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Effect of Acclimation and Vitamin C Addition in Some Physiological Traits and Productive Performance in Local Hens Reared Under Hot Climate

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Abstract. This study was carried out at the animals house–college of the veterinary medicine university of Mosul aimed to identify the effect of acclimation and adding vitamin C to drinking water of local hens reared under hot climate in some physiological traits and production performance. One hundred twenty unsexed one day old (local chicks) were divided to two division, the first division reared on ordinary condition and called not acclimated and other division also reared on ordinary condition yet exposed to (39 ±2)°C temperature for six hours daily at age (6, 9, 12 and 15) days to acclimate them to high temperature and called acclimated. At (22) days old birds divided to four treatments in each treatment thirty chicks with three replicate (ten birds in each). The treatments were as follows T1 Control (An acclimated), T2 Acclimated,T3 An acclimated and adding 150 mg vit.C / Litter drinking water,T4 Acclimated and adding 150 mg vit.C / Litter drinking water. Birds reared under cyclic temperature (25 -36 -25)°C in semi opened housed until 56 days old. Statistical analysis of data showed significant increase in Hetero., Lympho., Mono., Baso., Esino., pH, Hb, RBC, WBC, PCV, weight gain, body weight at slaughter, carcass weight, Relative weight of Gizzard, Spleen and Liver weight for birds of T4. Improving in Heat Tolerance in T3 and T4. No significant differences between treatments in Initial body weight, Relative Heart weight and Body Temperature.

Keywords: blood profile, hot climate, local breed hens, vitamin C.

Introduction

Heat stress is one of the major challenges which the poultry industry faces during summer in tropical and subtropical regions (Attia *et al*., 2017; Saiz del Barrio *et al*. 2020). And considered as important environmental which adversely affects the performance of poultry worldwide (Kumar *et al*., 2021) Acclimation birds to high temperature for different times at the early life of birds make it more resistant and adaptive to sudden changes in temperature , especially high and stress full , as a result of the development of thermoregulatory system , which begins to develop in the first days of bird's life, making the bird more resistant to higher temperatures in later periods of live (De Basilio *et al*., 2001). Under high temperature condition, birds change their behavior to maintain body homeostasis like increasing heat shock protein (Moura *et al*., 2018), adjusting metabolism (Sara *et al*., 2017). Climate considered the biggest factor affecting animal production, Acclimatization is a coordinated phenotypic response to environmental stressors and the response will decay if the stressors are removed , acclimation occurs in two phases short term which acute stress response occur as response is under homeostatic and long term response is under homeorhetic regulation. which called chronic stress response (Robert *et al*., 2019). When the environmental temperature reached above 30°C , birds reduce feed intake which cause decrease in weight gain then feed conversion ratio decline (Chand *et al*., 2016).Vitamin C is a water soluble vitamin , used as anti-stress , antioxidant , so considered as increasing the immune of broilers (Abhilash *et al*., 2012; Khan *et al*., 2012). Vitamin C can help reduce heat stress, removes free radicals

and prevents lipid peroxidation (Rahman *et al*., 2017).

Materials and Methods

This study was carried out at the animal house college of veterinary medicine – university of Mosul for a period 1July 2019 until 25 August (56) days . One hundred twenty unsexed one day old (local chicks) reared in semi opened house and all suitable environments were provided (Hassan and Asim; 2020). Birds were divided to two division, the first division reared on ordinary condition and called not acclimated and other division also reared on ordinary condition yet exposed to (39 ±2)°C temperature for six hours daily at age (6, 9, 12 and 15) days to acclimate to high temperature and called Acclimated . At (28) days old birds divided into four treatments in each treatment thirty chick with three replicate (ten birds in each). The treatments were as follows T1 Control (An acclimated), T2 Acclimated,T3 An acclimated and adding 150 mg vit.C / Litter drinking water,T4 Acclimated and adding 150 mg vit.C / Litter drinking water. Birds reared under cyclic temperature (25 -36 -25)°C in semi opened housed until 56 days old .feed and water were available for birds .Two birds from each replicate weighted , and slaughtered to calculate dressing percentage , Relative weight edible giblets (heart . liver .gizzard) and spleen, Blood collected to determine Hetero , Lympho , Mono , Baso , Esino , pH , HB , R.B.C., W.B.C. and P.C.V.(Abdul-Majeed and Abdul-Rahman; 2021). Rectal body temperature measured used rectal thermometer at the age 6 ,9,12 days old before and after heat exposure . At the end of rearing (56) days two birds from each replicate (Male and female) used to measure the heat tolerance Body Temperature (B.T.) measured before and after exposing to high temperature (40 ± 2) °C for two and four hours used the equation described by Sykes and Fatafth (1986).

$$\text{Heat Tolerance (°C / Hour)} = \frac{\text{B.T. after exposing} - \text{B.T. before exposing}}{\text{Number of Hours Exposing}}$$

Data were subjected to one – way analysis of variance in completely randomized design as described by Steel and Torri (1960) and SAS (2001) program was used in analysis data. The means in the different groups were tested for statistical significance using Duncan's multiple range test as described by Duncan (1955).

Results and discussion

Table (1) the effect of acclimation and adding vitamin C in Hetero , Lympho , Mono and Baso cells . statistical analysis of data showed significant increase in T2 ,T3 and T4 in Hetero as compared with T1, Significant increase in T4 as compared with other treatments in Mono and Baso cells . Significant increase in T1 for Lympho cells as compared with other treatments.

Table 1. Effect of Acclimation and Adding Vitamin C in hetero. , Lympho. , Mono. and Baso. Blood cells.

Treatments	Hetero. %	Lympho. %	Mono. %	Baso. %
T1	0.333 b±20.0	0.314 a±71.1	0.307 b±2.5	0.335 b±3.6
T2	0.859 a±31.5	0.611 c ±59.2	0.268 b ±3.5	0.213 c ±2.3
T3	0.592 a±31	0.653 b ±62.4	0.453 b±2.5	0.260 d±0.7
T4	0.520 a ±30.4	0.670 d±53	0.305 a±5.6	0.314 a±5.1

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water.

Table (2) the effect of acclimation and adding Vitamin C in Esino. , pH , HB , R.B.C. statistical analysis of data indicated significant increase for T4 in Esino. ,pH and HB as compared with other treatment and significant increase in T2 and T4 as compared with T1 and T3 In RBC.

Table 2. Effect of Acclimation and Adding Vitamin C in Esino. , pH , HB , RBC.

Treatments	Esino %	pH	HB (g/dl)	RBC (10^6/mm^3)
T1	0.290 b2.8±	0.026 d±37.5	0.245 c±11.65	0.052 b2.53±
T2	0.163 b±3.5	0.015 b 8.80±	0.307 b .36± 13	0.084 a2.63±
T3	0.163 b±3.4	0.010 c 7.99±	0.213 c12.37±	0.076 b2.56±
T4	0.340 a±5.9	0.026 a9.03±	0.347 a14.31±	0.043 a2.79±

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water.

Table (3) Effect of acclimation and adding Vitamin C in WBC , PCV , Initial Chick Body Weight, Weight gain. statistical analysis of data showed significant increase in WBC, PCV and Weight gain in T4 as compared with other treatments. no significant differences in initial body weight. Significant

increase in weight gain for T4 as compared with other treatments.

Table (4) effect of acclimation and adding Vitamin C in some carcass parameter .statistical analysis of data showed significant increase in T3 and T4 in body weight at slaughter as compared with T1 and T2 .significant increase in T4 as compared with other treatments in carcass weight . no significant differences in heart weight.

Table 3. Effect of Acclimation and Adding Vitamin C in WBC , PCV, Initial Chick Body Weight , Weight gain.

Treatments	WBC ($10^3/mm^3$)	PCV %	Initial Chick Body Weight(gm)	Weight gain (gm)
T1	0.859 d± 4.86	0.366 d31.30±	1.468 a49.30±	17.928c396.80±
T2	0.822 b±6.89	0.341 b35.50±	2.103 a 49.00±	14.249b 489.10±
T3	0.069 c5.91±	0.065 c34.30±	1.752 a46.73±	15.891 b473.87±
T4	0.047 a7.56±	0.221 a36.60±	1.735 a46.29±	29.718 a546.61±

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water.

Table 4. Effect of Acclimation and Adding Vitamin C in Body Weight at slaughter carcass weight and relative Heart Weight.

Treatments	Body Weight at Slaughter/ gm	Carcass Weight gm	Heart Weight %
T1	27.706 c445.80±	20.128 c275.20±	0.016 a0.24±
T2	29.718 b538.40±	8.773 b361.80±	0.026 a0.56±
T3	29.541 a520.60±	8.374 b348.92±	0.016 a0.54±
T4	30.345 a595.80±	15.236 a446.68±	0.016 a0.56±

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water.

Table (5): effect of acclimation and adding Vitamin C in edible giblets(Gizzard , Spleen, Liver) and body temperature. statistical analysis of data showed significant increase in relative gizzard weight in T1 and T4 , significant increase in spleen weight for T4,significant increase in liver weight for T3and T4 .No significant differences between treatments in body temperature.

Table 5. Effect of Acclimation and Adding Vitamin C in Relative weight of Gizzard , Spleen , Liver weight and Body temperature (°C).

Treatments	Gizzard Weight %	Spleen Weight %	Liver Weight %	Body temperature ºC
T1	0.071 a2.34±	0.000 b0.20±	0.044 c2.42±	0.088 a41.18±
T2	0.124 b3.16±	0.016 b0.24±	0.087 b3.12±	0.065 a41.13±
T3	0.130 b2.64±	0.013 b0.22±	0.170 a2.86±	0.065 a41.11±
T4	0.088 a3.46±	0.026 a0.65±	0.083 a3.24±	0.070 a41.07±

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water.

Table (6)Showed the effect of acclimation and adding Vitamin C in Body Temperature (B.T.) and Heat tolerance for local hens exposed to high temperature. Statistical analysis of data indicates no significant differences in Body Temperature before exposing but after 2 hours of exposing there was a significant decrease in body temperature for T3 and T4 as compared with T1 and T2. After 4 hours of exposing all birds died before reaching 4 hours. So no recorded of Body Temperature. Significant decrease in mortality and decrease in heat tolerance for T3 and T4 as compared with T1 and T2.

Table 6. Effect of Acclimation and Adding Vitamin C in Body Temperature (B.T.) and Heat tolerance for local hens exposed to high temperature (39±2)°C and heat tolerance at 56 days old.

Treatments	B. T. Before Exposing °C	B.T.After 2 hours Exposing°C	B.T.After 4 hours Exposing °C	Mortality %	Heat Tolerance °C/Hours
T1	a41.68	a43.47	-------	a100	a0.895
T2	a41.64	b43.48	-------	c66.6	a0.920
T3	a41.60	c42.62	-------	b83.8	b0.510
T4	a41.64	c42.56	-------	d50.0	b0.460

T1: Control , T2: Acclimated ,T3: An acclimated +Adding 150 mg Vit.C / litter drinking water , T4 : Acclimated + Adding 150 mg Vit.C / litter drinking water .

Discution

The decrease in blood parameters for control birds that show in the table (1) may be due to that high environmental temperature alters the poultry health and performances by causing heat stress which caused physiological, and production changes in poultry (Wasti and Mishra, 2020). The decrease in body weight of T1 as compared with other treatments may be due that heat stress in broilers reduces, body weight (Chand *et al*., 2014). The significant increase in weight gain may be due to the effect of acclimation which cause more resistance of birds to heat stress in addition to the effect of vit.C decline in performance and antioxidant status caused by heat stress (Sahin *et al*., 2003). The increase in body weight of birds at slaughter for T3 and T4 may be due to that supplemental vitamin C increases performance and yields better carcass traits in broilers reared under conditions of heat stress (Sahin and Kücük, 2001). The increase in mortality may be due to that heat stress reduces immune status and increase mortality (Chand et al., 2016).

Conclusions

In conclusion exposed birds to high temperature (39 ± 2) ºC for six hours daily at age (6, 9, 12 and 15) and adding 150 mg Vit. C / Litter in drinking water caused improving in heat tolerance and blood, productive performance and some blood parameters.

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