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Effect of certain heat stress alleviating agents on heamato biochemical parameter in broilers during heat stress

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Abstract
Three hundred day old broiler straight run chicks of "Vencobb 400" strain were equally and randomly distributed into five treatment groups which subdivided three four replicates containing 20 chicks in each. The dietary treatment groups were the control diet (BIS, 2007, A), Basal diet + Vitamin C @ 250 mg/ kg diet (B), Basal diet + Chromium picolinate @ 2.5 mg/kg diet (C), Basal diet + Magnesium sulphate @ 2.5 g/kg diet (D) Basal diet + Vitamin C @ 250 mg/ kg diet + Chromium picolinate @ 2.5 mg/kg diet + Magnesium sulphate @ 2.5 g/kg diet (E). The total protein, albumin and ALP were observed significantly higher all heat stress alleviating agents (CrPic, VitC and $MgSO_4$) groups at 21 and 42 day of age as compared to control. However, the serum glucose and cholesterol were observed significantly lower in bird fed alone or in combination heat stress alleviating agent groups at 21 and 42 day of age as compared to control. In conclusion, Chromium picolinate, Vit.C and $MgSO_4$ alone or in combination can be use in diet of broiler birds during summer.

Keywords: Broiler, heat stress, heamato biochemical parameter

Introduction
The heat stress has detrimental effects on the performance of broiler chickens through reducing growth rate, feed intake, feed efficiency and carcass quality as well as health [1][2][3]. Poultry birds do not have sweat glands for heat releasing factor, if panting failed to reduce the high internal body temperature, birds become inactive, exhausted and mortality occurred because of the circulatory, respiratory and electrolytes imbalance [1, 4]. The modern chicken genotypes produce more body heat, due to their greater metabolic activity [5] Many studies have shown impaired growth performance in broilers subjected to heat stress [6-8]. It was noted that heat stress causes alteration in the serum cholesterol, triglycerides [9] total protein, glucose [10] A Vitamin C plays a major role in the biosynthesis of corticosterone [21], a primary glucocorticoid hormone involved in gluconeogenesis to enhance energy supply during stress. However, under critically high ambient temperatures, the production of Vitamin C in broilers is inadequate for optimum performance. Several researchers have reported beneficial effects of Vitamin C supplements given either in diets and or in drinking water. Kassim and Norziha (1995) [11] reported that Vit. C supplementation in broilers improved weight gain and feed efficiency in the natural hot humid climate. The Chromium, as an integral component of the glucose tolerance factor (GTF), helps control appetite, hypoglycemia and protein uptake and plays a protective role against heart disease and diabetes. Dietary chromium supplementation has been shown to positively affect the growth rate and feed efficiency of growing poultry. Supplemental chromium and vitamin C significantly alleviated the cold stress suggesting that additional vitamin C and chromium supplementation into diets may be necessary under stress conditions [12]. Recently the beneficial effects of magnesium sulphate in alleviating heat stress have been highlighted in the literature [13]. Keeping above facts in view, the present study have been planned to evaluate the effects of certain heat stress alleviating agents viz. Vitamin C, Chromium picolinate and Magnesium sulphate either alone or in combination on heamato biochemical parameter in broilers during heat stress

Materials and Methods
The experiment was conducted from 7th May to 18th June, 2016 during this period the temperature ranged was very high i.e. 43-47.5 ^{0}C. Three hundred day old broiler Straight run chicks of "Vencobb 400" strain were equally and randomly distributed into five treatment groups which subdivided three four replicates containing 20 chicks in each, reared on deep

litter system in pens up to 6 weeks of age. The diets were formulated as per BIS, 2007.The dietary treatment groups were the control diet Control – Basal diet (A), Basal diet + Vitamin C @ 250 mg/ kg diet (B), Basal diet + Chromium picolinate @ 2.5 mg/kg diet (C), Basal diet + Magnesium sulphate @ 2.5 g/kg diet (D) Basal diet + Vitamin C @ 250 mg/ kg diet + Chromium picolinate @ 2.5 mg/kg diet + Magnesium sulphate @ 2.5 g/kg diet (E).The environmental temperature was noted during study period. The birds were offered water and feed ad libitum throughout the experimental period of 6 weeks. At the end third and sixth week of experiment five birds were selected at random from each group and about 5 ml of blood was collected aseptically from each of the birds. Then the blood samples were processed for separation of serum. The parameters were analyzed by using standard methods such as Serum cholesterol (CHOD/PAD), Serum protein (Biurette Method), Albumin - BCG end point method. Globulin – Calculated by difference (Total protein - Albumin). Serum glucose (DPEC - GOD/POD Ranbaxy) and Alkaline phosphates (Modified Kind and King's method). The data obtained on various parameters during this experimental trial were subjected to statistical analysis as described by Snedecor and Cochran (1994) [14].

Results and Discussion

Total serum protein

The maximum serum total protein level for 21 day was observed in chromium @ 2.5 mg/kg level group C (3.395±0.13), followed by vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (3.383±0.13), vit C @ 250 mg/kg level group B (3.253±0.08), magnesium sulphate@ 2.5 gram/kglevel group D (3.08±0.04) and lowestserum total protein level i.e.(2.953±0.07)was found in control group A.

The maximum serum total protein level for 42 day was observed in chromium @ 2.5 mg/kg level group C (3.493±0.18) and vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (3.493±0.14) followed by magnesium sulphate @ 2.5 gram/kg (3.315±0.13), vit C @ 250 mg/kg (3.303±0.09) and lowest serum total protein level i.e. (2.823±0.04) was found in control group A. the present results are line with Gursu *et al.*, (2004) [19] reported that changes observed in serum total protein by feeding vitamin C and folic acid to Japanese quails. Sujatha (2010) [15] reported that changes observed in serum total protein by feeding synthetic vitamin C to broiler birds. Ebrahimnazhad and Ghanbari (2014) [16] reported that changes observed in serum total protein by feeding chromium picolinate to broiler chicks. The significantly increase in serum total protein was observed in birds fed @1200µg/kg than control group however non-significant increase was observed in birds fed with 400, 800,1600 µg/kg as compared to birds fed with 1200 µg/kg chromium picolinate. Yildiz *et al.*, (2004) [17] reported that changes observed in serum total protein by feeding chromium picolinate to Japanese quails. The significant increase in serum total protein was observed in birds fed with 1000 ppb chromium picolinate, followed by 750, 500, 250 ppb of chromium picolinate. The increase in total protein level might be due to increase participation of magnesium sulphate in protein metabolism as it has important role in action of many enzymes. (Hou *et al.*, 2014) [18]

Table 1: Influence of dietary supplementation of heat stress alleviating agents on serum biochemical constituents of broilers at 3rd and 6 weeks of age.

Parameter	Serum total protein (mg/dl)		Serum Albumin (mg/dl)		Serum Glucose (mg/dl)		Serum ALP (KA unit)		Serum Cholesterol (mg/dl)	
	21 day	42 day	21 day	42 day	21 day	42 day	21 day	42 day	21 day	42 day
Group-A	2.95^{c} ±0.07	2.82^{b} ±0.04	1.77^{c} ±0.04	1.69^{b} ±0	308.86^{a} ±2.1	312.06^{a} ±1.17	45.88^{b} ±2.94	47.63^{c} ±2.68	120.65^{a} ±2.96	262.26^{a} ±4.71
Group-B	3.25^{abc} ±0.08	3.30^{a} ±0.09	1.95^{ab} ±0.05	1.93^{a} ±0.05	279.88^{bc} ±3.16	283.86^{bc} ±2.66	72.18^{a} ±4.61	74.93^{ab} ±3.69	109.58^{bc} ±1.3	195.38^{c} ±7.67
Group-C	3.39^{a} ±0.13	3.49^{a} ±0.14	2.03^{a} ±0.08	2.09^{a} ±0.09	273.06^{c} ±2.2	275.68^{cd} ±2.56	74.91^{a} ±4.54	77.25^{a} ±3.94	107.6^{c} ±1.06	187.73^{cd} ±7.34
Group-D	3.08^{bc} ±0.04	3.31^{a} ±0.13	1.84^{bc} ±0.02	1.953^{a} ±0.08	283.71^{b} ±3.16	285.63^{b} ±3.19	53.63^{b} ±2.69	65.88^{b} ±3.91	113.88^{b} ±2.69	218.03^{b} ±5.91
Group-E	3.38^{ab} ±0.13	3.49^{a} ±0.18	2.03^{a} ±0.08	2.10^{a} ±0.12	275.23^{bc} ±3.69	274.13^{d} ±4.01	80.28^{a} ±4.42	81.75^{a} ±4.61	107.28^{c} ±1.5	175.41^{d} ±5.68

Means bearing different superscripts differ significantly within a column, $P<0.05$.

Serum albumin

The serum albumin level at 21 day among different treatment groups varied between 1.776±0.04 and 2.036±0.08 g/dl. The serum albumin level at 42 day among different treatment groups varied between 1.69±0 and 2.103±0.12 g/dl. At 21 day of age significant higher values was observed in treatment group C and treatment group E and numerically higher values was observed in treatment group B and treatment group D. However at 42 day of age significant difference was found among all treatment groups.

The maximum serum albumin level for 42 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (2.103±0.12) and chromium @ 2.5 gram/kg level group C (2.09±0.09) followed by magnesium sulphate @ 2.5 gram/kg (1.953±0.08), vit C @ 250 mg/kg (1.933±0.05) and lowest serum albumin level i.e. (1.69±0) was found in control group A.

Present finding also correlate with Gursu *et al.*, (2004) [19] reported significant increase in serum total protein by feeding vitamin C and folic acid to Japanese quails. However, Sujatha (2010) [15] reported non-comparable difference in control and treatment group. El-Samra Abo-Egla *et al.* (2014) [20] observed non-significant difference in control and treatment group.

Serum Glucose

The serum glucose level at 21 day among different treatment groups varied between 273.066±2.2 and 308.866±2.1 g/dl. The serum glucose level at 42 day among different treatment groups varied between 274.133±4.01 and 312.066±1.17 g/dl. At 21day of age significant lower values was observed in treatment group C and numerically lower values was observed

in treatment group B, treatment group E and treatment group D as compared to control. However at 42 day of age significantly lower values was found among all treatment groups compared to control.

The minimum serum glucose level for 21 day was observed in chromium picolinate @ 2.5 mg/kg level group C (273.066±2.2) followed by vit. C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (275.233±3.69),vit C @ 250 mg/kg level group B(279.883±3.16),magnesium sulphate@ 2.5 gram/kg level group D(283.716±3.16)and highest serum glucose level i.e.(308.866±2.1)was found in control group A.

The minimum serum glucose level for 42 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (274.166±4.01) followed by chromium @ 2.5 mg/kg level group C (275.683±2.56), vit.C @ 250 mg/kg (283.866±2.66), magnesium sulphate @ 2.5 gram/kg (285.633±3.19), and highest serum glucose level i.e. (312.066±1.17) was found in control group A. The significant decrease in serum glucose might be due to increase in insulin level in blood which helps in glucose uptake and improvement in non-oxidative glucose metabolism. (Yildiz *et al.*, 2004) [17]. The concentrations of glucose, significantly affected (p>0.05) by supplementation of heat sress alleviating agents and their combination. The results of the current study indicated that addition Vit.C, CrPic. and Magnesium sulphate can improve the metabolism rate in heat-stressed broilers. Physiological stresses, such as heat and transportation stress, commonly lead to metabolism reduction in animals (Mushawwir *et al*.2018) [10]. Present finding also correlate with Gursu *et al*. (2004) [19] observed the significant decrease in serum glucose by feeding vit C and folic acid to Japanese quails. Sujatha (2010) [15] also reported significant decrease in serum glucose by feeding synthetic vitamin C to broiler birds. El-Samra Abo-Egla *et al.* (2014) [20] also observed significant decrease in serum glucose by feeding organic chromium and selenium at different dose rates. Sahin *et al.*, (2002) [12] observed significant decrease in serum glucose in Japanese quails fed with chromium picolinate. Yildiz *et al.*, (2004) [17] reported significant decreased serum glucose in laying quails fed with chromium picolinate.

Serum ALP

The maximum serum ALP level for 21 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (80.283±4.42) followed by chromium @ 2.5 gram/kg level group C (74.916±4.54), vit C @ 250 mg/kg (72.183±4.61), magnesium sulphate @ 2.5 gram/kg (53.633±2.69), and lowest serum ALP level i.e. (45.883±2.94) was found in control group A. The maximum serum ALP level for 42 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (81.75±4.61) followed by chromium @ 2.5 gram/kg level group C (77.25±3.94), vit C @ 250 mg/kg (74.933±3.69), magnesium sulphate @ 2.5 gram/kg (65.883±3.91) and lowest serum ALP level i.e. (47.633±2.68) was found in control group A. Present finding also correlate with Gursu *et al*., (2004) [19] observed the significant decrease in serum ALP by feeding vit C and folic acid to Japanese quails

Serum Cholesterol

The minimum serum cholesterol level for 21 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (107.283±1.5) followed by chromium @ 2.5 gram/kg level group C (107.6±1.06), vit C @ 250 mg/kg (109.583±1.3), magnesium sulphate @ 2.5 gram/kg (113.883±2.69), and highest serum cholesterol level i.e. (120.65±2.96) was found in control group A.

The minimum serum cholesterol level for 42 day was observed in vit C @ 250 mg/ kg+ chromium picolinate @ 2.5 mg/ kg+ magnesium sulphate @ 2.5gram/kg level group E (175.416±5.68) followed by chromium @ 2.5 gram/kg level group C(187.733±7.34), vit C @ 250 mg/kg (195.383±7.67), magnesium sulphate @ 2.5 gram/kg (218.033±5.91) and highest serum cholesterol level i.e. (262.266±4.71) was found in control group A. Present finding also correlate with Jain *et al.* (2015) observed significantly decrease in serum cholesterol level in broiler birds fed with vit C. Sujatha (2010) [15] also observed significant decrease in serum cholesterol level by feeding vit C to broiler birds. Gursu *et al*., (2004) [19] reported significant decrease in serum cholesterol level in Japanese quails fed with vit. C and folic acid. This significant increase in serum cholesterol in heat stressed birds might be due to stress induced sympatho-adrenal activity which further leads to protein and lipid catabolism in turn elevating plasma cholesterol concentration (Sujatha, 2010) [15]

Conclusions

The supplementation of chromium picolinate, vit. C and magnesium sulphate alone or in combination in broilers diet had shown significantly enhanced heamato biochemical profile, therefore, we conclude that these heat stress alleviating agents can be use in the ration of broilers during summer

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