Genetic Correlation of exterior and interior Quality Characteristics in White Quail Egg

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Abstract

This study was conducted in poultry field of the Department of Animal Production - College of Agriculture - Kirkuk University to study phenotype correlation of some interior and exterior specific egg characteristics of white Japanese quail. 60 white quails were used, distributed after sexual maturity to 30 families (male and female per family) placed in vertical battery cages and bred for 12 weeks. Eggs were collected 4 times during 4 periods (every 3 weeks) to evaluate the interior and exterior specific characteristics of the egg. The results of the statistical analysis indicated a positive and significant genetic correlation of egg weight with egg length, egg width, egg surface area and shell weight. Also, there was a significant correlation between egg width and egg shape index, while shell thickness did not show any genetic correlation among all the exterior characteristics of the egg. About the genetic correlations between interior egg quality, the results of the statistical analysis indicated that there was a positive and significant genetic correlation for Albumin high with Albumin index, Haugh unit, yolk height and yolk index, as well as indicated a positive and significant genetic correlation between albumin index and Haugh unit. As for yolk index, the results indicated no genetic correlation between it and yolk weight, yolk ratio and yolk to albumin ratio. As for the genetic correlations between interior and exterior characteristics of the egg, the results indicated no genetic correlation with egg shape index and interior egg characteristics, as well as between Albumin height and all the exterior egg characteristics, while a positive and significantly genetic correlation observed between yolk index and shell thickness. We conclude from this study that there are some genetic correlations between exterior and interior quality traits of the egg, which helps us to understanding the characteristics of specific egg to improve it and increase fertility.

Keywords: *Genetic, correlation, egg, interior, exterior, and quail.*

Introduction

Japanese quail is considered one of the small birds whereas the males are smaller than the females so the weight of wild birds is 90-100 g, while of domestic quail birds about 100-140 g (Minvielle, 2004). The plumage color of wild quail is mainly dark brown but the domestication and selection processes have resulted to appearance of many variety of different plumage colors (Tavaniello, 2013). Some genetic studies (Robert et al., 1987; Somes et al., 1979; Somes et al. 1984) indicated that the white color of quail is caused by a genetic mutation as a recessive trait that was given the symbol (wh), and the birds carrying this gene are white stained with some feathers on head, tail, back, and dorsal pelvis, while chest and ventral surface are completely white. Quails are preferred birds in scientific research because of their low maintenance costs for the small body, early sexual maturity, short generation period, and high egg production (Kayang et al. 2004). Females reach sexual maturity at the age of 35-42 d and egg production about 300 eggs per year, and the period of egg hatching is 16-18 days (Sezer, 2007). However, one of the determinants of the spread of quail breeding is the low fertility and hatchability compared to chickens (Mizutani, 2003), which encourages interest to studying the egg quality traits and the process of hatching to expanding its breeding. In a study conducted by Al-Obaidi et al., (2007) on the specific egg traits of brown and white Japanese quail, it was concluded that there were no significant differences in specific egg characteristics of the two variety studied, Also, there were no statistical differences between them in chemical properties of egg yolk and egg albumin, which showed great similarity between them, that is, Japanese quail, and laying hens. Egg shell is one of the most important exterior characteristics of egg (Narushin & Romanov, 2002) and some studies have indicated a positive and significant genetic correlation of egg weight with shell thickness on one hand and shell weight on the other (Stadelman, 1986). Other studies indicated that shell thickness was significantly affects on shell stiffness (Thompson et al., 1981; Buss, 1982) while Sezer, (2006) indicated that there was high and positive significant correlation between Specific gravity and shell thickness, shell weight and), Unit surface shell weight ranging between 0.56 to 0.82, while the correlations were negative and not significant with characteristics of egg weight ranged between -0.01 and 0.08. In view of the importance of studying the exterior and interior quality traits of quail eggs to improve hatching process and low fertility compared with laying hens, the experiment conducted to determine phenotypic correlations of interior and exterior of egg characteristics.

Material and Methods:

Experimental conditions and studied characteristics: This study was conducted in the poultry field of Department of Animal Production - College of Agriculture - University of Kirkuk, 60 quail birds were used in the experiment, distributed after sexual maturity into 30 families (male and female per family) placed in vertical battery cages, each battery contains 5 floors and each floor containing 3 cages with dimensions of one cage (30 x 25 x 35 cm) length, width and height respectively, water and fed were ad libitum and lighting hours was 16 h/day duration of experiment using 60-watt lamps. They were bred for 12 weeks and at end of every 3 weeks eggs were collected from families to determined exterior quality traits which included egg weight (EW), egg length (EL), egg breadth (EB), shape index (SI), specific gravity (SG), egg surface area (ESA), Unit surface shell weight (U), shell weight (SW), shell thickness (ST) and shell ratio (SR). The traits of the interior egg were also studied, which included albumin height (AH), albumin Length (AL), albumin index (AI), albumin weight (AW), albumin ratio (AR), Haugh unit (HU), yolk height (YH), yolk Length (YL), yolk index (YI), yolk weight (YW), yolk ratio (YR) and yolk to albumin ratio (Y:A R). Birds were fed to diet with a CP of 24.37% and metabolism energy of 2976 kcal/kg from day to 30 days old, then they were fed to diet with a CP level of 20% and metabolism energy of 2850 kcal/kg until end of the experiment.

Statistical analysis: The results were statistically analyzed for the experiment data according to the linear model using statistical program (SAS, 2005), and the simple correlation coefficients between the interior and exterior characteristics of egg were evaluated according by following equation:

$$r = \frac{n\left(\sum xy\right)-\left(\sum x\right)\left(\sum y\right)}{\sqrt{n\left(\sum x^2\right)-\left(\sum x\right)^2}\cdot\sqrt{n\left(\sum y^2\right)-\left(\sum y\right)^2}}$$

Results and Discussion:

Table 1 shows some statistical measures of interior and exterior egg specific traits of white Japanese quail. The table shows the averages of exterior specific traits of egg including EW, EL, EB, SI, SG, ESA, U, SW, ST and SR that was 10.81 g, 31.82 mm, 24.84 mm, 78.13%, 1.10, 23.84 cm2, 61.21 mg/cm2, 1.45 g, 0.31 mm, 13.53%, respectively. While the table indicates averages of interior specific traits of egg, including AH, AL, AI, AW, AR, HU, YH, YL, YI, YW, YR and Y;A ratio which amounted to 3.07 mm, 44.64 mm, 6.93%, 5.62 g, 51.98%, 81.13, 10.27 mm, 26.08 mm, 39.51%, 3.73 g, 34.84%, 66.70%, respectively.

Table 1: Descriptive statistics of egg quality characteristics of white Japanese quail[1]

Characteristics	Mean	SE[2]	Min.	Max.	CV[3]
Exterior egg quality characteristics					
Egg weight (g)	10.81	0.09	8.39	13.00	10.10
Egg length (mm)	31.82	0.12	26.70	35.10	4.29
Egg breadth (mm)	24.84	0.07	22.40	26.80	3.50
Shape Index (%)	78.13	0.24	71.79	88.38	3.43
Specific gravity	1.10	0.0008	1.08	1.14	0.81
Egg Surface Area (cm^2)	23.84	0.16	19.71	27.41	7.60
Unit surface shell weight (mg/cm^2)	61.21	0.61	47.23	90.21	10.92
Shell weight (g)	1.45	0.01	1.07	2.19	12.92
Shell thickness (mm)	0.31	0.005	0.20	0.40	20.87
Shell ratio (%)	13.53	0.13	10.21	19.80	11.26
Interior egg quality characteristics					
Albumen height (mm)	3.07	0.05	1.83	4.60	21.17
Albumen length (mm)	44.64	0.36	32.60	58.40	8.84
Albumen index (%)	6.93	0.14	4.34	10.89	22.7
Albumen weight (g)	5.62	0.05	4.20	7.15	11.47

Albumen ratio (%)	51.98	0.23	43.97	56.61	5.04
Haugh unit	81.13	0.43	68.50	91.25	5.90
Yolk height (mm)	10.27	0.07	8.08	12.09	8.34
Yolk length (mm)	26.08	0.14	21.40	30.10	6.28
Yolk index (%)	39.51	0.36	28.15	50.88	10.01
Yolk weight (g)	3.73	0.04	2.52	5.23	12.84
Yolk ratio (%)	34.48	0.20	29.96	41.60	6.58
Yolk: Albumen ratio (%)	66.70	0.69	53.05	90.32	11.45

[1]Total eggs evaluated (n) = 120, 2 SE: Standard error (%), 3 CV: Coefficient of variation (%).

Table 2 shows the effects of genetic correlation on the interior egg characteristics of white Japanese quail. The table shows that there is positive and significant genetic correlation for EW with EL, EB, ESA and SW, which amounted 0.826, 0.923, 0.999, 0.533, respectively, as well as a negative and significant genetic correlation among SG and SR were -0.258, -0.261, respectively, also negative and non-significant genetic correlation with SI, U and ST. The table also shows that there is a positive and significant genetic correlation for EL with EB, ESA and SW amounted to 0.646, 0.826, 0.350, respectively, as well as negative and significantly genetic correlation among SI , SG and SR amounted to -0.608, -0.315, -0.318, respectively, also negative and non-significantly genetic correlation observed between U as well ST.

Table 2: correlations of exterior egg quality characteristics of white Japanese quail[1]

	EL	EB	SI	SG	ESA	USSW	SW	ST	SR
EW	** 0.826	0.923**	-0.097$^{n.s}$	-0.258**	0.999**	-0.046$^{n.s}$	0.533**	-0.042$^{n.s}$	-0.261**
EL		0.646**	-0.608**	-0.315**	0.826**	-0.144$^{n.s}$	0.350**	-0.087$^{n.s}$	-0.318**
EW			0.210*	-0.203*	0.923**	-0.036$^{n.s}$	0.496**	-0.088$^{n.s}$	-0.234*
SI				0.160$^{n.s}$	-0.097$^{n.s}$	0.142$^{n.s}$	0.064$^{n.s}$	0.022$^{n.s}$	0.159$^{n.s}$
SG					-0.255**	0.976**	0.676**	0.033$^{n.s}$	0.999**
ESA						-0.043$^{n.s}$	0.535**	-0.042$^{n.s}$	-0.258**
USSW							0.818**	0.024$^{n.s}$	0.976**
SW								-0.006$^{n.s}$	0.674**
ST									0.034$^{n.s}$

[1]Total eggs evaluated (n) = 120, EW: Egg weight, EL: Egg length, EB: Egg breadth, SI: Shape Index, SG: Specific gravity, ESA: Egg Surface Area, USSW: Unit surface shell weight, SW: Shell weight, ST: Shell thickness, SR: Shell ratio. *p<0.05, **p<0.01, n.s: non-signification.

It is noted from above table a positive and significantly genetic correlation for EB with SI, ESA and SW amounted to 0.210, 0.923, 0.496, respectively, also negative and significantly genetic correlation among SG and SR amounted to -0.203, -0.234 Respectively, it was also observed a negative and non-significantly genetic correlation among U and ST. About SI, table above shows a positive and non-significantly genetic correlation among it and SG, U, SW, ST, SR, while negative and non-significantly genetic correlation with ESA. As for SG, it is noted in Table 2 a positive and significantly genetic correlation among it and U, SW as well SR amounted to 0.976, 0.676, 0.999, respectively, while a positive and non-significantly genetic correlation found with ST, but it is noted a negative and significantly genetic correlation with ESA was -0.255. ESA shown positive genetic correlation between it and SW amounted to 0.535, as well as a negative and significantly genetic correlation with SR was -0.258, while it was noted negative and non-significantly genetic correlation with U and ST. As for U, it is noted a positive and significantly genetic correlation between it and SW and SR was 0.818, 0.976, respectively, while positive and non-significantly genetic correlation with ST. As for SW, it was found a positive and significantly genetic correlation among it and SR was 0.674, while negative non-significantly genetic correlation observed among it and ST. Table above also shows a positive and non-significantly genetic correlation among ST and SR. The results were agreed with Duman et al., (2016) who indicated that increasing EW leads to decline SI, while Mitrovic et al., (2010) indicated that EW affected negatively on egg weight ratio, while Bernacki et al., (2013) appointed that was a negative correlation between the EW and egg weight ratio. Alkan et al., (2015) indicated that increasing of EW leads to increase SW, also appointed to importance of this relationship among egg weight and shell weight, because in order to understand this relationship it is necessary to break the egg, which reduces the productive efficiency of eggs. also appointed that was EL negatively affected on quality of shell egg and this is what we noticed in our study, as the increase in EL led to a decrease ST and SR, and the reason for this is that the size of the egg does not increase linearly with SR.

Table 3: correlations of interior egg traits of white Japanese quail[1]

	AL	AI	AW	AR	HU	YH	YL	YI	YW	YR	Y:A R
AH	$0.030^{n.s}$	0.921^{**}	$0.055^{n.s}$	$0.102^{n.s}$	0.945^{**}	0.235^{*}	$0.024^{n.s}$	0.191^{*}	$-0.027^{n.s}$	$-0.080^{n.s}$	$-0.090^{n.s}$
AL		-0.346^{**}	0.468^{**}	$0.028^{n.s}$	$-0.100^{n.s}$	$0.090^{n.s}$	0.472^{**}	-0.222^{*}	0.452^{**}	$0.103^{n.s}$	$0.041^{n.s}$
AI			$-0.199^{n.s}$	$0.093^{n.s}$	0.919^{**}	$0.171^{n.s}$	$-0.163^{n.s}$	0.257^{**}	-0.200^{*}	$-0.126^{n.s}$	$-0.110^{n.s}$
AW				0.451^{**}	$-0.102^{n.s}$	0.378^{**}	0.524^{**}	$-0.021^{n.s}$	0.585^{**}	-0.218^{*}	-0.338^{**}
AR					$0.116^{n.s}$	$0.117^{n.s}$	$-0.021^{n.s}$	$0.109^{n.s}$	-0.404^{**}	-0.815^{**}	-0.936^{**}
HU						0.253^{*}	$-0.099^{n.s}$	0.283^{**}	-0.202^{*}	$-0.145^{n.s}$	$-0.131^{n.s}$
YH							$0.106^{n.s}$	0.763^{**}	0.289^{**}	$0.016^{n.s}$	$-0.044^{n.s}$
YL								-0.556^{**}	0.551^{**}	$0.161^{n.s}$	$0.099^{n.s}$
YI									$-0.108^{n.s}$	$-0.083^{n.s}$	$-0.097^{n.s}$
YW										0.636^{**}	0.557^{**}
YR											0.962^{**}

[1]Total eggs evaluated (n) = 120, AW: Albumen height, AL: Albumen length, AI: Albumen index, AW: Albumen weight, AR: Albumen ratio, HU: Haugh unit, YH: Yolk height, YL: Yolk length, YI: Yolk index, YW: Yolk weight, YR: Yolk ratio, Y/A R: Yolk: Albumen ratio. *p<0.05, **p<0.01, n.s: non-signification.

Table 3 shows the genetic correlations between characteristics of interior egg in white Japanese quail, there is positive and significantly genetic correlation for AH with AI, HU, YH and YI amounted to 0.921, 0.945, 0.235, 0.191, respectively, while negative and non-significantly genetic correlation with YW, YR, as well Y:A ratio, while a positive and non-significantly genetic correlation noticed among AH, AW, AR and YL. As for AL, the table shown a positive and significantly genetic correlation among it and AW, YL, and YW amounted to 0.468, 0.472, 0.452, respectively, while it was noted a negative and significantly genetic correlation with AI and YI amounted to -0.346, -0.222, respectively. While it was observed a negative and non-significantly genetic correlation with HU, while positive and non-significantly genetic correlation appointed with AR, YH, YR, and Y:A ratio. As for AI, it is noted from table above a positive and significantly genetic correlation among it and HU and YI amounted to 0.919 and 0.257, respectively, while a negative and significantly genetic relationship was observed between it and YW amounted to -0.200, while it was noted positive and non-significant genetic correlation among it and AR and YH, while negative and non-significantly genetic correlation founded between it and AW, YL, YR, and Y:A ratio. About AW, a positive and significantly genetic correlation noted between it and AR, YH, YL, and YW, which amounted to 0.451, 0.378, 0.524, 0.585, respectively, while negative and significantly genetic correlation with YR and Y:A ratio amounting to -0.218, -0.388, respectively, while negative and non-significantly genetic correlation observed with HU and YI. As for AR, it is noted from table above a negative and significantly genetic correlation among it and YW, YR, and Y:A ratio amounted to -0.404, -0.815, -0.936, respectively, while negative and non-significantly genetic correlation founded with YL, while positive and non-significantly correlation was found among it and HU, YH and YI. About HU, it was noted a positive and significantly genetic correlation between it and YH and YI amounting to 0.253 and 0.283, respectively, while a negative and significantly genetic correlation observed among it and YW amounted to -0.202 while negative and non-significantly genetic correlation was found among HU, and YL, YR and Y:A ratio. As for YH, a positive and significantly genetic correlation observed between it and YI and YW amounted to 0.763 and 0.289, respectively, while positive and non-significantly genetic correlation observed among it and YL and YR while negative and non-significantly genetic correlation noted between it and Y:A ratio. YL shown a positive and significantly genetic correlation among it and YW amounted to 0.551, while negative and significantly genetic correlation observed between it and YI which amounted to -0.556, while positive and non-significantly genetic correlation observed between it and YR as well Y:A ratio. As for YI, it was negative and non-significantly genetic correlation was noticed between it and YW, YR, as well Y:A ratio. About YW, it was noted a positive and significantly genetic correlation among it and YR and Y:A ratio amounted to 0.636, 0.557, respectively. As for YR it was noted positive and significantly genetic correlation among it and Y:A ratio amounted to 0.962. This result agreed with Hussein et al., (1993); Tůmová & Gous, (2012); Gerber,

(2006) who indicated that there was a negative correlation of AW with HU and AH. HU was a good indicator of albumin quality of egg, and AW increased with the increase in age of bird (Gerber, 2006). The results also agreed with Bernacki et al., (2013) and Seker, (2004) who indicated that there was a significant and positive genetic correlation of AW with egg yolk traits, which include YH, YL and YW. As indicated by Gerber, (2006) that AW increases of AL, but reduces AH.

Table 4: correlations between exterior and interior egg characteristics of white Japanese quail[1]

	EW	EL	EB	SI	SG	ESA	USSW	SW	ST	SR
AH	$0.012^{n.s}$	$-0.028^{n.s}$	$0.029^{n.s}$	$0.066^{n.s}$	$-0.056^{n.s}$	$0.011^{n.s}$	$-0.060^{n.s}$	$-0.051^{n.s}$	$0.140^{n.s}$	$-0.058^{n.s}$
AL	0.513^{**}	0.393^{**}	0.467^{**}	$-0.013^{n.s}$	-0.203^{*}	0.512^{**}	$-0.094^{n.s}$	0.218^{*}	$-0.134^{n.s}$	-0.202^{*}
AI	-0.180^{*}	$-0.178^{n.s}$	$-0.145^{n.s}$	$0.075^{n.s}$	$0.029^{n.s}$	-0.182^{*}	$-0.016^{n.s}$	$-0.123^{n.s}$	0.186^{*}	$0.027^{n.s}$
AW	0.898^{**}	0.751^{**}	0.826^{**}	$-0.097^{n.s}$	-0.449^{**}	0.896^{**}	-0.267^{**}	0.289^{**}	$-0.018^{n.s}$	-0.452^{**}
AR	$0.015^{n.s}$	$0.019^{n.s}$	$0.012^{n.s}$	$-0.001^{n.s}$	-0.506^{**}	$0.012^{n.s}$	-0.521^{**}	-0.429^{**}	$0.036^{n.s}$	-0.507^{**}
HU	$-0.171^{n.s}$	$-0.174^{n.s}$	$-0.153^{n.s}$	$0.065^{n.s}$	$0.018^{n.s}$	$-0.172^{n.s}$	$-0.024^{n.s}$	$-0.125^{n.s}$	0.186^{*}	$0.016^{n.s}$
YH	0.364^{**}	0.357^{**}	0.286^{**}	$-0.159^{n.s}$	-0.227^{*}	0.364^{**}	$-0.153^{n.s}$	$0.075^{n.s}$	0.208^{*}	-0.226^{*}
YL	0.600^{**}	0.518^{**}	0.583^{**}	$-0.059^{n.s}$	-0.203^{*}	0.601^{**}	$-0.077^{n.s}$	0.279^{**}	-0.306^{**}	-0.205^{*}
YI	$-0.081^{n.s}$	$-0.033^{n.s}$	$-0.131^{n.s}$	$-0.092^{n.s}$	$-0.065^{n.s}$	$-0.081^{n.s}$	$-0.084^{n.s}$	$-0.120^{n.s}$	0.364^{**}	$-0.063^{n.s}$
YW	0.860^{**}	0.734^{**}	0.795^{**}	$-0.117^{n.s}$	-0.250^{**}	0.861^{**}	$-0.069^{n.s}$	0.433^{**}	$-0.071^{n.s}$	-0.253^{*}
YR	$0.158^{n.s}$	0.192^{*}	$0.144^{n.s}$	$-0.106^{n.s}$	$-0.086^{n.s}$	$0.160^{n.s}$	$-0.053^{n.s}$	$0.043^{n.s}$	$-0.065^{n.s}$	$-0.086^{n.s}$
Y:A R	$0.082^{n.s}$	$0.095^{n.s}$	$0.078^{n.s}$	$-0.051^{n.s}$	$0.178^{n.s}$	$0.085^{n.s}$	0.203^{*}	0.215^{*}	$-0.051^{n.s}$	$0.178^{n.s}$

[1]Total eggs evaluated (n) = 120, EW: Egg weight, EL: Egg length, EB: Egg Breadth, SI: Shape Index, SG: Specific gravity, ESA: Egg Surface Area, USSW: Unit surface shell weight, SW: Shell weight, ST: Shell thickness, SR: Shell ratio, AH: Albumen height, AL: Albumen length, AI: Albumen index, AW: Albumen weight, AR: Albumen ratio, HU: Haugh unit, YH: Yolk height, YL: Yolk length, YI: Yolk index, YW: Yolk weight, YR: Yolk ratio, Y/A R: Yolk: Albumen ratio. $^{*}p<0.05$, $^{**}p<0.01$, n.s: non-signification.

Table 4 shows the genetic correlations between interior and exterior specific egg traits of white Japanese quail. It is clear from above table that there is a positive and non-significantly genetic correlation for AH with EW, EB, SI, ESA and ST, while a negative and non-significantly genetic correlation was noted with EL and SG, U, SW and SR. As for AL, it was noted a positive and significantly genetic correlation among it and EW, EL, EB, ESA, as well SW amounted to 0.513, 0.393, 0.467, 0.512, 0.218, respectively, while we noted negative and significantly genetic correlation with SG and SR amounted to -0.203, -0.202, respectively, while it was observed a negative and non-significantly genetic correlation with SI, U as well ST. About AI we note from table above a positive and significantly genetic correlation among it and ST amounted to 0.186, while we note negative and significantly genetic correlation among it and EW as well ESA amounted to -0.180, -0.182 respectively, while positive and non-significantly genetic correlation with SI, SG and SR, while a negative and non-significantly genetic correlation with EL, EB, U as well SW. As for AW, it was noted from above table a positive and significantly genetic correlation between it and EW, EL, EB, ESA, as well SW amounted to 0.898, 0.751, 0.826, 0.896, 0.289, respectively, while negative and significantly genetic correlation was noticed with SG, U and SR were -0.449, -0.267, -0.452, respectively, while negative and non-significantly genetic correlation observed with SI and ST. AR noted from above table a negative and significantly genetic correlation among it and SG, U, SW as well SR amounted to -0.506, -0.521, -0.429, -0.507, respectively, while a positive and non-significant genetic correlation was observed with EW, EL, EB, ESA as well ST, while a negative and non-significant genetic correlation with SI. HU shown from above table a positive and significantly genetic correlation with ST amounted to 0.186, while a positive and non-significant genetic correlation with SI, SG and SR, while a negative and non-significantly genetic correlation was observed with EW, EL, EB, ESA, U and SW. As for YH, it was noted from above table a positive and significantly genetic correlation among it and EW, EL, EB, ESA, and ST amounted to 0.364, 0.357, 0.286, 0.364, 0.208, respectively, while it was noted a negative and significantly genetic correlation with SG and SR were -0.227 and -0.226, respectively, while It was noted a positive and non-significantly genetic correlation for SW, while negative and non-significantly genetic correlation with SI and U. About YL, we conclude from above table a positive and significantly genetic correlation among it and EW, EL, EB, ESA as well SW amounted to 0.600, 0.518, 0.583, 0.601, 0.279, respectively, while we conclude a negative and significantly genetic correlation among SG, ST and SR were -0.203, -0.306, -0.205 respectively, while a negative and non-significantly genetic correlation for SI and U. YI shown from above table a positive and significantly genetic correlation observed among it and ST amounted to 0.364, while a negative and non-significantly genetic correlation among EW, EL, EB, SI, SG, ESA, U, SW and SR. About YW, it was shown from table 4 a positive and significantly genetic correlation noticed between it and EW, EL, EB, ESA, as well SW amounted to 0.860, 0.734, 0.795, 0.861, 0.433 respectively, while negative and significantly genetic correlation noticed between YW SG and SR was -0.250, -0.253 respectively, while noticed a negative and non-significantly correlation between it and SI, U and ST. As for YR, noted a positive and significantly genetic correlation between it and EL were 0.192, while a positive and non-significantly genetic correlation noted between it and EW, EB, ESA and SW, while negative and non-significantly genetic correlation noted between it and SI, SG, U, ST as well SR. We notice a positive and significantly genetic correlation between Y:A ratio with U and SW amounted to 0.203 and 0.215, respectively, while positive and non-significantly genetic correlation noticed with EW, EL, EB, SG, ESA and SR, while a negative and non-significantly genetic correlation observed with SI and ST. This results agreed with Begli et al., (2010) and Alipanah et al., (2013) and Shafey et al., (2015) and Bernacki et al., (2013) and Agaviezor et al., (2011), who indicated a positive and significant genetic correlation for EW with AW and YW and that this relationship does not remain with age of chicken. The results also agreed with Alkan et al., (2013) and Debnath & Ghosh,

(2015) and Olawumi & Ogunlade, (2008) and Onunkwo & Okoro, (2015) who indicated that EW increases the diameter of albumin and the diameter of yolk, also agreed with Bernacki et al., (2013) and El-Safty & Mahrose, (2009) who indicated that there is no genetic correlation of EW with AR and YR.

Conclusion:

This study is useful to understanding interior and exterior egg quality traits of white Japanese quail to improve the quality and efficiency of egg production and improve hatchability and fertility characteristics by understanding the correlations relationship of exterior egg characteristics with interior.

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