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# EFFECT OF ALTERNATED DRINKING SALINE WELL WATER AND VITAMIN C SUPPLEMENTATION ON SOME PHYSIOLOGICAL RESPONSES AND PRODUCTIVE PERFORMANCE OF LAYING HENS UNDER SOUTH SINAI CONDITIONS

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**ABSTRACT:**This work aimed to study the effect of using vitamin C and alternation of drinking saline well water with tap water on hematological parameters, biochemical blood constituents, hormonal profile and productive performance of laying hens drinking saline well water under South Sinai conditions. A total number of 120 Commercial Browne Lohmann LSL laying hens (34 weeks old and average body weight of 1996.9±18.7 g) were randomly divided into four equal treatments (30 hens of each). The 1st treatment (Tr1), hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control). The 2nd treatment (Tr2), hens drank saline well water (containing 3398 ppm TDS) and fed basal diet. The 3rd treatment (Tr3), hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C). The 4th treatment (Tr4), hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. The results showed that red blood cells and hemoglobin level were significantly decreased, while, mean corpuscular volume and Heterophils/Lymphocytes ratio were significantly increased in Tr2 when compared with Tr1. Glucose level significantly decreased in Tr2 compared with other treatments. Cholesterol level significantly decreased in Tr3 when compared with Tr2, Tri-iodothyronine hormone significantly decreases in the Tr2 when compared with Tr3 group. Progesterone level significantly increased in Tr4 when compared with Tr2. However, there are significant differences among treatments in final body weight, egg weight, egg number, egg mass, feed conversion ratio and mortality rate. In conclusion, laying hens alternated drank saline water with tap water every week or using vitamin C in feeds may alleviate the drastic effect of drinking saline well water on blood parameters and thus positively reflected on laying hen's performance**.**

**Key words:** laying hens, saline water, vitamin C, productive performance, blood biochemical

## INTRODUCTION

Recent Egyptian agriculture policy has been directed towards intensive land reclamation in the desert lands. But the main problem is the new reclaimed desert areas depend on under groundwater for poultry drinking with varying degrees of salinity and this underground water often contains high concentrations of dissolved salts (Marai and Habeeb, 1994), Moreover, water salinity is the major factor determining the suitability of particular water source for livestock (Abdelsattar et al., 2020). Additionally, water is very essential nutrient for livestock, it is the next to oxygen as immediately important for life, Water represents between 55 % and 75 % of the weight of a chicken, 65 % of the egg, about 70 % is inside the cells and 30 % is in fluid surrounding the cells and in blood (Ahmed and Abdel-Rahman, 2004).

Many studies have been conducted to study the effect of utilizing natural saline water on poultry. This saline water often unsuitable for poultry drinking, and if the total dissolved salts (TDS) is high, this led to decrease the productive performance, disturbance biochemical parameters and blood picture of poultry (Hadziosmanovic *et al*., 1997; Ahmed and Abdel-Rahman, 2004 and Morsy *et al*., 2012). On the other hand, Yape Kii and Dryden (2005) showed that water salinity may cause harmful effects resulting in poor performance, illness or even death of animals. They have stated that adverse effects of salinity on health and performance varied based on many factors as species, breeds, adaptation and environment of animals. Alahgholi et al (2014) also stated that animal's tolerance to different amounts of NaCl in the water may depends on their species, age, water requirement, physiological condition, season and salt content of total diet.

So, many studies search about the best means to alleviate the drastic effects of drinking unsuitable saline water. Yoselewitz and Balnave (1989) concluded that using ascorbic acid in laying hens alleviate the drastic effects of drinking inappropriate saline water and this effect was dependent upon concentration of ascorbic acid, where ascorbic acid acted as a preventive rather than a remedial.

Other studies reported that, the productive performance of chickens was improved when saline water is replaced by tap water (Yoselewitz and Balnave, 1989), on the other hand, rabbits drank saline well water with tap water every week may reduce the drastic effect of drinking saline well water on blood constituents and thus may be positively reflected on rabbit's performance (Morsy *et al*., 2016). Therefore, this work aimed to study the effect of using vitamin C and alternation of drinking saline well water with tap water on hematological parameters, biochemical blood constituents, hormonal profile and productive performance of laying hens drinking saline well water under South Sinai conditions.

## MATERIALS AND METHODS

The present study was conducted in the South Sinai Research Station, located at Ras Suder that belongs to the Desert Research Center, Ministry of Agriculture, Egypt. The experiment started on March up to June. A total number of 120 Commercial Browne Lohmann LSL laying hens (34 weeks old and body weight of 1996.9±18.7 g) were randomly divided into four equal treatments (30 hens of each). The 1st treatment (Tr1), hens drank tap water

(containing 265 ppm TDS) and fed basal diet (considered as control). The 2nd treatment (Tr2), hens drank saline well water (containing 3398 ppm TDS) and fed basal diet. The 3rd treatment (Tr3), hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C). The 4th treatment (Tr4), hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. Saline well water and tap water were chemically analyzed (Table 1) according to Muller (1995).

Hens until the end of experiment (50 weeks) were housed in wire cages, supplied with clean fresh water and fed ad-libitum on recommended standard rations according to National Research Council (1994) as shown in Table (2).

Lighting program consisted of a period of 16 hours light and 8 hours of darkness. Hens were kept under the similar executive and hygienic conditions. Hens were healthy and treated with vaccines.

Blood samples (3 ml) were collected from wing vein from 30 birds of each treatment, 15 samples (0.5 ml) collected into anticoagulant EDTA treated for determination of red blood cells (RBC's), hemoglobin (Hb), packed cell volume (PCV %), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) were determined by the counter (HA-VET, Clinding – Belgium). The others 15 blood samples (2.5 ml) were collected in non-EDTA tubes. Serum was collected by centrifugation for 20 minutes at 3000 rpm and it stored at –20 $^{0}$ C until determination of aldosterone (Ald), progesterone ($P_4$) and tri-iodothyronine ($T_3$) hormones which determined by ELISA method using commercial kits. Blood metabolites (total protein (TP), albumin (Alb), glucose, cholesterol (Cho), creatinine (Crea), alanine transaminase (ALT) and aspartic transaminase (AST) were determined by using profitable kits. Globulin was calculated by the difference between total protein and albumin

Body weight (BW) was individually recorded at 34 weeks for initial body weight (IBW) and at 50 weeks of age for final body weight (FBW). Egg number (EN) and egg weight (EW) was daily recorded for 100 days (egg production period). Egg mass (EM) was calculated by multiplying average EW by EN. Total feed intake (TFI) was weekly recorded by calculated from the difference between the quantity of feed provided for each treatment and the residual quantity for the same treatment. Feed conversion ratio (FC) was calculated as follows: FC=TFI divided by total egg mass. Mortality rate (MR) was daily recorded during experiment period.

At the end of experiment thirty eggs were randomly collected from each treatment (120 eggs) to measure egg shell thickness with membrane in mm (average of the broad, narrow ends and equator areas of egg).

Data were analyzed by the least square analysis of variance using the General Linear Model Procedure (SAS, 2004) according to following model:

$Y_{ij}=\mu + Tr_i + e_{ij}$

Where, $Y_{ij}$ = observations, $\mu$ = overall mean, $Tr_i$ = effect of $i^{th}$ treatment (i: 1-4), $e_{ij}$ = experimental error.

Duncan's New Multiple Range Test (Duncan, 1955) separated differences among treatment means. Mortality rate

of hens was analyzed by Chi square analysis.

## RESULTS AND DISCUSSION

### 1. Hematological parameters

Table (3) showed that RBC's (Red blood cells) and Hb (Hemoglobin) were significantly decreased, while, MCV (Mean corpuscular volume) and H/L ratio (Heterophils/Lymphocytes ratio) were significantly increased in Tr2 (hens drank saline well water) when compared with Tr1 (hens drank tap water), on the other hand, there were insignificant differences between Tr1, Tr3 (hens drank saline well water and fed diet containing 2 % vitamin C) and Tr4 (hens drank saline well water followed with drank tap water every week as alternated system) in RBC's, Hb, PCV %, MCV and H/L ratio. Additionally, there are insignificant differences between treatments in MCH. MCHC and WBC.

From the previous results we can observed that, most hematological studies parameters were enhanced in Tr3 (hens drank saline well water and fed diet containing 2 % vitamin C) and Tr4 (hens drank saline well water followed with drank tap water every week as alternated system). These results may be attributed to the several roles of vitamin C in reducing the effects of stress, anti-oxidative effects and enhancing immune response that maybe help to improve the saline water effects (Mirabdollbaghi *et al*., 2006). While enhancement in Tr4 may be attributed to drink tab water after drink saline water clean and change the adverse effects of saline water.

### 2. Biochemical blood constituents

Table (4) showed that the significant differences among treatments in total protein, albumin, glucose, cholesterol, alanine transaminase and aspartic transaminase, while, there are insignificant differences among treatments in globulin, albumin/globulin ratio and creatinine.

Total protein (TP) significantly decreased in Tr2 when compared with Tr1. There were insignificant differences between Tr1 and Tr3 or between Tr1 and Tr4 (Table 4). The decreased in TP in Tr2 which drink saline water only might return to salinity stress results in the increase of Corticosterone central stress hormone in blood (Gharib *et al*., 2005). Such hormone demolishes part of the protein to synthesize sugar out of protein sources and then reducing the total protein level in the blood serum.

On the other hand, the increased TP in Tr3 might be due to the role of vitamin C that reflected by resisting salt stress by controlling the secretion of Deoxy-corticosterone secreted by the adrenal gland that vitamin C has a significant role in the synthesis of corticosterone hormone which rise the advantage of glucose by breaking the protein to generate energy (Baines, 1996). Also , the role of vitamin C is shown by decreasing the secretion of corticosterone hormone via the inhibition of both enzymes (hydroxylase -21 and controlling βhydroxylase ± 11 ) in the synthesis of such hormone out of the adrenal cortex (Pardue, 1983) which leads to the limitation of the protein demolishing activity in order to make use of sugar and then reserving a high level of protein in the blood plasma (Coles, 1986). Abou-Zaid *et al*. (2000) refer to the occurrence of a moral increase of the total protein concentration in the serum blood of Japanese quails upon adding vitamin C with 450 ppm level to the drinking water.

Albumin level significantly increased in Tr3 compared with the other treatments.

While, there is insignificant difference among treatments in globulin level and A/G ratio (Table 4), this result may be due to the supplementation of vitamin C enhanced the health of the hens by increasing their antioxidant status and immunity, as demonstrated by the increased activities of antioxidant enzymes, increased IgG levels and increased amino acids preservation in the spleen (Gan *et al*. 2018).

Glucose level significantly decreased in Tr2 compared with other treatments (Table 4). This result may be due to drinking saline water leads to blood constituent's dilution (Ahmed, 1996) or may attribute to increase energy requirements to keep the sodium/potassium gradient (Ahmed, 1996; Guyton and Hall, 2006 and Attia *et al*., 2015). On the other hand, insignificant differences between Tr1, Tr3 and Tr4 in the glucose level refer to success vitamin C in Tr3 and alternating water system (Tr4) to alleviate the adverse effects of drinking saline water on glucose level.

Cholesterol level significantly decreased in Tr3 when compared with Tr2, while, there were insignificant differences between Tr1 and Tr3 or between Tr1 and Tr4 (Table 4). This result might be due to about 20% of plasma cholesterol can be obtained from the diet the other part (80%) is synthesized by the liver or small intestine from acetyl-CoA. Al-Janabi *et al*. (1988) found that vitamin C led to decreased blood cholesterol, these results may refer to the influence of water salinity on the thyroid hormones and renal system with a disorder in lipoprotein metabolism resulting in increased the high-density lipoproteins in the blood, which are the cholesterol-rich lipoprotein components. So, the increase in total lipids due to saline water could be attributed to the elevated cholesterol, phospholipid and lipoprotein concentrations (Abdel-Samee and El-Masry, 1992; Pond *et al*., 1995; Ahmed and Abdel-Rahman, 2004 and Attia *et al*., 2015).

Alanine transaminase (ALT) there is insignificant difference between Tr1, Tr3 and Tr4, while, ALT significantly increased in Tr2 compare with Tr1 and Tr4. There is insignificant difference between Tr1 and Tr3 or between Tr2 and Tr4 in Aspartic transaminase (AST).

On the other hand, there is an insignificant difference among treatments in Creatinine levels. This increase in ALT and AST in Tr2 may reflect failure of the liver, which was supported by the plasma albumin decrease after drinking saline well water and / or reflecting inadequacy of renal glomerular filtration and impairment of kidney (Abdel Rahman *et al*., 2000). Reducing alanine and aspartate transaminase activity of Tr3 and Tr4 treatments might point to that alternating water system alleviating the saline stress on liver function and Vitamin C acts to reduce the level of ALT and AST enzymes and such reduction is attributed to Vitamin C role to control the secretion of corticosterone hormone from the adrenal gland (Mahmoud *et al*., 2004) which results in the limitation of their activity in blood (Oriordan *et al*., 1982).

insignificant differences between Tr1 (control) and other two groups (Tr3 and Tr4) in most biochemical traits, these results showing that chickens alternated drank saline water with tap water (Tr4) may reduce the saline stress by washing the body from excessive minerals which absorption from drinking saline well water, on other hand, vitamin C supplementation in Tr3 worked as a

protective rather than a remedial treatment.

**3. Hormonal profile**

Figures (1, 2 and 3) shows the influence of alternated drinking saline well water and vitamin C supplementation on hormonal profile, we observed that, there were insignificant differences among Tr1, Tr2 and Tr4 in Tri-iodothyronine ($T_3$) level, while, $T_3$ hormone recorded significantly decrease in the Tr2 when compared with Tr3 (Figure 1).

These results may be due to Vitamin C acts to increase the level of thyroxin hormone in blood due its role in the metabolism of amino acids namely phenylalanine and tyrosine which are regarded as two fundamental substances in the synthesis of the hormones of the thyroid gland, thyroxin and tri-iodothyronine (Younis et al., 2007). These results agree with Khalid (2017) who found that hormones of the thyroid gland in the blood was increased when birds drink saline water with supplementation with vitamin C, and Morsy *et al*. (2016) who reported that $T_3$ significantly decreased in rabbits drink saline water when compare with rabbit's drink fresh tap water.

However, progesterone level ($P_4$) significantly increased in Tr4 when compared with Tr2. While, there insignificant differences among Tr1, Tr2 and Tr3 (Figure 2). These results may be due to increase egg production in Tr4 compared with other treatments. Vitamin C plays important role in the synthesis of the Steroid hormones including sex hormones (LH and FSH) and thus it has an advantageous impact on the sexual performance C (Krautman *et al*., 1990), in addition to its role in reducing the negative role of the corticosterone hormone which accelerates the sexual maturity.

Aldosterone concentration significantly decreased in Tr2 when compared with Tr1 (Figure 3). On the other hand, there were insignificant differences between Tr1, Tr3 and Tr4. These results may be due to laying hens in Tr2 drank saline water may achieved the physiological of salt retention and salt excretion for an overload of salt by decreasing their plasma aldosterone concentration. Aldosterone is accountable for the activity of 50-70 % of total minerals corticoids as well as regulation and adjustment of water and electrolytes balance between the body compartments (Amal, 2003; El-Hawy, 2013 and Abd El-Galil *et al*., 2014).

**4. Productive performance**

Table (5) shows the productive performance of laying hens as affected by drinking saline well water. There are insignificant differences among treatments in daily feed intake and total feed intake. Meanwhile, there are significant differences among treatments in the final body weight, feed conversion ratio, egg weight, egg number, egg mass and mortality rate; these traits decreased significantly in Tr2 which drinking saline water only. These results may be due to drinking saline water in Tr2 in-improvement in nutrients digestibility (Balnave, 1993) while drinking tab water after the saline water in Tr4 or Vitamin C supplementation in Tr3 remove adverse effect of saline water. these results indicate that success the vitamin C and Weekly sequence drinking saline water containing 3398 ppm TDS and tap water containing 265 ppm TDS in treat the adverse effect of drinking the saline water on the productive performance of laying hens, these results agree with

Balnave *et al*. (1991) who found that Vitamin C acted as a preventive rather than a remedial treatment, these results agree with Morsy *et al*. (2012) which reported that feed conversion ratio, egg mass and egg number decreased significantly of laying hens drink saline water compare with drinking tap water. On the other hand, Perek and Kendler (1962) reported that drinking saline water of chickens and supplementation ration with vitamin C led to production heavier eggs. While, Krista *et al*. (1960) reported that the egg production was not significantly affected by added sodium chloride at 4,000 ppm. Khalilipour *et al*. (2019) found that in quail, drinking saline well water leads to higher feed intake, feed conversion ratio and mortality rate, lower body weight gain and lower profitability.

Drinking saline water has been shown to have adverse effect on shell quality in laying hens. This is a main problem due to an increase of breakage of eggs and great economic losses in commercial egg production. Shell thickness significantly increased in Tr3 which drank saline well water and fed diet containing 2 % vitamin C when compared with other treatment, this result may be due to vitamin C acts to improve the properties of the eggshell and reduce the effect of sodium chloride added to the drinking water and such results have been confirmed by Sardar and Khan (2005). Adding vitamin C with a concentration of 500 ml gm / Lit led to the improvement of eggshell properties. This might be attributed to the role of vitamin C in supporting the status of metals in the body that it acts to increase the concentrations of NaCl and P in the blood plasma (AL-Draghi *et al*., 1998). These results agree with Mirabdollbaghi *et al*. (2006) who found that using vitamin C with saline water reduces the adverse effects of saline well water on the egg shell quality.

## IN CONCLUSION

laying hens drank saline well water (containing 3398 ppm TDS) showed harmful effects on blood parameters and productive performance. However, laying hens alternated drank saline water with tap water every week or using vitamin C in feeds may alleviate the drastic effect of drinking saline well water on blood parameters and thus positively reflected on laying hen's performance**.**

**Table (1):** Chemical analysis of tap and saline well water.

| **Parameters** | **Tap water** | **Saline well water** |
|---|---|---|
| Total dissolved solids (mg/l) | 265.0 | 3398.0 |
| Electric conductivity (µS/m) | 0.53 | 9.96 |
| pH | 6.9 | 7.6 |
| Sodium (mg/l) | 30.0 | 640.0 |
| Potassium (mg/l) | 4.0 | 8.0 |
| Calcium (mg/l) | 46.0 | 302.7 |
| Magnesium (mg/l) | 10.7 | 160.3 |
| Carbonate (mg/l) | 0.0 | 15.0 |
| Bicarbonate (mg/l) | 125.0 | 115.9 |
| Sulphate (mg/l) | 52.3 | 800.0 |
| Chloride (mg/l) | 59.1 | 1414.0 |

**Table (2):** Composition and calculated analysis of the experimental diets.

| **Ingredients** | **Basal diet** | **Vitamin C (2 %)** |
|---|---|---|
| Vitamin C | 0.0 | 2.00 |
| Yellow corn | 57.00 | 55.00 |
| Soybean meal (44 % CP) | 29.00 | 29.00 |
| Wheat bran | 2.84 | 2.84 |
| Limestone ground | 7.60 | 7.60 |
| Dicalcium phosphate | 1.50 | 1.50 |
| Vitamins and minerals premix* | 0.40 | 0.40 |
| Oil | 1.30 | 2.00 |
| Salt | 0.30 | 0.30 |
| Dl- methionine | 0.06 | 0.06 |
| Total | 100 | 100 |
| **Calculated values** | | |
| Crude protein | 18.05 | 17.88 |
| Crude fiber | 3.32 | 3.32 |
| Ether extract | 2.81 | 2.81 |
| Ash | 2.37 | 2.37 |
| Metabolizable energy (kcal/kg) | 2763.6 | 2763.2 |
| Calcium (%) | 3.31 | 3.31 |
| Available phosphorus (%) | 0.40 | 0.40 |

* Each 2.5 kg Vitamins and minerals premix comprises (per ton of feed), Vit. A 10000000 IU, Vit.$D_3$ 2000000 IU, Vit. E I0g, Vit.$K_3$ 1000 mg, Vit. $B_1$ 1000 mg, Vit.$B_2$ 5000mg, Vit.$B_6$ 1.5g, Vit. $B_{12}$ 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 70g, Choline chlorite 10g, Iodine 300 mg, Copper 4g, Zinc 50g and Selenium 100 mg.

**Table (3):** Effect of vitamin C and alternation of drinking saline well water with tap water on hematological parameters of laying hens drinking saline well water.

| Traits | Tr1 | Tr2 | Tr3 | Tr4 | ±SE |
|---|---|---|---|---|---|
| RBC ($\times10^6$/mm$^3$) | 2.71$^{a}$ | 2.32$^{b}$ | 2.70$^{a}$ | 2.43$^{b}$ | 0.06 |
| Hb (g/dl) | 16.31$^{a}$ | 12.69$^{b}$ | 14.90$^{ab}$ | 14.14$^{ab}$ | 0.98 |
| PCV (%) | 29.66$^{ab}$ | 28.43$^{b}$ | 32.13$^{a}$ | 28.75$^{ab}$ | 1.11 |
| MCV (fl) | 109.97$^{b}$ | 122.90$^{a}$ | 118.97$^{ab}$ | 118.25$^{ab}$ | 4.12 |
| MCH (pg) | 61.42 | 54.61 | 55.59 | 58.92 | 4.44 |
| MCHC (%) | 57.62 | 45.48 | 46.89 | 50.08 | 4.48 |
| WBC ($\times10^3$/mm$^3$) | 6.91 | 7.89 | 7.54 | 7.30 | 0.44 |
| H/L ratio | 0.60$^{b}$ | 0.73$^{a}$ | 0.67$^{ab}$ | 0.66$^{ab}$ | 0.03 |

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet.

RBC's = Red blood cells; Hb = Hemoglobin; PCV (%) = packed cell volume; MCV = Mean corpuscular volume; MCH = Mean corpuscular hemoglobin; MCHC = Mean corpuscular hemoglobin concentration; WBC=White blood cells; H/L ratio= Heterophils/Lymphocytes ratio

[a,b] Means bearing different superscripts within the same row are significantly different ($P<0.05$).

**Table (4):** Effect of vitamin C and alternation of drinking saline well water with tap water on bio-chemical parameters of laying hens drinking saline well water.

| Traits | Tr1 | Tr2 | Tr3 | Tr4 | ±SE |
|---|---|---|---|---|---|
| TP (g/dl) | 8.49$^{ab}$ | 6.19$^{c}$ | 9.17$^{a}$ | 7.04$^{bc}$ | 0.61 |
| Alb (g/dl) | 3.61$^{b}$ | 3.11$^{b}$ | 4.23$^{a}$ | 3.60$^{b}$ | 0.19 |
| Glob (g/dl) | 4.88 | 3.08 | 4.94 | 3.44 | 0.63 |
| A/G ratio | 0.80 | 1.23 | 1.42 | 1.92 | 0.50 |
| Glucose(mg/dl) | 268.47$^{a}$ | 242.69$^{b}$ | 266.68$^{a}$ | 264.47$^{a}$ | 2.18 |
| Cho (mg/dl) | 94.57$^{ab}$ | 111.52$^{a}$ | 80.58$^{b}$ | 107.39$^{a}$ | 6.47 |
| ALT (i.u./l) | 57.46$^{b}$ | 66.87$^{a}$ | 60.92$^{ab}$ | 58.96$^{b}$ | 2.15 |
| AST (i.u./l) | 61.95$^{c}$ | 79.86$^{a}$ | 68.22$^{bc}$ | 74.79$^{ab}$ | 3.17 |
| Crea (mg/dl) | 0.97 | 0.86 | 0.33 | 0.69 | 0.24 |

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. TP=total protein; Alb=albumin; Glob=globulin; A/G ratio=albumin / globulin ratio; Cho=cholesterol; ALT=alanine transaminase; AST=aspartic transaminase; Crea= creatinine

[a,b,c] Means bearing different superscripts within the same row are significantly different ($P<0.05$).

**Table (5):** Effect of vitamin C and alternation of drinking saline well water with tap water on productive performance of laying hens drinking saline well water.

| Traits | Tr1 | Tr2 | Tr3 | Tr4 | ±SE |
|---|---|---|---|---|---|
| IBW (g) | 2000.63 | 1997.18 | 1997.09 | 1992.63 | 30.23 |
| FBW (g) | 2044.72$^{a}$ | 1902.36$^{b}$ | 2055.72$^{a}$ | 2064.18$^{a}$ | 43.69 |
| EW (g) | 68.45$^{a}$ | 64.29$^{b}$ | 68.08$^{a}$ | 68.92$^{a}$ | 1.02 |
| EN | 89.52$^{ab}$ | 81.15$^{c}$ | 86.07$^{b}$ | 91.50$^{a}$ | 1.91 |
| EM (g) | 6128.93$^{ab}$ | 5217.06$^{c}$ | 5856.97$^{b}$ | 6306.20$^{a}$ | 109.68 |
| DFI (g) | 113.30 | 112.76 | 112.12 | 109.48 | 3.25 |
| TFI (g) | 11330.16 | 11276.66 | 11212.00 | 10948.33 | 325.02 |
| FC | 1.85$^{bc}$ | 2.16$^{a}$ | 1.92$^{b}$ | 1.73$^{c}$ | 0.06 |
| Sh. Th. (mm) | 0.35$^{b}$ | 0.36$^{b}$ | 0.40$^{a}$ | 0.35$^{b}$ | 0.009 |
| MR % | (1/30) 3.33$^{b}$ | (6/30) 20.00$^{a}$ | (2/30) 6.67$^{ab}$ | (2/30) 6.67$^{ab}$ | |

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. IBW = Initial body weight (34 weeks); FBW = Final body weight (50 weeks); EW = Egg weight; EN= Egg number; EM= Egg mass ; DFI= Weekly feed intake; TFI = Feed intake; FC (g feed/g gain) = Feed conversion ratio; Sh. Th. = shell thickness; MR % = Mortality rate percentage

$^{a,b,c}$ Means bearing different superscripts within the same row are significantly different ($P<0.05$).

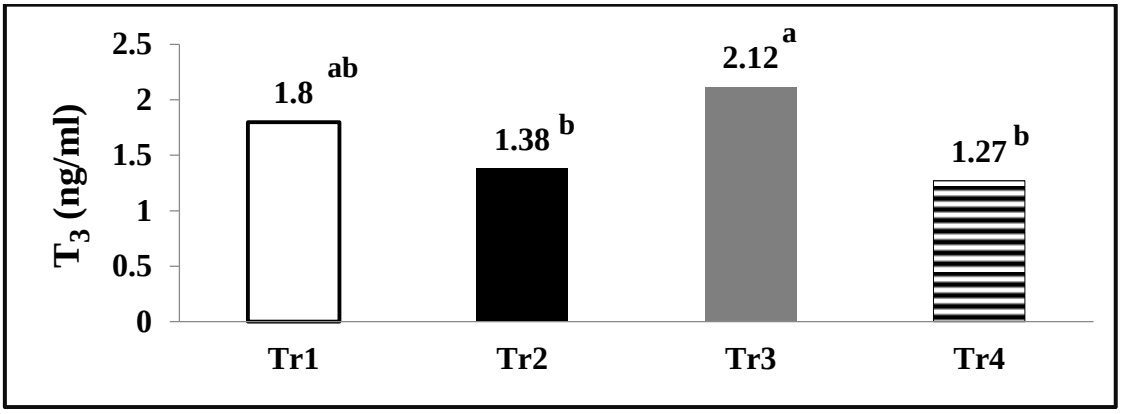


**Figure (1):** Effect of vitamin C and alternation of drinking saline well water with tap water on tri-iodothyronine hormone of laying hens drinking saline well water.

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. $T_3$=triiodothyronine hormone.

$^{a,b}$ Means bearing different superscripts are significantly different ($P<0.05$).

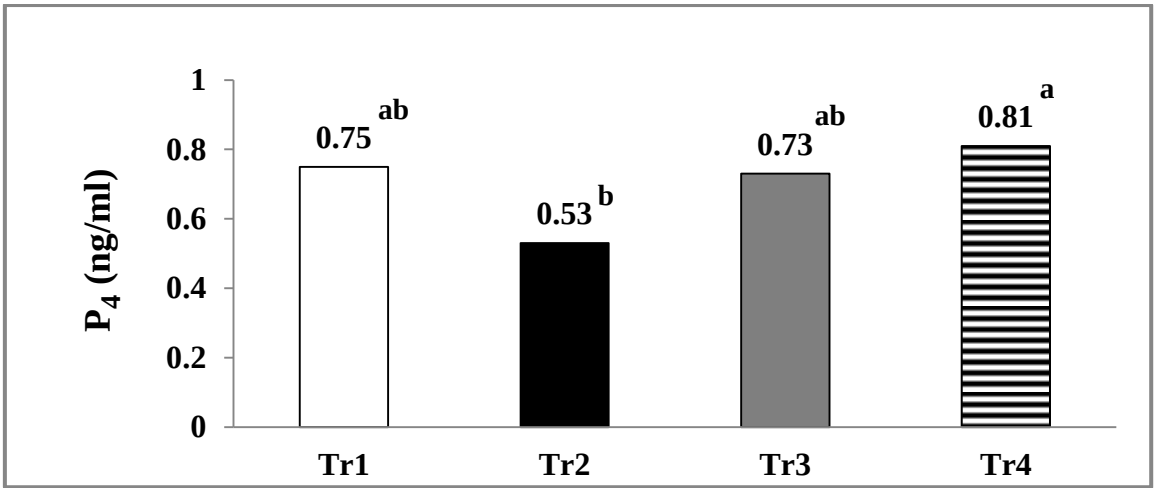


**Figure (2):** Effect of vitamin C and alternation of drinking saline well water with tap water on progesterone hormone of laying hens drinking saline well water.

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. $P_4$=progesterone hormone.

[a,b] Means bearing different superscripts are significantly different (P<0.05).

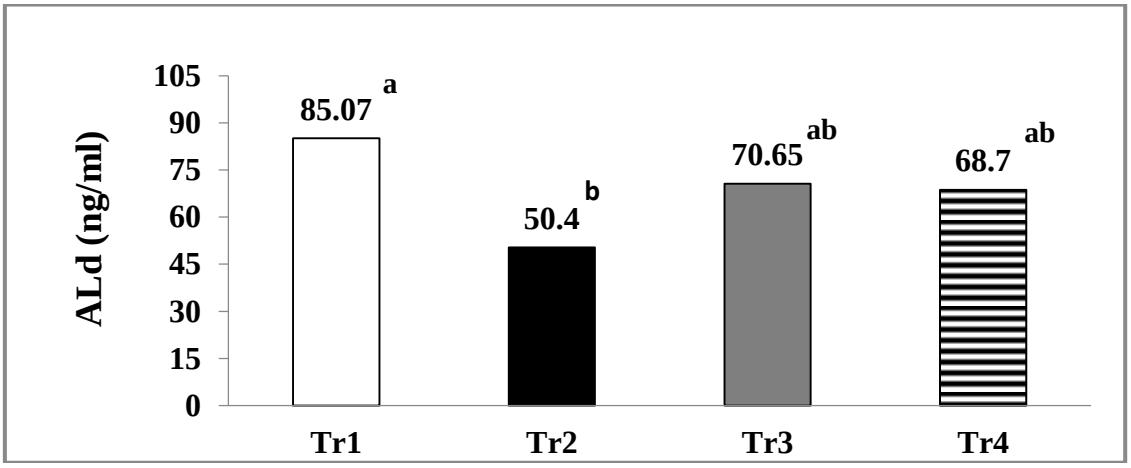


**Figure (3):** Effect of vitamin C and alternation of drinking saline well water with tap water on aldosterone hormone of laying hens drinking saline well water.

Tr1= hens drank tap water (containing 265 ppm TDS) and fed basal diet (considered as control), Tr2= hens drank saline well water (containing 3398 ppm TDS) and fed basal diet, Tr3 = hens drank saline well water and fed diet containing 2 % vitamin C (commercial product containing 20 % vitamin C), Tr4 = hens drank saline well water alternate weekly with drank fresh tap water until the end of experiment (hens drank saline well water every other week) and fed basal diet. Ald= aldosterone

[a,b] Means bearing different superscripts are significantly different (P<0.05).

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## الملخص العربى
## تأثير تناوب مياه الشرب المالحة ومكملات فيتامين ج على الاستجابات الفسيولوجية والأداء الإنتاجي للدجاج البياض تحت ظروف جنوب سيناء

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تهدف الدراسة إلى تأثير استخدام فيتامين ج وتناوب شرب مياه الآبار المالحة مع ماء الصنبور على المكونات الخلوية والبيوكيميائية للدم والهرمونات والأداء الإنتاجي للدجاج البياض التي تشرب مياه الآبار المالحة تحت ظروف جنوب سيناء. تم تقسيم ١٢٠ دجاجة بياضة من الدجاج اللوهمان التجارى (عمر ٣٤ أسبوع ومتوسط وزن جسم ١٩٩٦.٩ ± ١٨.٧ جم) بشكل عشوائي إلى أربع معاملات متساوية (٣٠ دجاجة لكل معاملة). المعاملة الاولى ، وفيها يشرب الدجاج ماء الصنبور (يحتوي على ٢٦٥ جزء في المليون من الأملاح الكلية الذائبة) ويتغذى على النظام الغذائي الأساسي (يعتبر كمجموعة تحكم). المعاملة الثانية ، وفيها يشرب الدجاج ماء البئر المالح (تحتوي على ٣٣٩٨ جزء في المليون من الأملاح الكلية الذائبة) ويتغذى على النظام الغذائي الأساسي. المعاملة الثالثة ، وفيها يشرب الدجاج ماء البئر المالح ويتغذى على نظام غذائي يحتوي على ٢٪ فيتامين سي (منتج تجاري يحتوي على ٢٠٪ فيتامين سي). المعاملة الرابعة ، وفيها يشرب الدجاج ماء البئر المالح تبادلينا مع شرب ماء الصنبور اسبوعيا حتى نهاية التجربة (الدجاج يشرب ماء البئر المالح اسبوع بعد اسبوع) ويتغذى على النظام الغذائي الأساسي. أظهرت النتائج أن خلايا كريات الدم الحمراء ومستوى الهيموجلوبين انخفض بشكل معنوى ، بينما زاد متوسط حجم الخلايا ونسبة الخلايا المتعادلة الى الخلايا الليمفاوية بشكل معنوى في المعاملة الثانية بالمقارنة مع المعاملة الاولى. انخفض معنوياً مستوى الجلوكوز في المعاملة الثانية مقارنة مع المعاملات الأخرى. انخفض معنوياً مستوى الكوليسترول في المعاملة الثالثة عند مقارنته بـالمعاملة الثانية ، هرمون الثيرونين ثلاثى اليود انخفاضًا معنويًا في المعاملة الثانية عند مقارنته مع مجموعة المعاملة الثالثة. زاد معنوياً مستوى البروجسترون في المعاملة الرابعة بالمقارنة مع المعاملة الثانية . كانت هناك إختلافات معنوية بين المعاملات في وزن الجسم النهائي ووزن البيضة وعدد البيض وكتلة البيض والتحويل الغذائى ومعدل النفوق. تخلص الدراسة الى أن شرب الدجاج البياض الماء المالح بالتناوب أسبوعياً مع ماء الصنبور العذب أو استخدام فيتامين ج في الأعلاف قد يخفف التأثير السلبى لشرب مياه الآبار المالحة على مقاييس الدم وبالتالي انعكس إيجابيًا على الأداء الانتاجى للدجاج البياض.

الكلمات داله : الدجاج البياض ، المياة المالحة ، فيتامين ج ، الاداء الانتاجى ، صفات الدم.