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BREED DIFFERENCES AND PHENOTYPIC CORRELATIONS OF ANTIOXIDANT ENZYMES ACTIVITIES, SOME PHYSIOLOGICAL PARAMETERS AND PRODUCTIVE TRAITS OF CHICKEN

1. BREED DIFFERENCES

By

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Abstract: *The present study was conducted at El Takamoly Poultry Project, Fayoum, Egypt during the period from January 2008 to February 2009. Four thousand one day old chicks of chicken breeds: Dandarawi (Dan), Fayoumi (Fay), Sinai (Sin) and White Leghorn (WL) were used in this study. The objectives of the present study were determining the effects of breed and age on antioxidant enzymes activities [glutathione peroxidase (GPX), superoxide dismutase (SOD), and catalase (CAT)] of red blood cells haemolycate, some physiological and haematological parameters [hemoglobin (Hb), haematocrit (Ht), red blood cells count (RBCs), lymphocyte (LYMP), basophil (BASO), eosinophil (ESINO) and neutrophils (STAFF and SEGMENT) and some productive performance focus to eggshell quality in different chicken breeds (Fay, Dan and Sin as local breeds compare to WL as a hybrid foreign breed for egg production) under prevailing conditions of Egypt. Blood samples were collected at one day, at the age of first egg (AFE) and at the period of the highest egg production (HEP) .*

The main results were as follows: *WL breed had significantly the highest GPX, CAT and SOD activities while, Dan had the lowest activities and Sin and Fay were intermediated. Age influenced significantly the GPX, CAT and SOD activities. The highest values were detected in day-old chicks, decreased up to AFE and then increased until the period of HEP. Hb and Ht were significantly lower in WL chickens than other breeds. No breed-related differences in RBCs were found among the four breeds. RBCs were significantly increased at HEP compared to those at one day and AFE. Regarding to the interaction between breed and age, WL at the first day had* *the lowest RBCs count, while it had the highest value at HEP. WL had the highest LYMP, while Sin had the lowest value. WL had the highest ESINO count while Fay had the lowest count. Fay had the highest BASO count while Dan had the lowest count. Regarding to breed and age interaction effect, Fay at the first day had the highest BASO count, while Dan had the lowest count at the first day. Sin and WL breed had heavier body weight than Fay and Dan. Dan and Sin reached age at first egg earlier than Fay and WL. WL pullets produced the heaviest eggs whereas Dan chickens produced the lightest eggs. Eggs produced by WL and Dan had significantly highest shell%. WL as a hybrid foreign breed for egg production had higher shell%, Haugh unit scores, specific gravity, shell weight per unit surface, egg surface area, egg shell volume than indigenous breeds while, indigenous breeds had higher yolk%, thicker shell thickness and higher yolk color score. In spite of the reproductive merit of local breeds, their productive efficiency still need improvement through applying a consistent and sustainable breeding program.* ***In conclusion:*** *Leghorn breed had superiority values for antioxidant enzymes activities of red blood cells haemolycate ,some productive traits, haematological parameters. While, Dan had the lowest and Fay and Sin had intermediated values for previous parameters. A high variability of Dan breed directs a more attention conducted such breed. Variations in antioxidant enzymes activities, some physiological and haematological parameters in different chicken breeds during development suggest that they are genetically regulated. This finding indicates that these parameters are useful and important with potential use in breeding programs as early predictors for indirect selection or crosses which associated with disease resistance, performance traits and highly tolerance to oxidative stress.*

INTRODUCTION

Breeding work that focused on improving production parameters is inversely correlated to some physiological parameters in poultry. The characterization of different chicken breeds has become essential to establish the current status of breeds available in different countries of the world. Information about their genetic background play an important role both in breeding programs and in conservation of local breeds. Therefore, the breeding programs must be taken genetic background into consideration **(Crawford, 1984)**. The breeding strategies in developing countries should be focused on the genetic potential of the local breeds **(Yalcin *et al.*, 1997)**. Collection, evaluation and conservation of different chicken genotypes are an insurance against future need. The improving genetically resistance to disease and therefore immune capacities of animals is more important and desirable, which can be achieved by selection for the components of the immune system. Worthy mentioning, characterization and evaluation of immune parameters in various genotypes can offer knowledge that can be incorporated into breeding programs for enhancing the natural resistance to diseases. Genetic variation in resistance to disease has long been noted **(Yakoub *et al.*, 2005; Galal, 2008)**. Knowledge of differences in diseases resistance ability between different strains may be valuable in genetic selection programs **(Miller *et al.*, 1992)**.

Animals, including poultry, produce free radicals as by-products of metabolism that could potentially damage or destroy biological molecules in cells. Damage due to free radicals may lead to cellular injury, cancer, aging, atherosclerosis, other pathological disorders and dysfunctions in some organs **(Mates *et al.*, 1999; Ozturk and Gumuslu, 2004)**. Normally, the body is protected against reactive oxygen metabolites and their toxic products by a wide range of known defense mechanisms, like antioxidant enzymes. The cell's first line of cellular antioxidant defense is based on the activity of three enzymes: glutathione peroxidase (GPX), superoxide dismutase (SOD), and catalase (CAT). Endogenous enzymatic antioxidants play vital role in scavenging oxidative radicals and maintaining the health, productivity and reproductive characteristics of the animals and protecting cells from the actions of reactive oxygen species by reducing chemical radicals and preventing the process of lipid peroxidation. Also, they are considered as markers for evaluation of oxidative stress **(Spurlock and Savage, 1993)**. Genetic variations in GPX activity has been suspected previously in chicken **(Cunningham *et al.*, 1987; Shen *et al.*, 1992; Farahat *et al.*, 2008a; b)**, goose **(Mézes *et al.*, 1989)** and rabbit **(Mézes *et al.*, 1994)**. Blood parameters analysis is very important among the research because it supports and interpret the results of the research **(Ozbey and Esen., 2007)**. The study of the variation in blood picture and constituents in the fowls, sets an important foundation to the study of growth and egg production. Moreover, it helps in explaining the reaction of developed strains of poultry to their environments.

Unquestionably, several factors can affect the poultry egg characteristics, including hen age, environment, nutrition and genetics. Genetic differences in egg quality and eggshell formation characteristics exist between breeds, strains and families within the species **(Monira *et al.*, 2003; Anderson *et al.*, 2004; El-Safty, 2004; Bain, 2005; Zein El-Dein *et al.*, 2009).** Genetic improvement of laying traits should parallel high quality of the product. The consumer demands force including in the breeding goal also the traits related to the egg quality. The function of the eggshell is to protect the contents of the egg from mechanical impacts and micro bacterial invasions and to control the exchange of water and gases through the pores during the extra uterine development of the chick embryo **(Nys *et al.*, 1999)**. In the food market, the eggshell functions as a packaging material and its good quality is crucial to consumer selection and safety. So, great care is needed to preserve it intact **(Hamilton, 1982; Tullet, 1987)**. In many developing countries, the local birds are mainly used in the subsistence and small scale-sector, supplying most of the eggs and meat consumed. Both Fayoumi and Dandarawi strains are most widespread native breeds of chickens in Egypt. Since these local strains are expected to be more adapted to the unfavorable local conditions, they could be utilized in the process of establishing a local hybrid for egg production **(Saleh *et al*., 1994; Mahmoud, 2000; El Full *et al.* 2005; Zaky, 2006)**. Therefore, the evaluation of these local and foreign breeds under the same conditions is highly needed, before starting a breeding program to establish an efficient egg type chickens.

The objectives of the present study were determining the effects of breed and age on antioxidant enzymes activities GPX, SOD and CAT; some physiological; haematological parameters and some productive performance focus to eggshell quality in different chicken breeds (Fayoumi, Dandarawi and Sinai as local breeds compare to White Leghorn as a hybrid foreign breed for egg production) under prevailing conditions of Egypt.

MATERIALS AND METHODS

Birds, diet and management:

This experiment was carried out at El Takamoly Poultry Project, Fayoum, Egypt during the period from January 2008 to February 2009. Chemical analyses were performed in the laboratories of the Poultry Department, Faculty of Agriculture, Fayoum University**.** Four thousand one day old chicks of chickens breeds: Dandarawi, (Dan) Fayoumi (Fay), Sinai (Sin) and White Leghorn (WL) were used in this study. All animals were clinical healthy and reared under the same environmental, managerial and hygienic condition during the whole of period. The chicks were vaccinated according the recommended vaccinated program. The birds of different breeds fed the same diets (Table 1) according to their age (starter, grower, pre-production and production). The minerals and vitamins were adequately supplied to cover the requirements according to the **Egyptian Ministerial Decree No. 1498 (1996)**.

Physiological parameters:

A total number of 360 blood samples were collected from brachial vein (30 ♀ of each breed at each age) at one day, at the age at first egg (AFE), age at first egg was recorded as age at 5% egg production for each breed which calculated as the number of days until 5% egg production had been reached (AFE, days) and at the period of the highest egg production (HEP) at 38 weeks of age to determine the antioxidant enzymes activities, hemoglobin (Hb), haematocrit (Ht), red blood cells (RBCs) count, lymphocyte (LYMP), basophil (BASO), eosinophil (ESINO), neutrophils (STAFF and SEGMENT) by using ABX. Cell counter by Mieros 18. Antioxidant enzymes activities (CAT, SOD, GPX) were determined, in red blood cells haemolycate by enzymatic methods using available commercial kits (SCLAVO INC., 5 Mansard Count., Wayne NJ 07470, USA).

Production traits:

Body weight (BW) were measured at the same time as the blood samples were obtained. Age at first egg (AFE, days), rate of lay till 90 and 120 days, and 52 weeks, (RL%), egg weight (EW, g) were recorded for each breed.

Egg quality traits:

30 eggs were taken from each breed at the period of the highest egg production; 38 weeks of age to evaluate exterior, interior and shell egg quality according to **Stino *et al.* (1982)**. Egg shape index (SI) was estimated as the maximum width to its length. Eggs were individually weighed, then broken and the inner contents were placed on a leveled glass surface to determine yolk and albumen grade. Percentages of yolk, albumen and shell were calculated. Yolk index (YI) was calculated as the ratio of yolk height to its diameter. Haugh unit (HU) scores were calculated according to **Haugh (1937)**. Shell thickness (ST) was measured by Ames shell thickness gauge to the nearest mm. Yolk color (YC) scores were determined using Roche fan. Egg specific gravity (ESG) was calculated by **Harms *et al.* (1990)**. Egg surface area (ESA) was calculated according to **Paganel *et al.* (1974)**. Shell weight per unit surface area (SWUSA)= shell weight,mg/ESAcm^2. Egg shell volume (ESV) was calculated according to **Rahn (1981)** and shell density (SD) was estimated according **to Nordstrom and Qusterhant (1982)**.

Statistical analysis:

Data of body weight, antioxidant enzymes activities and blood parameters were subjected to a two-way analysis of variance with breed and age as main effects: the model used where; $\mathbf{Y_{ijk} = \mu + G_i + A_j + (GA)_{ij} + e_{ijk}}$, where; $\mathbf{\mu}$ =overall mean, $\mathbf{G_i}$ = breed effect, $\mathbf{A_j}$ =age, $\mathbf{(GA)_{ij}}$ =interaction between breed and age, and $\mathbf{e_{ijk}}$ =experimental error, while data of productive traits were subjected to a one-way analysis of variance with breed effect. The statistical model used was as follows; $\mathbf{Y_{ij} = \mu + G_i + e_{ij}}$, Where; $\mathbf{\mu}$ = Overall mean, $\mathbf{G_i}$ = breed effect, $\mathbf{e_{ij}}$ = experimental error, using the General Linear Model (GLM) procedure of SPSS User's Guide, **(SPSS, 1999)**. Means were compared for main effects and their interaction by Duncan's new multiple range test **(Duncan's, 1955)** when significant F values were obtained ($P<0.05$).

RESULTS AND DISCUSSION

Phenotypic variations of antioxidant enzyme activities of erythrocyte haemolysate:

The status of antioxidants enzymatic (GPX, CAT and SOD) in RBCs haemolycate of Dan, Sin, Fay and WL breeds are depicted in Table 2. The phenotypic variations of RBCs antioxidant enzymes activities in different breeds showed that WL breed had significantly highest while, Dan had the lowest RBCs GPX, CAT and SOD activities (961.97, 577.02 and 781.84 vs. 923.52, 548.08 and 748.15, respectively). However, Sin and Fay were intermediated as shown in Table 2. These results appear to support those of **Mizuno (1984) and Farahat *et al.*, (2008a and b)** which found breed differs in the activity of antioxidant enzymes in chicken.

Several studies have suggested that many enzymes activity in animal tissues are affected by age. According to the free radical ageing theory **(Harman, 1956)**, ageing can be considered as a process of irreversible changes associated with an accumulation or integration of free radicals induced by damages in the cell. In general, studies of variations in the activity of antioxidant enzymes in chicken with ageing have shown mixed pattern of increases and decreases that are both tissue and species dependent. Changes in the status of antioxidant enzymes activities in RBCs indicated that, age also influenced significantly on the RBCs GPX, CAT and SOD activities (Table 2). It was the highest in day-old chicks, decreased up to AFE and then increased until the period of highest egg production (Table 2). The same trend of age effect of these study was reported by **Godin *et al.* (1995)** for Japanese quail, **Maini *et al.* (2007)** for broiler chicks and **Farahat *et al.* (2008b)** for layer chickens. Also, breed and age interaction effect was significant, WL at the age of HEP had the highest RBCs GPX, CAT and SOD activities, and the lowest value was recorded at the age of AFE for the same breed (Table 2). There were inconsequent different in the GPX, CAT and SOD activities of RBCs among breeds in all age groups, the order of breeds was not the same at each age as shown in Table 2. The existence of genetic variation in the antioxidant enzymes activities in different chicken breeds suggests that, antioxidant enzymes activities is genetically regulated which indicate that antioxidant enzymes activities may be candidates for use in different breeding programs like selection, this selection could be improve performance and disease resistance. These data suggest also that selective breeding of chicken for new strains high tolerance to oxidative stress might be possible depend on the variations existed in antioxidant enzymes activities. Also, such strains would be valuable tools in studies of biochemical basis of mode of nutritional and physiological action of different minerals which are the component of these enzymes. The significant differences within breeds also provided evidences of genetic regulation of the antioxidant enzymes activities, which give an opportunity to make selection within breeds to produce lines more resistant to oxidative stress. It is very important to point out that the three antioxidant enzymes had the same results of the breed and age effects, so that estimate of one of them could be use as indicator of the other two, but further research is needed to prove that hypothesis.

Physiological and haematological parameters:

Results of some physiological and haematological parameters for the different breeds are presented in Tables 3, 4 and 5. The results showed that both Hb (10.97) and Ht (36.44) were significantly lower in WL chickens than other breeds. On the other hand, no significantly differences among Dan, Fay and Sin chicken were found (Table 3). Regarding age effect, Hb (12.34) and Ht (40.02) was significantly increased at HEP compared to those at one day and AFE. Breed and age interaction effect for Hb and Ht was significant (Table 3). In spite of WL at the first day had the lowest Hb value (10.15), it had high Hb value (12.43) at HEP that is mean WL which was bred in Egyptian environment for long time react like Egyptian breeds, also must be to take in consideration the chickens age. **El Menshawy (2003)** found that blood Hb content of different strains was significantly different. Fayoumi at HEP had the highest Ht value (12.52). The higher level of Ht may have enhanced oxygen delivery to the tissue. Also, this increment is supposed to be a factor for increased blood volume as a reaction to increase body oxygen requirement. The RBCs results showed that, no significantly differences among WL, Dan, Fay and Sin chicken were found (Table 4). Regarding to age effect, RBCs was significantly increased at HEP compared to those at one day and AFE. Breed and age interaction effect for RBCs was significant, WL at the first day had the lowest RBCs (2.48) count, while it had the highest (3.04) count at HEP. WL had the highest LYMP (56.94), while Sin had the lowest value (53.00). ESINO cells play a major phagocytes role in the defense against parasitic organism **(Glick *et al.*, 1964)**. WL had the highest ESINO (2.33) count, while Fay had the lowest count (1.78). There was no significant difference due to the age effect. Regarding to breed and age interaction effect, WL at the AFE had the highest (2.83) count, while Fay had the lowest (1.50) count (Table 4). Fayoumi had the highest BASO (0.17) count, while Dan had the lowest count (0.06). There was no significant difference due to the age effect. Breed and age interaction effect showed that, Fay at the first day had the highest count, while Dan had the lowest count (Table 5). In contrary, **El Safty et al. (2006)** reported that, there were insignificant differences for ESINO cells between two genotype of chickens. White blood cells reacting with Lymphokines to increase their ability to battle the foreign invasion, significant differences were found among breeds for SEGMENT cells count, Sin had the highest value and WL had the lowest (42.75 vs. 38.42). Age had a significant effect on SEGMENT cells, it was the highest at the HEP and lowest at AFE as shown in Table 5. Regarding to age and breed interaction effect on SEGMENT cells, Fay at the HEP had the significant highest count (3.08), where Sin had the lowest values at AFE (1.50). Also, breed had significant effect on STAFF cells, Dan had the highest values, while Sin had the lowest. Concerning the age effect, it decreased from the first day till the AFE and then increased at the HEP (Table 5). Breed and age interaction effect showed that STAFF cells were significant highest in WL breed (2.83) and lowest in Fay breed (1.50) at AFE. The results of the present study indicated that, there are a definite changes in the profile of the blood cells throughout the life and these changes are affected by the breed**,** similar trends were reported by **Burton and Harrison (1969), Abdel-Hameed and Neat (1972) and Khan *et al.* (1987)**.

Productive performance:

Body weight:

The results indicated that Sin and WL breed had heavier body weight than Fay and Dan at most age studies (Table 3). These results clearly showed that there were considerable differences in the growth pattern of all breeds, which may be due to their genetic pool as previously reported by **Hamdy (2000), Elewa (2004) and El Full *et al.* (2005)** for some local strains of chickens. Also, breed differences in body weight were reported by numerous workers **(El Menshawy, 2003; El Tantawy *et al.*, 2007; El Anwer *et al.*, 2009)**. Although genetic background of the breed or strain is considered as an important factor in controlling its body weight, still there are other factors control it. Consequently, variations in body weight of the same breed or strain at the same age have been observed in the literature **(Habeb, 2007; El Anwer *et al.*, 2009)**.

Egg production traits:

Results of egg characteristics for the different breeds are given in Table 6. Dan and Sin reached age at first egg (151 and 153days of age, respectively) earlier than Fay and WL (160 and 162 days of age, respectively). Similar results were observed by **Saleh *et al.* (1994)**. WL pullets produced the heaviest eggs, whereas Dan chickens produced the lightest eggs and Sin had intermediate values (Table 6). The performance of egg weight for Dan, Fay and Sin breeds in the present study are similar to those reported by **El Full *et al.* (2005) and Zaki (2006). Metwally (2006)** reported heavier egg weight for Dandarawi (40.70 to 44.08g) whereas lower estimates of egg weight (36.1) was reported by **El Afifi *et al.* (2008)**. Regarding the rate of laying, no significant differences were observed among breeds during the three periods. Lower performance of egg production for Dan were reported by **Saleh *et al.* (1994) and El Full *et al.* (2005)** for some local strains of chickens. The differences among reports were mainly due to different environments effects. Also, WL which was bred in Egyptian environment for long time react like Egyptian breed.

Egg quality traits:

Results presented in Table 6 showed that breed significantly affected egg quality traits. It could be seen that Sin had significantly highest albumen% as compared to other breeds, whereas Fay had the lowest albumen% and a highest yolk% as compared to other breeds. It can be seen that the larger eggs have a greater proportion of albumen, but a lower proportion of yolk which was in agreement with the results of **El Full *et al.* (2005) and Zaky, (2006)**. No breed-related differences in the yolk% were found among Dan, Sin and WL. Eggs which were produced by WL and Dan had significantly highest shell% whereas eggs produced by Sin had the smallest shell%. Fayoumi showed significantly highest scores for YC than other breeds, while WL had the lowest and Sin and Dan had intermediate values (Table 6). Similar trend was reported by **El Full *et al.* (2005)** for this trait concerning Fay, Dan and Sin breeds. No breed-related differences in the yolk index and HU were found among Dan, Sin and WL, however eggs produced from Fay had significant lowest yolk index and HU. Similar trend was reported by **El Labban (2000) and El Full *et al.* (2005)**, while lower values for WL and Fay were found by **Zaki (2006)**. Dan and Fay had higher shape index than Sin which characterized by lower estimates indicating that Sin as a developed strains produce eggs that tend to be less elongated compared to other breeds. On the contrary, **Ezzeldin and El Labban (1989)** reported that local strains produce eggs that tend to be less elongated compared to crossbred strains. From Table 6, it is clear that Fay had significantly thicker shells and Sin had the lowest. **Ezzeldin and El Labban (1989) and El Full *et al.* (2005)** reported the same trend that egg shell of local strains were thicker than in crossbred eggs. On the contrary, **Ramsy (1984) and Zaki (2006)** reported insignificant breed differences in shell thickness and shell index. Egg specific gravity has been recommended as an accurate indicator of shell strength **(Well's, 1968)**. Despite being an indirect measure, it correlates well with direct methods but is non-destructive and has the practical advantage of speed and simplicity. It has also been shown to be an accurate predictor of shell thickness, much more reliable for this purpose than percentage shell **(Tyler and Geake, 1961)**. Results presented in Table (6) show some egg shell quality traits for different breeds. Eggs which were produced by Sin hens had significantly lowest specific gravity comparably with those produced from both Dan and WL, while Fay breed was intermediate. Concerning shell density, the present result showed that there was no significant difference among breeds. Shell weight per unit surface area of WL genotype was significantly higher than that of Dan, Sin and Fay. In accordance to egg shell area, it could be observed that the ESA of WL and Sin breed was significantly higher than that of Fay and Dan. The eggs produced from WL recorded significantly highest egg shell volume compared to produced from Sin and Dan. Similar trend of genotype differences for internal egg quality and egg shell quality traits was reported by **El Safty et al. (2006) and Zein El Dein *et al.*(2009)**.

The results revealed that, WL as a hybrid foreign breed for egg production had higher shell%, Haugh unit scores, specific gravity, shell weight per unit surface, egg surface area, egg shell than indigenous breeds while, indigenous breeds had higher yolk%, thicker shell thickness and higher color score, which means a good merit of the egg quality performance of the indigenous breeds. In spite of the reproductive merit of local breeds, their productive efficiency still need improvement through applying a consistent and sustainable breeding program.

From the previous results it could be concluded that:

1. Leghorn breed had superiority values for antioxidant enzymes activities of red blood cells haemolycate, some productive traits, haematological parameters compared with local breeds. While, Dan had the lowest and Fay and Sin had intermediated values for previous parameters. A high variability of Dan breed directs a more attention conducted such breed.

2. Variations in antioxidant enzymes activities, some physiological and haematological parameters in different chicken breeds during development suggest that they are genetically regulated. This finding indicates that these parameters are useful and important with potential use in breeding programs as early predictors for indirect selection or crosses which associated with disease resistance and performance traits and highly tolerance to oxidative stress.

Table 1. : Composition and analyses of the diets.

Item	Starter	Grower	Pre-production	Production
				%
Yellow corn, ground	61.00	63.20	64	66.2
Soybean meal	30.40	17.20	28.7	22.4
(44%CP)	4.50	15.60	1.30	5.4
Wheat bran	1.47	1.30	1.40	1.40
Dicalcium phosphate	1.80	1.90	3.75	3.83
Limestone	0.30	0.30	0.30	0.30
Salt	0.40	0.40	0.40	0.40
Vit-Min. Premix*	0.10	0.07	0.12	0.07
Methionine	0.03	0.03	0.03	0
Lysine %	**100.00**	**100.00**	**100.00**	**100.00**
Total				
Determined analysis:	19	15	18	16
CP	2800	2721	2817	2805
ME, K cal./Kg	4.05	4.30	3.61	3.60
CF	2.60	3	2.70	2.80
NFE				
Calculated analysis:**	19.02	15.03	18.40	16.00
CP	2.70	3.00	2.86	2.86
EE	4.06	4.36	3.69	3.69
CF	2800.70	2721.39	2820	2805.26
ME, K cal./Kg	1.03	1.01	1.75	1.77
Ca	0.76	0.77	0.76	0.72
Total P	0.50	0.46	0.47	0.47
Available P	1.09	0.77	1.03	0.85
Lysine	0.43	0.33	0.44	0.36
Methionine	0.74	0.59	0.73	0.62
Methionine+Cystine				

*****Vit+Min Permix1 was added as 3.0Kg / ton of diet and supplied the following (as mg or IU per Kg of diet): vit A 10000 IU, VitD31000 IU, Vit E 10mg, Vit K31mg, Vit B1 1mg, Vit B2 4mg, Vit B6 1.5mg, Pantothenic acid 10mg, Vit B12 0.01mg, Folic acid 1mg, Niacin 20mg, Biotin 0.05mg, Choline chloride 500mg, Zn 45mg, Cu 3mg, Fe 30mg, I 0.3mg, Se 0.1mg, Mn 40 mg, Ethoxyquin 3000mg.

******According to **NRC (1994).**

Table 2. Effects of breed, age and their interaction on glutathione peroxidase (GPX), catalase (CAT) and superoxide dismutase (SOD) activities (unit/liter) in red blood cells haemolycate (Means ± SE).

Main Effects		GPX	CAT	SOD
Breed effect				
Leghorn		**961.97±27.51[a]**	**577.02±31.50[a]**	**781.84±27.90[a]**
Dandarawi		**923.52±19.06[c]**	**548.08±24.90[c]**	**748.15±19.25[c]**
Fayoumi		**946.80±23.42[b]**	**562.52±26.70[b]**	**765.70±20.95[b]**
Sinai		**944.76±24.16[b]**	**563.25±28.10[b]**	**765.60±23.15[b]**
Age effect				
1st day		**1018.29±7.62[a]**	**610.97±4.50[b]**	**773.90±5.79[b]**
AFE		**771.90±8.90[b]**	**347.36±4.01[c]**	**609.80±7.03[c]**
HEP		**1042.59±13.36[a]**	**729.81±9.35[a]**	**912.27±11.69[a]**
Breed x age effect				
Leghorn	**1st day**	**1004.35±9.57[cd]**	**602.61±5.74[d]**	**763.31±7.27[cd]**
	AFE	**754.61±14.67[e]**	**339.58±6.60[e]**	**596.14±11.59[e]**
	HEP	**1126.94±19.32[a]**	**788.86±13.52[a]**	**986.07±16.90[a]**
Dandarawi	**1st day**	**980.80±14.25[d]**	**588.48±8.55[d]**	**745.41±10.83[d]**
	AFE	**788.29±23.56[e]**	**354.73±10.60[e]**	**622.75±18.62[e]**
	HEP	**1001.47±14.05[cd]**	**701.03±9.80[b]**	**876.28±12.30[b]**
Fayoumi	**1st day**	**1061.55±9.11[b]**	**636.93±5.40[c]**	**806.78±6.93[c]**
	AFE	**778.24±14.19[e]**	**350.21±6.39[e]**	**614.81±11.21[e]**
	HEP	**1000.59±30.14[cd]**	**700.41±21.10[b]**	**875.52±26.37[b]**
Sinai	**1st day**	**1026.45±17.12[bcd]**	**615.87±10.27[cd]**	**780.10±13.01[cd]**
	AFE	**766.46±18.02[e]**	**344.91±8.11[e]**	**605.51±14.20[e]**
	HEP	**1041.37±24.68[bc]**	**728.96±17.28[b]**	**911.20±21.59[b]**

[a,b,c,d,e] Means having different letters exponents within column at each effect are significant different (P ≤ 0.05). AFE: age at age at first egg and HEP: the period of the highest egg production.

Table 3. Effects of breed and age and their interaction on body weight (BW), hemoglobin (Hb) and haematocrit (Ht) (Means ± SE).

Main Effects		BW	Hb g/dl	Ht%
Breed effect				
Leghorn		1071.33±128.54^{ab}	10.97±0.19^{b}	36.44±0.59^{b}
Dandarawi		882.08±106.29^{c}	11.26±0.15^{a}	38.00±0.40^{a}
Fayoumi		1009.99±120.08^{b}	11.25±0.17^{a}	37.01±0.51^{ab}
Sinai		1128.31±139.88^{a}	11.35±0.14^{a}	37.41±0.44^{ab}
Age effect				
1st day		28.03±0.47^{c}	10.64±0.10^{b}	36.28±0.37^{b}
AFE		1364.58 ±30.11^{b}	10.64±0.09^{b}	35.35±0.39^{c}
HEP		1676.17±39.02^{a}	12.34±0.08^{a}	40.02±0.12^{a}
Breed x age effect				
Leghorn	1st day	26.48±0.72^{e}	10.15±0.17^{e}	34.86±0.78^{d}
	AFE	1475.00±52.77^{c}	10.33±0.19^{ed}	34.18±0.85^{d}
	HEP	1712.50±59.07^{b}	12.43±0.09^{a}	40.28±0.13^{a}
Dandarawi	1st day	25.39±0.72^{e}	10.62±0.23^{bcd}	37.47±0.87^{b}
	AFE	1179.17±45.42^{d}	11.04±0.17^{b}	37.12±0.66^{bc}
	HEP	1441.67±50.69^{c}	12.13±0.09^{a}	39.40±0.28^{a}
Fayoumi	1st day	29.47±0.85^{e}	10.81±0.18^{bc}	35.90±0.55^{bcd}
	AFE	1370.83±41.50^{c}	10.43±0.17^{cde}	34.59±0.55^{d}
	HEP	1629.67±41.98^{b}	12.52±0.09^{a}	40.55±0.13^{a}
Sinai	1st day	30.78±0.59^{e}	10.98±0.16^{b}	36.89±0.49^{bc}
	AFE	1433.33±65.23^{c}	10.78±0.19^{bcd}	35.50±0.80^{bcd}
	HEP	1920.83±86.26^{a}	12.28±0.08^{a}	39.85±0.25^{a}

^{a,b,c,d,e} Means having different letters exponents within column at each effect are significant different ($P \leq 0.05$). AFE: age at age at first egg and HEP: the period of the highest egg production.

Table 4. Effects of breed and age and their interaction on erythrocyte (RBCs), lymphocytes (LYMP) and eosinophils (ESINO) (Means ± SE).

Main effects		**RBCs10^6/mm^3**	**LYMP%**	**ESINO%**
Breed effect				
Leghorn		**2.67±0.05^a**	**56.94±1.84^a**	**2.33±0.14^a**
Dandarawi		**2.72±0.03 ^{a}**	**56.44±1.59^{ab}**	**2.08±0.15^{ab}**
Fayoumi		**2.71±0.04^a**	**55.00±1.54^{ab}**	**1.78±0.16^b**
Sinai		**2.75±0.04^a**	**53.00±1.23^b**	**2.31±0.15^a**
Age effect				
1st day		**2.59±0.03^b**	**57.94±1.60^a**	**2.02±0.14^a**
AFE		**2.55±0.03^b**	**58.90±1.24^a**	**2.33±0.18^a**
HEP		**2.99±0.01^a**	**49.21±0.58^b**	**2.02 ± 0.02^a**
Breed x age effect				
Leghorn	**1st day**	**2.48±0.06^e**	**63.25± 3.13^a**	**2.17±0.24^{abc}**
	AFE	**2.49±0.06^e**	**61.08± 2.35^{ab}**	**2.83±0.30^a**
	HEP	**3.02±0.02^a**	**46.50± 1.37^e**	**2.00±0.01^{bc}**
Dandarawi	**1st day**	**2.57±0.06^{cde}**	**50.58± 2.49^{cde}**	**1.92±0.29^c**
	AFE	**2.69±0.05^{cd}**	**66.00± 2.26^a**	**2.25±0.359^{abc}**
	HEP	**2.89±0.02^b**	**52.75± 0.48^{cde}**	**2.08±0.01^{abc}**
Fayoumi	**1st day**	**2.64±0.06^{cd}**	**61.33± 3.15^{ab}**	**1.83±0.34^c**
	AFE	**2.47±0.02^e**	**54.83± 2.13^{bcd}**	**1.50±0.34^c**
	HEP	**3.03±0.01^a**	**48.83± 1.07^{de}**	**2.00±0.01^{bc}**
Sinai	**1st day**	**2.68±0.05^{cd}**	**56.58± 2.98^{bc}**	**2.17±0.27^{abc}**
	AFE	**2.54±0.05^{de}**	**53.67± 1.46^{cd}**	**2.75±.33^{ab}**
	HEP	**3.01±0.03^{ab}**	**48.75± 0 .83de**	**2.00±0.01^{bc}**

[a,b,c,d,e] Means having different letters exponents within column at each effect are significant different (P ≤ 0.05). AFE: age at age at first egg and HEP: the period of the highest egg production.

Table 5. Effects of breed and age and their interaction on neutrophils (SEGMENT and STAFF), eosinophils (ESINO) and basophils (BASO) (Means ± SE).

Main Effect		**SEGMENT %**	**STAFF%**	**BASO%**
Breed effect				
Leghorn		38.42± 1.89[b]	2.22±0.16[ab]	0.08±0.05[a]
Dandarawi		38.94± 1.55[b]	2.50±0.18[a]	0.06±0.04[a]
Fayoumi		40.86± 1.53[ab]	2.19±0.18[ab]	0.17±0.06[a]
Sinai		42.75± 1.21[a]	1.83±0.14[b]	0.11±0.05[a]
Age effect				
1st day		37.81±1.57[b]	2.13±0.15[b]	0.13±0.04[a]
AFE		36.83±1.32[b]	1.83±0.13[b]	0.10±0.04[a]
HEP		46.08±0.60[a]	2.60±0.14[a]	0.08±0.04[a]
Breed x age effect				
Leghorn	**1st day**	32.17±3.09[e]	2.33±0.28[abcd]	0.08±0.08[ab]
	AFE	34.17±2.75[de]	1.83±0.30[cd]	0.08±0.08[ab]
	HEP	48.92±1.35[a]	2.50±0.26[abc]	0.08±0.08[ab]
Dandarawi	**1st day**	44.83±2.40[abc]	2.75±0.39[ab]	0.00±.00[b]
	AFE	29.58±2.12[e]	2.08±0.26[bcd]	0.08±0.08[ab]
	HEP	42.42±0.66[abc]	2.66±0.26[abc]	0.08±0.08[ab]
Fayoumi	**1st day**	34.92±3.22[de]	1.58±0.19[d]	0.33±0.14[a]
	AFE	41.67±2.26[bc]	1.92±0.34[bcd]	0.08±0.08[ab]
	HEP	46.00±1.10[abc]	3.08±0.23[a]	0.08±0.08[ab]
Sinai	**1st day**	39.33±2.82[cd]	1.83±0.21[cd]	0.08±0.08[ab]
	AFE	41.92±1.59[bc]	1.50±0.15[d]	0.17±0.08[ab]
	HEP	47.00±1.89[ab]	2.17±0.30[bcd]	0.08±0.08[ab]

[a,b,c,d,e] Means having different letters exponents within column at each effect are significant different (P ≤ 0.05). AFE: age at age at first egg and HEP: the period of the highest egg production.

Table 6. Egg production traits, egg components%, interior and exterior egg quality for different breeds (Means ± SE).

Breed	Dandarawi	Sinai	Fayoumi	Leghorn
Egg production traits				
AFE	151	153	160	162
EW	42.4±0.89[c]	48.5±0.71[b]	44.4±0.61[c]	50.7±0.83[a]
RL%(90 day)	62.30±2.05[a]	64.28±1.66[a]	64.28±2.05[a]	65.15±1.74[a]
RL%(120 day)	65.43±5.26[a]	62.58±4.18[a]	65.43±5.26[a]	64.08±4.46[a]
RL%(52 weeks)	65.33±3.93[a]	64.34±3.21[a]	65.33±3.39[a]	63.83±3.33[a]
Egg components%				
Alb%	58.39±0.61[a]	59.43±0.87[a]	54.84±0.49[b]	57.89±0.45[a]
Y%	29.58±0.48[b]	29.47±0.66[b]	33.43±0.27[a]	29.76±0.38[b]
Sh%	12.03±0.21[a]	11.10±0.38[b]	11.74±2.02[ab]	12.35±0.19[a]
Interior egg quality				
YC	6.70±0.25[b]	6.93±0.19[b]	8.23±0.11[a]	6.03±0.25[c]
YI	44.05±0.64[a]	43.83±0.52[a]	41.60±0.58[b]	43.03±0.58[ab]
HU	75.35±2.15[a]	76.74±1.60[a]	66.65±1.78[b]	77.07±1.14[a]
Exterior egg quality				
SI	76.81±2.51[a]	75.75±0.48[a]	77.43±0.51[a]	76.13±0.58[a]
ST	37.47±0.38[ab]	35.86±0.35[b]	38.97±0.69[a]	37.10±0.41[ab]
ESG	1.100±0.001[a]	1.095±0.002[b]	1.099±0.001[ab]	1.102 ±0.001[a]
SD	0.091±0.002[a]	0.087±0.003[a]	0.091±0.002[a]	0.098±0.001[a]
SWUSA	0.088±0.002[b]	0.085±0.003[b]	0.087±0.002[b]	0.096±0.001[a]
ESA	57.73±0.80[b]	63.12±0.62[a]	59.60±0.54[b]	64.98±0.71[a]
ESV	21.65±0.41[c]	22.64±0.34[bc]	23.21±0.44[ab]	24.1236±0.42[a]

[a,b,c] :Means within the same raw had different superscripts are significantly different ($P \leq 0.05$). AFE : age at firs egg, EW: Egg weight, RL: Rate of laying, Alb%: Albumen%, Y%: Yolk%, Sh%: Shell%, YC: Yolk color, YI: Yolk index, HU: Haugh units, SI: Shape index, ST: Shell thickness mm. ESG: Egg specific gravity, ESA: Egg surface area, SWUSA: Shell weight per unit surface area. ESV: Egg shell volume and SD: Shell density.

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الملخص العربي

اختلافات أنواع من الدجاج ومعاملات الارتباط لنشاط الإنزيمات المضادة للأكسدة وبعض المقاييس الفسيولوجية والصفات الإنتاجية

1. اختلافات الأنواع

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أجريت هذه الدراسة في مزارع المشروع التكاملي بالعزب بالفيوم في المدة من يناير 2008 إلى فبراير 2009 وقد استعمل عدد 4000 كتكوت عمر يوم من سلالات الدندراوى، الفيومي، سينا و اللجهورن الأبيض بغرض قياس تأثير النوع والعمر على نشاط الإنزيمات المضادة للأكسدة (الجلوتاثيون بيرواوكسيديز، السوبرأوكسيدديسميوتيز والكاتيليز) وبعض القياسات الفسيولوجية (هيموجلوبين، هيماتوكريت، كرات الدم الحمراء و كرات الدم البيضاء) وبعض صفات إنتاج البيض مع التركيز على صفات جودة البيضة والقشرة. تم اخذ عينات الدم عند عمر يوم و العمر عند أول إنتاج للبيض وعند أعلى إنتاج للبيض.

أظهرت النتائج أن: نشاط الإنزيمات المضادة للأكسدة كان أعلى قيم معنويا في اللجهورن واقل قيم في الدندراوى وكانت لسلالتي الفيومي والسينا قيم متوسطة. تأثير العمر كان معنويا على درجة نشاط إنزيمات مضادات الأكسدة فكانت أعلى قيمة عند عمر يوم ثم ينخفض عند أول إنتاج للبض ثم يرتفع ثانية عند أعلى إنتاج للبيض. يتميز اللجهورن بانخفاض الهيموجلوبين والهيماتوكريت بصفة عامة. وكانت أعلى قيم لهما عند أعلى إنتاج للبيض مقارنة بالعمر عند أول يوم أو عند أول إنتاج للبيض. عند اخذ تأثير العمر مع النوع في الاعتبار فان اللجهورن سجل أقل عدد لكرات الدم الحمراء عند عمر يوم واحد بالرغم من ذلك فانه تميز بأعلى عدد عند عمر اعلي إنتاج للبيض. كانت أعلى قيم لكرات الدم من نوع الايزينوفيل في اللجهورن بينما كانت اقل قيمة في الفيومي ولكن بالنسبة لتقدير كرات الدم من نوع البازوفيل فكانت أعلى قيم في الفيومي واقل قيم في الدندراوى وأيضا عند اخذ تأثير العمر مع النوع في الاعتبار فان الفيومي عند عمر يوم واحد تميز بأعلى قيم بينما الدندراوى كان اقل القيم عند نفس العمر. تميزت دجاجات اللجهورن و سينا بثقل الوزن مقارنة بالفيومي أو الدندراوى. كان البيض المنتج من اللجهورن أثقل وزنا بينما البيض المنتج من الدندراوى كان اقل وزنا ولكن من الجدير بالملاحظة أن نسبة قشرة البيضة في كلا السلالتين كانت أعلى من السلالتين الأخريين. تميز البيض المنتج من دجاجات السينا بانخفاض الوزن النوعي.

والخلاصة أن دجاجات اللجهورن كانت متفوقة على السلالات المحلية بالنسبة لنشاط الإنزيمات المضادة للأكسدة في كرات الدم الحمراء وبعض القياسات الفسيولوجية ومعظم الصفات الإنتاجية. يمكن توظيف الاختلافات بين وداخل الأنواع لنشاط الإنزيمات المضادة للأكسدة في كرات الدم الحمراء وبعض القياسات الفسيولوجية والمناعية في برامج التربية والانتخاب المختلفة لإنتاج سلالات مقاومه لمخاطر الأكسدة والسمية وبعض الأمراض المتعلقة بالمناعة مع الأخذ في الاعتبار الصفات الإنتاجية.