

## RELATIONSHIP BETWEEN PARATHYROID, CALCITONIN HORMONES AND PRODUCTIVE, PHYSIOLOGICAL AND IMMUNOLOGICAL PERFORMANCE OF SOME LOCAL STRAINS

By

M. S. H. Hassan, S. M. M. Elsoudany and Kh. Roushdy  
Poul. Breed. Dep., Anim. Prod. Res. Instit., Dokki, Giza, Egypt

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**Abstract:** *One hundred day-old female chicks from each of Silver Montazah, Mandarah and El- Salam strains were used to evaluate both parathyroid and calcitonin hormones. At 2 weeks of age, ten blood samples/each strain were collected to determine both serum parathyroid and calcitonin hormones. Classification appeared high levels of both hormones in Silver Montazah birds, medium in Mandarah and lower in El-salam ones. The heavier body weights and egg weights were correlated with the lower levels of both hormones.*

*Silver Montazah birds which are higher in both hormone levels recorded earlier age at sexual maturity, laid more eggs, gained more egg mass, lower shell-less eggs and gave good shell quality.*

*Mandarah strain showed the highest primary and secondary immuno response against SRBC's followed by Silver Montazah, lowest in El- Salam ones. The same trend was found in weights of bursa, spleen and thymus.*

### INTRODUCTION

Parathyroid and calcitonin are important hormones in egg quality. Both hormones played an important role in the metabolism of calcium and phosphorus in the formation of egg-shell and in the influence of sexual maturity. Yasuoka et al (2001) suggested that the binding properties of parathyroid hormone related peptide receptor and of calcitonin' receptor may be influenced by gonadal hormones relating to sexual maturity. The calcitonin has been considered as the physiological antagonist of parathyroid hormone in terms of increasing the effect of plasma calcium concentration by inhibition of bone resorption with stimulation of low renal calcium excretion (Austin and Heath, 1980 and McKenzie et al.; 1990). Klandorf et al (1997) reported that concentrations of plasma total calcium

correlate with plasma calcitonin concentration, but calcitonin concentration was reduced by feed restriction and exposure to continuous light.

In avian reproduction large amounts of calcium are required to form the shells of eggs successively for long periods as well as to form fetal skeletons (Gilbert, 1971; Johnson, 1986).

The objective of this study is to study the relationship between the concentration of both parathyroid and calcitonin hormones with productive performance, physiological and immunological characteristics of Silver Montazah, Mandarah and El-salam local strains.

### **MATERIALS AND METHODS**

This study was carried out at the Poultry Research Farm, Animal Production Department, Faculty of Agriculture, Cairo university, Giza, Egypt, and Animal production Research Institute Laboratories.

One hundred day- old chicks from each Silver Montazah , Mandarah and El- salam local strains were used in this study.

During the grower period ( from day-old to sexual maturity) , birds reared on floor under the same environmental condition .Growing diets contained ( 19-15) %crude protein and (2800-2900) kcal ME/kg , 0.4%available phosphorus and 0.9% calcium . Diet and water provided ad-libitum. Body weight and feed consumption were recorded monthly.

At 2 weeks of age, ten blood samples from each strain were collected randomly from the brachial vein, then centrifuged at 3000 rpm for 20 min.

#### **Classification of strains:**

Serum parathyroid and serum calcitonin hormones were determined using RIA techniques according to Peebles and Morks (1991). Levels of both hormones were used to classify the three strains to high, medium and low levels of hormones at 2 weeks of age as presented in (Table 1).

The classification appeared high levels for parathyroid and calcitonin hormones in Silver Montazah birds, medium levels in Mandarah ones, and low levels in El- Salam ones.

**Table (1)** Serum concentration of parathyroid and calcitonin hormones at 2 weeks of age of some local strains.

| Parameters                     | Strains                  |                          |                          |
|--------------------------------|--------------------------|--------------------------|--------------------------|
|                                | Silver Montazah          | Mandarah                 | El-salam                 |
| Parathyroid hormone (ng / dl ) | *50.66±4.16 <sup>a</sup> | 45.73±4.16 <sup>b</sup>  | 41.55±4.16 <sup>c</sup>  |
| Calcitonin hormone ( pg/ml)    | 156.11±2.24 <sup>a</sup> | 137.55±2.24 <sup>b</sup> | 121.86±2.24 <sup>c</sup> |

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

#### Productive performance:

Production period starting from first egg to 9 months of age (90 days of production). Birds from strain were housed in individual house , fed commercial layer diet containing 16% crude protein , 2780 kcal ME/kg, 0.45 %available phosphorus and 3.30 % calcium. Daily light was 16-17 hr. Water and diet provided ad- libitum, body weight and feed consumption were recorded monthly through the whole experimental period . Age at sexual maturity, first egg weight, egg number, egg weight, shell – less eggs number and egg quality were determined.

#### Physiological parameters:

Blood samples were collected at 2, 4, 6 and 8 months of age from five birds/ strain. Each sample(5ml blood) was centrifuged immediately at 3000 rpm for 20 min ;serum was stored at -20C° until the chemical analysis. Calcium , phosphorus, Alkaline phosphatase, cholesterol, glucose, total protein, albumin and globulin were determined according to Tietz (1986). Goldberg (1971),Richmond (1973), Weichselbaum (1964) ,Baure (1982) and Allain (1974),respectively. Aspartate Amino Transferase (AST) and Alanine Amino Transferase (ALT) enzymes were analyzed using commercial diagnostic kits. Parathyroid, calcitonin, triiodothyronine (T3) and thyroxine (T4) hormones were determined using RIA techniques according to Peebles and Morks (1991). Five birds / strain were taken at 2 and 8 months of age, weighed and slaughtered. Bursa, spleen, thymus (immune organs), liver, heart, kidney, gizzard, abdominal fat, ovary and oviduct were weighed to nearest 0.1g and estimated to relative weights(organ weight / body weight × 100).

#### Immunological traits:

Ten birds/ strain at 3, 4, 7 and 8 months of age were injected intravenously with one ml of suspension(Sheep Red Blood Cell's), SRBC 0.07 ml packed SRBC mixed with 0.93 ml physiological saline 0.9 %NaCl. The SRBC were obtained in heparin solution from unrelated texel sheep and wash three times in physiological saline. Another 10 chicks were injected

with 1 ml physiological saline (0.68% NaCl) and served as all strains. To measure the secondary response, the same antigens were injected 4 weeks following the first challenge to the same strains. Seven days following the antigen challenge, blood samples were collected and sera were frozen until the measurement of primary and secondary responses according to Vanderzijpp *et al.* (1983) and Bachman and Mashaly (1986).

#### **Statistical analysis:**

All results were analyzed by using the general liner models (GLM) adapted by microcomputer of statistical system (SAS) software package (1996).

## **RESULTS AND DISCUSSION**

### **1- Productive traits:**

#### **1.1-Body weight:**

Body weights from one-day to 9 months old are presented in Table (2). Results have declared that growth pattern was not similar among the strains. Weights were significantly heavier at all ages in El-salam birds, followed by Mandarah. and lighter in Silver Montazah. These weight differences may be due to the genetic variation between the local strains.

This result agrees with the findings of Afifi (1994), Saleh *et al.* (1994), Nawar *et al.* (1995) and EL-sayed *et al.* (2001) who obtained different weights for some local strains. Younis and Abdel-Ghany (2003) reported the superiority of El-salam weight than that of Mandarah and Silver Montazah. Also, Hamdy (2000), Elewa (2004) and El-Full *et al.* (2005) showed the over – weight of El-salam strain than other local ones.

Body weight records, in this study, were higher than those reported by El-Hossari *et al.*(1992), Mossad *et al.* (1995), El-sayed *et al.* (2001) and Romia (2005).

According to the levels of parathyroid and calcitonin hormones (Table 1), it is clear that there was an opposite trend between heavy body weights and level of these hormones.

The result agrees with that reported by Yasuoka *et al.* (2001) who found the higher body weights correlated with the lower levels of both hormones in white Leghorn hens.

#### **1.2- Feed consumption:**

Data in Table (2) showed that El-salam birds, followed by Mandarah consumed significantly more amount of feed at all ages than Silver

Montazah. This could be attributed to the heavy El-salam and Mandarah body weights, which had required more feed than Silver Montazah.

In this study, the mean feed consumption for the three local strains during 6-9 months of age was about 108 and 124 g, respectively.

Similar result was reported by Saleh et al. (1994), Iraqi et al. (2000), Hamdy (2000), El-sayed et al. (2001) and Romia (2005) who reported 110 – 120 g / hen feed consumption for local strains during the egg production period.

### **1.3-Egg production traits:**

Results in Table (3) declared that age at sexual maturity was significantly delayed in El-salam hens (173.2 days) than both Mandarah (170.4 days) and Silver Montazah (167.6 days).

This delayed period may be due to the El-salam heavy body weights. More days in age at sexual maturity were reported in both Mandarah (174 days) and Silver Montazah hens (168 days) by Hamdy (2000),

El-Full et al. (2005) and Romia (2005) and also in Silver Montazah (179.9 days) by Younis and Abdel-Ghany (2004).

It could be noticed that earlier age of maturity related with the high level of both hormones (Table 1). The result agrees with that reported by Yasuoka et al. (2001) who found white Leghorn hens which higher in both hormone levels recorded earlier age at sexual maturity.

Data in Table (3) showed that the first egg weights ranged between 35- 38 g for these local strains. Both El-salam and Mandarah hens laid significantly heavier eggs (38.5 and 37.9g) than Silver Montazah ones (35.4 g), respectively. Saleh et al. (1994), and Romia (2005) found that the first egg weight of some local strains ranged between 34 – 38 g.

Egg weight at 7, 8 and 9 months of age showed generally the similar trend of first egg weight, in which weights increased significantly in both El-salam and Mandarah eggs than Silver Montazah. Younis and Abdel-Ghany (2003) obtained heavier eggs in El-salam hens than Mandarah and Silver Montazah.

Concerning parathyroid and calcitonin hormones (Table 1), it can be observed that egg weight showed the same trend of body weight, in which higher egg weights correlated with the lower hormone levels.

Concerning egg number, it is clear from Table (3) that El-salam hens had laid fewer eggs during 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> month of age compared with

Mandarah, while Silver Montazah laid significantly more eggs than El-salam. The result agrees with the reports by Nawar et al. ( 1995) , Hamdy (2000) , Younis and Abdel-Ghany ( 2004) and Romia ( 2005) who found that El-salam hens laid fewer eggs, but Silver Montazah had laid more eggs compared with other local strains . Also, Younis and Abdel-Ghany ( 2003) recorded that Silver Montazah and Mandarah strains laid higher egg number during 90 days production than El-salam hens.

Significant negative phenotypic correlation between age at sexual maturity and egg number during 90 days production was reported in El-salam, Mandarah and Silver Montazah hens by El-sayed et al. (2001) . This correlation value was recorded as  $- 0.38$  by Ghanem (1995) and El-Tahawy (2000).

With regard to egg mass , El-salam strain had significantly lower egg mass at 7, 8 and 9 months of age than both Mandarah and Silver Montazah . Silver Montazah hens had recorded higher egg mass at 7 and 8 th month of age than Mandarah. This result attributed to the lower egg number of El-salam hens and the higher egg number of Silver Montazah .This result agrees that reported by Younis and Abdel-Ghany ( 2003) who found that egg mass during 90 days production was higher in Mandarah and Silver Montazah strains than El-salam hens .

With regard to parathyroid and calcitonin hormones (Table1), results declared that egg number and egg mass showed the same trend of age at sexual maturity, in which hens with higher hormone levels recorded more egg number and egg mass.

Concerning shell- less eggs, El-salam hens laid more ones (6 eggs) during the 90 days production, followed by Mandarah (3 eggs) than Silver Montazah ones (one egg) (Table 3). It considered that number of shell less eggs included with the level of egg production of the strain.

Results of parathyroid and calcitonin hormones (Table1) declared that number of shell- less eggs correlated with the level of both hormones. Higher hormone levels due to lower shell-less eggs .Austin and Heath (1980) and Mckenzie et al. (1990) showed that calcitonin hormone increasing the effect of good production traits in commercial hens may be return of the calcitonin has been considered as the physiological antagonist of parathyroid hormone in terms of increasing the effect of plasma calcium concentration by inhibition of bone resorption with stimulation of low renal calcium excretion or may be return of the concentrations of plasma calcitonin correlate with plasma calcium concentration(Nichols 1970).Rasmussen et al.(1964) showed that actinomycin D , which inhibits

DNA-mediated protein synthesis at the transcription level , prevents the long- term effect of parathyroid hormone on the blood calcium, Nichols (1970) has postulated that the immediate response of bone cells , particularly osteocytes , to parathyroid hormone is to increase their rate of calcium turnover , under the stimulus of an increased level of cyclic AMP.

#### **1.4-Egg quality:**

It can be observed from Table (4) that there were no significant differences in shape index, some egg composition and haugh units between three strains. Significant differences were observed in yolk index, albumin weight, shell weight, shell weight(%), shell thickness and yolk color between the different strains. Yolk color was darker in Silver Montazah and El-salam eggs than Mandarah. Similar result was reported by Romia(2005) and El-Full et al. (2005) who observed high yolk color score in Silver Montazah and El-salam eggs than Mandarah.

Both shell weight and shell thickness were thicker and better in Silver Montazah followed by Mandarah than El-salam eggs which had more thinner shell thickness may be due to more shell – less eggs (Table 3). Romia (2005) disagree with this result who found that shell thickness was higher at 36 weeks of age in Mandarah eggs than Silver Montazah .

Values in this study were closed to that which was reported in Silver Montazah at 44 weeks of age as 7.27 g shell weight, 0.362 mm shell thickness and 80.67% calcium in shell by El-nagar et al. (2005). Genedy et al. (1999) obtained 46.2 yolk index, 6.0 yolk color, 78.1 haugh units and 0.372 mm shell thickness in Mandarah eggs at 38 weeks of age.

It can be observed that shell weight and shell thickness showed the same trend of shell-less eggs (Table 3) , in which good shell quality correlated with the higher hormone levels .Klandorf et al. (1997) reported that the concentration of plasma calcitonin was correlated with plasma total calcium concentration. Egg shell quality was improved by increasing the level of calcitonin hormone. The increase of hormone may be attributed to the increase of calcium absorption and inhibition of bone resorption with stimulation of low renal calcium excretion (Austin and Heath, 1980 and Mckenzie et al . 1990)

#### **2-Physiological traits:**

Results in Table (5) showed that levels of serum calcium, phosphorus and alkaline phosphatase were significantly higher at all ages in Silver Montazah birds, followed by Mandarah and lower in El-salam strains. It means that these high levels were correlated with the increase of egg

production .Elewa (2004) and Samara et al. (1996) found that alkaline phosphatase level increased in the high production strains. Amin (1998) showed that alkaline phosphatase enzyme has played important role for egg production in commercial hen strain.

Calcium and phosphorus levels have decreased with advance of age, while alkaline phosphatase, cholesterol and glucose levels showed an opposite trend (Table 5).

The result of calcium and phosphorus traits agree with Elewa (2004), El-Gendi et al( 1994) , Samara et al. ( 1996) and El-zahaby (1999) .

In this study , phosphorus level was lower than 4.70 mg / 100 ml in Silver Montazah at 44 weeks of age by El-nagar et al .( 2005) .

On the other hand, calcium, Alkaline phosphatase and cholesterol levels were higher than that reported as 11.84 mg/dl, 7.43 u/l in Silver Montazah at 44 weeks of age by El-nagar et al.( 2005) and as 114.25 mg /100ml in Mandarah at 44weeks of age by Hassan et al .( 2003), respectively.

Calcium, phosphorus and alkaline phosphatase levels, showed the same trend of results of parathyroid and calcitonin hormones (Table1) there were high in Silver Montazah followed by Mandara hand lower in El-salam strains .The result agrees with that reported by Klandorf et al. (1997) who showed that concentration of plasma calcitonin correlated with plasma total calcium concentration, but calcitonin level was reduced by feed restriction and exposure to continuous light. Increase calcium level may be due to the inhibition of bone resorption with stimulating of low renal calcium excretion.

Improving egg shell quality can be observed also in Silver Montazah followed by Mandarah and lower in El-salam eggs (Table 3). This improvement can be due to the high level in plasma calcium concentration. Gilbert (1971) and Johnson (1986) reported that in avian reproduction large amount of calcium are required for forming the shells of eggs successively for long periods as well as forming fetal skeletons .

As shown in Table (6), there was significant increase in serum albumin in Silver Montazah followed by Mandarah than El-salam hens. While serum globulin increased in Mandarah followed by Silver Montazah then El-salam. There were no significant differences in serum total protein between different hens.

Values in this study was higher than that reported by Hassan et al .(2003) who found that in total protein, albumin and globulin as 3.62, 2.20 and 1.42 mg / 100 ml in Mandarah hens at 44 weeks of age, respectively .

Data in Table (6) showed significant increase in levels of AST and ALT in Silver Montazah followed by Mandarah than in El-salam . Levinsky and Davidson (1957) injected chickens with parathyroid extract that due to increase the activity of liver function, increase urinary excretion of phosphate and increase AST and ALT.

Results in Table (7) showed that levels of both parathyroid and calcitonin hormones at 2, 4, 6 and 8 months take the same trend of these hormones at 2 weeks of age (Table 1).

Light body weights, early sexual maturity, high egg number , high egg mass and good egg quality of Silver Montazah may be correlated with the high levels of both hormones. On the other hand, El-salam ones appeared as an apposite trend in both production and hormone levels .

Results of T3 and T4 showed an significantly increase their in levels during production period in Mandarah hens (Table 7). In this study T3 and T4 levels in Silver Montazah were higher than those reported by El-nagar et al. (2005) as 0.102 and 2.30 ng / ml at 44 weeks of age, respectively .

### **3-Relative internal organ weights:**

Concerning relative internal organ weights, there were no significant differences were found (Table 8) in liver, heart, kidney and gizzard weights between strains. Ovary and oviduct relative weights have increased significantly in Silver Montazah followed by Mandarah than El-salam hens. Abdominal fat increased in El-salam followed by Silver Montazah than Mandarah hens.

#### **4-Immune response:**

##### **4.1-Against SRBC's:**

It is clear that from Table (9) that Mandarah hens showed the highest primary and secondary response against SRBC's followed by Silver Montazah and the the lowest in El-salam ones. El-kaiaty (1993) and Hamdy (2000) obtained high primary and secondary immuno- response in Mandarah than other local strains.

##### **4.2-Relative immuno organs weight :**

Data in Table (9) showed that Mandarah had significantly bigger bursa, spleen and thymus at 2 month of age and thymus at 8 months of age than other strains .El-kaiaty (1993) and Elewa(2004)have reported also that immune organs are varied between Fayoumi and Matrouh hens.

#### **Conclusion**

It could be concluded from the results obtained that there was a relationship between increase the levels of parathyroid and calcitonin hormones , increasing egg production and improving the egg quality (Silver Montazah).The medium levels of these hormones gave higher immuno response and higher relative immuno internal organs weights (Mandarah) . But the low levels of these hormones gave the higher egg shell less number and lower the immuno response (El-salam).

Selection for some physiological parameters in can be used some local and developed strains before egg production period for improving productive ,physiological and immunological performance.

**Table (2)** Body weight (g) and feed consumption(g/day) for some local strains during growing and production periods.

| Parameters       | Age<br>(Month) | Strains           |                             |                              |                              |                              |
|------------------|----------------|-------------------|-----------------------------|------------------------------|------------------------------|------------------------------|
|                  |                | Silver Montazah   | Mandarah                    | Ei-salam                     |                              |                              |
| Body weight      | <u>Growing</u> |                   |                             |                              |                              |                              |
|                  | <u>Period</u>  | 1 day             | * 41.63± 3.16 <sup>b</sup>  | 43.55±3.16 <sup>ab</sup>     | 46.32 ± 3.16 <sup>a</sup>    |                              |
|                  |                | 1                 | 252.19± 28.11 <sup>b</sup>  | 267.18± 28.11 <sup>a</sup>   | 274.11 ± 28.11 <sup>a</sup>  |                              |
|                  |                | 2                 | 611.28± 52.08 <sup>b</sup>  | 637.59± 52.08 <sup>ab</sup>  | 694.19 ± 52.08 <sup>a</sup>  |                              |
|                  |                | 3                 | 856.05± 67.50 <sup>b</sup>  | 871.18± 67.50 <sup>ab</sup>  | 903.07 ± 67.50 <sup>a</sup>  |                              |
|                  |                | 4                 | 1058.66± 70.33 <sup>b</sup> | 1105.77±70.33 <sup>ab</sup>  | 1177.19 ± 70.33 <sup>a</sup> |                              |
|                  |                | 5                 | 1293.61± 75.00 <sup>b</sup> | 1319.55 ± 75.00 <sup>b</sup> | 1383.20 ± 75.00 <sup>a</sup> |                              |
|                  |                | 6                 | 1412.56± 81.18 <sup>b</sup> | 1472.17± 81.18 <sup>ab</sup> | 1552.22± 81.18 <sup>a</sup>  |                              |
|                  |                | <u>production</u> | 7                           | 1517.77±76.66 <sup>b</sup>   | 1531.60± 76.66 <sup>b</sup>  | 1622.11 ± 76.66 <sup>a</sup> |
|                  | <u>period</u>  | 8                 | 1562.18± 80.13 <sup>b</sup> | 1620.19±80.13 <sup>ab</sup>  | 1703.91 ±80.13 <sup>a</sup>  |                              |
|                  |                | 9                 | 1594.35± 92.22 <sup>b</sup> | 1666.62±92.22 <sup>ab</sup>  | 1836.66± 92.22 <sup>a</sup>  |                              |
| Feed consumption | <u>Growing</u> |                   |                             |                              |                              |                              |
|                  | <u>period</u>  | 1 day - 1         | * 34.79± 4.51 <sup>a</sup>  | 36.70 ± 4.51 <sup>a</sup>    | 37.21 ± 4.51 <sup>a</sup>    |                              |
|                  |                | 1-2               | 47.72 ± 5.63 <sup>b</sup>   | 51.66 ± 5.63 <sup>a</sup>    | 53.23 ± 5.63 <sup>a</sup>    |                              |
|                  |                | 2-3               | 56.50± 6.00 <sup>b</sup>    | 59.75 ± 6.00 <sup>ab</sup>   | 64.70± 6.00 <sup>a</sup>     |                              |
|                  |                | 3-4               | 66.19 ± 6.77 <sup>b</sup>   | 68.60± 6.77 <sup>ab</sup>    | 71.80±6.77 <sup>a</sup>      |                              |
|                  |                | 4-5               | 87.60 ±7.80 <sup>b</sup>    | 89.66 ± 7.80 <sup>a</sup>    | 92.91± 7.80 <sup>a</sup>     |                              |
|                  |                | 5-6               | 96.95 ± 9.42 <sup>b</sup>   | 100.73 ± 9.42 <sup>ab</sup>  | 104.80± 9.42 <sup>a</sup>    |                              |
|                  |                | <u>production</u> | 6-7                         | 104.50 ± 16.00 <sup>b</sup>  | 108.85 ± 16.00 <sup>a</sup>  | 110.25 ± 16.00 <sup>a</sup>  |
|                  |                | <u>period</u>     | 7-8                         | 113.45±16.40 <sup>b</sup>    | 117.30 ± 16.40 <sup>a</sup>  | 119.55 ± 16.40 <sup>a</sup>  |
|                  |                | 8-9               | 120.35± 16.11 <sup>b</sup>  | 125.15 ± 16.11 <sup>a</sup>  | 127.10 ± 16.11 <sup>a</sup>  |                              |

\* Values are mean ± S.E , a and b in the same row are significantly different (P ≤ 0.05) .

**Table (3)** Egg production traits for some local strains during production periods.

| Parameters                        | Age (month) | Strains                    |                           |                           |
|-----------------------------------|-------------|----------------------------|---------------------------|---------------------------|
|                                   |             | Silver Montazah            | Mandarah                  | El-salam                  |
| Age at sexual maturity (day)      |             | *167.60±10.22 <sup>b</sup> | 170.40±10.22 <sup>b</sup> | 173.20±10.22 <sup>a</sup> |
| Weight of first egg (g)           |             | 35.40±1.17 <sup>b</sup>    | 37.90±1.17 <sup>a</sup>   | 38.50±1.17 <sup>a</sup>   |
| Egg weight (g)                    | 7           | 37.40±3.22 <sup>b</sup>    | 40.10±3.22 <sup>a</sup>   | 41.00±3.22 <sup>a</sup>   |
|                                   | 8           | 40.30±3.11 <sup>b</sup>    | 43.50±3.11 <sup>a</sup>   | 43.70±3.11 <sup>a</sup>   |
|                                   | 9           | 43.50±5.11 <sup>b</sup>    | 46.90±5.11 <sup>a</sup>   | 48.20±5.11 <sup>a</sup>   |
| Egg number (egg/month)            | 7           | 13.70±0.41 <sup>a</sup>    | 11.90±0.41 <sup>b</sup>   | 9.50±0.41 <sup>c</sup>    |
|                                   | 8           | 15.30±1.03 <sup>a</sup>    | 13.70±1.03 <sup>ab</sup>  | 11.20±1.03 <sup>b</sup>   |
|                                   | 9           | 18.20±1.61 <sup>a</sup>    | 17.30±1.61 <sup>ab</sup>  | 15.90±1.16 <sup>b</sup>   |
| Egg mass                          | 7           | 512.38±19.90 <sup>a</sup>  | 477.20±19.90 <sup>b</sup> | 389.50±19.90 <sup>c</sup> |
|                                   | 8           | 616.60±20.19 <sup>a</sup>  | 596.00±20.19 <sup>b</sup> | 489.44±20.19 <sup>c</sup> |
|                                   | 9           | 791.70±51.33 <sup>ab</sup> | 811.40±51.33 <sup>a</sup> | 766.38±51.33 <sup>b</sup> |
| Egg shell less number (egg/month) | 7           | 0                          | 1                         | 1                         |
|                                   | 8           | 1                          | 1                         | 2                         |
|                                   | 9           | 0                          | 1                         | 3                         |

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

**Table (4)** Egg quality at the end of 90 days egg production for some local strains.

| Parameters           | Strains                 |                          |                         |
|----------------------|-------------------------|--------------------------|-------------------------|
|                      | Silver Montazah         | Mandarah                 | El-salam                |
| Shape Index (%)      | *67.54±3.02             | 69.25±3.02               | 68.60±3.02              |
| Yolk Index (%)       | 50.29±2.13 <sup>a</sup> | 47.75±2.13 <sup>b</sup>  | 47.31±2.13 <sup>b</sup> |
| Yolk weight (g)      | 15.87±0.90              | 15.54±0.90               | 15.92±0.90              |
| Albumin weight (g)   | 20.28±1.22 <sup>b</sup> | 24.84±1.22 <sup>ab</sup> | 25.83±1.22 <sup>a</sup> |
| Shell weight (g)     | 7.35±0.56 <sup>a</sup>  | 6.52±0.56 <sup>b</sup>   | 6.45±0.56 <sup>b</sup>  |
| Yolk weight (%)      | 37.81±1.95              | 37.38±1.95               | 38.15±1.95              |
| Albumin weight (%)   | 47.71±1.66              | 48.80±1.66               | 48.61±1.66              |
| Shell weight (%)     | 14.48±0.43 <sup>a</sup> | 13.82±0.43 <sup>ab</sup> | 13.24±0.43 <sup>b</sup> |
| Shell thickness (mm) | 0.365±0.05 <sup>a</sup> | 0.352±0.05 <sup>ab</sup> | 0.325±0.05 <sup>b</sup> |
| Yolk color           | 7.00±0.41 <sup>a</sup>  | 6.00±0.41 <sup>b</sup>   | 7.00±0.41 <sup>a</sup>  |
| Haugh unit (%)       | 74.72±2.05              | 75.77±2.05               | 76.32±2.05              |

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

**Table(5)** Serum constituents in some local strains during growing and production periods.

| Parameters                   | Age (month)       | Strains         |                          |                           |                          |
|------------------------------|-------------------|-----------------|--------------------------|---------------------------|--------------------------|
|                              |                   | Silver Montazah | Mandarah                 | El-salam                  |                          |
| Calcium (mg / dl)            | Growing period    | 2               | 15.73±1.36 <sup>a</sup>  | 13.44±1.36 <sup>ab</sup>  | 12.28±1.36 <sup>b</sup>  |
|                              |                   | 4               | 14.77±1.08 <sup>a</sup>  | 13.86±1.08 <sup>a</sup>   | 13.11±1.08 <sup>b</sup>  |
|                              | Production period | 6               | 14.59±1.11 <sup>a</sup>  | 13.66±1.11 <sup>ab</sup>  | 12.86±1.11 <sup>b</sup>  |
|                              |                   | 8               | 13.88±0.95 <sup>a</sup>  | 13.57±0.95 <sup>a</sup>   | 12.04±0.95 <sup>b</sup>  |
| Phosphorus (mg / 100 ml)     | Growing period    | 2               | 4.40±0.29 <sup>a</sup>   | 3.70±0.29 <sup>ab</sup>   | 3.33±0.29 <sup>b</sup>   |
|                              |                   | 4               | 3.92±0.33 <sup>a</sup>   | 3.62±0.33 <sup>a</sup>    | 3.08±0.33 <sup>b</sup>   |
|                              | Production period | 6               | 3.88±0.30 <sup>a</sup>   | 3.60±0.30 <sup>a</sup>    | 2.81±0.30 <sup>b</sup>   |
|                              |                   | 8               | 3.95±0.42 <sup>a</sup>   | 3.55±0.42 <sup>a</sup>    | 2.77±0.42 <sup>b</sup>   |
| Alkaline phosphatase (U / L) | Growing period    | 2               | 11.33±2.13 <sup>a</sup>  | 10.11±2.13 <sup>ab</sup>  | 9.02±2.13 <sup>b</sup>   |
|                              |                   | 4               | 14.60±2.44 <sup>a</sup>  | 12.30±2.44 <sup>b</sup>   | 11.88±2.44 <sup>b</sup>  |
|                              | Production period | 6               | 15.22±1.88 <sup>a</sup>  | 13.05±1.88 <sup>b</sup>   | 12.55±1.88 <sup>b</sup>  |
|                              |                   | 8               | 17.00±2.06 <sup>a</sup>  | 14.95±2.06 <sup>b</sup>   | 14.77±2.06 <sup>b</sup>  |
| Cholesterol (mg / 100 ml)    | Growing period    | 2               | 122.90±3.00 <sup>b</sup> | 126.45±3.00 <sup>b</sup>  | 148.11±3.00 <sup>a</sup> |
|                              |                   | 4               | 130.56±4.66 <sup>a</sup> | 129.55±4.66 <sup>b</sup>  | 160.04±4.66 <sup>a</sup> |
|                              | Production period | 6               | 141.83±5.00 <sup>b</sup> | 146.90±5.00 <sup>ab</sup> | 164.00±5.00 <sup>a</sup> |
|                              |                   | 8               | 145.95±8.11 <sup>b</sup> | 152.22±8.11 <sup>ab</sup> | 170.50±8.11 <sup>a</sup> |
| Glucose (mg/dl)              | Growing period    | 2               | 148.66±6.80 <sup>a</sup> | 147.85±6.80 <sup>a</sup>  | 150.02±6.80 <sup>a</sup> |
|                              |                   | 4               | 154.77±7.00 <sup>b</sup> | 161.40±7.00 <sup>ab</sup> | 166.66±7.00 <sup>a</sup> |
|                              | Production period | 6               | 161.50±6.53 <sup>b</sup> | 164.06±6.53 <sup>b</sup>  | 188.90±6.53 <sup>a</sup> |
|                              |                   | 8               | 176.05±8.19 <sup>b</sup> | 174.77±8.19 <sup>b</sup>  | 206.44±8.19 <sup>a</sup> |

\* Values are mean ± S.E ,a and b in the same row are significantly different (P ≤ 0.05).

**Table (6)** Serum constituents in some local strains during growing and production periods.

| Parameters               | Age<br>(month) | Strains                   |                           |                           |
|--------------------------|----------------|---------------------------|---------------------------|---------------------------|
|                          |                | Silver Montazah           | Mandarah                  | El-salam                  |
| Total protein<br>(mg/dl) | 2              | *4.90±0.27 <sup>a</sup>   | 5.16±0.27 <sup>a</sup>    | 4.45±0.27 <sup>a</sup>    |
|                          | 4              | 4.75±0.50 <sup>a</sup>    | 4.88±0.50 <sup>a</sup>    | 4.38±0.50 <sup>a</sup>    |
|                          | 6              | 4.60±0.35 <sup>a</sup>    | 4.53±0.35 <sup>a</sup>    | 4.00±0.35 <sup>a</sup>    |
|                          | 8              | 5.07±0.41 <sup>a</sup>    | 4.93±0.41 <sup>a</sup>    | 4.77±0.41 <sup>a</sup>    |
| Albumin<br>(mg / dl)     | 2              | 3.21±0.23 <sup>a</sup>    | 3.16±0.23 <sup>a</sup>    | 2.78±0.23 <sup>b</sup>    |
|                          | 4              | 2.66±0.30 <sup>a</sup>    | 2.55±0.30 <sup>a</sup>    | 2.40±0.30 <sup>a</sup>    |
|                          | 6              | 2.50±0.27 <sup>a</sup>    | 2.33±0.27 <sup>a</sup>    | 2.15±0.27 <sup>a</sup>    |
|                          | 8              | 3.00±0.34 <sup>a</sup>    | 2.52±0.34 <sup>b</sup>    | 2.44±0.34 <sup>b</sup>    |
| Globulin<br>(mg / dl)    | 2              | 1.69±0.15 <sup>b</sup>    | 2.00±0.15 <sup>a</sup>    | 1.67±0.15 <sup>b</sup>    |
|                          | 4              | 2.09±0.26 <sup>a</sup>    | 2.33±0.26 <sup>a</sup>    | 1.98±0.26 <sup>b</sup>    |
|                          | 6              | 2.10±0.30 <sup>a</sup>    | 2.20±0.30 <sup>a</sup>    | 1.85±0.30 <sup>b</sup>    |
|                          | 8              | 2.07±0.21 <sup>b</sup>    | 2.41±0.21 <sup>a</sup>    | 2.33±0.21 <sup>a</sup>    |
| AST<br>( IU /L)          | 2              | 110.95±9.44 <sup>a</sup>  | 97.77±9.44 <sup>b</sup>   | 86.80±9.44 <sup>c</sup>   |
|                          | 4              | 113.88±8.30 <sup>a</sup>  | 107.50±8.30 <sup>b</sup>  | 95.00±8.30 <sup>c</sup>   |
|                          | 6              | 115.65±9.60 <sup>a</sup>  | 114.06±9.60 <sup>a</sup>  | 100.44±9.60 <sup>b</sup>  |
|                          | 8              | 126.02±10.55 <sup>a</sup> | 116.30±10.55 <sup>b</sup> | 108.74±10.55 <sup>c</sup> |

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

**Table (7)** Serum parathyroid, calcitonin, T3 and T4 hormones in some local strains during growing and production periods.

| Parameters                 | Age<br>(month)    | Strains         |                           |                           |                           |
|----------------------------|-------------------|-----------------|---------------------------|---------------------------|---------------------------|
|                            |                   | Silver Montazah | Mandarah                  | El-salam                  |                           |
| Parathyroid hormone(ng/dl) | Growing period    | 2               | *56.11±4.73 <sup>a</sup>  | 51.67±4.73 <sup>b</sup>   | 50.91±4.73 <sup>b</sup>   |
|                            |                   | 4               | 68.92±5.22 <sup>a</sup>   | 61.15±5.22 <sup>a,b</sup> | 55.18±5.22 <sup>c</sup>   |
|                            | Production period | 6               | 75.55±6.06 <sup>a</sup>   | 66.90±6.06 <sup>b</sup>   | 58.19±6.06 <sup>c</sup>   |
|                            |                   | 8               | 83.00±7.00 <sup>a</sup>   | 72.45±7.00 <sup>b</sup>   | 70.58±7.00 <sup>b</sup>   |
| Calcitonin hormone(pp/ml)  |                   | 2               | 172.36±8.16 <sup>a</sup>  | 166.17±8.16 <sup>a</sup>  | 147.22±8.16 <sup>b</sup>  |
|                            |                   | 4               | 185.91±9.21 <sup>a</sup>  | 176.15±9.21 <sup>b</sup>  | 159.73±9.21 <sup>c</sup>  |
|                            |                   | 6               | 203.03±11.32 <sup>a</sup> | 191.98±11.32 <sup>b</sup> | 180.11±11.32 <sup>c</sup> |
|                            |                   | 8               | 237.18±14.50 <sup>a</sup> | 205.00±14.50 <sup>b</sup> | 198.22±14.50 <sup>b</sup> |
| T3 hormone (ng/ml)         |                   | 2               | 4.18±0.88 <sup>a</sup>    | 4.55±0.88 <sup>a</sup>    | 4.23±0.88 <sup>a</sup>    |
|                            |                   | 4               | 3.80±0.70 <sup>a</sup>    | 3.97±0.70 <sup>a</sup>    | 3.64±0.70 <sup>a</sup>    |
|                            |                   | 6               | 3.44±0.35 <sup>a</sup>    | 3.92±0.35 <sup>a</sup>    | 3.28±0.35 <sup>b</sup>    |
|                            |                   | 8               | 2.32±0.09 <sup>b</sup>    | 2.90±0.09 <sup>a</sup>    | 2.77±0.09 <sup>a</sup>    |
| T4 hormone (ng/ml)         |                   | 2               | 14.55±1.44 <sup>a</sup>   | 14.30±1.44 <sup>a</sup>   | 14.18±1.44 <sup>a</sup>   |
|                            |                   | 4               | 14.22±2.00 <sup>a</sup>   | 14.07±2.00 <sup>a</sup>   | 13.80±2.00 <sup>a</sup>   |
|                            |                   | 6               | 14.00±2.45 <sup>a</sup>   | 14.05±2.45 <sup>a</sup>   | 13.56±2.45 <sup>b</sup>   |
|                            |                   | 8               | 13.98±1.95 <sup>a,b</sup> | 14.38±1.95 <sup>a</sup>   | 13.78±1.95 <sup>b</sup>   |

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

**Table (8)** Relative internal organ weights in some local strains during growing and production periods.

| Parameters    | Age<br>(month)    | Strains                  |                          |                          |                          |
|---------------|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|               |                   | Silver<br>Montazah       | Mandarah                 | El-salam                 |                          |
| Liver         | Growing period    | 2                        | *3.64±0.36 <sup>a</sup>  | 3.70± 0.36 <sup>a</sup>  | 3.90± 0.36 <sup>a</sup>  |
| Heart         |                   | 0.63 ± 0.10 <sup>a</sup> | 0.68± 0.10 <sup>a</sup>  | 0.72± 0.10 <sup>a</sup>  |                          |
| Kidney        |                   | 0.93 ± 0.13 <sup>a</sup> | 0.87± 0.13 <sup>a</sup>  | 0.87± 0.13 <sup>a</sup>  |                          |
| Gizzard       |                   | 2.54± 0.21 <sup>a</sup>  | 2.46 ± 0.21 <sup>a</sup> | 2.67 ±0.21 <sup>a</sup>  |                          |
| Abdominal fat |                   | 1.71± 0.18 <sup>b</sup>  | 1.28 ± 0.18 <sup>c</sup> | 2.17± 0.18 <sup>a</sup>  |                          |
| Liver         | Production period | 8                        | 1.80± 0.19 <sup>a</sup>  | 1.70 ± 0.19 <sup>a</sup> | 1.79 ± 0.19 <sup>a</sup> |
| Heart         |                   | 0.42 ± 0.03 <sup>a</sup> | 0.43 ± 0.03 <sup>a</sup> | 0.45 ± 0.03 <sup>a</sup> |                          |
| Kidney        |                   | 0.45 ± 0.04 <sup>a</sup> | 0.46 ± 0.04 <sup>a</sup> | 0.41 ± 0.04 <sup>a</sup> |                          |
| Gizzard       |                   | 1.51 ±0.13 <sup>a</sup>  | 1.38 ± 0.13 <sup>a</sup> | 1.42 ± 0.13 <sup>a</sup> |                          |
| Abdominal fat |                   | 2.13± 0.16 <sup>b</sup>  | 1.58 ± 0.16 <sup>c</sup> | 2.54 ± 0.16 <sup>a</sup> |                          |
| Ovary         |                   | 2.99±0.22 <sup>a</sup>   | 2.66 ±0.22 <sup>a</sup>  | 2.29 ±0.22 <sup>b</sup>  |                          |
| Oviduct       |                   | 4.64 ± 0.31 <sup>a</sup> | 3.77 ± 0.31 <sup>b</sup> | 3.30± 0.31 <sup>c</sup>  |                          |

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

**Table (9)** Immune response and relative immuno internal organ weights in some local strains during growing and production periods.

| Parameters                      | Age (month)       | Strains         |                            |                           |                           |                          |
|---------------------------------|-------------------|-----------------|----------------------------|---------------------------|---------------------------|--------------------------|
|                                 |                   | Silver Montazah | Mandarah                   | El-salam                  |                           |                          |
| Primary immuno response         | Growing period    | 3               | *38.11±5.75 <sup>b</sup>   | 43.96±5.75 <sup>a</sup>   | 35.93±5.75 <sup>b</sup>   |                          |
| Secondary immuno response       |                   | 4               | *182.71±22.00 <sup>a</sup> | 186.60±22.00 <sup>a</sup> | 141.70±22.00 <sup>b</sup> |                          |
| Primary immuno response         | Production period | 7               | 70.55±9.70 <sup>b</sup>    | 82.85±9.70 <sup>a</sup>   | 54.92±9.70 <sup>c</sup>   |                          |
| Secondary immuno response       |                   | 8               | 265.15±32.30 <sup>a</sup>  | 272.22±32.30 <sup>a</sup> | 241.00±32.30 <sup>b</sup> |                          |
| Immuno internal organs weights: | Growing period    | 2               | Bursa                      | 0.41 ± 0.04 <sup>ab</sup> | 0.45 ± 0.04 <sup>a</sup>  | 0.25 ± 0.04 <sup>b</sup> |
| Spleen                          |                   |                 | 0.29 ± 0.03 <sup>b</sup>   | 0.36 ± 0.03 <sup>a</sup>  | 0.29 ± 0.03 <sup>b</sup>  |                          |
| Thymus                          |                   |                 | 0.41 ± 0.05 <sup>b</sup>   | 0.60 ± 0.05 <sup>a</sup>  | 0.52 ± 0.05 <sup>ab</sup> |                          |
| Spleen                          | Production period | 8               | 0.24 ± 0.03 <sup>ab</sup>  | 0.28 ± 0.03 <sup>a</sup>  | 0.20 ± 0.03 <sup>b</sup>  |                          |
| Thymus                          |                   |                 | 0.31 ± 0.04 <sup>a</sup>   | 0.31 ± 0.04 <sup>a</sup>  | 0.23 ± 0.04 <sup>b</sup>  |                          |

\*G.M. of Antibody production of primary response and secondary response.  
Values are Mean ± S.E. a, b and c in the same row are significantly different (P ≤ 0.05).

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## الملخص العربي

### العلاقة بين هرموني الجار درقية والكالسيتونين والاداء الانتاجي والفيسيولوجي والمناعي لبعض سلالات الدجاج المحلي

مجدى سيد حسن حسن - سامى محمود محمد السوداني - خالد رشدى  
قسم تربية الدواجن - معهد بحوث الإنتاج الحيواني - مركز البحوث الزراعية  
- وزارة الزراعة - الدقي - الجيزة - ج.م.ع.

استخدم في هذه الدراسة عدد ٣٠٠ كتكوت انثى من ثلاثة سلالات من السحاج هي المنتزة  
الفضى - المنطرة - السلام . ١٠٠ كتكوت من كل سلالة عمر يوم حتى عمر ٩ شهور لدراسة العلاقة  
بين هرموني الجار درقية والكالسيتونين وجودة البيض لهذة السلالات . حيث عند عمر ٢ أسبوع تم اخذ  
١٠ عينات دم من كل سلالة لتقدير كلا من هرموني الجار درقية والكالسيتونين. وبناء على هذا التقدير تم  
تقسيم السلالات إلى سلالة عالية في مستوى هذة الهرمونات وهي المنطرة الفضى ، وسلالة متوسطة وهي  
المنطرة وسلالة منخفضة وهي السلام . وتم تقدير بعض الصفات الإنتاجية مثل وزن الجسم واستهلاك  
العلية وإنتاج البيض وجودة البيض وبعض التقديرات الفسيولوجية والمناعية وتم ذبح عدد ٥ دجاجات من  
كل سلالة لتقدير الأوزان النسبية لبعض الأعضاء.

وأوضحت النتائج : أن هناك ارتباط وعلاقة بين انخفاض وزن الجسم ووزن البيض والارتفاع  
في مستوى هرموني الجار درقية والكالسيتونين لسلالة المنطرة الفضى وكذلك هناك ارتباط وعلاقة بين  
ارتفاع هذين الهرمونين والوصول لعمر النضج الجنسي مبكرا وزيادة عدد البيض الناتج مع زيادة كتلة  
البيض بالإضافة لانخفاض عدد البيض منخفض سمك القشرة والبرشت مع إعطاء جودة قشرة جيدة .  
سلالة المنطرة أعطت أعلى استجابة مناعية أولية وثانوية عند الحقن بكرات الدم الحمراء للغنم تلتها سلالة  
المنطرة الفضى واقل استجابة مناعية كانت لسلالة السلام ، ونفس النتيجة وجدت في الأوزان النسبية لكلا  
من البرسا والطحل والغدة التيموسية وهي الأعضاء المناعية الثانوية فكانت أعلام سلالة المنطرة ثم  
المنطرة الفضى وقلهم سلالة السلام .

النتائج تكل على وجود علاقة بين ارتفاع مستوى هرموني الجار درقية والكالسيتونين وزيادة  
إنتاج البيض وتحسين جودة البيض الناتج، وهي علاقة يمكن الاهتمام بها والاستفادة منها قبل الإنتاج في  
الانتخاب والتحسين الوراثي والمناعي والفسيولوجي للسلالات المحلية لتحسين إنتاج البيض كما ونوعا.