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GENETIC SELECTION OF SOME IMMUNOLOGICAL TRAITS IN LOCAL EGYPTIAN CHICKEN STRAIN

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ABSTRACT

This work was carried out to investigate the effectiveness of selection for high immune response against Newcastle Disease Virus (NDV) vaccine in local Egyptian chicken strain (Dokki-4) for two generations. Two lines (selected and control) of Dokki-4 strain were used; in the selected line, chicks were selected according to its immune response against NDV vaccine. In the control line, chicks were randomly chosen. The population families were vaccinated against the common prevalent diseases according to the vaccination programs in the Sakha Animal Production Research Station, Kafr El-Sheikh. Results of selection for high immune response against NDV vaccine showed that; selection was efficient in native Egyptian chicken strain (Dokki-4) for increasing antibody titer levels in the high selected line when compared with the control line ($P < 0.05$) in two generations. Highly significant differences between generation and line were detected. Sex differences in immune response to NDV vaccine were significant ($P < 0.05$) for the overall averages a long all generations of selection. Female's titers were higher than those of corresponding males of the same line and generation. Realized response per generation in the selected line was 16.76 and 60.18 for male and 18.54 and 69.50 for female in the first and second generations respectively. This study conducted that the cumulative response for high antibody titers responses against NDV vaccine was 76.94 for male and 88.04 for female after two generations of selection. There were significant differences in livability percentage between high and control lines for antibody response; where high line had higher livability than the control line. The high selected line showed a higher survival rate post challenge, with significant difference ($P < 0.05$) than the control group in the first week (92.86 % and 86.11 %) and the second weeks (87.69 % and 77.42 %) of observing vaccinated birds. It could be concluded that, genetic selection for high antibody titers against NDV vaccine in Dokki-4 strain improved immune response at different ages under investigation with increasing livability percentages and disease resistance of the birds through two successive generations of selection.

INTRODUCTION

Chickens are susceptible to many infectious diseases. One of the most important of these is the viral disease known as Newcastle disease, which causes devastating losses in both commercial and village chickens. For several decades Egypt was suffered from repeated attacks of Newcastle disease virus causing high economic losses in poultry industry and vaccination was the only way to decrease the severity of losses from this disease.

The transmission of NDV occurs through newly introduced birds, selling or giving away sick birds, exposure to fecal and other excretions from infected birds and contact with contaminated feed, water, equipment and clothing **(Tu et al., 1998).** Genetic selection for improved immune responsiveness and disease resistance would improve effectiveness of vaccination and medication. Stocks of genetically improved resistance may receive lower doses of drugs, and highly attenuated vaccines and still have adequate protection against disease outbreaks.

The disease causes high economic losses due to high mortality, morbidity, stress, decreased egg production and hatchability **(Alexander, 2000).** Immune response is an indicator for disease resistance. The ability of the animal to respond immunologically controlled by polygenes that affect the integrity of the immune system. Quantitative geneticists have traditionally used estimates of heritability to describe the genetic control of inheritance of a particular trait **(El-Adel, 2005).**

Sivaraman and Kumar (2013) investigated that breeding for better immunocompetence status by selection index could lead to better health status in term of improved survival rate in broiler chicken over the generation of selection and further suggested that index selection for more number of generations coupled with economic traits would seem to be a viable option for development of disease resistant chicken lines. The best method for diagnosis of the disease is isolation and characterization of agent. Serological tests are useful tools in diagnosis of infection. Hemagglutination inhibition (HI) test is the most commonly used test for detection of immune response in affected birds **(Alexandr and Senne, 2008)**.

The main objectives of this study were to investigate the effectiveness of selection for high immune response against NDV vaccine in local Egyptian chicken strain (Dokki-4) for two successive generations.

MATERIALS AND METHODS

This study was carried out at Sakha Animal Production Research Station, Kafr El-Sheikh Governorate, Agricultural Research Center, Ministry of Agriculture; Egypt. This experiment was conducted on a local Egyptian chicken strain (Dokki-4) in two successive generations from July 2012 to December 2014 (Table 1).

Management of hatched chicks:

Chicks were wing banded according to their sire families and weighted at hatch. Birds were vaccinated against Marek's and moved to brooding pens. Chicks were subjected to continuous lighting during the first 12 weeks of age. Then natural light was decreased to 14 hours/ day for one month. Afterwards, lighting period was increased by one hour/ month to reach 16 hours (**Chao and Lee, 2001**). Feed and water were allowed ad libitum throughout the experiment and the chicks were fed a starter ration (19 % CP and 2800 K. cal) from hatch to 8 weeks of age, a growing ration (15% CP and 2700 K. cal) from 9 to 20 weeks of age and then fed a layer ration (16% CP and 2700 Kcal) up to 56 weeks of age.

All chicks were vaccinated against prevalent diseases. The pullets were housed in individual laying cages at 20 weeks of age. Productive and reproductive traits of the chickens were recorded.

Vaccination and immunization:

All chicks were vaccinated against prevalent diseases. Hitchener B1 was used at 7^{th} day of age followed by Lasota at 15^{th} and 30^{th} days of age and then Lasota was used every two weeks. Levels of antibody titer were measured to evaluate the response of birds after

injection with 0.5 ml inactivated oil adjuvant Newcastle Disease Virus vaccine. The immunization of birds was done at 21 and 42 days of age.

Blood samples:

Blood samples were collected by slaughtering a random sample of birds within each sire family at one day old to determine maternal immunity and from wing veins at 21, 35 and 42 days of age for each individual within each sire family, in separate labeled centrifuge tubes. Collected blood was left to clot at 37 ^{o}C for 30 minutes then kept at 4 ^{o}C. Clotted blood samples were centrifuged at 3000 r.p.m. for 15 minutes to obtain clear serum. Serum samples were kept in small labeled sterile tubes and stored at -20 ^{o}C, **(Stoot and Fellab, 1983)**.

Hemagglutination inhibition test (HI):

The test was carried out according to the standard procedures described by **Majiagble and Hitchner (1977)**. The basic components of HI test were Hemagglutination antigen (HA), the serum in double fold serial dilutions and 1% (v/v) chicken RBC suspension.

Studied traits:

Immune response: antibody titers (HI titers) were measured for each individual at day of hatch and at 21, 35 and 42 days of age.

The livability percentage:

The livability % was calculated during the first 12 weeks of age in each generation as following: The livability % = (No. of survive chicks / No. of hatched chicks) X 100.

Challenge procedures:

From the second generation (the high selected line and the control one), 336 chicks were taken. Each line was distributed into two treatments for vaccination against Newcastle Disease Virus (one of them vaccinated and other non-vaccinated). Chicks of each group were brooder in conventional floor brooder far from the farm and that were kept under strict hygienic measures to avoid exposure to infection.

Chicks of the vaccinated and non-vaccinated groups were challenged via intramuscular injection at 60 days of age with 0.5 ml of diluted local velogenic ND **(Reda and Sheble 1976)** kindly provided by Newcastle Disease Vaccine Department, Serum and Vaccine Research Institute, Abbasia, Cairo, Egypt. Birds were kept under daily observation for 14 days. Dead birds during the observation period and all survivors at the end of the observation period were recorded.

Statistical analysis:

Data of growth traits were analyzed using fixed models **SAS institute (1988)**:

$$Y_{ijkl} = \mu + G_i + L_j + S_k + (GL)_{ij} + (GS)_{ik} + (LS)_{jk} + (GLS)_{ijk} + e_{ijkl}$$

Where: Y_{ijk}= an observations, μ = overall mean, G_i = the fixed effect of i^{th} generation, L_j = the fixed effect of j^{th} line, $(GL)_{ij}$ = effect of the interaction between generation and line, S_k = the fixed effect of k^{th} sex, and $(GL)_{ij}$, $(GS)_{ik}$, $(LS)_{jk}$ and $(GLS)_{ijk}$ = effects of the interactions between the three factors studied, and e_{ijkl} = random error.

Significant differences among means were tested by **Duncan Test (1955)**.

The realized genetic gain per generation was estimated as a deviation of the selected

line mean from the control line mean according to the following equation

$$\mathbf{R_t = (S_t - S_{t-1}) - (C_t - C_{t-1})}$$

Where: R_t realized gain due to selection in the t^{th} generation and S and C averages performance of the selected and the control populations **(Guill and Washburn, 1974).**

Actual selection differential was calculated as the difference between average of the selected parent for certain trait and the average of their mean of population **(Falconer, 1989)**.

Standardized selection differential (Selection intensity) was calculated as;

Selection intensity (i) = S / Sd

Where S = the selection differential, Sd = the standard deviation.

Realized heritability estimates of the selected trait were obtained for each generation as the ratio of realized response to selection differential **(Falconer, 1989).**

Realized h^2 = R / S

= Response to selection / selection differential

= (Average of the progeny of selected parents – average of population from which the parents were selected) / (Average of individual selected as parents – population mean).

Selection density (v) calculated by the following equation (**Falconer, 1989);**

V= No. of selected parents/ No. of all population

Selection differential(S): was calculated as the difference between average of the selected parents for a certain traits and the average of mean of population.

The expected response to selection (R): was calculated according to the general equation **(Falconer, 1989).**

R= Selection differential (S) x heritability (h^2).

Table (1): Number of males and females used in each generation with their proportions and selection intensity.

Gen.	line	No. of tested birds		No. of selected birds		% of selected birds		Selection intensity	
		M	F	M	F	M	F	M	F
Base	High	320	460	42	146	13.12	31.73	0.92	0.91
	Cont.	18	150	--	--	--	--	--	--
1st	High	86	210	13	66	15.11	31.42	1.55	0.92
	Cont.	15	108	--	--	--	--	--	--
2nd	High	79	196	12	72	15.18	36.73	1.78	0.97
	Cont.	16	112	--	--	--	--	--	--

Gen = generation; 1st= First generation; 2nd= Second generation;
High =high selected line; Cont. = Control line; M=male; F=Female

Table (2): Antibody responses to NDV vaccine at different ages of Dokki-4 chicken strain.

Gen.	Line	Age at vaccination (days)				
		Maternal Immunity	21st day of age	35th day of age	42nd day of age	Overall mean
		antibody titers ± SE				
Base	High	63.32±0.34	30.20±0.21	71.20±0.41	54.50±0.15	62.31±0.08
	Cont.	63.11±0.22	30.25±0.31	70.67±0.17	54.10±0.24	62.01±0.62
Overall mean of G0		63.29±0.25^{C}	30.00±0.36^{C}	70.55±0.41^{C}	54.32±0.23^{C}	
First	High	74.67±0.42a	35.08±0.31^{a}	90.45±0.16^{a}	72.88±0.85^{a}	75.27±0.42^{a}
	Cont.	65.87±0.19^{b}	31.29±0.63^{b}	75.13±0.47^{b}	56.44±0.39^{b}	63.92±0.52^{b}
Overall mean of G1		69.02±0.63^{B}	33.18±0.52^{B}	82.38±0.68^{B}	64.66±0.53^{B}	
Second	High	78.80±018^{a}	41.91±0.12^{a}	175.21±0.11^{a}	101.04.±0.17^{a}	106.51±0.13^{a}
	Cont.	68.32±0.63^{b}	36.56±0.13^{b}	86.27±0.37^{b}	51.44±0.16^{b}	67.64±0.22^{b}
Overall mean of G2		72.94±0.74^{A}	38.23±0.41^{A}	129.97±0.26^{A}	76.16±0.62^{A}	

A, B and C different letters were significant generation within the same column (P< 0.05).
a, b and c different letters were significant line within the same column (P< 0.05).
Gen. = generation; G0= Base generation; G1= First generation; G2= Second generation;
Cont. = Control line; High =high selected line.

Table (3): Antibody responses against NDV vaccine at 21, 35 and 42 days of age of males and females Dokki-4 chicken strain.

Gen.	Line	Maternal Immunity		21st day of age		35th day of age		42nd day of age		Overall mean	
		antibody titers ± SE									
		Male	female	Male	female	Male	female	Male	female	Male	female
Base	High	61.22 ±0.63	65.14 ±0.26	32.96 ±0.71	33.99 ±0.29	70.14 ±0.41	71.63 ±0.65	52.96 ±0.46	56.74 ±0.71	61.25^{b} ±0.18	64.11^{a} ±0.27
	Cont.	60.54 ±0.61	64.33 ±0.71	29.14 ±0.48	31.54 ±0.63	68.36 ±0.32	70.56 ±0.26	53.22 ±0.17	55.52 ±0.37	60.23^{b} ±0.16	63.32^{a} ±0.32
Overall mean of G0		63.29 ± 0.25^{C}		30.00 ± 0.36^{C}		70.55 ± 0.41^{C}		54.32 ± 0.23^{C}			
First	High	68.36 ±0.15	70.16 ±0.32	34.12 ±0.41	36.10 ±0.18	89.45 ±0.21	92.26 ±0.24	64.63 ±0.19	66.65 ±0.45	71.25^{b} ±0.36	73.51^{a} ±0.47
	Cont.	67.99 ±0.13	71.45 ±0.32	32.65 ±0.18	33.01 ±0.14	70.91 ±0.37	72.65 ±0.11	56.69 ±0.18	54.33 ±0.52	63.75^{b} ±0.25	65.11^{a} ±0.65
Overall mean of G1		69.02 ± 0.63^{B}		33.18 ± 0.52^{B}		81.38 ± 0.68^{B}		63.66 ± 0.53^{B}			
Second	High	71.95 ±0.09	76.25 ±0.14	41.21 ±0.81	40.32 ±0.91	165.26 ±11.25	178.25 ±0.91	77.98 ±0.33	81.26 ±0.32	96.99^{b} ±0.45	101.24^{a} ±0.19
	Cont.	64.89 ±0.07	68.74 ±0.25	33.41 ±016	32.65 ±0.41	86.54 ±0.42	89.14 ±0.11	61.89 ±0.22	64.85 ±0.22	68.75^{b} ±0.41	70.77^{a} ±0.34
Overall mean of G2		72.44 ± 0.74^{A}		38.23 ± 0.41^{A}		129.97 ± 0.26^{A}		74.16 ± 0.62^{A}			
Effect of line	High	66.56^{x} ±0.11	70.32^{x} ±0.23	36.47^{x} ±0.44	36.71^{x} ±0.12	108.22^{x} ±0.88	113.36^{x} ±0.42	64.98^{x} ±0.44	68.11^{x} ±0.09	76.13^{b} ±0.21	79.25^{a} ±0.13
	Cont.	63.76^{y} ±0.16	67.71^{y} ±0.34	31.34^{y} ±0.57	32.01^{y} ±0.23	74.62^{y} ±0.55	77.54^{y} ±0.66	56.58^{y} ±0.49	57.98^{y} ±0.31	63.51^{b} ±0.34	65.75^{a} ±0.11

A, B and C different letters were significant generation within the same column ($P< 0.05$).

a, b and c different letters were significant sex within the same column ($P< 0.05$).

X and Y different letters were significant line within the same column ($P< 0.05$).

Gen. = generation; G0= Base generation; G1= First generation; G2= Second generation;

Cont. = Control line; High =high selected line.

Table (4): Antibody titer responses against NDV vaccine in Dokki-4 chicken strain as well as selection differential (S), Selection density (V), Realized response (R) and expected response (ER) for selected and control lines of selection after two week of injection.

Gen.	Selected line X± SE		Control line X± SE		Selection differential (S)		Selection density (V)		Realized response (R)		Expected response (ER)	
	M	F	M	F	M	F	M	F	M	F	M	F
Base	70.14±0.81	71.63±0.19	69.36±0.67	70.56±0.28	6.68	6.11					1.67	1.52
First	89.45±0.76	92.26±0.74	70.91±0.43	72.65±0.46	21.08	20.05	15.11	31.42	16.76	18.54	5.27	5.01
Second	165.26±0.21	178.25±0.39	86.54±0.62	89.14±0.23	83.11	81.54	15.18	36.73	60.18	69.50	20.78	20.37
CR									76.94	88.04	27.72	26.90

Gen = generation; CR = Cumulative response; .M=male; F=female

Table (5): Livability percentage in base, first and second generations of selection for high antibody titers responses with different vaccination programs against NDV vaccine in Dokki-4 chicken strain

Gen.	Line	Livability %
Base	high	±0.236^{b}٩٠,٧٨
	Cont.	89.11±0.126^{b}
First	high	±0.428^{a}٩٦,٣٧
	Cont.	±0.089^{c}٨٧,٧٩
Second	high	±0.366^{a}٩٥,١١
	Cont.	±0.09^{b}٩١,٢٠

A, b… different letters were significant within the same column (P< 0.05).

Gen=generation; High =high selected line; Cont. =control line.

Table (6): Results post challenging of the second generation of selection for antibody titer responses against NDV vaccine and the control line of Dokki-4 chicken strain.

Group	Challenged vaccinated birds						Group	Challenged non-vaccinated birds					
	The first week			The second week				The first week			The second week		
	Dead	Alive	total	Dead	Alive	total		Dead	Alive	total	Dead	A live	total
high	10	130	140	16	114	130	high	68	62	130	62	0	62
Cont.	5	31	36	7	24	31	Cont.	21	7	30	7	0	7
Total	15	161	176	24	138	161	Total	89	69	160	69	0	69

High =high selected line; Cont. =control line.

RESULTS AND DISCUSSION

Least square means ± their standard error for serum antibody levels against Newcastle disease virus vaccine at different ages (hatch, 21, 35 and 42 days) with their overall average across two generations of selection for high antibody titers were presented in table 2.

In the base generation, least square means (LSM) for antibody titers were increased gradually due to vaccination. Respectively, they were 63.29, 30.20, 71.20 and 44.50 at hatch, 21, 35 and 42 days of age with an overall average of 52.31 for selected line while, they were 63.29, 29.99, 70.67 and 43.10 with an overall average of 51.01 for control line. The respective response had the same trend at the first generation of selection; they were 74.67, 35.08, 90.45 and 62.88 with an overall average of 65.27 for high selected line while, they were 65.87, 31.29, 75.13 and 46.44 with an overall average of 53.92 for control line. In the second generation, the titers were 78.80, 41.91, 175.21 and 91.04 with an overall average of 96.51 for high selected line while, they were 68.32, 36.56, 86.27 and 41.44 with an overall average of 57.64 for control line.

Increased immune responsiveness ($P<0.05$) to specific disease antigens in selected high line, was also noticed by **Liu et al. (1995) and Mandour et al. (2007).** By comparing the total averages between the high and control lines of the second generation of selection; results revealed significant differences ($p<0.05$) between the high vaccinated line (106.51) and the control vaccinated ones (67.64) (Table 3). These results agree with result of **Abdel Ghany and Mandour (2005)** who reported that, the selection was efficient in native Egyptian chickens for increasing antibody titer levels in the high line or reducing antibody titer levels in the low line when compared with the control line. Also, **El-Adel (2005)** concluded that, selection for high immune response to NDV significantly improved antibody titers at different ages under investigation in Inshas strain. Therefore, the change in the immune response to NDV was possible through selection. The same results were reported by **Helal (1999)** and **Mandour et al. (2003)** in Japanese quails being divergently selected for high and low antibody titers to NDV vaccine.

The differences between means of the total average for antibody titers in successive generations for the selected lines were utilized to measure the response to selection. Differences between the base, first and second generations were statistically significant ($P<0.05$). Little environmental variation was observed among generations, evidenced by non-significant differences between the controls of base, first and second generations ($P > 0.05$).

Least square means and their standard errors of male and female progenies tested in each generation at different ages and their overall averages were listed in table 3. Sex differences in immune response to NDV vaccine were significant ($P < 0.05$) for the overall averages a long all generations of selection. Female's titers were higher than those of corresponding males of the same generation.

Females showed higher antibody titers than males ($P < 0.05$) in the base, first and second generations at hatch and at 21, 35 and 42 days of age, as well as, the overall average for the high selected line. Also; the control line showed the same trend at hatch and at 21, 35 and 42 days of age (Table 3).

Although **Saleh et al. (1999) and Bovenhuis et al. (2002)** found that there were significant differences ($P < 0.05$) between

males and females in antibody titers to NDV vaccine, yet the non significant effect of sex on antibody response to Newcastle disease virus vaccines was reported by **Kaiser et al, (1998); Helal (1999)** and **El-Adel (2005)**.

Direct response of selection for high antibody titers against NDV vaccine was presented in table 4. The means for high antibody titers responses against NDV vaccine for the male in base, first and second generations were 70.14, 89.45 and 165.26 and 71.63, 92.26 and were 178.25 for female in selected line. While in control line the values for male were 69.36, 70.91 and 86.54, and for female were 70.56, 72.65 and 89.14, respectively.

We can conclude that the chickens of the selected line in the 1st and 2nd generations of high antibody titers response against NDV vaccine were significantly ($p \leq 0.001$) more than those of the control line. Moreover, highly significant differences between generation and line were detected. The genetic response per generation in the selected trait was 16.76 and 60.18 for male and 18.54 and 69.50 for female in the first and second generations, respectively. This result conducted that the cumulative response for high antibody titers responses against NDV vaccine was 76.94 for male and 88.04 for female after two generations of selection.

The selection differential values were 6.68, 21.08 and 83.11 for male and 6.11, 20.05 and 81.54 for female in the base, first and second generations, respectively. However, the density of selection for this trait was 15.11 and 8.16 for male and 31.42 and 30.10 for female in the first and second generations. Expected responses for the male were 1.67, 5.27 and 20.78 and for female were 1.52, 5.01 and 20.38 in base, first and second generations, respectively. This result conducted that the cumulative response for high antibody titers responses against NDV vaccine was 27.72 for male and 26.91 for female after two generations of selection (Table 4). Generally, the results of the present study cleared that the realized response to improve high antibody titer responses against NDV vaccine was higher than the expected genetic gain.

The livability percentage estimated from the hatch to twelve weeks of age for the base, first and second generations of the high and the control lines were presented in table 5. The high selected line in the first generation showed a higher percentage of livability (96.37 %) than the base and the second generations (95.11 % and 90.78 %); respectively. The control vaccinated group of the second generation showed a higher percentage of livability (91.20 %) than the control lines of the base and the first generations (89.11 and 87.79 %); respectively.

Livability percentage in the second generation was higher in the high selected line (95.11 %) than the control line (91.20 %). These results indicate that selection for high antibody titer can be associated with improvement the livability of Dokki-4 breed throughout the first twelve weeks of age. This finding agree with the finding of **El Damarwi (1999)** who reported that, there were significant differences in livability percentage between high and low lines for antibody response; where the high line had higher livability percentage than the low line. In addition, **El-Adel (2005)** reported that, selection and vaccination increased livability percentage (> 91.34) of Inshas strain. Also, **Mandour et al. (2007)** reported that, vaccination against IBDV significantly enhanced viability % (low mortality) up to 12 weeks of age.

Disease resistance to challenge:

The observed number of the dead and live birds with the percentages of the live one

for the high selected line and control groups post challenge (either vaccinated or non-vaccinated) with virulent strain of the Newcastle disease virus were assigned into first and second week of observation (Table 6).

The high selected line showed a higher survival rate with significant difference ($P < 0.05$) than the control group in the first (92.86 % and 86.11 %) and the second weeks (87.69 % and 77.42 %) of observation for vaccinated birds. These results were in agreement with result of **Yonash et al. (2001)** who confirmed the genetic association between immune response and disease resistance and **Cotter et al, (1992)** who found significant differences in mortality between high and low antibody response lines being challenged at three days with Staphylococcus aureus. These results indicated that improved disease resistance might be achieved via selection for immune response to NDV vaccine after several generations of selection **(El-Damarawi, 1999).** These results disagree with the finding of **El-Adel (2005)** who reported that, the high selected line after challenge with virulent strain of NDV showed a higher survival rate with non significant difference ($P > 0.05$) than the control group in the first (94.50 % vs 90 %) and the second weeks (87.50 % vs 83.335 %) of observation for vaccinated birds.

CONCLUSION

It could be concluded that, genetic selection for high antibody titers against NDV vaccine in Dokki-4 strain improved immune response at different ages under investigation with increasing livability percentages and disease resistance of the birds through two successive generations of selection.

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الملخص العربي

الانتخاب الوراثي لبعض الصفات المناعية في سلالة من الدجاج المصري المحلي

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أجريت هذه الدراسة بمحطة بحوث الإنتاج الحيواني بسخا – كفر الشيخ – مركز البحوث الزراعية على سلالة من الدجاج المصري المحلي (دقي-٤) على مدى جيلين متتالين خلال الفترة من شهر يوليو ٢٠١٢ حتى شهر ديسمبر ٢٠١٤ لبحث تأثير الانتخاب للاستجابة المناعية العالية ضد لقاح فيروس مرض النيوكاسل على مقاومة المرض ونسبة الحيوية (القدرة على المعايشة) خلال أول ١٢ أسبوع من العمر حيث تم استخدام خطين من سلالة دقي- ٤ (الخط العالي المنتخب وخط الضبط). ففي الخط المنتخب كانت الكتاكيت تنتخب طبقاً لأعلى استجابة مناعية ضد لقاح فيروس مرض النيوكاسل بينما في خط الضبط تم اختيار الكتاكيت عشوائياً. وخلال هذه الدراسة تم التحصين ضد معظم الأمراض الموجودة طبقاً لبرنامج التحصين بمحطة بحوث الإنتاج الحيواني بسخا– كفر الشيخ.

وكانت أهم النتائج التي سجلت كالتالي :

- كان الانتخاب مؤثراً في سلالة دقي-٤ وذلك بزيادة مستوى الأجسام المناعية في الخط العالي بالمقارنة بخط الضبط على مدى جيلين متتالين، حيث أوضحت الدراسة فروقا معنوية بين الأجيال والخطوط. وأوضحت النتائج اختلافاً معنوياً واضحاً في مستوى الأجسام المناعية بين الخط العالي(78.80 و 41.91 و175.21 و 91.04بمتوسط كلى 96.51) وخط الضبط (68.32 و36.56 و86.27 و ٤١,٤٤ بمتوسط كلى ٥٧,٦٤) في الجيل الثاني عند الفقس و٢١ و٣٥ و٤٢ يوم من العمر.
- كانت هناك فروقا معنوية بالنسبة للجنس بين المتوسطات خلال أجيال الانتخاب حيث سجلت الإناث أعلى استجابة مناعية عن الذكور لنفس الجيل والخط . وكانت الاستجابة الوراثية بالجيل للخط المنتخب ١٦,٧٦ و ٦٠,١٨ للذكور و ١٨,٥٤ و ٦٩,٥٠ للإناث في الجيل الأول والثاني على الترتيب.
- وسجلت الاستجابة التراكمية لأعلى استجابة مناعية ضد لقاح فيروس مرض النيوكاسل ٧٦,٩٤ بالنسبة للذكور و ٨٨,٠٤ بالنسبة للإناث على مدى جيلين متتالين.

- وأظهرت الدراسة فروقا معنوية لنسبة الحيوية (القدرة على المعايشة) خلال أول ١٢ أسبوع من العمر بين الخط العالي وخط الضبط حيث كانت نسبة الحيوية أعلى في الخط العالي المنتخب (95.11%) عن نظيرتها في خط الضبط (91.20%) فى الجيل الثانى.
- كما كان الخط المنتخب أعلى في معدل مقاومة العدوى الأصطناعية بفيروس النيوكاسل الضارى مع وجود فروق معنوية عن مجموعة الضبط في الأسبوع الأول (٩٢,٨٦ % و ٨٦,١١% على الترتيب) والأسبوع الثاني (٨٧,٦٩% و ٧٢,٤٢% على الترتيب) من الملاحظة للطيور المحصنة .

من هذه النتائج نستخلص أنه يمكن تحسين الحالة المناعية فى سلالة دقى-٤ ضد مرض النيوكاسل خلال الانتخاب الوراثي للأجسام المناعية العالية ضد لقاح فيروس مرض النيوكاسل على مدى جيلين متتالين من الانتخاب حيث يحفز الأستجابة المناعية العالية فى الأعمار المختلفة ويزيد من حيوية الطائر وقدرته على المعايشة و مقاومته للمرض خلال أول ١٢ أسبوع من العمر.