associated with modulating the microbiota. So the present study states that prebiotic influences the higher growth performance in broilers under heat stressed condition but not normal condition.

Effects of prebiotic on blood parameters

The present findings showed that when supplementation of prebiotic in broilers during high environmental temperature the hematological parameters (TEC, Hb, PCV, ESR) significantly (p<0.01) varied from both control groups. The significantly increased (p<0.05) hematological parameters (TEC, Hb, PCV, ESR) of broilers under heat stress condition in experimental groups may due to the stimulating effects of prebiotic on hemopoitic organs. There are some prebiotics which are essential for normal growth of the hemopoitic organs and erythropoiesis. The given prebiotics (A-MOS) may stimulate the hemopoitic organs and causes erythropoiesis results increase the hematological parameters during high environmental temperature.

Table 2. Effects of prebiotic on hematological parametersin broilersduring heat stress

Groups	TEC (Millions/mm^3)	Hb (gm/dl)	PCV (%)	ESR (mm in 1^{st} hour)
NE-T (Normal control)	2.22^{bc}±0.073	7.40^{c}±0.071	23.80^{c}±0.860	3.86^{b}±0.186
HS-A (Heat stress control)	2.12^{c} ±0.097	7.18^{c} ±0.066	21.00^{d}±0.707	4.62^{a} ±0.058
HS-B (Prebiotic)	2.36^{a}± 0.093	8.08^{b} ±0.102	25.80^{bc}± 0.800	4.26^{ab}±0.051
Level of significance	*	*	*	*

Values followed by different superscript letters in the same column differ significantly (p<0.05). The hematological parameters of this study resembles to that of Dukes (1955), 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. This study showed that supplementation of prebiotic in broilers ration significantly (p<0.05) increase most of the hematological parameters as compared to those in control group.

Effects of prebiotic on biochemical parameters

The results of our study showed that when supplementation of prebiotic in broilers during high environmental temperature, the biochemical parameters like uric acid significantly (p<0.05) increased in treated groups than control groups and there was no significant (p>0.05) difference among groups for serum cholesterol. Increased uric acid in the treated group resembles the findings of Swain and Johri (2000). Moreover, Huff *et al.* (1992) reported that supplementation of prebiotics increased uric acid and creatinine level which also supports our findings. The significantly increases (P<0.05) uric acid level in broilers under heat stress condition may be due to the stimulating effects of prebiotic on the organs of urinary system. There are some prebiotics which are essential for normal physiology of the urinary organs and have stimulating effects on the enzymes responsible for uric acid formation (Kumar and Rawat, 1976). The prebiotics (A-MOS) used in this study may also have stimulating effect on the renal enzyme which is responsible for uric acid formation in broilers during high environmental temperature.

Values followed by different superscript letters in the same column differ significantly ($p<0.05$). In this study, no noticeable difference on the level of cholesterol was observed due to prebiotic treatment. Wilson *et al.* (1998) stated the synthesis of bile acids from cholesterol in the liver is the most important way of cholesterol excretion and when prebiotic supplementation in broilers during high environmental temperature the cholesterol level gradually decrease which also supports the findings our study.

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

Treatment groups	Uric acid (mg/dl)	Cholesterol (mg/dl)
NE-T (Normal control)	$5.88^{b}\pm0.177$	$138.20^{a}\pm2.417$
HS-A (Heat stress control)	$6.10^{b}\pm0.333$	$132.80^{a}\pm2.437$
HS-B (Prebiotic group)	$6.26^{b}\pm0.266$	$136.60^{a}\pm2.713$
Level of significance	*	NS

It is concluded that supplementation of 0.2 gm prebiotic/litre drinking water in treatment groups significantly ($p<0.01$) increased the live body weight and hematological parameters. The biochemical parameters like uric acid varied significantly ($p<0.05$) among groups and there was no significant ($p>0.05$) difference among groups in serum cholesterol after treating prebiotic in broilers under heat stress condition.

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