J. of Animal and Poultry Production, Mansoura Univ., Vol 12 (5):169 - 173, 2021

Journal of Animal and Poultry Production

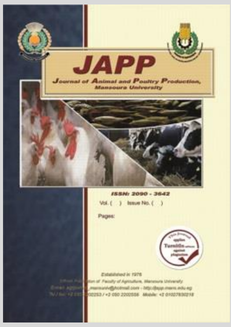
Journal homepage: www.japp.mans.edu.eg
Available online at: www.jappmu.journals.ekb.eg

Alleviating Transport Stress of Broiler Using Vitamin C and Acetyl Salicylic Acid

Hana O. Ibrahim* and Atoof A. Aziz

Department of Animal Sciences, College of Agricultural Engineering Sciences, University of Sulaimani, Sulaimanyah, Kurdistan Region, Iraq

Cross Mark



ABSTRACT

Alleviating the effects of transportation stress was the purpose of this study by using 270 thirty-five-day-old Ross 308 broiler chickens to check out the effects of vitamin C and acetyl salicylic acid (ASA) at different levels via drinking water. Birds in the experiment were randomly allocated to 27 identical pens (140×120×90 cm) with 10 birds each (5 males and 5 females -almost equal in weight-). At the last 24 hours of experiment pens were assigned to 9 water treatments: at levels of 0 (Control),50mg/L vitamin (T1),100mg/L vitamin C (T2), 1 gm/L salicylic acid (T3), 1.5 gm/L salicylic acid (T4), 50mg/L vitamin C with 1 gm/L salicylic acid (T5), 50mg/L vitamin C with 1.5 gm/L salicylic acid (T6), 100mg/L vitamin C with 1 gm/L salicylic acid (T7) and 100mg/L vitamin C with 1.5 gm/L salicylic acid (T8). Studied traits were: glucose, total protein, uric acid, albumin, calcium, globulin, ALT, AST, Creatine Kinase and hormones (T3 and T4) studied in this experiment. Results indicate that incorporating Vit. C and ASA into broilers water compared to control group decrease the value of all stress indicator in a way that each of (glucose, albumin, globulin, uric acid, calcium, ALT, AST, Creatine Kinase and T3) significantly decreased. However, T4 was significantly increased while total protein was not changed. Results concluded that supplementation of the broiler drinking water with Vitamin C and ASA before transportation can be used as effective way for alleviating transporting stress and supporting the broilers to have more stable physiology during transportation.

Keywords: Broiler Chicken, Transport stress, Vitamin C, Acetyl salicylic acid

INTRODUCTION

The growth of human population, growth of cities and improved incomes are the reasons for the developing countries' demand for food of animal origin (Abdullah *et al.*, 2011). Based on this need, a rise in the production of the poultry sector has been faster growing than any other livestock sectors. (Bessei, 2018). Therefore, increasing demand for poultry meat has obliged the founding of new farms and slaughter houses out of their original production area, resulting in a significant increase in poultry transport (Metheringham and Hubrecht, 1996). Conditions of transportation are always considered as source of physiological stress since the very act of handling, crating, loading and transporting poultry has a detrimental effect on the health, physiology and the productivity of the birds (Scope *et al.*, 2002).

The technological progression in commercial vehicles used to transport broilers has not reached yet to Iraq and especially Kurdistan region in terms of module materials, size, and weatherization measures. Therefore, with increased transportation, there is also increased demands for ways to alleviate the stress, particularly with hot climatic conditions. Due to the high mechanical cooling costs of the vehicle, efforts are mainly focused on nutritional correction (abidin and khatoon, 2013).

Vitamin C and acetylsalicylic acid (ASA) are known to have immunomodulatory effects. They have been used as a remedy for many diseases, especially stress in human (Pardue and Thaxton 1986; Balz, 2003), and poultry (Minka and Ayo, 2008; McKee and Harrison, 1995; Ayo and Sinkalu 2003) and other livestock [Ayo et al. 2006). However, the combined effect of ascorbic acid and ASA for reducing the stress caused by broiler transport is better to study. Therefore, this study was to designed to know the alleviating effect of vitamin C and ASA supplementation via drinking water on broilers during transport stress.

MATERIALS AND METHODS

270 Ross 308 (135 males and 135 females) broilers were evaluated from 35 to 42 days of age. Birds were housed at clean well–ventilate room previously disinfected and the management of the nine treatment groups with three replicates were identically carried out. No reused wood shavings were used as litter with the thickness of 5cm.

Birds have been fed manually and feed and water were available at all times during the experiment period which lasted one week. This period was used as adaptation period.

All broilers in this experiment were provided the same commercial diet "grower diet" as shown in tables 1. At the last day Vitamin C and acetylsalicylic acid were added into drinking water at levels of 0 (Control), 50mg/L vitamin (T1), 100mg/L vitamin C (T2), 1 gm/L salicylic acid (T3), 1.5 gm/L salicylic acid (T4), 50mg/L vitamin C with 1 gm/L salicylic acid (T5), 50mg/L vitamin C with 1.5 gm/L salicylic acid (T6), 100mg/L vitamin C with 1 gm/L salicylic acid (T7) and 100mg/L vitamin C with 1.5 gm/L salicylic acid (T8). Broiler chickens were transported from Bakrajo Poultry Breeding Field, to a slaughter house in Piramagroon town, by truck with

* **Corresponding author.**
E-mail address: hanaomeribrahim89@gmail.com
DOI: 10.21608/jappmu.2021.178565

average speed (60 km/h). Transportation was carried out at the end of the day 42. Transportation included broilers from all chickens with numbered legs. The broilers were carried with two hands to hold the wings against the body. Each crate (0.94×0.58×0.27 m3) was contained all birds from of one replicate which means the number of all crates was (27) containing broilers from different groups and they all were randomly distributed in the truck.

Table 1. Ingredient of the grower diet used in the experiment

Treatments / Ingredients %	Control	Treatment 1	Treatment 2	Treatment 3
Yellow Corn	61	61	61	61
Soya bean meal	24	24	24	24
Protein conc.*	7	7	7	7
Wheat	5	4.98	4.96	4.94
Sunflower oil	2.5	2.5	2.5	2.5
DCP** phosphate Phosphate	0.3	0.3	0.3	0.3
Salt	0.2	0.2	0.2	0.2
Arginine	0	0.02	0.04	0.06
Total	100	100	100	100
	Calculated composition***			
Protein	20.15	20.13	20.13	20.13
ME Kcal / Kg	3150	3145	3145	3145
Calcium	0.6	0.6	0.6	0.6
Phosphorus	0.35	0.35	0.35	0.35
Lys.	1.16	1.16	1.16	1.16
Me.	0.54	0.54	0.54	0.54
Meth. to Cyst.	0.85	0.85	0.85	0.85
Arginine	1.387	1.407	1.427	1.447
Arg:Lys	(1.19):1	(1.21):1	(1.23):1	(1.24):1

*** Protein concentrate used in the diets was produced in Holland (WAFI) which contains: 40 % crude protein, 2100 Kcal ME / Kg, 5% crude fat, 2% crude fiber, 6.5% calcium, 2.50% phosphorus, %3.85 lysine, 3.70 % methionine, and 4% cystine.**

**** DCP: Di Calcium Phosphate.**

***** The calculated composition of the diets was determined according to NRC (1994).**

Each crate contained 8 chickens (body weight: approximately 2.840 Kg). So, each crate approximately had the density of 22.720 kg/crate. Before the trip, birds were individually weighed and from brachial vein (1 mL) of blood was collected from each broiler. Transportation began at 8:30pm) outside temperature was recorded at (34.3± 3°C) and inside temperature was (33.6 ± 1.5 °C with 40.0 RH). The crates were randomly set inside the truck to ensure that all broilers get the same microenvironment of the truck. The route was approximately 35 km. After the bird reached to the slaughter house in Piramagroon,

Again, the weight of all birds were individually recorded and blood samples were collected.

Blood samples were centrifuged at (1500 rpm for 10 minutes) to separate serum. The serum was used to measure glucose, globulin, uric acid, calcium, albumin and total protein and activities of (ALT), (AST) and Creatine Kinase (CK), also hormones like T3 and T4. By using the procedures from the instructions of each kit of these assays all the parameters were assayed. These kits were prepared by (Fabricante: Biolabo Sa, 02160, Maizy, France).

Data collected from this experiment were analyzed by the single factor analysis using software XLStat, version 2019.2.2 59614. The significant differences between means of traits included in this study were determined using Duncan's multiple range test (DMRT) under the probability ($p < 0.05$).

RESULTS AND DISCUSSION

Results

Changes in concentration of Total protein, Albumen, Globulin and Glucose

Effect of Vit. C and ASA on plasma total protein, albumen, globulin and glucose is summarized in (Table 2).

Table 2. Effect of Vit. C and ASA on total protein, albumin, globulin and glucose before and after the journey stress (Means ± S.E)

Treatments	Total Protein (g/dl) Before the Journey	Total Protein (g/dl) After the journey	Albumin (g/dl) Before the Journey	Albumin (g/dl) After the journey	Globulin (g / dl) Before the Journey	Globulin (g / dl) After the Journey	Glucose (g / dl) Before the Journey	Glucose (g / dl) After the Journey
C	2.83 ± 0.24a	2.80 ± 0.23 a	1.60 ± 0.22 a	1.54 ± 0.24 a	1.23 ± 0.15 a	1.25 ± 0.24 b	229.45 ±7.95 a	259.13 ± 8.92 a
T1	2.82 ± 0.22a	2.83 ± 0.26 a	1.59 ± 0.19 a	1.54 ± 0.17ab	1.23 ± 0.13 a	1.26 ± 0.2 ab	231.94 ± 8.86 a	258.20 ± 8.64 a
T2	2.83 ± 0.2a	2.99 ± 0.26 a	1.57 ± 0.24 a	1.54 ± 0.18 ab	1.25 ± 0.15 a	1.25 ± 0.23 ab	238.93 ± 7.18 a	257.67 ± 6.22a
T3	2.82 ± 0.19a	2.79 ± 0.25 a	1.56 ± 0.25 a	1.53 ± 0.22 ab	1.25 ± 0.16 a	1.25 ± 0.18 ab	226.16 ± 6.60 a	257.29 ± 10.51 a
T4	2.85 ± 0.21a	2.80 ± 0.25 a	1.56 ± 0.15 a	1.52 ± 0.23 abc	1.24 ± 0.17 a	1.27 ± 0.25 ab	226.65 ± 10.32 a	236.84 ± 10.69 b
T5	2.84 ± 0.24a	2.80 ± 0.22 a	1.59 ± 0.18 a	1.52 ± 0.14 abc	1.24 ± 0.11 a	1.28 ± 0.12 ab	234.89 ± 3.73 a	240.24 ± 11.61 ab
T6	2.83 ± 0.23a	2.79 ± 0.25 a	1.57 ± 0.23 a	1.51 ± 0.18 bc	1.25 ± 0.14 a	1.27 ± 0.23 ab	235.62 ± 8.66 a	235.53 ± 10.11 ab
T7	2.81 ± 0.21a	2.82 ± 0.26 a	1.58 ± 0.21 a	1.51 ± 0.2 bc	1.23 ± 0.14 a	1.31 ± 0.16 a	227.51 ± 8.48 a	234.69 ± 10.44 ab
T8	2.84 ± 0.18a	2.79 ± 0.23 a	1.60 ± 0.22 a	1.50 ± 0.18 c	1.24 ± 0.15 a	1.28 ± 0.21 ab	232.04 ± 10.0 a	225.28 ± 11.32 b

C: control group; T1 T2 adding Vitamin C to the drinking water of broiler chicken at levels of 50 mg/L and 100 mg/L respectively. T3 and T4 adding ASA (1 gm/L and 1.5 gm/L) respectively. T5 and T6 adding (50 mg Vit. C and 1 gm of ASA/L) and (50 mg Vit. C and 1.5 gm of ASA/L) respectively. T7 and T8 adding (100 mg Vit. C and 1 gm of ASA/L) and (100 mg Vit. C and 1.5 gm of ASA/L) respectively.

[a, b, c……]: Values within columns followed by different letters differ significantly ($p<0.05$).

Results revealed that before the stress journey supplementing broiler via drinking water didn't significantly ($P > 0.05$) changed any biochemical traits. Furthermore, after the stress of transportation all traits except (total protein) significantly ($P < 0.05$) changed in a way that plasma albumen decreased in almost all supplemented groups which the highest mean value for this trait was recorded in control group (1.549 g/dl) meanwhile in contrast to albumin, globulin was increased ($P < 0.05$) and the mean value for this trait was recorded in T7 (1.310 g/dl) and T7 comes after it, then the increase of these traits was decreases up to lowest level of supplementation. The highest level of glucose was recorded in control group and the lowest in T8, and mean value of this trait was (259.13and 225.28) g/dl for (control and T8) respectively

Changes in Calcium, Uric acid, cholesterol

Results from Table 3 revealed that adding Vit. C and ASA to the water of broiler chickens significantly decreased

(P < 0.05) uric acid and calcium during the transportation; However, the effects of treatments weren't the same for cholesterol because this trait wasn't different (P > 0.05) after the journey. The highest mean values of uric acid (2.984 g/dl) and calcium (10.829 g/dl) were in control group while the lowest value for both were recorded in T8.

Changes in Enzyme activity

Means of studied enzymes are displayed in (Table 4). After transportation, there is a significant decrease in the activity of AST, ALT, and CK in the treated broilers. Furthermore, the lowest means of these enzymes' activity were (129.85 U/L, 40.32 U/L, 38.98 U/ml $^{-1}$) for AST, ALT, and CK respectively and they all recorded in T8 compared to the highest means of value which were recorded in control group.

Hormonal changes (Triiodothyronine T3 and Tetraiodothyronine T4)

Effect of Vit. C and ASA on T3 and T4 concentrations is summarized in Table 5.

Table 3. Effect of Vit. C and ASA on calcium, uric acid and cholesterol before and after the journey stress (Means ± S.E)

Treatments	Calcium (g/dl) Before the Journey	Calcium (g/dl) After the journey	Uric Acid (g / dl) Before the Journey	Uric Acid (g / dl) After the Journey	Cholesterol (g/dl) Before the Journey	Cholesterol (g/dl) After the journey
C	10.818 ± 1.23 a	10.829 ± 1.31 a	2.906 ± 0. 31a	2.984 ± 0. 21a	97.938 ± 9.76a	98.185 ± 10.55a
T1	10.854 ± 1.2a	10.777 ± 1.23 ab	2.906 ± 0. 53a	2.980 ± 0. 20a	98.916 ± 9.59a	98.109 ± 9.21a
T2	10.879 ± 1.24a	10.765 ±1.20 ab	2.918 ± 0. 43a	2.939 ± 0. 24ab	97.679 ± 9.41a	98.004 ± 9.71a
T3	10.856 ± 1.24a	10.738 ± 1.23 ab	2.909 ± 0. 60a	2.938 ± 0. 31b	97.576 ± 9.96a	97.863 ± 10.76a
T4	10.847 ± 1.27a	10.737 ± 1.25 ab	2.904 ± 0. 23a	2.912 ± 0. 24b	97.710 ± 9.13a	97.584 ± 9.72a
T5	10.905 ± 1.17a	10.717 ± 1.34 ab	2.917 ± 0. 45a	2.891 ± 0. 20bc	97.725 ± 10.16a	97.819 ± 11.70a
T6	10.834 ± 1.25a	10.683 ± 1.28ab	2.920 ± 0. 57a	2.911 ± 0. 27b	97.738 ± 9.09a	98.421 ± 9.89a
T7	10.826 ± 1.27a	10.664 ±1.24 ab	2.899 ± 0. 53a	2.899 ± 0. 17bc	98.662 ± 9.32a	98.169 ± 9.37a
T8	10.891 ± 1.25a	10.618 ± 1.33 b	2.903 ± 0. 49a	2.865 ± 0. 25c	99.010 ± 9.36a	97.634 ± 9.99a

C: control group; T1 T2 adding Vitamin C to the drinking water of broiler chicken at levels of 50 mg/L and 100 mg/L respectively. T3 and T4 adding ASA (1 gm/L and 1.5 gm/L) respectively. T5 and T6 adding (50 mg Vit. C and 1 gm of ASA/L) and (50 mg Vit. C and 1.5 gm of ASA/L) respectively. T7 and T8 adding (100 mg Vit. C and 1 gm of ASA/L) and (100 mg Vit. C and 1.5 gm of ASA/L) respectively.
a, b, c-----: Values within columns followed by different letters differ significantly (p<0.05).

Table 4. Effect of Vit. C and ASA on activity of AST, ALT and CK before and after the journey stress (Means ± S.E)

Treatments	AST (U / L) Before the Journey	AST (U / L) After the journey	ALT (U / L) Before the Journey	ALT (U / L) After the journey	Creatine Kinase (U/mL^{-1}) Before the Journey	Creatine Kinase (U/mL^{-1}) After the Journey
C	119.11 ± 8.79a	150.80 ± 13.23 ab	38.71 ± 4.56a	51.83 ± 6.33a	44.84 ± 5.29a	46.17 ± 3.64a
T1	120.29 ± 9.40a	151.82 ± 13.84 ab	38.72 ± 4.45a	51.77 ± 7.06a	44.50 ± 4.93a	45.48 ± 3.51a
T2	121.19 ± 11.66a	150.78 ± 12.50 ab	38.82 ± 4.58a	49.59 ± 6.61a	43.41 ± 4.66a	45.15 ± 3.27a
T3	122.85 ± 10.62a	145.89 ± 11.25 ab	38.84 ± 5.64a	49.68 ± 5.95a	44.27 ± 4.48a	45.48 ± 3.49a
T4	123.14 ± 8.63a	143.86 ± 15.77 ab	39.21 ± 5.44a	48.44 ± 5.48ab	43.37 ± 4.76a	43.63 ± 3.53ab
T5	123.52 ± 8.41a	140.79 ± 13.22 b	39.56 ± 5.34a	47.26 ± 7.21ab	44.57 ± 4.72a	42.93 ± 3.57ab
T6	119.38 ± 8.81a	140.79 ± 12.36 b	39.67 ± 5.19a	46.93 ± 6.84ab	43.33 ± 4.98a	41. 44 ± 3.61b
T7	123.09 ± 8.93a	137.85 ± 12.39 bc	38.97 ± 4.53a	45.45 ± 6.88b	44.43 ± 4.54a	39.63 ± 3.42bc
T8	119.71 ± 8.58a	129.85 ± 11.23 c	38.44 ± 5.62a	40.32 ± 5.69c	44.31 ± 4.77a	38.96 ± 3.48c

C: control group; T1 T2 adding Vitamin C to the drinking water of broiler chicken at levels of 50 mg/L and 100 mg/L respectively. T3 and T4 adding ASA (1 gm/L and 1.5 gm/L) respectively. T5 and T6 adding (50 mg Vit. C and 1 gm of ASA/L) and (50 mg Vit. C and 1.5 gm of ASA/L) respectively. T7 and T8 adding (100 mg Vit. C and 1 gm of ASA/L) and (100 mg Vit. C and 1.5 gm of ASA/L) respectively.
a, b, c-----: Values within columns followed by different letters differ significantly (p<0.05).

Table 5. Effect of Vit. C and ASA on T3 and T4 before and after the journey stress (Means ± S.E)

Treatments	T3 (ng/mL) Before the Journey	T3(ng/mL) After the Journey	T4 (μg/dl) Before the Journey	T4 (μg/dl) After the Journey
C	3.679 ± 0.02a	3.289 ± 0.02a	3.160 ± 0.09 a	3.372 ± 0.07 d
T1	3.731 ± 0.01a	3.278 ± 0.02a	3.160 ± 0.05 a	3.388 ± 0.05 cd
T2	3.659 ± 0.02a	3.271 ± 0.03ab	3.169 ± 0.15 a	3.408 ± 0.06 c
T3	3.689 ± 0.02a	3.207 ± 0.02bc	3.165 ± 0.08 a	3.421 ± 0.08 bc
T4	3.741 ± 0.03a	3.187 ± 0.03c	3.165 ± 0.11 a	3.433 ± 0.10 b
T5	3.781 ± 0.01a	3.178 ± 0.03c	3.165 ± 0.10 a	3.441 ± 0.12 b
T6	3.649 ± 0.02a	3.168 ± 0.03c	3.163 ± 0.07 a	3.566 ± 0.05 a
T7	3.669 ± 0.02a	3.167 ± 0.02c	3.199 ± 0.11 a	3.571 ± 0.07 a
T8	3.639 ± 0.01a	3.059 ± 0.02d	3.169 ± 0.13 a	3.575 ± 0.03 a

C: control group; T1 T2 adding Vitamin C to the drinking water of broiler chicken at levels of 50 mg/L and 100 mg/L respectively. T3 and T4 adding ASA (1 gm/L and 1.5 gm/L) respectively. T5 and T6 adding (50 mg Vit. C and 1 gm of ASA/L) and (50 mg Vit. C and 1.5 gm of ASA/L) respectively. T7 and T8 adding (100 mg Vit. C and 1 gm of ASA/L) and (100 mg Vit. C and 1.5 gm of ASA/L) respectively.
a, b, c-----: Values within columns followed by different letters differ significantly (p<0.05).

Results revealed that treated groups were lower (P < 0.05) in T3 concentration and T8 recorded the lowest mean compared to control which recorded highest value after the journey. Means value of T3 were (3.059 ng/mL and 3.289 ng/mL) for T8 and Control group respectively. In contrast to (T3), T4 has an increase (P < 0.05) in almost all groups except control, which means the smallest mean of value was recorded in control group and the highest was in T8. Means value for this trait were (3.575 (μg/dl) and 3.372 (μg/dl) for T8 and control respectively.

Discussion

In the current experiment, treated groups recorded a low level of glucose, albumin and globulin; However, these groups showed no significant differences in total protein value compared to the control group which may be refers to the role of ASA and Vit. C in alleviating the impact of stress.

Initially exposed to stress, the bird's neurogenic system is activated by releasing epinephrine, catecholamines and norepinephrine (Siegel, 1980). It seems that epinephrine has the main role in changing metabolism (Assenmacher, 1973). Epinephrine connects to receptors on the cell membrane called P-adrenergic (Bern and Levy, 1990). This results in activations of enzyme; activation of certain protein kinases is most notable which signal the body to activate gluconeogenesis and glycogenolysis (Guyton, 1991). During stress, the main function of norepinephrine is to enact non-shivering thermogenesis to provide energy to skeletal muscles from adipose tissue, this is due to devoting the majority of energy from glucose to other tissues. (Bern and Levy, 1990; Guyton, 1991).

A study of Abdel-Fattah (2006) confirmed that under heat stress conditions, Japanese quail in comparison to the control group has shown significant decreased plasma of albumin, glucose, total protein, and Albumin to Globulin ration concentration after supplementation of 500 mg/kg ASA. It is worthy to note that plasma globulin was not affected.

Results from experiment shows that supplementation ASA and Vit C significantly lowered calcium levels in broiler blood due to their role in in alleviating the impact of stress, because the pituitary gland sends signals to the internal tissue to release Glucocorticoids GCs in response to stress. These are released into the blood and lead to many cellular events that boost alteration in the cells and tissues to adapt to stressful stimuli, (Chrousos, 2009). Franchini et al., (1993) reported that mineralization of the skeleton of young poultry was enhanced by Vitamin C supplement. Recently it was reported that administration of ASA inhibited hypercalcemic effect of a-hydroxyvitamin D3 (Ueno et al., 1980) and decreases serum levels of total calcium (Kawashima et al.,1980).

Based on the results it is confirmed that, compare to a control group, CK, AST and ALT activity is significantly decreased by supplementing broilers with ASA and Vit C. This reduction of activity of these two enzymes in blood plasma may be a result of ASA and Vit C's important role in decreasing the impacts of stress. Moreover, Vitamin C could partially stop certain types of damages in the hepatic cells (McDowell, 1989; Parola et al. 1992; Sies and Stahl, 1992; Burtis and Ashwood, 1994; Netke et al. 1997).

Since one of the commonly used indicators of damages in skeletal muscles is CK activity (Clarkson et al., 1992; Morton and Carter, 1992; Komulainen et al., 1995; Sorichter et al ., 1997; Clarkson and Sayers, 1999), and its suitability to be used in birds is dependent on the number of studies (Franson et al., 1985; Bollinger et al., 1989; Dabbert and Powell, 1993; George and John, 1993; Knuth and • Chaplin, 1994; Totzke et al., 1999). In addition, AST and ALT enzymes are mainly found in liver, however also found in heart cells, red blood cells, muscle tissue and other organs such as pancreas and kidneys. When there is a disease or damage to a body tissue or an organ, more AST and ALT are released resulting in a higher level of the enzyme in the bloodstream (Al - Daraji et al., 2008), Thus, the level of AST and ALS is proportional to the extent of the damage to the tissue.

In the present study, stress of transportation resulted in changes of T3 and T4 at deferent levels in control groups. These results may be due to the action nature of this hormone. Since thyroid gland activity can be affected by intensity of heat and its secretion is changed due to changes happening in the histology of the gland. (Rachid *et al.* 2001).

In our study, opposite to the low level of T3 in non-supplemented group, the concentration of T4 was higher in supplemented group. This result may be explained by increasing the albumin concentration in plasma and the binding affinity of albumin to T4. Another reason of increasing T4 concentration in supplemented group is of a declining rate of conversion of T4 to T3 (Bueno *et al.*, 20 17), consequently T4 concentration elevated due to lower deterioration and longer half-life of T4 in circulation.

CONCLUSION

Vitamin C and ASA via drinking water can be used to reduce the negative impact of transportation stress of broiler. The best result was obtained from adding 100mg/L vitamin C with 1.5 gm/L salicylic acid.

REFERENCES

Abdel-Fattah, S.A. (2006). Physiological and immunological adjustments of dietary ascorbic acid and acetyl salicylic acid in heat stressed Japanese quail. Egyptian Poultry Science 26: 1395-1418.

Abdulla R.B. Wan Embong W.K., and Soh H.H. (2011). Biotechnology in animal production in developing countries. Proceedings of the 2nd international conference of agricultural and animal science, November 25-27, 2011, Singapore, pp:88-91.

Abidin Z. and Khatoon A. (2013). Heat stress in poultry and the beneficial effects of ascorbic acid (vitamin C) supplementation during periods of heat stress.: a review. World's Poultry Science Journal, Vol. 69, March.

Al – Daraji, H. J., Al – Hayani, W. K. and Al –Hassani, A. S. (2008). Avian Hematology. University of Higher Education and Scientific Research, University of Baghdad, College of Agriculture.

Assenmacher, I. 1973. The peripheral endocrine glands. Pages 186–286 in Avian Biology. Vol. 3. D. S. F

Ayo J. O. and V. O. Sinkalu, (2003). "Effect of ascorbic acid on diurnal variations in rectal temperature of Shaver Brown pullets during the hot-dry season," in *Proceedings of the 38th Annual Science Conference Nigeria Society Animal Production*, vol. 28, pp. 38–42, Ibadan, Nigeria.

Ayo J. O., N. S. Minka, and M. Mamman, (2006). "Excitability scores of goats administered ascorbic acid and transported during hot-dry conditions," *Journal of Veterinary Science*, vol. 7, no. 2, pp. 127–131.

Balz, F. (2003). "Vitamin C intake," *Nutrient Disease*, vol. 14, pp. 1–18.

Berne, R. M., and M. N. Levy. (1990). Principles of Physiology. The C. V. Mosby Company, St. Louis, MO.

Bessei, W. (2018). "Impact of Animal Welfare on Worldwide Poultry Production." World's Poultry Science Journal 74: 211–224.

Bollinger, T., Wobeser, G., Clark, R. G., Nieman, D. J. and Smith, J. R. (1989). Concentration of creatine kinase and aspartate aminotransferase in the blood of wild mallards following capture by three methods for banding. *J. Wildl. Diseases* 25, 225–231.

Bueno JPR, Nascimento MRBM, Martins JMS, Marchini CFP, Gotardo LRM, Sousa GMR, Mundim AV, Guimarães EC, Rinaldi FP (2017). Effect of age and cyclical heat stress on the serum biochemical profile of broiler chickens. Semina Ciênc Agrár 38:1383–1392.

Burtis C. A., Ashwood E. R. (1994). Tietz textbook of clinical chemistry (2nd ed.), pp. 1275-1512, WB Saunders Co., Philedelphia, U.S.A.

Chrousos G. P. (2009). Stress and disorders of the stress system. *Nat Rev Endocrinol.* (2009) 5:374–81. 10.1038/nrendo. 106.

Clarkson, P. M. and Sayers, S. P. (1999). Etiology of exercise-induced muscle damage. *Can. J. Appl. Physiol.* 24, 234–248.

Clarkson, P. M., Nosaka, K. and Braun, B. (1992). Muscle function after exercise-induced muscle damage and rapid adaptation. *Med. Sci. Sports Exer.* 24, 512–520.

Dabbert, C. B. and Powell, K. C. (1993). Serum enzymes as indicators of capture myopathy in mallards (*Anas platyrhynchos*). *J. Wildl. Diseases* 29, 304–309.

Franchini A, Meluzzi A, Manfreda G and Tosarelli C (1993). Effects of Vitamin C on broiler skeleton development. Atti dell' Associazione Scientifica de Produzione Animale (Italy) Vol 10: 519-524.

Franson, J. C., Murray, H. C. and Bunck, C. (1985). Enzyme activities in plasma, kidney, liver, and muscle of five avian species. *J. Wildl. Diseases* 21, 33–39.

George, J. C. and John, T. M. (1993). Flight effects on certain blood parameters in homing pigeons (*Columba livia*). *Comp. Biochem. Physiol.* 106A, 707–712.

Guyton, A. C. (1991). Textbook of Medical Physiology. 8th ed. W. B. Saunders Company, Philadelphia, PA.

Kawashima, H. Monji N.and Castro A. (1980). Effect of calcium chloride on aspirin-induced hypoinsulinemia in rats, Biochem. Pharmacol., 29, 1627-1630.

Knuth, S. T. and Chaplin, S. B. (1994). The effects of exercise on plasma activities of lactate dehydrogenase and creatine kinase in red-tailed hawks (*Buteo jamaicensis*). *J. Raptor Res.* 28, 27–33.

Komulainen J., Takala, T. E. S. and Vihko, V. (1995). Does increased serum creatine kinase activity reflect exercise-induced muscle damage in rats? *Int. J. Sports Med.* 16, 150–154.

McDowell L. R. (1989). Vitamins in animal nutrition-comparative aspects to human nutrition: vitamin C. pp. 10—52, 93—131, Acad. Press, London.

Mckee, J.S. And Harrison, P.C. (1995). Effects of supplemental ascorbic acid on the performance of broiler chickens exposed to multiple concurrent stressors. Poultry Science 74: 1772-1785.

Metheringham, J. and Hubrecht, R. (1996). Poultry in transit a cause for concern. British Veterinary Journal152, 247–249.

Minka N. S. and J. O. Ayo, (2008). "Haematology and behaviour of pullets transported by road and administered with ascorbic acid during the hot-dry season," *Research in Veterinary Science*, vol. 85, no. 2, pp. 389–393.

Morton, R. H. and Carter, M. R. (1992). Elevated serum enzyme activity: an explanation based model. *J. Appl. Physiol.* 73, 2192–2200.

National Research Council. (1994). Nutrient Requirements of Poultry. 9th review edition. National Academic Science. Washington, DC.

Netke S. P., Roomi M. V., Tsao C., Niedzwiecki A. (1997). Ascorbic acid protects guinea pigs from acute aflatoxin toxicity. Toxicol. Appl. Pharmacol. 143, 429-435.

Pardue S. L. and J. P. (1986). Thaxton, "Ascorbic acid in poultry. A review," *World's Poultry Science Journal*, vol. 42, no. 6, pp. 107–1123.

Parola M., Leonarduzzi G., Biasi F., Albano E., Biocca M. E., Poli G., Dianzani M. U. (1992). Vitamin E dietary supplementation protects against carbon tetrachlorideinduced chronic liver damage and cirrhosis. Hepatology 16, 1014-1021.

Rachid MA, Nunes VA, Serakides R, Nascimento JAFB (2001) Histomorfometria efunção da tireoide de frangos de corte após ingestão por curto período de toxina T-2 de Fusarium sporotrichioides. Arq Bras Med Vet Zootec 53:66–70.

Scope A, Fillip T, Gabler C, Resch F. (2002). The influence of stress from transport and handling on hematological and clinical chemistry blood parameters of racing pigeon (*Columbia liva domestica*) *Avian Disease.*, 46:224–229.

Siegel, H. S. (1980). Physiological stress in birds. Bioscience 30:529–533.

Sies H., Stahl W., Sundquist A. R. (1992). Antioxidant functions of vitamins. Vitamin E and C, β-carotene, and other carotenoids. Ann. N. Y. Acad. Sci. 669, 7-20

Sorichter, S., Mair, J., Koller, A., Gebert, W., Rama, D., Calzolari, C., Artner-Dworzak, E. and Puschendorf, B. (1997). Skeletal troponin I as a marker of exercise-induced muscle damage. *J. Appl. Physiol.* 83, 1076–1082.

Totzke, U., Fenske, M., Hüppop, O., Raabe, H. and Schach, N. (1999). The influence of fasting on blood and plasma composition of herring gulls (*Larus argentatus*). *Physiol. Biochem. Zool.* 72, 426–437.

Ueno K., Kawashima H., Ohnuma N., Kurozumi S., Hashimoto Y. and Orimo H.: (1980). Aspirin inhibition of hypercalcemic effect of 1α-hydroxyvitamin D_3 in rats, Jpn. J. Pharmacol., 30, 675-678.

التقليل من إجهاد النقل لفروج اللحم باستخدام فيتامين سي وحامض أسيتيل ساليسليك

هناء عمر ابراهيم وعطوف عبدالرحيم عزيز

قسم علوم الحيوان، كلية علوم الهندسة الزراعية، جامعة السليمانية، السليمانية، اقليم كردستان، العراق

عوامل الاجهاد ما قبل الذبح يؤثر بشكل سلبي على الحالة الفسلجية لفروج اللحم. لذلك تهدف هذه التجربة لتقليل تأثير عوامل الاجهاد اثناء النقل، حيث أستخدمت في هذه التجربة 270 فروج لحم من نوع ROSS 308 بعمر يوم 35 يوم لمعرفة تاثير استخدام مستوايات مختلفة من الـ فيتامين C و (acetylsalicylic acid ASA) عن طريق مياه الشرب. وتم توزيع الطيور عشوائياً على 27 اقفاص متماثلة (140×120×90) لكل منها 10 طيور (5 ذكور و 5 إناث - متساوية في الوزن تقريباً). قبل 24 ساعة من نهاية التجربة تم توزيع الاقفاص الى 9 معاملات مائية وبتراكيز صفر (مجموعة السيطرة; C) و 50 ملغ/لتر فيتامين C (المعاملة الأولى; T1) و 100ملغ/لتر فيتامين C (المعاملة الثانية; T2) و 1 غم/لتر من (ASA) (المعاملة الثالثة; T3)، و 1.5 غم/ لتر (ASA) (المعاملة الرابعة; T4)، و 50 (ملغ فيتامين C + 1 غم من ASA) / لتر (المعاملة الخامسة; T5)، و50 (ملغ فيتامين C + 1.5 غم من ASA) / لتر (المعاملة السادسة; T6) ، و 100(ملغ فيتامين C + 1 غم من ASA) / لتر (المعاملة السابعة; T7)، واخيراً 100(ملغ فيتامين C + 1.5 غم من ASA) / لتر (المعاملة الثامنة; T8). والصفات المدروسة كانت: تركيز كل من البروتين كلي، سكر الدم، البومين، كلوبيلين، كاليسيوم، حامض اليوريك، الكوليسترول، هرمون T3 و T4 و نشاط انزيم GPT و GOT و Creatine Kinase (CK). اشارت نتائج التجربة بعد النقل الى ان اضافة فيتامين C و (ASA) الى الماء لفروج اللحم ادت الى انخفاض معنوي (أ≤ 0.05) في كل من (سكر الدم، الالبومين، كلوبيلين، حامض اليوريك، الكالسيوم، و نشاط انزيمات GOT و GPT و CK و ايضا هرمون T3). اما هرمون T4 ارتفعت (أ≤ 0.05) تركيزها بعد النقل و تركيز الكوليسترول لم يتأثر باضافة فيتامين C و (ASA). من هذه النتائج يمكن الاستنتاج إلى أن إضافة فيتامين C و ASA لمياه الشرب للفروج قبل النقل يمكن استخدامها كوسيلة فعالة للتقليل من إجهاد النقل والحصول على الاسقرار الفسلجي أثناء النقل.