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EFFECT OF DIETARY SODIUM BICARBONATE AND POTASSIUM CHLORIDE SUPPLEMENTATION ON ACID-BASE BALANCE, PLASMA ELECTROLYTES AND ALDOSTERONE HORMONE OF GOLDEN MONTAZAH HENS UNDER HOT CLIMATE CONDITION.

By

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Abstract: *A total number of 270 female and 27 male at 20 weeks of age, from Golden Montazah were randomly distributed into nine equal groups .Hens were individually rearing under the same hot climate condition to study the effect of dietary sodium bicarbonate and potassium chloride supplementation on acid–base balance, plasma electrolytes and aldosterone hormone for Golden Montazah hens.*

The strain classificated into nine groups of three replicates each:

1- The first group was control considered fed egg production diet.

2-The second group hens fed egg production diet with 0.25% sodium bicarbonate supplementation.

3-The third group hens fed egg production diet with 0.50% sodium bicarbonate supplementation.

4-The fourth group hens fed egg production diet with 0.2% potassium chloride supplementation.

5-The fifth group hens fed egg production diet with 0.3% potassium chloride supplementation.

6-The sixth group hens fed egg production diet with 0.25% sodium bicarbonate plus 0.2% potassium chloride supplementation.

7-The seventh group hens fed egg production diet with 0.25% sodium bicarbonate plus 0.3% potassium chloride supplementation.

8-The eightieth group hens fed egg production diet with 0.50% sodium bicarbonate plus 0.2% potassium chloride supplementation.

9-The ninth group hens fed egg production diet with 0.50% sodium bicarbonate plus 0.3% potassium chloride supplementation.

These groups were taken along the experimental period which lasted four months during summer season, the temperatures degree were over 30°C during the experimental period and taken some productive, physiological and immunological parameters. The obtained data revealed the following results:

Dietary sodium bicarbonate a t 0.25%, 0.50% and potassium chloride at 0.2%, 0.3% supplementation alone and combination between there give good and positive effects on body weight, feed conversion, egg production, egg quality, fertility% and hatchability % compared with the control group.

Dietary sodium bicarbonate at 0.25%, 0.50% and potassium chloride at 0.2%, 0.3% supplementation alone and combination between there give positive effects on acid –base balance, electrolytes and aldosterone hormone in plasma, cholesterol and total lipids were decreased in egg yolk compared with the control group .

Dietary sodium bicarbonate at 0.25%, 0.50% and potassium chloride at 0.2%, 0.3% supplementation alone and combination between there give high antibody titters against Newcastle and Influenza diseases and some immuno blood compositions compared with the control group.

Using sodium bicarbonate at 0.25%, 0.50% and potassium chloride at 0.2%, 0.3% supplementation alone or their combinations was improved some traits of productive, physiological and immunological performance for Golden Montazah hens under hot climate condition.

INTRODUCTION

In hot climate, poultry production is generally reduced, due to the rise in environmental temperature. Heat stress in birds cause many biochemical and physiological changes such as: Shift in acid-base balance, hyperthermia, increased of O_2 and production of CO_2, increased production of free radical and corticosterone. (Mebta and Sbingari, 1999).

Physiological feed additives are those that help the normal development of physiological functions or that make up for their deficiencies (Peris and Calafat, 2005).

In that, sodium bicarbonate and potassium chloride supplementation as physiological feed additives these are playing an important role for regulates the blood pressure, chemical management of acid-base balance and using for anti heat stress, Therefore, one of the best methods used to control heat stress is the chemical management of acid-base balance by supplementing feed or water with different electrolyte salts such as sodium bicarbonate ($NaHCO_3$), potassium chloride (KCl), calcium chloride (CaC_2), and ammonium chloride (NH_4Cl) (Teeter *et al.*, 1985; Branton *et al.*, 1986; Boregs,1997; and Ahmad *et al.*, 2005).These electrolytes, in different amounts and proportions, proved the beneficial effect on the productive performance for laying hens under different heat stress regimens.

Genedi (2000) reported that adding anti-stressors ($NaHCO_3$, KCl) to drinking water of Leghorn and Matrouh hens improved body weight gain and significantly increased the Hb% under heat stress condition. Also, using only $NaHCO_3$ supplementation increased PCV values for these hens.

Also, El-sheikh and Salama (2010) found that using 100 mg $NaHCo_3$ or 75 mg KCl per liter water could be beneficial for local laying hens under hot summer condition of Egypt to get the best laying performance and egg quality.

Yin *et al.* (2001) observed that adding 0.3% $NaHCO_3$ as water supplementation significantly improved egg laying rate, egg weight and egg mass for ISA Brown laying hens.

Badran (2003) demonstrated that sodium bicarbonate supplementation at levels of 2, 3 and 4% caused a significant increase in total plasma protein, globulin, sodium, calcium and phosphorus compared to those of the control group, Also sodium bicarbonate supplementation at levels of 2, 3 and 4% caused no effect on plasma T3 hormone concentration for local laying hens.

Diets formulated with high anion contents (chloride: Cl^-) decreased blood pH and caused an academia in broilers. Similarly, high dietary cation contents (sodium: Na^+, potassium: K^+) increased blood pH and resulted in alkalemia (Ahmad and Sarwar, 2006).

Sodium deficiency or the administration of aldosterone suppresses the immune response of neural injury, resulting in attenuation of peripheral gustatory function. Also, these additives showed a potential key link among downstream consequences of sodium imbalance, taste function, and immune activity (Guagliardo *et al.*, 2009). Aloes the same line, aldosterone is an adrenal hormone that regulates sodium, fluid, and potassium balance. Jerome Conn first described the syndrome of autonomous and excessive aldosterone secretion or "primary aldosteronism." Contrary to the historical belief, recent studies indicate that primary aldosteronism is a common cause of hypertension with a prevalence of 5-10% among general hypertensive patients. Various animal models have demonstrated that aldosterone in association with a high salt diet results in target-organ inflammation and fibrosis. (Gaddam *et al.*, 2009).

Also, aldosterone hormone is an important regulator of Na (+) and K (+) transport in the distal nephron modulating the surface expression of transporters through the action of the mineral corticoid receptor as a ligand-dependent transcription factor as it stimulates the rapid activation of protein kinase-based signalling cascades that modulate the genomic effects of the hormone (Thomas *et al.*, 2008).

The present study was designed to assess the effect of dietary sodium bicarbonate and potassium chloride supplementation on acid–base balance, plasma electrolytes and aldosterone hormone in Golden Montazah hens under hot climate condition.

MATERIALS AND METHODS

This study was conducted at El-Fayum Poultry Production Research Station, Animal Production Research Institute, Agricultural Research Center, Egypt. A total number of 270 hens plus 27 cocks from Golden Montazah strain of 20 weeks old were equally divided into 9 groups of 3 replicates (10 hens+1 cock each) and housed in individual cages. These groups were taken along the experimental period which lasted four months during summer season under hot climate condition over 30 °c in whole experimental period.

Classification of groups:

The experimental diets were offered for the one strain (270 hens +27cocks) from 20-40 weeks of age as follows:

1-The basal diet without any supplement serves as a control diet (T1).The nutrient compositions of the control egg production diet presented in Table (1).

2-The second group hens fed egg production diet with 0.25% sodium bicarbonate supplementation (T2).

3-The third group hens fed egg production diet with 0.50% sodium bicarbonate supplementation (T3).

4-The fourth group hens fed egg production diet with 0.2% potassium chloride supplementation (T4).

5-The fifth group hens fed egg production diet with 0.3% potassium chloride supplementation (T5).

6-The sixth group hens fed egg production diet with 0.25% sodium bicarbonate plus 0.2% potassium chloride supplementation (T6).

7-The seventh group hens fed egg production diet with 0.25% sodium bicarbonate plus 0.3% potassium chloride supplementation (T7).

8-The eightieth group hens fed egg production diet with 0.50% sodium bicarbonate plus 0.2% potassium chloride supplementation (T8).

9-The ninth group hens fed egg production diet with 0.50% sodium bicarbonate plus 0.3% potassium chloride supplementation (T9).

Productive performance measurements:

Traits included weight gain (WG), egg number (EN), egg weight (EW), egg mass (EM), feed consumption (FC), feed efficiency (FE) and some reproductive performance. EM was calculated as gram egg per hen per experimental period. FC was calculated as gram feed per hen per day. FE was calculated as gram feed consumed per gram egg produced. At 6^{th} and 12^{th} weeks of the experiment, a total number of 180 eggs (20 eggs from each treatment) were taken to determine egg quality (EQ).

After 8 weeks from beginning of the experiment, a total number of 1350 eggs (50 eggs from each replicate/week) were incubated to evaluate the reproductive traits of hatchability and fertility eggs percentage (HE and FE).

Some physiological, environmental and immunological traits:

At the end of the experimental period, blood samples were taken (10 from each treatment) into tubes for estimate blood pH using pH meter.

The body temperature, respiratory rate, house humidity and litter ammonia were taken at the end the experimental period intervals. Indoors ambient temperature and humidity were recorded at the end of the experimental period, and the averages were estimated in the International Research Central. At the same time, blood samples were taken(10 from each treatment) into dry clean centrifuge tubes containing drops of heparin , centrifuged at 4000 rpm for 15 minutes and the clear plasma was separated, and stored in deep freezer at – 20°C.

Blood constituents including some plasma electrolytes Na, K, Cl, Ca, P and some enzymes ALT, AST, Acid and alkaline phosphatase enzymes and Total protein, Albumin, Globulin and some hormones T3, T4 and aldosterone hormone were determined by commercial kits at Animal Production Research Institute, Ministry of Agriculture, Giza, Egypt.

After measuring the egg quality, 5 yolk samples from each treatment were separated from the broken eggs, and extracted to determine yolk parameters according to Folch *et al.* (1957). Yolk cholesterol, Low density lipoprotein (LDL) and total lipids were determined using a suitable commercial kit. High density lipoprotein (HDL) concentration of each assayed yolk sample was calculated by subtracting the LDL value from its total cholesterol. Yolk samples were determined by commercial kits at Animal Production Research Institute, Ministry of Agriculture, Giza, Egypt.

At 36 and 40 weeks of age, hemagglutination-inhibition (HI) test was applied for determination of antibodies response in plasma samples according to OIE Manual (2005). After 2 weeks of immunization of the flock by Lasota vaccine against Newcastle Disease Virus (NDV) and against Avian Influenza Disease Virus (AIDV).

Commercial ELISA kits were used for detection of antibodies against nucleoprotein and matrix against of NDV and AIDV (Biockek B.V, Gouda and Holland). Hemagglutination-inhibition (HI) test titter regarded as positive if there is inhibition at serum dilution of 1/16 (4 log 2).

Hematocrit volume was estimated by using the microhematocrit method according

to Bauer (1970). Blood samples were packed in heparinzed capillary tubes sealed at one end and the tubes were centrifuged in a microhematocrit centrifuge at 12000 rpm for 5 minutes and the micro-capillary reader estimated the packed cell volume. Hemoglobin (Hb) concentration was estimated in gm/100 ml blood by using photoelectric Hemoglobinometer according to Singh (1983). The Red blood cells (RBCs) counted (x 10^6 mm^3) by hemocytometer using the method of Bauer (1970), M.C.V., M.C.H. and M.C.H.C were calculated according to Mangrum (1975).

Statistical analysis:

Data were subjected to computerize one- way analysis of variance and Duncan's multiple range test procedures using SAS (2001). The percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis.

RESULTS AND DISCUSSION

1- Productive traits:

1-1-Body weight gain:

Table (2) shows that treatments had a significant ($P \leq 0.05$) effect on body weight gain in all treatments which was improved compared with that of the control group, whereas, the group for 0.2 % KCl only (T4) and that fed 0.25 $NaHCO_3$+ 0.2% KCl (T6) inclusion give little increase during the experimental period. Also, values of body weight gain were increased in all groups fed 0.25 $NaHCO_3$ +0.3% KCl (T7) or 0.50 $NaHCO_3$ +0.2% KCl (T8) inclusion compared with the control group through the whole experimental periods.

The higher body weight gain by the electrolytes ($NaHCO_3$ or KCl) groups may be attributed to the partial correction in acid-base balance or to the increase in water intake, which act as a heat sink and give good feed metabolism in these hens.

These results agree with that of Mushtaq *et al.*, (2000) who added sodium bicarbonate 4% to diet of laying hens, kept under 30-33°c, they found that live weight gain was greatest in hens compared with that of the control group .

Genedi (2000) reported that adding anti-stressors ($NaHCO_3$, KCl or $NaHCO_3$+ KCl) to drinking water improved body weight gain for heat stressed hens of Leghorn and Matrouh.

Sayed and El-Manylawi (2003) showed that adding 1% KCl, 1% $NaHCO_3$ and 1% NH4Cl or commercial electrolytes (Pharaday) to the diets of one-day-old Arbor Acres broilers increased body weight and improved feed conversion.

On the other hand, El-Sheikh and Salama (2010) found that using 100 mg $NaHCO_3$ or 75 mg/L water did not significantly affect body weight change values as compared to that of the control group. Also, Badran (2003) found that sodium bicarbonate supplementation at levels of 2, 3 and 4% did not effect on body weight or weight gain.

1-2- Feed consumption and feed efficiency:

Table (2) illustrates the effect of feeding diets containing different levels of Sodium bicarbonate and Potassium chloride on feed consumption. The groups fed diets of the high levels of sodium bicarbonate and potassium chloride alone and combinations gave lower values of feed consumption than the control group throughout all period.

Our data obtained in Table (2) showed that all groups fed sodium bicarbonate and potassium chloride alone or combinations were improved and give the best values of feed efficiency compared with

control group during the whole experimental periods.

The lower feed consumption by the electrolytes ($NaHCO_3$ or KCl) groups may be attributed to the partial correction in acid-base balance or to the increase in water intake, which act as a heat sink, and depression of activity of birds during rearing these birds under hot climate condition during summer months.

These results are in agreement with findings of Junqueira *et al.*, (2000) who reported that feed consumption values was decreased as NaHCO3 inclusion increased from 0.67 to 2.56 % in the diet of commercial laying hens. Attlla *et al.*, (2002) showed that supplementing drink water with $NaHCO_3$, KCl or $NaHCO_3$+ KCl, feed consumption was decreased of hens exposed to high environmental temperature34°c for 4 continuous hours daily followed by 22°c to 24°c normal temperature throughout three months.

Also, Badran (2003) found that there are no significant differences between the control and treatments of 2 or 3 % $NaHCO_3$ supplementation in the amounts of feed consumption, where, the lowest feed consumption value was significantly obtained when 4 % $NaHCO_3$ supplementation was used.

Sayed and El-Manylawi (2003) showed that adding 1% KCl, 1% $NaHCO_3$ and 1% NH_4Cl or commercial electrolytes (Pharaday) to the diets of one- day - old Arbor Acres improved feed conversion values.

On the other hand, EL-Sheikh and Salama (2010) illustrated that feed consumption values were increased by both levels of $NaHCO_3$ (75 and 100 mg/L water) and give the best values of feed conversion compared with those of the control group.

1-3-Egg number, egg weight and egg mass:

Main egg production traits (egg number, egg weight and egg mass) showed significant ($P \leq 0.05$) differences among the most treatments (Table 3). The groups fed diets of the high levels of sodium bicarbonate and potassium chloride alone and combination gave higher values of egg production traits than the control group during the total period for Golden Montazah laying hens from 24 to 40 weeks of age.

Our data obtained in Table (3) shows that all groups fed sodium bicarbonate and potassium chloride alone or combinations were improved and increased egg number, egg weight and egg mass. Also, increasing sodium bicarbonate and potassium chloride in diets resulted in increasing egg production and group fed diets of 0.50 $NaHCO_3$ +0.3% KCl (T9) increased egg weight and egg mass as compared to the control group during the all periods.

The higher values of egg production traits by the electrolytes ($NaHCO_3$ or KCl) groups may be attributed to the partial correction in acid-base balance or to the increase calcium metabolism, and high levels of some cations (Na +K) in blood improving ovary and oviduct for egg production in these hens. Also, the groups fed sodium bicarbonate and potassium chloride alone or their combinations that improved Golden Montazah laying hens productive performance with changing dietary Na^+, K^+ and Cl^- levels might be due to the normalization of blood pH and blood electrolyte balance.

Similar reports were noted by Attlla *et al.*, (2002) who found that supplementing drink water with $NaHCO_3$, KCl or $NaHCO_3$+ KCl improved egg number of hens exposed to high environmental temperature34°C for 4 continuous hours daily followed by 22°C to 24°C normal temperature throughout three months .

However, Yin *et al.*, (2001) observed that adding 0.3% $NaHCO_3$ as water supplementation significantly improved egg laying rate, egg weight and egg mass for ISA Brown laying hens.

Also, Genedi (2000) reported that adding potassium chloride (KCl) to drink water increased egg number, but the using of sodium bicarbonate ($NaHCO_3$) increased the egg weight for Matrouh hens. Also, using mixture of $NaHCO_3$+ KCl significantly increased the egg number and egg mass, but using KCl alone increased egg weight for Leghorn strain during exposed hens to heat stress.

On the other hand, El-Sheikh and Salama (2010) reported that using of 100 mg $NaHCO_3$ or 75 mg KCl/L water did not significantly affect egg number values as compared to those of the control group for Dokki-4 laying hens during summer season.

Also, Nizamettin *et al.*, (2005) suggested that there was no need for supplementation of sodium bicarbonate and Potassium carbonate into practical laying hens diets during peak production, these results are different with our finding due to different in egg production period and strain of bird as well as dietary electrolyte balance (DEB) propertics.

However, Badran (2003) found that sodium bicarbonate supplementation at levels of 2, 3 and 4% did not affect egg production or egg weight.

1-4- Hatching characteristics:

Table (4) shows that all groups fed diets of sodium bicarbonate and potassium chloride alone or their combinations were improved and recorded the best values of fertility and hatchability percentage and did not significantly ($P \leq 0.05$) affect on chick weight (g) .This increment was increased with increasing either sodium bicarbonate or potassium chloride level compared with the control group at the end of the experimental period.

These results agree with those El-Sheikh and Salama (2010) who reported that using 100 mg $NaHCO_3$ or 75 mg KCl/L water recorded a significant increase in fertility and hatchability percentage, as well as chick weight (g) was significantly increased as compared to the control group for Dokki-4 laying hens during summer season.

1-5-Egg quality:

Table (5) shows that significant differences in some egg quality parameters. Using sodium bicarbonate and potassium chloride alone or their combinations significantly increased shell weight, shape index, shell thickness and Haugh units, while other egg quality parameters were not affected by the dietary treatments for Golden Montazah laying hens at the end the experimental period.

The higher values of shell weight and shell thickness by the electrolytes ($NaHCO_3$ or KCl) groups may be attributed to the partial correction in acid-base balance or to the increase of some cations (Na +K) in blood and these cations plays an important role for improving calcium metabolism and in eggshell formation in these laying hens.

Similar results was obtained by Badran (2003)who found that Sodium bicarbonate supplementation 2, 3 and 4% caused a significant increase in shell percentage and shell thickness for local laying hens. Also, Gezen *et al.*, (2005) reported that a moderate dietary electrolyte balance (DEB) 256 ME q/Kg can improve egg shell quality.

Using $NaCO_3$ and KCl in these study resulted to improve egg quality, This results agrees with that reported by Chen and Balnave (2001) who reported an optimal activity of carbonic anhydrate that plays an important role in eggshell formation in slightly alkaline medium, Moreover, an excessive Chloride intake limited calcium transports to shell gland lumen, using young hens at 32 week of age.

However, Genedi (2000) found that adding KCl to drinking water increased the overall mean of egg weight, shell weight and shell thickness for the heat stressed hens in

Leghorn strain, but using $NaHCO_3$+ KCl significantly increased the overall means of shell weight, shell thickness, yolk index and Haugh units for Matrouh strain.

These results are in agreement with findings of EL-Sheikh and Salama (2010) who found that using of 100 mg $NaHCO_3$ or 75 mg KCl/L water did not significantly affect shell weight, albumin weight, yolk weight, yolk index and Haugh units score, but albumin weight and yolk weight were significantly affected by $NaHCO_3$ or KCl supplementation in drink water only as compared to the control group in July month compared to June and August months during the total period-for Dokki-4 laying hens during summer season at 24 to 36 weeks of age. Also, using of 100 mg $NaHCO_3$ or 75 mg KCl/L water could be beneficial for local laying hens under hot summer condition of Egypt to get the best laying performance and egg quality.

Also, Dai and Bessei (2007) found that egg shell thickness, egg shell strength was not accepted by 0.2 and 0.4 % KCl supplementation.

2- Some physiological and environmental characteristics:

Effect of dietary sodium bicarbonate and potassium chloride supplementation on blood pH, body temperature, respiratory rate, litter ammonia and house humidity are illustrated in Table (6).Results shows that adding of sodium bicarbonate and potassium chloride alone or their combinations into diets decreased the blood pH to be nearly as the normal pH for the control group.

The groups fed egg production diet with the electrolytes ($NaHCO_3$ and KCl) may be attributed to carbonated feed provides a source of carbon dioxide (CO_2) and H^+, which corrected the acid-base in balance during respiratory alkalosis.

This result agree with those of Genedi (2000) who found that using $NaHCO_3$, KCl or mixture of them for heat stressed hens from two strains Leghorn and Matrouh low decreased the blood pH compared with the control group and give good blood acid- base balance in all groups for commercial and local strains.

Also, data in (Table 6) shows that all hens in groups fed sodium bicarbonate and potassium chloride alone or their combinations did not affect body temperature and house humidity. Also, respiratory rate and litter ammonia decreased significantly ($P \leq 0.05$) in groups fed sodium bicarbonate and potassium chloride alone or their combinations compared with the control group at the end of the experimental period.

These results agree with Dai and Bessei (2007) who found that body temperature was not accepted by 0.2 and 0.4 % KCl.

In addition, the same trend was observed with Genedi (2000) who exposed two layer strains (Leghorn and Matrouh) to heat stress ranged from 32.5 to 34°c for four continues hours daily followed by 22 to 24°C, with 0.65 % $NaHCO_3$ as a water supplementation had no significantly effect on body temperature for both strains .

Mushtaq *et al.* (2000) observed that adding $NaHCO_3$ (1 to 4%) to commercial layers reared under 30-35°c had no significant effect on their body temperature.

Junqueira *et al.*, (2000) stated that exposing commercial laying hens to high environmental temperature (33°c) with different levels of $NaHCO_3$ supplementation (from 0.67 to 2.56%) in the diet did not effect on body temperature.

3-Physiological traits:

3-1-Blood parameters:

3-1-1- Some plasma electrolytes:

Effects of dietary sodium bicarbonate and potassium chloride supplementation on some plasma electrolytes are illustrated in (Table 7), shows that adding of sodium bicarbonate and potassium chloride alone or

their combinations significantly increased the plasma concentration of calcium, phosphorus, Na^+, Cl^- and K^+ compared with those of the control group .Also, increasing levels of sodium bicarbonate alone or their combination with potassium chloride supplementation give the high level of plasma Na^+. Increasing levels of potassium chloride alone or their combination with sodium bicarbonate supplementation give the high level of plasma Cl^- and K^+ ions compared with the control group.

Normally the groups fed egg production diet with the electrolytes ($NaCO_3$ or KCl) may be attributed to carbonated feed provides a source of carbon dioxide (CO_2) and H^+, which corrected the acid-base in balance during respiratory alkalosis.

These results agree with Guagliardo *et al.,* (2009) who showed that sodium deficiency or administration of aldosterone hormone suppresses the immune response to neural injury, resulting in attenuation of peripheral gustatory function. Also, shows a potential key link among downstream consequences of sodium imbalance, taste function, and immune activity.

The same trend was observed with Junqueira *et al.,* (2000) who stated that the addition of $NaHCO_3$ from 0.67 to 2.65 % for commercial layer diets increased plasma phosphorus concentration level.

Also, Genedi (2000) reported that adding KCl to heat stressed hens from Leghorn strain increased the plasma concentration of Na^+, CL^- and K^+, but for strain Matrouh increased the plasma concentration of Ca^{++}, CL^- and K^+. Also, using $NaHCO_3$ no significant effect of heat stress on plasma sodium and calcium levels for Leghorn and Matrouh strains.

3-1-2- Some plasma parameters:

Results in Table (8) indicated that adding of sodium bicarbonate and potassium chloride alone or their combinations significantly increased total protein and globulin and did not significantly ($P \leq 0.05$) affect plasma albumin compared with those of the control group .

Also, adding sodium bicarbonate and potassium chloride alone or their combinations into diets significantly decreased AST and ALT enzymes compared with results of the control group.

These results agree with Badran (2003) who demonstrated that sodium bicarbonate supplementation at levels of 2, 3 and 4% caused a significant increase in total plasma protein, globulin, sodium, calcium and phosphorus in blood plasma compared to the control group for local laying hens.

On the other hand, Genedi (2000) reported that adding $NaHCO_3$ or KCl into drink water of heat stressed birds from the two strains Leghorn and Matrouh increased the plasma albumin concentration and there were no effects on the plasma total protein and globulin.

3-1-3- plasma Aldosterone, thyroid hormones and ratio T_3/T4:

Plasma Aldosterone

Results of Table (9) declared that supplementing diet with sodium bicarbonate and potassium chloride alone or their combinations resulted to decrease ($P \leq 0.05$) Aldosterone hormone compared with those of the control group.

Similar results were found by Guagliardo *et al.*, (2009) who showed that sodium deficiency or administration of Aldosterone suppresses the immune response to neural injury, resulting in attenuation of peripheral gustatory function. Also, a potential key link among downstream consequences of sodium imbalance, taste function, and immune activity were found.

In connection, aldosterone is an important regulator of Na (+) and K (+) transport in the distal nephron modulating the surface expression of transporters through the action of the mineral corticoid receptor as a

ligand-dependent transcription factor, Aldosterone stimulates the rapid activation of protein kinase-based signalling cascades that modulate the genomic effects of the hormone (Thomas *et al.*,2008).

Plasma thyroid hormones and ratio of T_3 /T_4:

Plasma T_3 and T_4 hormones were significantly ($P \leq 0.05$) decreased by supplementing diets with sodium bicarbonate and potassium chloride alone or combinations when compared with the control group Table (9). While, the addition of sodium bicarbonate and potassium chloride alone or their combinations did not influence on ratio of T_3 / T_4.

These results agreed with those showed by Attlla et al. (2002) who found that supplementing drink water with $NaHCO_3$, KCl decreased T_3 hormone of hens exposed to high environmental temperature34°c for 4 continuous hours daily followed by 22°c to 24°c normal temperature throughout three months.

Also, Genedi (2000) found that adding $NaHCO_3$ to drinking water for heat stressed hens from Matrouh strain reduced the plasma triiodothyronine hormone (T_3), but there were no significant effect on Leghorn strain.

On the other hand, Badran (2003) found that sodium bicarbonate supplementation at levels of 2, 3 and 4% caused no effect on plasma T_3 hormone concentration for local laying hens.

3-2-Yolk parameters:

Results in Table (10) declared that supplemental diet with both sodium bicarbonate and potassium chloride alone or combinations significantly decreased the yolk cholesterol, LDL, HDL and total lipids and gave the least concentration, respectively compared with those of the control group. Therefore, these results could not be assessed or discussed.

The lower yolk cholesterol and total lipids by the electrolytes ($NaHCO_3$ or KCl) groups may be attributed to the partial correction in acid-base balance or to the decrease the activity of the rate –limiting enzyme in cholesterol synthesis HMG-Co A reductase in liver affected by adding these electrolytes ($NaHCO_3$ or KCl).

4-Immunological traits:

4-1-Hematological parameters:

Results of Table (11) observed that both Red blood cells, Platelet count, Neutrophili, Lymphocytes, Monocytes, Eosinophiles, HCT, MCV, MCH and MCHC were increased by using sodium bicarbonate and potassium chloride alone or their combinations compared with those the control group at the end the experimental period. Whereas no significant different ($P \leq 0.05$) was recorded with parameters of hemoglobin and white blood cells compared with those of the control group.

The use of $NaHCO_3$ or KCl as a source of Na, K and Cl may be attributed towards survivability for Golden Montazah hens.

This is in agreement with that reported by Badran (2003) who found that sodium bicarbonate supplementation (2, 3 and 4%) caused no effect on blood PH, HBC, PCV, WBC and RBC for local laying hens. Also, Genedi (2000) illustrated that adding both $NaHCO_3$ and KCl to drinking water for heat stressed hens significantly increased the Hb% for two strains Leghorn and Matrouh, only $NaHCO_3$ supplementation increased PCV values for the two strains.

4-2-Antibody titters against avian Newcastle and Influenza diseases:

Antibody titters against avian Newcastle and Influenza diseases determined are shown in Table (12) with using both sodium bicarbonate and potassium chloride alone or their combinations were significantly increased found in this respect

compared with the control group at the end of the experimental period.

The use of $NaHCO_3$ or KCl as a source of Na, K and Cl may be attributed to the partial correction in acid-base balance or to these minerals may be plays an important role for increasing immuno response against some diseases and also attributed towards Golden Montazah hens survivability.

This result agrees with those reported by Genedi (2000) who found that using the anti-stressors ($NaHCO_3$, KCl and $NaHCO_3$+ KCl) to stressed hens decreased the mortality rate and improved the immuno response compared with the control group for the two strains Leghorn and Matrouh. In connection sodium deficiency or administration of aldosterone suppresses the immune response to neural injury, resulting in attenuation of peripheral gustatory function, a potential key link among downstream consequences of sodium imbalance, taste function, and immune activity (Guagliardo *et al.*, 2009).

CONCLUSION

It could be concluded from the results obtained that dietary sodium bicarbonate and potassium chloride supplementation had a good effects on acid–base balance, plasma electrolytes and Aldosterone hormone and enhanced the productive, physiological and immunological performance under hot climate condition of Golden Montazah hens.

Table (1): Composition and calculated analysis of the basal diet.

Ingredients	%
Yellow corn	63.50
Soybean meal (44%)	24.57
Wheat bran	2.0
Lime stone	7.77
Premix*	0.30
NaCl	0.30
Di calcium phosphate	1.50
DL methionine	0.06
Total	100
Calculated analysis**	
CP	16.00
ME Kcal /kg	2703.34
Crude fiber, %	3.47
Crude fat, %	2.86
Calcium, %	3.32
Available phosphorus, %	0.406
Lysine, %	0.889
Methionine, %	0.350
Methionine + cystine	0.620
Sodium	0.135

* Premix contain per 3kg vit A 10 000 000, vit D3 2000 000 IU, vit E 10000mg, Vit K3 1000mg, vit B1 1000mg, vit B2 5000mg, vit B6 1500mg, vit B12 10mg, pantothenic acid 10000mg, Niacin 30000mg, Biotin 50mg, Folic acid 1000mg, Choline 250gm, Selenium 100mg, copper 4000mg, iron 30000mg, manganess 60000mg, zinc 50000mg, iodine 1000mg, cobalt 100mg and CaCO3 to 3000g.

** According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Effect of dietary sodium bicarbonate and potassium chloride supplementation on some productive performance of Golden Montazah hens at the end of the experimental period.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Body weight gain (g)	*342.72^{c} ±17.22	410.35^{b} ±17.22	442.70^{b} ±17.22	380.33^{c} ±17.22	461.45^{ab} ±17.22	362.00^{c} ±17.22	507.54^{a} ±17.22	513.88^{a} ±17.22	401.36^{b} ±17.22
Feed consumption (g/hen/day)	116.55^{a} ±9.25	115.20^{ab} ±9.25	109.61^{c} ±9.25	113.04^{b} ±9.25	107.22^{c} ±9.25	112.93^{b} ±9.25	106.88^{c} ±9.25	110.97^{b} ±9.25	105.77^{c} ±9.25
Feed conversion	0.340^{a} ±0.05	0.281^{b} ±0.05	0.248^{b} ±0.05	0.297^{ab} ±0.05	0.232^{c} ±0.05	0.312^{ab} ±0.05	0.211^{c} ±0.05	0.216^{c} ±0.05	0.264^{b} ±0.05
Egg number (hen/period)	14.53^{c} ±2.36	16.41^{ab} ±2.36	17.03^{a} ±2.36	15.40^{b} ±2.36	17.56^{a} ±2.36	15.53^{ab} ±2.36	16.85^{ab} ±2.36	15.92^{b} ±2.36	18.46^{a} ±2.36
Egg weight (g)	39.75^{b} ±6.07	42.15^{a} ±6.07	42.27^{a} ±6.07	42.15^{ab} ±6.07	42.78^{a} ±6.07	41.73^{ab} ±6.07	41.91^{a} ±6.07	41.40^{ab} ±6.07	42.31^{a} ±6.07
Egg mass (g)	581.86^{c} ±36.55	697.46^{ab} ±36.55	728.10^{ab} ±36.55	633.27^{b} ±36.55	758.44^{a} ±36.55	655.22^{b} ±36.55	712.01^{ab} ±36.55	665.44^{b} ±36.55	789.46^{a} ±36.55

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P ≤0.05).

Body weight gain (g) = Final body weight – Initial body weight -

Feed conversion = Feed consumption / Body weight gain-

-Feed intake, Egg number, Egg weight and egg mass were taken the means at the end of the experimental periods.

Table (3): Effect of dietary sodium bicarbonate and potassium chloride supplementation on egg production of Golden Montazah hens.

Parameters	Age (Week)	Treatments								
		T1	T2	T3	T4	T5	T6	T7	T8	T9
Egg number (egg/hen /month)	24-28	*11.37^{b} ±1.48	12.45^{b} ±1.48	13.25^{a} ±1.48	10.94^{b} ±1.48	13.40^{a} ±1.48	11.60^{b} ±1.48	12.80^{ab} ±1.48	12.45^{ab} ±1.48	13.76^{a} ±1.48
	28-32	13.75^{b} ±1.94	15.88^{a} ±1.94	14.95^{ab} ±1.94	14.15^{b} ±1.94	16.03^{a} ±1.94	13.75^{b} ±1.94	14.88^{ab} ±1.94	14.50^{a} ±1.94	17.05^{a} ±1.94
	32-36	15.36^{c} ±2.20	18.11^{ab} ±2.20	19.00^{a} ±2.20	17.28^{ab} ±2.20	19.10^{a} ±2.20	16.92^{b} ±2.20	17.78^{ab} ±2.20	17.95^{ab} ±2.20	20.36^{a} ±2.20
	36-40	17.65^{c} ±2.55	19.20^{b} ±2.55	20.90^{ab} ±2.55	19.24^{b} ±2.55	21.70^{a} ±2.55	19.85^{b} ±2.55	21.93^{a} ±2.55	18.78^{b} ±2.55	22.65^{a} ±2.55
	Overall mean	14.53^{c} ±2.36	16.41^{ab} ±2.36	17.03^{a} ±2.36	15.40^{b} ±2.36	17.56^{a} ±2.36	15.53^{ab} ±2.36	16.85^{ab} ±2.36	15.92^{b} ±2.36	18.46^{a} ±2.36
Egg weight (g)	24-28	37.20^{b} ±5.31	38.75^{ab} ±5.31	38.22^{ab} ±5.31	36.89^{b} ±5.31	39.75^{a} ±5.31	38.35^{ab} ±5.31	39.00^{a} ±5.31	37.80^{b} ±5.31	39.60^{a} ±5.31
	28-32	38.77^{c} ±5.70	41.60^{a} ±5.70	41.19^{a} ±5.70	39.77^{b} ±5.70	41.48^{a} ±5.70	41.70^{a} ±5.70	41.88^{a} ±5.70	40.58^{ab} ±5.70	40.12^{ab} ±5.70
	32-36	40.94^{c} ±6.19	43.70^{a} ±6.19	44.17^{a} ±6.19	41.90^{b} ±6.19	43.85^{a} ±6.19	42.92^{ab} ±6.19	42.65^{ab} ±6.19	42.70^{ab} ±6.19	42.92^{ab} ±6.19
	36-40	42.07^{c} ±7.00	44.55^{ab} ±7.00	45.50^{a} ±7.00	43.80^{b} ±7.00	46.02^{a} ±7.00	43.95^{b} ±7.00	44.11^{ab} ±7.00	44.53^{ab} ±7.00	46.58^{a} ±7.00
	Overall mean	39.75^{b} ±6.07	42.15^{a} ±6.07	42.27^{a} ±6.07	42.15^{ab} ±6.07	42.78^{a} ±6.07	41.73^{ab} ±6.07	41.91^{a} ±6.07	41.40^{ab} ±6.07	42.31^{a} ±6.07
Egg mass (g)	24-28	422.96^{c} ±20.15	482.44^{b} ±20.15	506.42^{ab} ±20.15	403.58^{d} ±20.15	532.65^{a} ±20.15	444.86^{c} ±20.15	499.20^{ab} ±20.15	470.61^{b} ±20.15	544.90^{a} ±20.15
	28-32	533.09^{c} ±23.30	660.61^{a} ±23.30	615.79^{ab} ±23.30	562.75^{b} ±23.30	664.92^{a} ±23.30	573.38^{b} ±23.30	623.17^{ab} ±23.30	588.41^{b} ±23.30	684.05^{a} ±23.30
	32-36	628.84^{d} ±34.42	791.41^{b} ±34.42	839.23^{ab} ±34.42	724.03^{c} ±34.42	837.54^{ab} ±34.42	726.21^{c} ±34.42	758.32^{bc} ±34.42	766.47^{b} ±34.42	873.85^{a} ±34.42
	36-40	742.54^{c} ±38.70	855.36^{b} ±38.70	950.95^{ab} ±38.70	842.71^{b} ±38.70	998.63^{a} ±38.70	872.41^{b} ±38.70	967.33^{ab} ±38.70	836.27^{b} ±38.70	1055.04^{a} ±38.70
	Overall mean	581.86^{c} ±36.55	697.46^{ab} ±36.55	728.10^{ab} ±36.55	633.27^{b} ±36.55	758.44^{a} ±36.55	655.22^{b} ±36.55	712.01^{ab} ±36.55	665.44^{b} ±36.55	789.46^{a} ±36.55

* Values are means ±S.E , a, b, c and d in the same row between treatments and between means are significantly different (P≤0.05).

Table (4): Effect of dietary sodium bicarbonate and potassium chloride supplementation on hatching characteristics of Golden Montazah hens.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Fertility %	*87.32^{c} ±2.15	89.14^{b} ±2.15	91.55^{ab} ±2.15	89.14^{b} ±2.15	92.15^{ab} ±2.15	88.52^{b} ±2.15	91.76^{ab} ±2.15	92.15^{ab} ±2.15	93.74^{a} ±2.15
Hatchability %	79.45^{c} ±1.48	80.92^{b} ±1.48	80.92^{b} ±1.48	81.48^{b} ±1.48	84.64^{ab} ±1.48	83.88^{ab} ±1.48	85.87^{a} ±1.48	85.87^{a} ±1.48	86.56^{a} ±1.48
chick weight (g)	31.28 ±1.48	30.98 ±1.48	31.37 ±1.48	30.97 ±1.48	30.89 ±1.48	31.33 ±1.48	31.36 ±1.48	31.45 ±1.48	31.53 ±1.48

* Values are means ±S.E, a, b and c in the same row between treatments and between means are significantly different ($P \leq 0.05$).

Table (5): Effect of dietary sodium bicarbonate and potassium chloride supplementation on egg quality of Golden Montazah hens.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Egg length (cm)	*5.20 ±0.50	5.04 ±0.50	5.00 ±0.50	5.13 ±0.50	4.97 ±0.50	4.93 ±0.50	4.83 ±0.50	5.03 ±0.50	5.10 ±0.50
Egg breadth (cm)	3.93 ±0.32	3.87 ±0.32	4.03 ±0.32	3.90 ±0.32	3.84 ±0.32	3.80 ±0.32	3.87 ±0.32	3.84 ±0.32	3.83 ±0.32
Yolk height (mm)	16.55 ±1.22	16.72 ±1.22	16.80 ±1.22	16.32 ±1.22	15.78 ±1.22	15.78 ±1.22	15.93 ±1.22	15.91 ±1.22	15.50 ±1.22
Albumin height (mm)	6.65 ±0.63	6.57 ±0.63	6.50 ±0.63	6.53 ±0.63	6.47 ±0.63	6.43 ±0.63	6.43 ±0.63	6.47 ±0.63	6.55 ±0.63
Albumin weight (%)	54.27 ±2.65	55.20 ±2.65	54.16 ±2.65	55.17 ±2.65	54.68 ±2.65	55.70 ±2.65	54.70 ±2.65	54.55 ±2.65	54.76 ±2.65
Shell weight (%)	14.13^{b} ±0.83	15.30^{ab} ±0.83	15.90^{a} ±0.83	15.90^{a} ±0.83	16.37^{a} ±0.83	15.53^{ab} ±0.83	16.61^{a} ±0.83	15.36^{ab} ±0.83	16.48^{a} ±0.83
Yolk weight (%)	30.50 ±1.82	29.50 ±1.82	30.94 ±1.82	30.02 ±1.82	30.45 ±1.82	29.27 ±1.82	30.69 ±1.82	30.09 ±1.82	30.76 ±1.82
Shape index (%)	67.90^{c} ±3.02	69.55^{b} ±3.02	71.13^{a} ±3.02	69.55^{b} ±3.02	69.29^{b} ±3.02	69.42^{b} ±3.02	71.19^{a} ±3.02	71.30^{a} ±3.02	72.24^{a} ±3.02
Yolk index (%)	36.80 ±1.72	35.90 ±1.72	35.55 ±1.72	35.42 ±1.72	36.10 ±1.72	35.92 ±1.72	36.11 ±1.72	35.70 ±1.72	36.66 ±1.72
Shell thickness (mm)	31.00^{c} ±1.65	32.01^{b} ±1.65	33.79^{a} ±1.65	32.86^{ab} ±1.65	32.90^{ab} ±1.65	33.01^{ab} ±1.65	33.79^{a} ±1.65	33.87^{a} ±1.65	34.12^{a} ±1.65
Yolk Color	6.20 ±0.61	6.45 ±0.61	6.95 ±0.61	6.80 ±0.61	6.39 ±0.61	5.95 ±0.61	6.20 ±0.61	6.70 ±0.61	6.70 ±0.61
Haugh units (%)	74.20^{c} ±2.31	78.89^{a} ±2.31	77.50^{ab} ±2.31	75.11^{b} ±2.31	76.63^{ab} ±2.31	77.50^{ab} ±2.31	77.75^{ab} ±2.31	79.15^{a} ±2.31	79.13^{a} ±2.31

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different ($P \leq .05$).

Table (6): Effect of dietary sodium bicarbonate and potassium chloride supplementation on physiological and environmental characteristics of Golden Montazah hens at the end of the experimental period.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Blood pH	7.38 ±1.62	7.30 ±1.62	7.11 ±1.62	7.18 ±1.62	7.07 ±1.62	7.07 ±1.62	7.18 ±1.62	7.25 ±1.62	7.12 ±1.62
Body temperature (°C)	41.78 ±5.04	41.36 ±5.04	41.20 ±5.04	41.00 ±5.04	41.20 ±5.04	41.50 ±5.04	41.30 ±5.04	41.66 ±5.04	40.80 ±5.04
Respiratory rate (count/ min)	106.30^{a} ±8.51	104.11^{ab} ±8.51	103.75^{ab} ±8.51	102.65^{ab} ±8.51	100.44^{b} ±8.51	101.00^{b} ±8.51	$99..42^{b}$ ±8.51	102.65^{ab} ±8.51	98.20^{b} ±8.51
Litter ammonia (ppm)	44.22^{a} ±3.65	40.74^{b} ±3.65	41.30^{b} ±3.65	40.03^{b} ±3.65	41.16^{b} ±3.65	40.00^{b} ±3.65	38.41^{c} ±3.65	38.88^{c} ±3.65	37.35^{c} ±3.65
House humidity (%)	59.55 ±7.00	58.92 ±7.00	60.30 ±7.00	59.43 ±7.00	59.16 ±7.00	60.01 ±7.00	59.04 ±7.00	60.40 ±7.00	61.21 ±7.00

* Values are means ±S.E, a, b and c in the same row between treatments and between means are significantly different (P≤0.05).

Table (7): Effect of dietary sodium bicarbonate and potassium chloride supplementation on some plasma electrolytes of Golden Montazah hens.

Treatments	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Ca (mg/dl)	$*11.14^{c}$ + 2.30	11.86^{b} +2.30	14.04^{ab} +2.30	11.92^{b} +2.30	13.95^{ab} +2.30	12.30^{b} +2.30	14.25^{a} +2.30	14.31^{a} +2.30	14.50^{a} +2.30
P (mg/dl)	4.55^{c} +1.46	4.97^{b} +1.46	5.62^{ab} +1.46	5.02^{b} +1.46	5.59^{ab} +1.46	5.09^{b} +1.46	5.81^{a} +1.46	$5..85^{a}$ +1.46	5.98^{a} +1.46
K (mmol/L)	4.24^{b} +1.25	4.25^{b} +1.25	4.40^{b} +1.25	4.76^{ab} +1.25	4.82^{ab} +1.25	4.96^{a} +1.25	4.98^{a} +1.25	5.08^{a} +1.25	5.11^{a} +1.25
Na (mmol/L)	144.15^{c} +12.70	148.48^{b} +12.70	151.78^{ab} +12.70	147.80^{b} +12.70	148.33^{b} +12.70	150.15^{ab} +12.70	150.60^{ab} +12.70	152.05^{ab} +12.70	155.85^{a} +12.70
Cl (mmol/L)	90.23^{d} +8.33	91.89^{d} +8.33	93.92^{c} +8.33	93.92^{c} +8.33	100.73^{b} + 8.33	98.00^{b} +8.33	103.71^{ab} +8.33	98.86^{b} +8.33	114.14^{a} +8.33

* Values are means ±S.E , a, b, c and d in the same row between treatments and between means are significantly different (P ≤ 0.05).

Table (8): Effect of dietary sodium bicarbonate and potassium chloride supplementation on some plasma parameters of Golden Montazah hens.

Treatments	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Total protein (g/100ml)	$*6.16^{c}$ ±0.45	7.00^{ab} ±0.45	7.19^{a} ±0.45	6.59^{b} ±0.45	6.77^{b} ±0.45	6.61^{b} ±0.45	7.31^{a} ±0.45	7.01^{ab} ±0.45	7.08^{ab} ±0.45
Albumin (g/100ml)	3.28 ±0.34	3.62 ±0.34	3.85 ±0.34	3.55 ±0.34	3.50 ±0.34	3.42 ±0.34	3.78 ±0.34	3.53 ±0.34	3.51 ±0.34
Globulin (g/100ml)	2.88^{b} ±0.13	3.38^{a} ±0.13	3.34^{a} ±0.13	3.04^{ab} ±0.13	3.27^{a} ±0.13	3.19^{ab} ±0.13	3.53^{a} ±0.13	3.48^{a} ±0.13	3.57^{a} ±0.13
AST (IU/L)	75.00^{a} ±8.91	78.04^{a} ±8.91	53.75^{c} ±8.91	64.00^{b} ±8.91	76.0^{a} ±8.91	72.00^{a} ±8.91	68.25^{b} ±8.91	59.75^{c} ±8.91	68.25^{b} ±8.91
ALT (IU/L)	31.10^{a} ±1.86	26.35^{ab} ±1.86	23.02^{c} ±1.86	26.39^{ab} ±1.86	24.97^{b} ±1.86	29.92^{a} ±1.86	27.05^{ab} ±1.86	23.60^{c} ±1.86	27.05^{ab} ±1.86

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P≤0.05).

Table (9): Effect of dietary sodium bicarbonate and potassium chloride supplementation on some plasma hormones of Golden Montazah hens.

Treatments	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Aldosterone (pg/ml)	*227.46^{a} ±12.10	215.88^{ab} ±12.10	201.33^{ab} ±12.10	211.55^{ab} ±12.10	191.00^{b} ±12.10	206.72^{ab} ±12.10	186.44^{b} ±12.10	190.59^{b} ±12.10	180.24^{c} ±12.10
T_3 (ng/ml)	5. 33^{a} ±0.31	4. 92^{ab} ±0.31	5.00^{ab} ±0.31	4.68^{b} ±0.31	4.75^{b} ±0.31	4.75^{b} ±0.31	4.82^{b} ±0.31	5.05^{ab} ±0.31	4.28^{c} ±0.31
T_4 (ng/ml)	15.69^{a} ±1.65	14.90^{b} ±1.65	14.75^{ab} ±1.65	13.78^{c} ±1.65	14.90^{b} ±1.65	14.68^{b} ±1.65	15.45^{ab} ±1.65	15.32^{ab} ±1.65	14.16^{c} ±1.65
Ritio T3/T4	0.339 ±0.01	0.330 ±0.01	0.339 ±0.01	0.340 ±0.01	0.318 ±0.01	0.323 ±0.01	0.312 ±0.01	0.329 ±0.01	0.302 ±0.01

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P ≤0.05).

Table (10): Effect of dietary sodium bicarbonate and potassium chloride supplementation on some yolk parameters of Golden Montazah hens.

Treatments	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Cholesterol (mg/g)	*15.96^{a} ±3.30	15.08^{ab} ±3.30	14.78^{b} ±3.30	13.77^{b} ±3.30	12.66^{c} ±3.30	12.98^{c} ±3.30	12.69^{c} ±3.30	13.85^{b} ±3.30	12.97^{c} ±3.30
LDL (mg/g)	11.52^{a} ±2.08	11.75^{a} ±2.08	10.70^{ab} ±2.08	10.55^{ab} ±2.08	9.41^{b} ±2.08	9.80^{b} ±2.08	9.05^{c} ±2.08	10.66^{ab} ±2.08	9.15^{c} ±2.08
HDL (mg/g)	4.44^{a} ±0.85	4.33^{a} ±0.85	4.08^{ab} ±0.85	3.22^{b} ±0.85	3.25^{b} ±0.85	3.18^{b} ±0.85	3.64^{b} ±0.85	3.19^{b} ±0.85	3.72^{ab} ±0.85
Total lipids (mg/g)	287.15^{a} ±15.07	270.19^{b} ±15.07	281.90^{ab} ±15.07	292.71^{a} ±15.07	250.88^{c} ±15.07	266.18^{b} ±15.07	244.40^{c} ±15.07	275.55^{b} ±15.07	254.70^{c} ±15.07

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P ≤ 0.05).

Table (11): Effect of dietary sodium bicarbonate and potassium chloride supplementation on hematological parameters of Golden Montazah hens at the end of the experimental period.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Hemoglobin (g/dl)	*10.03 ±1.41	10.50 ±1.41	10.13 ±1.41	11.20 ±1.41	10.37 ±1.41	10.83 ±1.41	10.23 ±1.41	11.40 ±1.41	11.27 ±1.41
Red blood cells (10^6/mm^3)	2.66^{b} ±0.28	2.63^{b} ±0.28	2.70^{b} ±0.28	3.00^{a} ±0.28	2.77^{b} ±0.28	2.84^{ab} ±0.28	3.01^{a} ±0.28	3.09^{a} ±0.28	2.65^{b} ±0.28
White blood cells (10^3 /mm^3)	14.60 ±2.52	15.16 ±2.52	15.65 ±2.52	14.63 ±2.52	14.83 ±2.52	15.16 ±2.52	15.37 ±2.52	15.80 ±2.52	14.75 ±2.52
Platelet count (ML)	30.00^{c} ±4.07	35.67^{b} ±4.07	41.67^{a} ±4.07	42.00^{a} ±4.07	36.67^{b} ±4.07	34.33^{b} ±4.07	37.33^{b} ±4.07	32.33^{c} ±4.07	35.00^{b} ±4.07
Neutrophili (ML)	27.00^{c} ±3.80	34.00^{a} ±3.80	31.33^{b} ±3.80	30.67^{b} ±3.80	28.00^{c} ±3.80	30.33^{b} ±3.80	32.67^{b} ±3.80	35.00^{a} ±3.80	27.67^{c} ±3.80
Lymphocytes (ML)	55.00^{c} ±7.23	56.67^{c} ±7.23	60.33^{ab} ±7.23	58.67^{ab} ±7.23	63.67^{a} ±7.23	60.33^{ab} ±7.23	63.67^{a} ±7.23	57.67^{c} ±7.23	61.67^{ab} ±7.23
Monocytes (ML)	5.33^{ab} ±0.77	5.33^{ab} ±0.77	5.33^{ab} ±0.77	6.33^{a} ±0.77	4.67^{c} ±0.77	5.33^{ab} ±0.77	5.33^{ab} ±0.77	5.33^{ab} ±0.77	6.67^{a} ±0.77
Eosinophiles (ML)	3.00^{b} ±0.42	4.00^{ab} ±0.42	4.33^{ab} ±0.42	4.33^{ab} ±0.42	3.67^{b} ±0.42	4.00^{ab} ±0.42	4.00^{ab} ±0.42	4.67^{a} ±0.42	4.00^{ab} ±0.42
HCT (ML)	37.33^{b} ±5.36	37.67^{b} ±5.36	37.33^{b} ±5.36	41.33^{a} ±5.36	39.67^{a} ±5.36	40.00^{a} ±5.36	37.33^{b} ±5.36	42.33^{a} ±5.36	41.67^{a} ±5.36
MCV(ML)	137.0^{b} ±9.78	143.1^{a} ±9.78	138.7^{ab} ±9.78	137.4^{b} ±9.78	142.9^{a} ±9.78	141.4^{a} ±9.78	140.9^{a} ±9.78	139.0^{ab} ±9.78	141.2^{a} ±9.78
MCH (ML)	36.83^{b} ±4.55	39.87^{a} ±4.55	37.50^{ab} ±4.55	37.30^{ab} ±4.55	37.27^{ab} ±4.55	38.20^{a} ±4.55	38.50^{a} ±4.55	37.63^{ab} ±4.55	37.87^{ab} ±4.55
MCHC (ML)	25.87^{b} ±2.96	27.80^{a} ±2.96	27.10^{a} ±2.96	27.03^{a} ±2.96	26.80^{ab} ±2.96	27.03^{a} ±2.96	27.30^{a} ±2.96	26.87^{ab} ±2.96	27.00^{a} ±2.96

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P ≤ 0.05).

Table (12): Effect of dietary sodium bicarbonate and potassium chloride supplementation on antibody titters against avian Newcastle and Influenza diseases of Golden Montazah hens at the end of the experimental period.

Parameters	Treatments								
	T1	T2	T3	T4	T5	T6	T7	T8	T9
Newcastle titter against	*162.40^{c} ±11.28	166.25^{c} ±11.28	192.83^{ab} ±11.28	175.14^{b} ±11.28	214.00^{a} ±11.28	173.15^{b} ±11.28	198.15^{ab} ±11.28	196.44^{ab} ±11.28	220.22^{a} ±11.28
Influenza titter against	6.50^{b} ±1.04	6.75^{b} ±1.04	7.63^{ab} ±1.04	6.75^{b} ±1.04	7.44^{ab} ±1.04	6.81^{b} ±1.04	7.95^{a} ±1.04	7.80^{a} ±1.04	7.95^{a} ±1.04

* Values are means ±S.E , a, b and c in the same row between treatments and between means are significantly different (P≤ 0.05).

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الملخص العربى

تأثير أضافة بيكربونات الصوديوم وكلوريد البوتاسيوم فى العليقة على الأتزان الحامضى - القاعدى، ألكتروليتات البلازما وهرمون الألدوستيرون فى دجاج المنتزة الذهبى تحت ظروف الجو الحار

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استخدم في هذه الدراسة عدد ٢٧٠ دجاجة و٢٧ ديك من عمر ٢٠أسبوع حتى ٤٠ أسبوع من سلالة المنتزة الذهبى وتم تقسيمهما الى ٩ مجاميع كل مجموعة منها ٣ مكررات كل مكرر ١٠ دجاجات وديك تبعا للمعاملات الآتية

١- مجموعة كنترول وتغذت على عليقة انتاج البيض بالمحطة والتى احتوت على مخلوط أملاح وفيتامينات بالاضافة لباقى المكونات .

٢- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٢٥% بعليقة انتاج البيض الكنترول .

٣- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٥٠% بعليقة انتاج البيض الكنترول .

٤- مجموعة أضيف لها كلوريد البوتاسيوم بنسبة ٠.٢% بعليقة انتاج البيض الكنترول .

٥- مجموعة أضيف لها كلوريد البوتاسيوم بنسبة ٠.٣% بعليقة انتاج البيض الكنترول .

٦- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٢٥% + كلوريد البوتاسيوم بنسبة ٠.٢% بعليقة انتاج البيض الكنترول

٧- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٢٥%+ كلوريد البوتاسيوم بنسبة ٠.٣% بعليقة انتاج البيض الكنترول

٨- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٥٠% + كلوريد البوتاسيوم بنسبة ٠.٢% بعليقة انتاج البيض الكنترول

٩- مجموعة أضيف لها بيكربونات الصوديوم بنسبة ٠.٥٠% + كلوريد البوتاسيوم بنسبة ٠.٣% بعليقة انتاج البيض الكنترول

وأستمرت المعاملات السابقة لمدة ٤ شهورخلال فصل الصيف ، وتم تربية الدجاج فى أقفاص فردية وتحت نفس ظروف حرارة الصيف المرتفعة حيث كانت الحرارة معظم شهور التجربة اعلى من ٣٠ درجة منوية والتهوية والاضاءة والرطوبة والماء حر للطيور خلال فترة التجربة .

- وتم أخذ وزن الجسم واستهلاك العلف وحساب معدل التحويل الغذائى وتسجيل انتاج البيض عدد ووزن ثم حساب كتلة البيض وأخذ دفعات بيض تفريخ حيث تم باستخدام التلقيح الصناعى وتم تقدير صفات جودة البيض و تم أخذ كلا من معدل التنفس ودرجة حرارة الجسم وعينات من الفرشة لتقدير نسبة الرطوبة والامونيا .

- وفى نهاية التجربة تم أخذ عدد ١٠ عينات دم من كل مجموعة لتقدير التقديرات الفسيولوجية بالبلازما مثل تقدير كلا من الصوديوم والبوتاسيوم والكلوريد والكالسيوم والفوسفور والبروتين الكلى والالبيومين والجلوبيولين وانزيمات وظائف الكبد وهرمونات الدرقية وهرمون الالدوستيرون وكذلك تم أخذ ٥عينات من صفار البيض من كل مجموعة لتقدير كلا من الكولستيرول الكلى والكوليستيرول منخفض الكثافة والدهون الكلية وأخذ

بعض التقديرات المناعية كعد كرات الدم الحمراء والبيضاء وهيموجلوبين الدم وعمل صورة دم كاملة وكذلك تم تقدير الاستجابة المناعية ضد مرضى النيوكاسيل وأنفلونزا الطيور.

وكانت أهم النتائج المتحصل عليها هى :-

- **أضافة كلا من بيكربونات الصوديوم بنسب ٠.٢٥ ،٠.٥٠% وكلوريد البوتاسيوم بنسب ٠.٢ ، ٠.٣% الى العليقة سواء بصورة فردية او متجمعة بالمقارنة بالمجموعة الكنترول أدت الى تأثيرات ايجابية على وزن الجسم والكفاءة التحويلية وانتاج البيض كما ونوعا ونسب الفقس والخصوبة**
- **أضافة كلا من بيكربونات الصوديوم بنسب ٠.٢٥ ،٠.٥٠% وكلوريد البوتاسيوم بنسب ٠.٢ ، ٠.٣% الى العليقة سواء بصورة فردية او متجمعة بالمقارنة بالمجموعة الكنترول أدت الى تأثيرات ايجابية على الأتزان الحامضى – القاعدى ، ألكتروليتات البلازما وهرمون الألدوستيرون وتقليل مستوى الكوليستيرول والدهون الكلية بصفار البيض .**
- **أضافة كلا من بيكربونات الصوديوم بنسب ٠.٢٥ ،٠.٥٠% وكلوريد البوتاسيوم بنسب ٠.٢ ، ٠.٣% الى العليقة سواء بصورة فردية او متجمعة بالمقارنة بالمجموعة الكنترول أدت الى تأثيرات ايجابية على تحسين الاستجابة المناعية ضد أمراض النيوكاسيل وانفلونزا الطيور مع تحسين بعض مكونات الدم المناعية.**

النتائج تدل على أهمية أستخدام كلا من بيكربونات الصوديوم وكلوريد البوتاسيوم كأضافات غذائية فسيولوجية حيث أدت الى زيادة إنتاج البيض وتحسين جودة البيض الناتج كما ونوعا وتحسين نسب الفقس والتفريخ والخصوبة ، مع تحسين الحالة الفسيولوجية والمناعية للسلالات المحلية تحت ظروف الجو الحار أثناء تربية مثل هذة السلالات فى شهور الصيف وكل هذا يؤدى الى زيادة العائد من تربية مثل هذة السلالات.