PRODUCTIVE PERFORMANCE AND IMMUNOCOMPETENCE PARAMETERS OF NAKED NECK AND NORMALLY FEATHERED CHICKEN GENOTYPES GOT FROM DIFFERENT MATERNAL LINES

By

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Abstract: *Productive performance, humoral, cell-mediated immunities and phagocytic ability were examined in naked neck (Nana) and normally feathered (nana) genotypes got from different maternal lines (Brown and White Hy-line breeder hens). Cell-mediated immunity was examined by Phytohemagglutinin-P (PHA-P) assay at 30 wk of age. At 32 and 34 wk of age, 20 birds from each genotype within dam line were injected by sheep red blood cells (SRBCs), and blood samples were collected at 7 and 14 d post-primary and secondry injection (PPI and PSI, respectively). Phagocytic ability was measured by carbon clearance assay at 35 of age. Regarding adaptability, comb and wattle lengths were significantly increased by the naked neck gene allowing for increasing heat dissipation. In the absence of interaction, the presence of Na gene significantly increased egg number compared to normal feathered counterparts. Also, the naked neck hens had larger egg weight. With respect to immunocompetence parameters, the results showed that the naked neck genotype had significantly (P < 0.05) higher total antibody titers to SRBCs than its nana counterparts. In both dam lines, the naked neck genotype had significantly faster carbon clearance ability than the nana sibs.*

Key Word:* *Naked Neck Gene, Dame Line, Immune Response

INTRODUCTION

The immune system of poultry is a complex network of different cell types and soluble factors that give rise to an effective response to pathogenic challenges. Proper and efficient function of the immune system is directly associated with poultry production, reproduction and health (Chao and Lee, 2001). The phagocytic ability and cell-mediated and humoral immunities combine to provide birds with a complete spectrum of resistance processes. To enhance the efficiency of their immune systems, several lines of chickens have been selected divergently against specific antigens (Steadham and Lamont, 1993; Sarker *et al*., 1999a, b). These selection processes must affect the major functions of the immune system, which leads to changes in the selected and correlated traits, resulting in differences in the immune responses among the selected lines. Major genes are believed not only responsible of adaptability to the tropical climate, but also resistance to diseases.

In Egyptian local Sharkasi, Abdel-Rahman (1998) detected an increase in body weight for naked neck genotypes (NaNa or Nana) over normal (nana) at hatch and 4 weeks of age, but the differences were insignificant. Body weight at 15 weeks of age was heavier for naked neck birds (Nana) compared to normal (nana) birds (Younis *et al*. 1998). Alvarez *et al*. (2002a) reported that the NaNa and Nana hens had better growth rate (P<0.05) than nana ones. Singh *et al.* (2001) reported that there were significant differences for weight gain and feed intake between Nana and nana genotypes from 4 to 8 weeks of age. The same trend was observed for weight gain trait, but for feed intake trait, the differences were not significant. In the same trend, Galal and Fathi (2001) showed that the naked neck gene was associated with higher feed consumption compared to fully feather, one-concerning the term of feed conversion ratio, they added that the Na allele had a better affect on feed conversion ratio, where the Nana genotype had significantly better feed conversion ratio as compared to nana one.

Significantly higher cell-mediated immune (CMI) estimate was observed in NaNa and Nana broilers as compared to nana ones (Patra *et al*., 2004). Martin *et al*. (1989) and Haunshi (1999) reported that the naked neck and frizzle genes did not significantly affect CMI immunity response to Concanavalin A (Con-A). Inversely, Alvarez *et al*. (2002b) found that the heterozygous naked neck genotype had a better cellular and humoral response than their normally feathered (nana) and homozygous naked neck genotypes. Also, Alvarez *et al*. (2003) showed that the Nana chickens are most resistant to Salmonella Gallinarum (SG) infection and is the best responder to vaccination with SG antigens compared to NaNa and nana sibs. El-Safty *et al*. (2006) observed that the Nana hens had a significantly greater dermal swelling response to phytohemagglutinin-P (PHA-P) compared to normally feathered ones. Introduction of major genes of tropical interest to, overcome the heat stress in hot climates and to improve the production, which will have an impact on innate immunity, thereby affecting the immune competence of chicken (Dorny *et al*., 2005). However, contradictory information is available with respect to influence of Na gene on immunity (Haunshi *et al*., 2002; Kaufman, 2008). Therefore, the present study was conducted to evaluate the effect of Na gene on immune response parameters of got from different maternal lines.

MATERIALS AND METHODS

Genetic Flock and Management:

This experiment was carried out at Poultry Breeding farm, Poultry Production Department, Faculty of Agriculture, Ain Shams University. A total of 200 hens aged 25 weeks of age (50 Brown-Nana, 50 Brown-nana, 50 White-Nana and 50 White-nana) were taken from F1 of the crossing between heterozygous naked neck (Nana) males and both Brown and White normally feathered Hy-line (nana) females. All hens were housed in batteries with single cages and fed diet with 18% crude protein. Birds were subjected to 16L: 8D lighting regime with free access feed and water. Temperatures of house birds were fluctuated between 29.4 to 32.5°C during the experiment period.

Productive Parameters:

Body weights, comb and wattle lengths were individually recorded for each genotype within maternal line. The feed consumption was measured from 30 to 40 weeks of age. Also, feed conversion ratio was calculated. Also, egg number and egg weight were recorded within each genotype through the experimental period.

Immunocompetence Measurements:

Phytohemagglutinin injection (*In vivo* cell-mediated immunity assay)

Response induced in vivo by mitogen was evaluated by injection of phytohemagglutinin-P (PHA-P) into the toe web between the second and the third digits of chicks. Ten birds from each genotype within strain, at 30 weeks of age were used. Each chick was intradermally injected in the toe web of the left foot with 100*g phytohemagglutinin-P (Sigma Chemical Co., St. Louis, MO 63178) in 0.1 ml of sterile saline measured with a constant tension caliper before injection and at 24, 48 and 72 hr after PHA-P injection. The toe web swelling was calculated as the difference between the thickness of the toe web before and after injection.

Antibody response against sheep red blood cells (SRBCs)

Sheep red blood cells (SRBCs) were used as T-dependent antigens to quantify the antibody response. Twenty chicks from each genotype were injected intramuscular with SRBC (3% suspension in PBS, 1 ml/male) at 32 weeks of age followed by a booster injection of SRBC suspension at 34 weeks (after 14 days of the first injection). Blood samples were collected at 7 and 14 days after the first injection and again at 7 and 14 days post booster. The plasma from each sample was collected; heat inactivated at 56°C for 30 min and then analyzed for total, mercaptoethanol-sensitive (MES) and mercaptoethanol-resistant IgG anti-SRBC antibodies as described by (Yamamoto and Glick, 1982). Briefly, 50 µL of plasma was added in an equal amount of PBS in the first column of a 96-well V-shaped bottom plate, and the solution was incubated for 30 min at 37°C. A serial dilution was then made (1:2) and 50 µL of 2% SRBC suspension was added to each well. Total antibody titers were then red after 30 min. of incubation at 37°C. The well immediately preceding a well with a distinct SRBC button was considered as the endpoint titer for agglutination. For MES (IgM) response, 50 µL of 0.01 M mercaptoethanol in PBC was used instead of PBS alone, followed by the aforementioned procedure. The difference between the total and the IgG response was considered to be equal to the IgM antibody level.

Carbon clearance (mononuclear phagocytic system function assay)

The phagocytic ability of chicks was determined by the carbon clearance assay (CCA) based on the method of Cheng and Lamont (1988) and modified by Fathi *et al.* (2003). Briefly, the supernatant fraction of Black India ink (Design/Hggins, 4415, Sanford, Bellwood, Illinios 60104) was obtained through centrifugation (5000 rpm for 30 min). At 35 weeks of age, 5 birds from each genotype within dam line were injected with ink at the rate of 1 ml/kg body weight into the left wing vein. The blood samples at 0, 3 and 15 min after ink-injection were taken from the opposite wing and immediately transferred into 2 ml of 1% sodium citrate. The samples were then centrifuged at 5000 rpm for 4 min. The relative amount of carbon particles remaining in the supernatant was measured spectrophotometerically at a wave length of 640 nm using samples at zero min as the zero value.

Statistical Analysis

Data were subjected to a two-way analysis of variance with strain and dame line effects using the General Linear Model (GLM) procedure of SAS User's Guide (2001).

RESULTS AND DISCUSSION

Productive Parameters:

Productive performance of naked neck and normal feathered genotypes got from different maternal lines is summarized in Table (1). The body weight of laying hens did not significantly affected by naked neck, maternal line and their interaction. Regarding adaptability, comb and wattle lengths were significantly increased by the naked neck gene allowing for increasing heat dissipation. Similar results were obtained by Chen *et al.* (2004) and Bordas *et al.* (1980). With respect to strain effect, it could be noticed that the White strain had significantly taller comb and widest wattle compared to Brown one. The comb and wattle lengths were significantly affected by interaction between naked neck gene and maternal line. The last result could be attributed to the effect of naked neck gene on comb and wattle length which is more pronounced in Brown strain rather than White one. In the absence of interaction, the presence of Na gene significantly increased egg number compared to normally feathered counterparts. Also, the naked neck hens had a larger egg weight. Similar results were obtained by Chen *et al*. (2002).

Regarding feed efficiency, heterozygous naked neck hens exhibited the highest feed intake and the feed efficiency ratio tended to be better with no significant differences between the genotypes. Under high ambient temperature, Galal and Fathi (2001) concluded that the naked neck gene was associated with higher feed consumption compared to fully feather one. Concerning the term of feed conversion ratio, the same authors found that the Na allele had a better effect on feed conversion ratio, where the Nana genotype had significantly better fed conversion ratio as compared to nana one. Also, Alvarez *et al*. (2002a) found that the feed conversion ratio was 2.42 in nana, 1.84 in Nana and 1.92 for NaNa hens under moderate ambient temperature. Under the high ambient temperature (34°C), Jianxia (2002) reported that male broilers with frizzle and naked neck genes increased feed intake by 6.0% in average when compared to the normally feathered broilers. With respect to strain effect, it could be noticed that the Brown strain consumed significantly higher feed compared to White one. Conversely, the White strain had a better feed conversion ratio compared to Brown one.

Table 1: Productive performance of naked neck and normal feathered genotypes got from different maternal lines.

	Body weight (g)	Comb length (cm)	Wattle length (cm)	Egg number	Egg mass (g)	Egg weight (g)	Feed consumption (g)	Feed conversion ratio
Genotype (G)								
Nana	**1582..9**	**5.08**	**3.01**	**67.50**	**4165.65**	**61.71**	**9312.46**	**2.24**
nana	**1553.5**	**4.70**	**2.58**	**65.39**	**3967.41**	**60.69**	**9064.85**	**2.29**
SEM	**90.21**	**0.89**	**0.54**	**1.25**	**88.95**	**1.22**	**92.45**	**0.11**
Prob.	**NS**	*****	*****	******	******	*****	******	**NS**
Strain (S)								
Brown	**1836.4**	**3.49**	**2.51**	**66.19**	**4091.12**	**61.80**	**9405.41**	**2.30**
White	**1300.0**	**6.30**	**3.07**	**66.70**	**4041.94**	**60.60**	**8971.90**	**2.22**
SEM	**88.56**	**1.12**	**0.61**	**1.33**	**90.42**	**1.50**	**98.45**	**0.13**
Prob.	******	******	******	**NS**	**NS**	*****	******	*****
G*S								
Brown-Nana	**1854.6**	**3.85**	**2.91**	**67.85**	**4229.77**	**62.34**	**9601.58**	**2.27**
Brown-nana	**1818.2**	**3.13**	**2.12**	**64.53**	**3952.46**	**61.25**	**9209.24**	**2.33**
White-Nana	**1311.2**	**6.32**	**3.10**	**67.15**	**4101.52**	**61.08**	**9023.35**	**2.20**
White-nana	**1288.8**	**6.28**	**3.04**	**66.24**	**3982.35**	**60.12**	**8920.46**	**2.24**
SEM	**92.17**	**1.10**	**0.69**	**2.10**	**92.15**	**1.22**	**94.36**	**0.14**
Prob.	**NS**	*****	*****	*****	*****	**NS**	**NS**	**NS**

Immunocompetence Parameters:

Cell –mediated immunity

Genetic control of cell-mediated immunity in chickens has been demonstrated (Cheng and Lamont, 1988; Sarker *et al*., 1999a,b). Phytohemagglutinin-P, T-cell mitogen, induce a proliferation in T-lymphocytes. Injection of PHA-P at selected site in chickens can be considered as an inducer of localized T-lymphoproliferative response (Cheema *et al*., 2003). This response was measured at 24, 48 and 72hrs post PHA-P injection into the toe web, and is reported in Table (2) and is illustrated in Figure (1). It could be speculated that the naked neck genotypes had a significantly hyper responder to PHA-P injection compared to normally feathered counterparts. Similar results were obtained by Fathi *et al.* (2005) and El-Safty *et al*. (2006). Also, Patra *et al*. (2004) reported that significantly higher cell-mediated immunity (CMI) estimates were observed in Nana and NaNa genotypes compared to nana counterparts. Galal (2008) found that the presence of Na gene in a double state significantly increased dermal swelling response to phytohemagglutinin-P (PHA-P) injection compared to nana counterparts. The Nana genotype was intermediated in the most cases. There was a good indication that cell-mediated immunity plays an important role in controlling and clearing intracellular bacterium (Kougt *et al.*, 1994, 1995). Also, selection on cellular responsiveness might add to enhancement of resistance to coccidiosis (Parmentier *et al*., 2001). Therefore, the naked neck birds may be more resistance to coccidiosis than that of normally feathered ones. With respect to strain effect, our result showed that the White strain had a hyper responder to PHA-P injection at 48 hr compared to Brown ones. The interaction between genotype and strain did not significantly affect cell-mediated immunity of chicken.

Table 2: Toe-web swelling (difference) of naked neck and normal feathered genotypes got from different maternal lines

	Time (hr)		
	24	**48**	**72**
Genotype (G)			
Nana	**0.497**	**0.331**	**0.064**
nana	**0.406**	**0.144**	**0.034**
SEM	**0.032**	**0.021**	**0.002**
Prob.	*****	******	*****
Strain (S)			
Brown	**0.452**	**0.197**	**0.064**
White	**0.451**	**0.278**	**0.034**
SEM	**0.015**	**0.011**	**0.010**
Prob.	**NS**	******	*****
G*S			
Brown-Nana	**0.510**	**0.289**	**0.085**
Brown-nana	**0.393**	**0.104**	**0.043**
White-Nana	**0.483**	**0.372**	**0.043**
White-nana	**0.418**	**0.183**	**0.024**
SEM	**0.013**	**0.011**	**0.008**
Prob.	**NS**	**NS**	**NS**

24 = 24 hr post PHA-P injection 48 = 48 hr post PHA-P injection
72 = 24 hr post PHA-P injection
* P < 0.05 ** P < 0.01 NS = non-significance

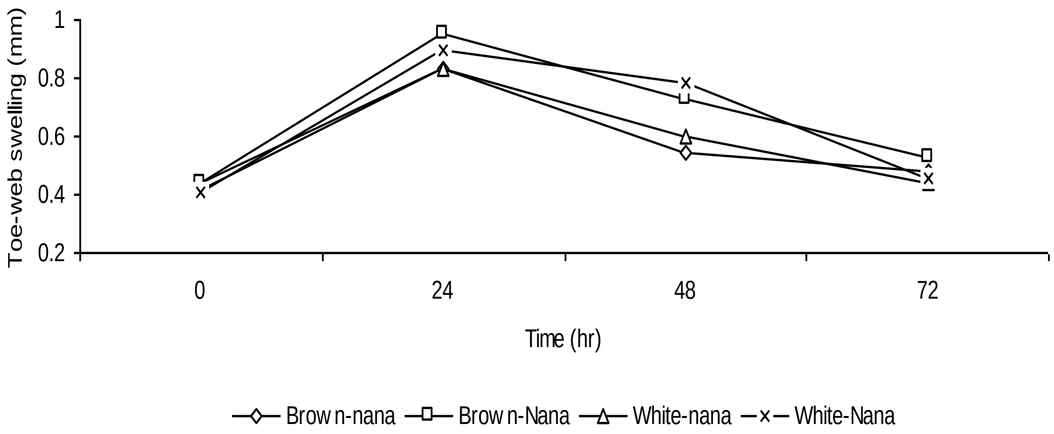

Fig. 1: Toe-web swelling (mm) of naked neck and normal feathered genotypes got from different maternal lines.

Humoral Immunity:

Total anti-SRBCs antibody

Genetic variation in the immune system has been well established in the chicken. One of the model systems used for genetic analysis of humoral immune response is the SRBC anti-body response. Sheep red blood cells (SRBCs) have been chosen in this study as antigen because they are natural multi–determinant, non-pathogenic antigen and chicken phagocytosis of SRBCs opsonied with FC receptor for lysis and stimulate T-cell dependant response (Saxena *et al*., 1997).

Data illustrated in Table (3) and Figure (2) showed that the Nana genotype recorded highly total anti-SRBCs antibody titer at 7 days post primary injection compared to nana ones. There was no significant difference between genotypes at 14 days post primary SRBCs-injection. Regarding to secondary immune response, it could be speculated that the Nana genotype showed highly significant total anti-SRBCs antibody titer at both 7 and 14 days post secondary injection compared to nana ones. The last result could be indicate that the Nana genotype had a better immunological memory than that of nana ones and the two types of responses may be under different genetic control. Boa-Amponsem *et al*. (1999) concluded that immunological memory may be influence by genetic selection. The present result also may indicate that the Nana genotype was more resistant to parasites and viruses diseases. Lines of chickens selected for their ability to produce high antibody to SRBC exhibited higher antibody to Newcastle disease virus, more resist to *Mycoplasma gallisepticum* (van der Zijpp *et al*., 1983) and low mortality rate when they were exposed to Marek's disease virus (Pinard *et al*., 1993) compared to chicken lines that produced low antibody. Therefore, disease resistance may be indirectly improved by selection for immune parameters. The higher secondary immune response in Nana genotype might positively affect the effectiveness of vaccination. Parmentier *et al*. (1996) found that a line of chicken selected for humoral response to SRBC antigen responded better to vaccination with viral antigens than a line selected in the opposite direction. In the absence of interaction, the presented result showed that the White strain had significantly higher total anti-SRBCs antibody titer at 7 days post primary injection compared to Brown ones. Similar trend was noticed at 7 days post secondary SRBCs injection. With respect to interaction between genotype and dam line, it could be noticed that the total anti-SRBCs antibody titer measured at all times were significantly affected by interaction between Na gene and dam line. This result could be attributed to the effect of Na gene on the total anti-SRBCs antibody titer was more pronounced in Brown strain rather than White ones.

Immunoglobulin (M & G):

Data presented in Tables (4&5) and Figures (3&4) showed the effect of genotype, strain and their interaction on the immunoglobulins M and G. In accordance to immunoglobulin-M, the present result observed that the Nana genotype gave significantly higher IgM titer compared to nana at all times. The immunoglobulin-M measured at 7 and 14 days post primary injection of White strain was significantly higher than that of Brown ones. Similar trend was noticed at 7 days post secondary injection. Regarding to interaction between strain and genotype, it could be noticed that the immunoglobulin-M was significantly affected by interaction between strain and genotype. The last result indicated that the effect of Na gene on immunoglobulin response was more pronounced in Brown strain rather than White ones. With respect to immunoglobulin-G, it could be noted that the immunoglobulin-G titer measured at all times did not significantly affected by genotype. Inversely, there was significant difference between strains at all times, except of at 7 days post primary injection. The White strain showed significantly higher IgG titer at 14 days post primary injection and 7 days post secondary injection.

Table 3: Total anti-SRBCs antibody of naked neck and normal feathered genotypes got from different maternal lines

	Primary antibody response			**Secondary antibody response**	
	7PPI	**14PPI**		**7PSI**	**14PSI**
Genotype (G)					
Nana	**5.75**	**3.82**		**6.88**	**3.99**
nana	**5.21**	**3.57**		**6.28**	**3.30**
SEM	**0.18**	**0.21**		**0.14**	**0.11**
Prob.	*	**NS**		*	**
Strain (S)					
Brown	**5.24**	**3.33**		**6.17**	**3.60**
White	**5.71**	**4.06**		**6.99**	**3.69**
SEM	**0.13**	**0.16**		**0.18**	**0.12**
Prob.	**NS**	*		*	**NS**
G*S					
Brown-Nana	**5.67**	**3.52**		**6.63**	**4.10**
Brown-nana	**4.81**	**3.14**		**5.71**	**3.10**
White-Nana	**5.82**	**4.12**		**7.13**	**3.87**
White-nana	**5.60**	**4.00**		**6.85**	**3.50**
SEM	**0.12**	**0.11**		**0.10**	**0.14**
Prob.	*	*		*	*

7PPI = 7 day post primary SRBCs injection 14PPI = 14 day post primary SRBCs injection
7PSI = 7 day post secondary SRBCs injection 14PSI = 14 day post secondary SRBCs injection
* P< 0.05 ** P< 0.01 NS= non-significance

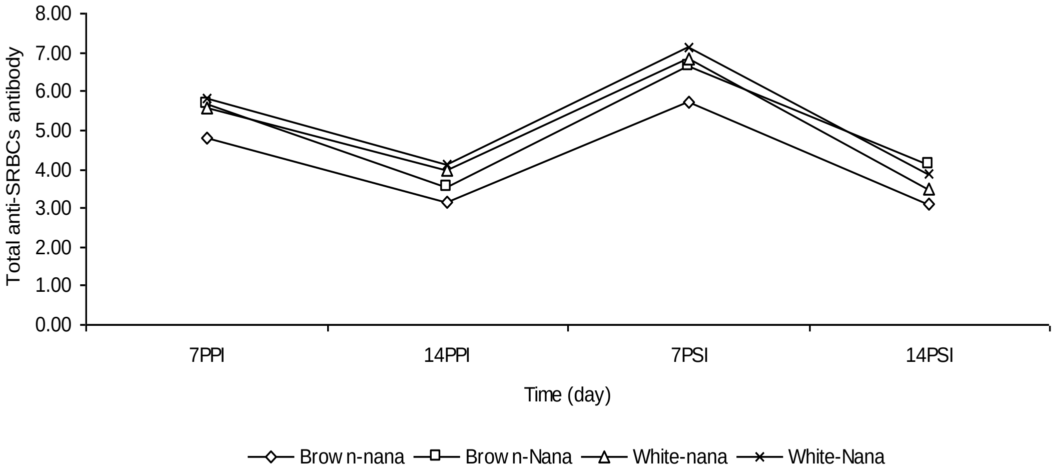

Fig. 2: Total anti-SRBCs antibody of naked neck and normal feathered chicken got from different maternal lines.

7PPI = 7 day post primary SRBCs injection 14PPI = 14 day post primary SRBCs injection
7PSI = 7 day post secondary SRBCs injection 14PSI = 14 day post secondary SRBCs injection

Opposite trend was noticed at 14 days post secondary injection. Okada and Yamamoto (1987) demonstrated that the high immunoglobulin-G (IgG) level was associated with high antibody response to SRBC and lipopolysaccharides. Also, Martin et al. (1989) reported that IgG level was higher for high antibody level than low antibody level. The interaction between strain and genotype did not significantly effect on IgG titer measured at all times, except of at 14 days post secondary injection.

Phagocytic Ability:

Several researchers have reported that phagocytic activity of chickens is genetically regulated (Lamont, 1986; Cheng and Lamont, 1988; Qureshi and Miller, 1991; Qureshi and Taylor, 1993). Studies with MHC B-congenic White Leghorn chicken lines have shown that certain chicken macrophage functions, such as phagocytosis, intracytoplasmic bacterial killing, and blood monocyte chemotaxis are influenced by allelic differences of B-congenic chickens (Qureshi *et al.*, 1986, 1988).

The defensive functions of phagocytosis come into effect immediately upon the invasion by the foreign materials, whereas the T cells needs time to be stimulated and proliferate before they respond to the invasion (Lamont, 1986). The Phagocytic activity was measured by injection of India ink into the birds for all genetic lines and comparing their ability to clear the injected carbon from circulating over a period of time. This was accomplished by obtaining optical density of the plasma samples collected at zero and after 3 and 15 min of ink injection. An increase in the percentage of optical density (OD) value would be indicative of more carbon present in the sample at the time of quantification. Data presented in Figure (5) showed that the naked neck birds had significantly lower levels of carbon in their blood circulation as compared to normally feathered genotype. These result indicated that the mononuclear phagocytic index for naked neck birds was more efficient than those for normally feathered genotype. The last results may be indicated that the birds carrying the Na gene had more resistance for bacterial, viral and parasitic infections. Qureshi *et al.* (2000) reported that birds with higher macrophage phagocytic potential and nitrite production could be protected against bacterial, viral, and parasitic infections. Cheng and Lamont (1988) suggested that phagocytosis may be under the influence of B complex. Under Egyptian environmental conditions, Nazmi (2006) found that the Nana genotype had significantly lower levels of carbon in their circulation as compared to nana genotype. Conversely, Haunshi *et al*. (2002) did not detect a difference between naked neck and normally feathered genotypes for phagocytic ability.

Table 4: Immunoglobulin-M (IgM) of naked neck and normal feathered genotypes got from different maternal lines.

	Primary antibody response			**Secondary antibody response**	
	7PPI	**14PPI**		**7PSI**	**14PSI**
Genotype (G)					
Nana	**3.36**	**2.14**		**3.46**	**2.29**
nana	**2.63**	**1.93**		**2.95**	**1.61**
SEM	**0.112**	**0.113**		**0.108**	**0.106**
Prob.	**	**		**	**
Strain (S)					
Brown	**2.63**	**1.98**		**3.20**	**1.56**
White	**3.36**	**2.09**		**3.22**	**2.34**
SEM	**0.103**	**0.112**		**0.105**	**0.114**
Prob.	**	**		**NS**	**
G*S					
Brown-Nana	**3.10**	**2.10**		**3.61**	**2.00**
Brown-nana	**2.15**	**1.85**		**2.78**	**1.12**
White-Nana	**3.62**	**2.17**		**3.31**	**2.57**
White-nana	**3.10**	**2.00**		**3.12**	**2.10**
SEM	**0.100**	**0.091**		**0.014**	**0.012**
Prob.	**	*		*	*

7PPI = 7 day post primary SRBCs injection 14PPI = 14 day post primary SRBCs injection
7PSI = 7 day post secondary SRBCs injection 14PSI = 14 day post secondary SRBCs injection
* P< 0.05 ** P< 0.01 NS= non-significance

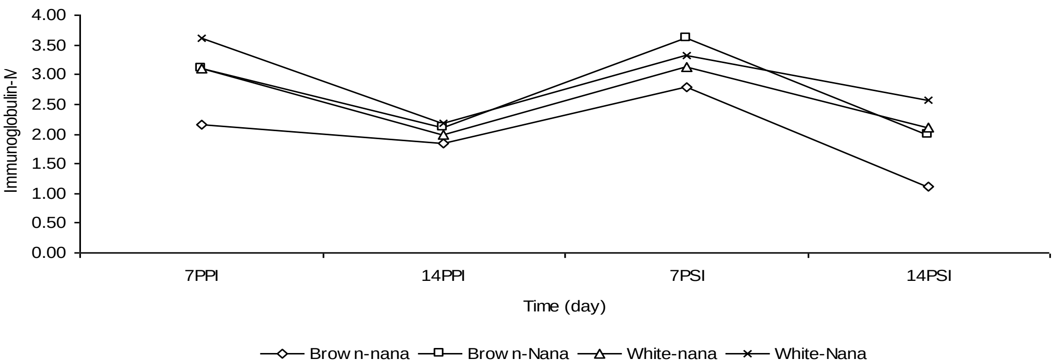

Fig. 3: Immunoglobulin-M of naked neck and normal feathered chicken got from different maternal lines.

Table 5: Immunoglobulin-G (IgG) of naked neck and normal feathered genotypes got from different maternal lines.

	Primary antibody response			Secondary antibody response	
	7PPI	14PPI		7PSI	14PSI
Genotype (G)					
Nana	2.39	1.69		3.42	1.70
nana	2.58	1.65		3.33	1.69
SEM	0.131	0.121		0.110	0.010
Prob.	NS	NS		NS	NS
Strain (S)					
Brown	2.62	1.36		2.98	2.04
White	2.36	1.98		3.78	1.35
SEM	0.120	0.115		0.130	0.142
Prob.	NS	*		**	**
G*S					
Brown-Nana	2.57	1.42		3.02	2.10
Brown-nana	2.66	1.29		2.93	1.98
White-Nana	2.20	1.95		3.82	1.30
White-nana	2.50	2.00		3.73	1.40
SEM	0.105	0.112		0.121	0.123
Prob.	NS	NS		NS	*

7PPI = 7 day post primary SRBCs injection 14PPI = 14 day post primary SRBCs injection
7PSI = 7 day post secondary SRBCs injection 14PSI = 14 day post secondary SRBCs injection
* P< 0.05 ** P< 0.01 NS= non-significance

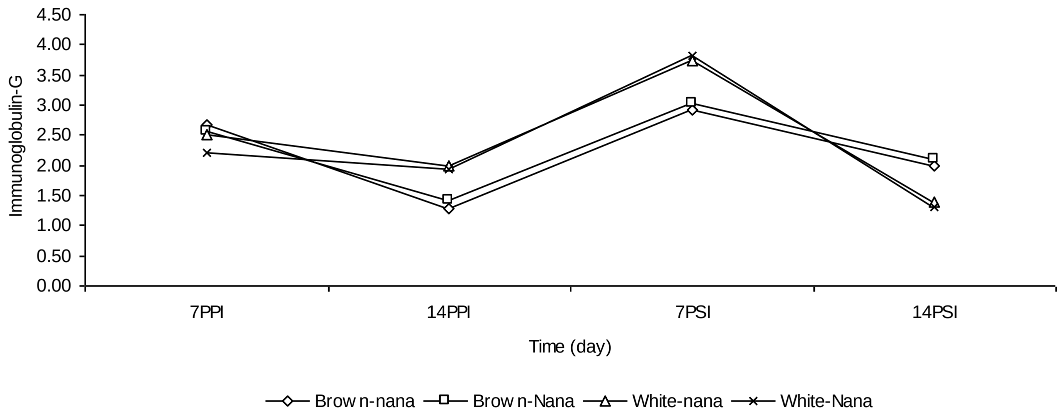

Fig. 4: Immunoglobulin-G of naked neck and normal feathered chicken got from different maternal lines.

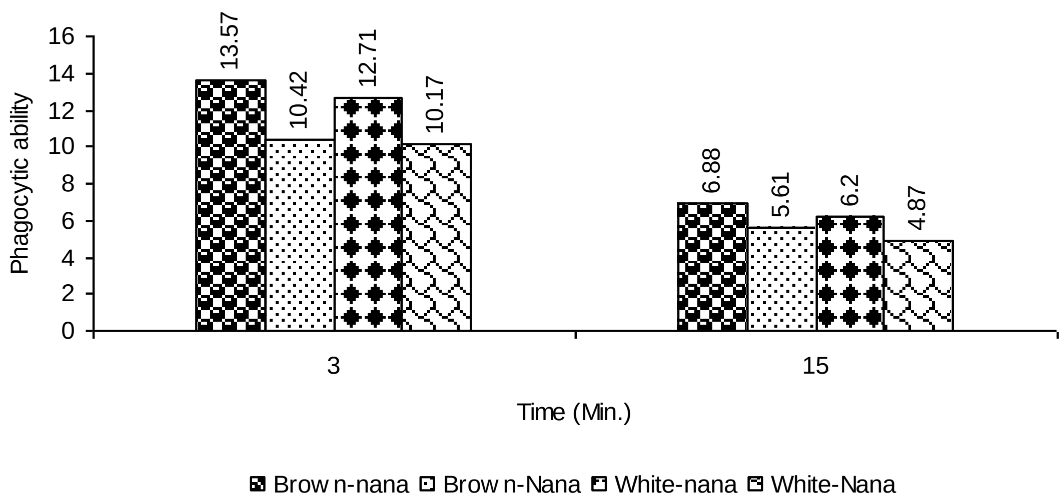

Fig.5: Phagocytic ability of naked neck and normal feathered genotypes got from different maternal lines.

REFERENCES

Abdel-Rahman, A.M. (1998). *The effect of naked neck gene (Na) on growth and carcass measurements in local Sharkasi males under Assiut conditions. Proceedings, 10th of the Egyptian Society of Anim. Prod., Assiut, Dec. 13-15.*

Alvarez M.T., Ledesma N., Tellez G., Molinari J.L. and Tato P. (2003). *Comparison of the immune response against Salmonella enterica serovar Gallinarum infection between naked neck chickens and a commercial chicken line. Avian Pathology, 32:193-203.*

Alvarez, M.T., Carrasco E., Tato P. and Tellez G. (2002a). *Comparison of production parameters and egg quality between laying hens indigenous naked neck (Na) and commercial Babcock B-380. Proceeding of 91st Poultry Science annual meeting, Newark, University of Delaware, USA, 11-14 August..*

Alvarez, M.T., Téllez, G. and Tato, P. (2002b). *Effect of broody hen on the immune response against Newcastle virus disease (NDV) vaccine of indigenous naked neck (Na) and normally feathered laying hens. Proceedings of 91st Poultry Science annual meeting, Newark, University of Delaware, USA, 11-14 Aug.*

Boa-Amponsem, K., Dunnington, E.A., Baker, K.S. and Siegel, P.B. (1999). *Diet and immunological memory of lines of White Leghorn chickens divergently selected for antibody response to sheep red blood cells. Poultry Science, 78:165-170.*

Bordas, A., Monnet, L.E. and Mérat, P. (1980). *Gene counu, performances ponte et efficacite alimentaire selon la temperature chez la poule. Ann. Genet. Sel. anim., 12 (4), 343-361.*

Cheema M.A., Qureshi M.A. and Havenstein G.B. (2003). *A comparison of the immune response of a 2001 commercial broiler with a 1957 randombred broiler strain when fed representative 1957 and 2001 broiler diets. Poultry Science, 82:1519-1529.*

Chen, C. F., A. Bordas, and M. Tixier-Boichard (2002). *Effect of high ambient temperature and naked neck genotype on egg production in purebred and crossbred dwarf brown-egg layers selected for improved clutch length.CD-ROMcommunication no. 18–08 in Proc. 7th World Congr. Genet. Appl. Livest. Prod., Montpellier, France.*

Chen, C. F., A. Bordas, D. Gourichon, and M. Tixier-Boichard (2004). *Effect of high ambient temperature and naked neck genotype on performance of dwarf brown-egg layers selected for improved clutch length. Br. Poult. Sci. 45:346–354.*

Cheng S. and Lamont S.J. (1988). *Genetic analysis of immunocompetence measures in a white Leghorn chicken line. Poultry Science, 67:989-995.*

Chao, C.H. and Lee, Y.P. (2001). *Relationship between reproductive performance and immunity in Taiwan country chickens. Poult. Sci. 80:535-540.*

Dorny, P., R. Baelmans, H. K. Parmentier, M. G. B. Nieuwland, F. Demey and D. Berkvens (2005). *Serum haemolytic complement levels in German Dahlem Red chickens are affect by three major genes (Naked neck, Dwarf, Frizzled) of tropical interest, Trop. Anim. Health Prod. 37:1-9.*

El-Safty, S.A., Ali, U.M. and Fathi. M.M. (2006). *Immunological parameters and laying performance of naked neck and normally feathered genotypes of chickens under winter conditions of Egypt. International Journal of Poultry Science 5:780-785.*

Fathi M.M., Galal A., El-Safty S.A. and Abdel-Fattah S.A. (2005). *Impact of naked neck and frizzle genes on cell-mediated immunity of chickens. Egyptian Poultry Science, 25:1055-1067.*

Fathi, M.M., Ali, R.A. and Qureshi, M.A. (2003). *Comparison of immune responses of inducible Nitric Oxide Synthase (iNOS) hyper-and hypo responsive genotypes of chickens. International Journal of Poultry Science, 2: 280-286.*

Galal, A. (2008). *Immunocompetance and some heamatological parameters of Naked neck and normally feathered chicken. J. Poult. Sci. 45:89-95.*

Galal, A. and M. M. Fathi (2001). *Improving carcassyield of chicken by introducing naked neck and frizzle genes under hot prevailing conditions. Egyptian Poult. Sci. 21:339-362.*

Haunshi S. (1999). *Studies on general immune competence in specialized chicken populations. M.V. Sc. Thesis submitted in Poultry Science, IVRI, Izatnagar, UP, India.*

Haunshi, S., D. Sharma, L. M. S. Nayal, D. P. Singh and R. V. Singh (2002). *Effect of naked neck (Na) and frizzle gene (F) on immune competence in chickens. Br. Poult. Sci. 43:28-32.*

Jianxia, W. (2002). *The effects of different feathering types in male broilers under normal and high environmental temperatures an performance and metabolism characteristics. Proceeding of 91st Poultry Science annual meeting, Newark, University of Delaware, USA, 11-14 Aug.*

Kaufman, J. (2008). *The avian MHC. In: Avian immunology (Ed. F. Davison, B. Kaspers and K. A. Schat). pp. 159-181 (London, Academic Press).*

Kougt M.H., McGrude E.D., Hargis B.M., Corrier D.E. and Deloach J.R. (1994). *Characterization of the pattern of inflammatory cell influx in chicks following the intraperitoneal administration of line Salmonella* *enteritidies-immune lymphokines. Poultry Science, 74:8-17.*

Kougt M.H., McGrude E.D., Hargis B.M., Corrier D.E. and Deloach J.R. (1995). *In vivo activation of heterophil function in chickens following injection with Salmonella enteritidies-immune lymphokines. Journal of Leukocyte Biology, 57:56-62.*

Lamont, S.J. (1986). *Genetic association of reticuloendothelial activity in chickens. Proc. 3rd world Congress on Genet. Applied to Livestock Production. Agricultural Communications, University of Nebraska, Lincoln, NB. Vol. XI: 643-647.*

Martin, A., Gross, W. b. and Siegel, P.B. (1989). *IgG and IgM responses in high and low antibody selected lines of chickens. J. hered. 80: 249-252.*

Nazmi, A. (2006). *Study on Immunogenetic Differences in Naked Neck and Normally Feathered Chickens. M. Sc. Thesis, Ain Shams University.*

Okada, I., and Yamamato, Y. (1987). *Immunocompetence and Marek's disease resistance in three pairs of chicken lines selected for different immunological characters. Poult. Sci. 66:769-773.*

Parmentier H.K., Yousif Abuzeid S., de Vries Reilingh G., Nieualand M.G.B. and Graat E.A.M. (2001). *Immune response and resistance to Eimeria acervuline of chickens divergently selected for antibody responses to sheep red blood cells. Poultry Science, 80:894-900.*

Parmentier, H.K., Nieuwland, M.G.B., Rijke, E., De Vries Reilingh, G. and Schrama, J.W. (1996). *Divergent antibody response to vaccines and divergent body weights of chickens lines selected for high and low humoral responsiveness to sheep red blood cells. Avian Disease, 40:634-644.*

Patra B.N., Bais R.K.S., Sharma D., Singh B.P., Prasad R.B. and Bhushan B. (2004) *Immunocompetence status of white plumage naked neck versus normally feathered broilers in tropical climates. Asian-Australian Journal of Animal Science, 14:560-563.*

Pinard, M.H., Van Arendonk, J.A.M., Nieuwland, M.G.B. and van der Zijpp, A.J. (1993). *Divergent selection for humoral responiveness in chickens: distribution and effect of major histocompatibility complex types. Genet. Sel. Evol. 25:191-203.*

Qureshi, M.A. and Taylor Jr. R.L. (1993). *Analysis of macrophage function in Rous sarcoma-induced tumor regressor and progressor 6.B congenic chickens. Vet. Immunol. Immunopathol. 37:285-294.*

Qureshi, M.A., and Miller, L. (1991). *Comparison of macrophage function in several commercial broiler genetic lines. Poultry Science, 70:2094-2101.*

Qureshi, M.A., Dietert, R.R. and Bacon, L.D. (1986). *Genetic variation in the recruitment and activation of chicken peritoneal macrophage. Proc. Soc. Exp. Biol. Med. 181:560-568.*

Qureshi, M.A., Dietert, R.R. and Bacon, L.D. (1988). *Chemotactic activity of chicken blood mononuclear leukocytes from 1515 –B- congenic lines to bacterially-derived chemoattractants. Vit. Immunol.Immunopathol, 19:351-360.*

Qureshi, M.A., Yu, M. and Saif, Y.M. (2000). *A novel "small round virus" inducing poult enteritis and mortality syndrome and associated immune alterations. Avian Disease, 44:275-283.*

Sarker, N., S. Yamaguchi, M. Nishibori, M. Tsudzuki, and Y. Yamamoto, (1999b). *Effect of divergent selection for serum IgM and IgG levels on the change in gene frequency of blood* *group systems and blood protein loci in chickens. Anim. Sci. J. 70:421–428.*

Sarker, N.,M. Tsudzuki, M. Nishibori, and Y. Yamamoto, (1999a). *Direct and correlated response to divergent selection for serum immunoglobulin M and G levels in chickens. Poultry Sci. 78:1–7.*

SAS Institute (2001). *SAS/STAT User's Guide: Statistics. Ver. 8.2, SAS Institute Inc., Cary, NC.*

Saxena, V.K., Singh, H., Pai, S.K., and Kumar, S. (1997). *Genetic studies on primary antibody response to sheep erythrocytes in guinea fowl. Br. Poult. Sci. 38:156-158.*

Singh, C.V., Kumar, D. and Singh, Y.P. (2001). *Potential usefulness of the plumage reducing naked neck (Na) gene in poultry production at normal and high ambient temperatures. World's Poult. Sci. J., 57:139-156.*

Steadham, E.M., and S. J. Lamont, (1993). *Gene complementation in biological crosses for humoral immune response to glutamic acid-alanine-tyrosine. Poultry Sci. 72:76–81.*

Van Der Zijpp, A.J., Frankena, K., Boneschanscher, J. And Nieuwland, M.G.B. (1983). *Genetic analysis of primary and secondary immune response in the chicken. Poultry Science, 62:565-572.*

Yamamoto, Y. and Glick, B. (1982). *A comparison of the immune response between two lines of chickens selected for differences in the weight of the bursa of Fabricius. Poult. Sci. 61:2129-2132.*

Younis, H., El-Sayed, M. and Saleh, K. (1998). *Genetic studies to improve productive performance of laying hybrids by single genes.1- Meat production from males of different genotypes. Proceedings, 10th of the Egyptian Society of Anim. Prod., Assiut, Dec. 13-15.*

الملخص العربي

الأداء الإنتاجى ومقاييس المقدرة المناعية للطيور عارية الرقبة وطبيعية التريش الناتجة من خطوط امهات مختلفة

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تم دراسة الاداء الانتاجى و المناعة المنسابة والمناعة الخلوية والمقدرة الالتهامية للدجاج عارى الرقبة وطبيعى التريش الناتج من خطوط امهات مختلفة (الهاى لاين البنى والابيض). تم قياس المناعة الخلوية عند عمر 30 اسبوع بأستخدام مادة PHA-P. عند عمر 32 و 34 اسبوع تم أخذ 20 طائر من كل تركيب وراثى داخل كل خط امى وحقنت بكرات دم الغنم الحمراء، وأخذت عينات الدم بعد 7 و 14 يوم من الحقنة الاولى وكذلك بعد الحقنة الثانية. تم قياس المقدرة الالتهامية بأستخدام الحبر الصينى عند 35 أسبوع من العمر. بالنسبة للأقلمة فقد شوهد أن طول العرف والداليات يزداد فى وجود العامل المسئول عن عرى الرقبة مما يصاحبه زيادة فى معدل الفقد الحرارى. بغض النظر عن نوع الامهات فأن وجود العامل الوراثى عرى الرقبة يؤدى الى زيادة عدد البيض الناتج وايضا زيادة حجم البيضة. بالنسبة للمقدرة المناعية فقد اوضحت النتائج ان الطيور الحاملة للعامل الوراثى عرى الرقبة انتجت اجسام مناعية ضد كرات دم الغنم الحمراء اعلى من نظيرتها طبيعية التريش. الطيور عارية الرقبة الناتجة من كلا الخطين الاميين لها مقدرة التهامية اعلى من نظيرتها طبيعية التريش.