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USING GENERAL AND SPECIFIC COMBINING ABILITIES TO EXPECTED BREEDING VALUES, GENETIC VALUES AND HYBRID PERFORMANCE IN CHICKENS

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ABSTRACT: The objectives of this study were to investigate the difference in body weight due to crossing of one exotic meat type strain [Sasso chickens (SS)] and one developed local chicken strain [Gimmizah (GG)] in a full 2×2 diallel design to estimate crossbreeding effects [direct additive effect, heterotic effect, reciprocal effect, general combining ability (GCA), and specific combining ability (SCA)]. Therefore, using general and specific combining abilities were predicted of breeding values (BV) and genetic values (GV). Full diallel crossing 2x2 among these genotypes had been done (2 purebreds and 2 crossbreds). Body weight for males and females from hatch to 12 wks of ages were recorded for different produced genotypes.

The obtained results showed that within pure breed mating, the (SS) chicks were significantly (P<0.001) heavier at the different studied ages compared to the (GG) chicks. Within crosses mating, S×G cross chicks were superior chicks compared to G×S cross chicks at hatch, 4, 8 and 12 wks of ages.

The most of heterosis estimates (H %) for body weight at the different studied ages for both sexes of S×G cross were positive and high compared to those of the reciprocal cross (G×S) which the most values were negative H%. Also, the reciprocal effects were positive (2.34, 27.04, 65.80 and 139.76 g) for overall BW means at the aforementioned ages, respectively. These results indicated that using Sasso as a sire of (S×G cross), BW was improved compared to that of the reciprocal cross (G×S) at the different studied ages.

All values of GCA for SS were positive and had high estimates compared to that of GCA for GG. Also, the cross SxG had high and positive SCA values compared to GxS cross. The highest positive expected breeding values of BW were realized for Sasso strain at the different studied ages. Also, expected genetic values for crosses showed that the progeny of S×G cross had the highest positive values for most of BW in both of the males and females for the different studied ages. No differences (g) between the actual and expected BW were found at all ages studied. In conclusion, crossing between Sasso sires (exotic meat type strain) and Gimmiza dams (developed local strain) improved significantly body weight at the different studied ages compared to mating of Gimmiza as sires.

Key words: diallel crossing - general and specific combining abilities -breeding value.

INTRODUCTION

Genetic improvement of poultry is based on two alternative approaches; crossbreeding and selection. Crossbreeding can be used as a tool that allows manipulating genetic variation to change the populations in a fashion that attempts to optimize desired phenotype. A breeding program for local chickens in developing countries is still out of competition with commercial breeding company which has access to technology advantages and economics of scale. The main purpose of crossing is to produce superior crosses to improve the performance of the developed local chickens and to combine different characteristics in which the crossed breeds were valuable for growth or egg production traits (Saadey et al., 2008; Lalev et al., 2014; Amin, 2015 and Soliman et al., 2016).

During the past 40 years, more than 15 local Egyptian strains of chickens have been developed, through crossing native and standard breeds. Commercial foreign breeds of chickens play an important role in grading and improvement of economic traits of native strains in Egypt (Mohamed, 2003).

The poultry industry has a history of using diallel crossing to establish a broad genetic basis for the development of new breeds or lines and to find superior crossbreds (Aly et al., 2005). High positive heterosis percentages for body weight at different ages among crossbreds and reciprocal crossbreds were obtained in chicken (Mandour et al,. 1992 and 1996). Hybrid vigor has become a routine tool for poultry breeders to produce progeny that exhibit more desirable phenotype than those of their parental populations (Williams et al., 2002). The estimation of crossbreeding effects (combining ability, General (GCA) and Specific (SCA), direct genetic effect, heterotic effect, maternal effect and reciprocal effect) is therefore of major importance (Wolf and Knizetova, 1994).

Full diallel crossing is used to test the combining ability of parental populations. The term GCA is used to designate the average performance of an inbred line in hybrid combinations, while SCA is used to designate those cases in which certain combinations do relatively better or worse than would be expected on the basis of the average performance of the lines involved (Kabir et al., 2011). The combining ability also helps to identify the most desirable combiner that may be used to exploit hybrid vigor (Saadey et al., 2008 and Amin, 2007). Many reports showed that general combining ability (additive genetic effects) was high and important as well as specific combining ability (non-additive effects that involve dominance and epitasis) for body weight at different ages in chickens (Mohamed et al., 2005; Saadey et al., 2008; Razuki and AL-Shaheen, 2011 and Lalev et al., 2014). Nawar et al. (2003); Amin, 2015 and Soliman et al., (2016) found that crossing between Sasso sires (exotic standard meat type strain) and dams from (developed local breed) improved significantly body weight at different ages.

The objectives of this study were to investigate the difference in body weight due to crossing of one exotic standard meat type strain [Sasso chickens,(SS)] and one of local Egyptian chickens strain [Gimmizah, (GG)] in a full 2×2 diallel design to estimate crossbreeding effects [direct additive effect, heterotic effect, reciprocal effect, general combining ability, (GCA) and specific combining ability (SCA)]. Therefore, using general and specific combining abilities were predicted of breeding values (BV), genetic

values (GV) and hybrid performance in chickens.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Center, Faculty of Agriculture, Alexandria University, for one generation.

Experimental Flock History:

One developed local strain Gimmizah (GG) and other exotic parental meat types' strain, Sasso (SS) were used. The local breed was obtained from the Poultry Improvement Project (Ferhash, Behaira Governorate), while the commercial exotic strain were obtained from the General Poultry Company, Cairo, Egypt. Birds were apparently healthy, vaccinated and medicated against the common diseases (according to the vaccination program, in the corresponding centers) and being tested against these diseases. The mating design was made in 2x2 full diallel crossing and all possible combinations (2 crosses) among these genotypes had been done (2 purebreds and 2 crossbreds), Table (1).

Four groups included 256 hens from 2 genotypes (128 hens from each genotype) and 16 cocks from 2 genotypes used in sire position (1 male: 8 females) divided into 8 replicates for each different mating among these genotypes had been done (2purebreds and 2 crossbreds).

The eggs were collected daily for 7 days period; four weekly hatches were taken in the four genotypes. At hatching, the chicks were pedigreed by wing-banded, weighted brooded in floor brooders with starting temperature of 32°C for the first week after hatching, and then decreased 2-3°C each week thereafter. At eight weeks of age, the chicks were sexed, weighted and moved to the rearing houses. Also at twelve weeks of age the chicks were weighted. All chicks were fed ad libitum basis on the commercial starting diet (up to 4 wks) of 21% CP and 2700 kcal/ kg and grower diet (4-12 wks) of 18% CP and 2700 kcal/kg.

Studied traits:

Body weight in males and females (BW) were recorded for each genotype at hatch, 4, 8 and 12wks of age.

Statistical analyses:

Data were analyzed for variation between the crosses and within crosses (between progeny) using the general linear model procedure of SAS Software (SAS Institute, 2000). Differences which considered significant were compared by Duncan Test (Duncan, 1955). Following a linear model was used to analyze the data:

$Y_{ijk} = \mu + G_i + S_j + (GS)_{ij} + e_{ijk}$

Where

Y_{ij} = the observed value of the ij^{th} chick,

μ = the overall mean,

G_i= the effect of the i^{th} genotype,

S_j= the effect of the j^{th} sex,

$(GS)_{ij}$ = the interaction effect of the i^{th} genotype and the j^{th} sex,

e_{ijk} = the effect of random error.

Genetic parameter of diallel crosses:

1- Heterosis and Reciprocal Heterosis Percentages:

Heterosis was calculated on percentage of mid-parents:

$\{F_1-[(P_1 + P_2)/2] / [(P_1 + P_2) / 2] \times 100\}$ using mean,

Where F_1 = the first cross and P_1 or P_2 is a parent in diallel and reciprocal crosses (Williams et al., 2002).

Heterosis % for cross (S×G) = {(S×G) - [(SS + GG)/2] / [(SS + GG) / 2] x 100}

2- Reciprocal effect (R_E):

Reciprocal effect for the combination i x j was calculated as $r_{ij} = (y_{ij}-y_{ji})/2$.

Reciprocal effect for cross (S×G) = [(S×G) - (G× S)] /2.

3-Direct additive effect (D_E) (i.e. line group of sire differences):

D_E for (SS) =1/2[(SS) + (SxG)] –1/3 [(SS) + (GG) + (GxS)]

$D_E$for (GG) =1/2[(GG) + (GxS)] – 1/3 [(GG) + (SS) + (SxG)]

3- General Combining Ability (GCA):

The GCA values were calculated as the deviation of a specific genotype means from the overall mean for giving trait estimated for 4 diallel crosses [i.e., $GCA_i = (\sum yi/n) - \mu$], where GCA_i= the GCA for strain (SS and GG Genotypes), yi = trait for a progeny with either one of his or her parents or both parents from line i, and μ = overall mean for gave trait estimated from all 4 diallel crosses (Odeh et al., 2003). The GCA for (S×S) calculated from the formula as:- GCA for (S×S) = {1/3*[(SS) + (S x G) + (G×S)] –1/4*[(SS) + (GG) +(S×G) + (G×S)]}

4- Specific Combining Ability (SCA):

The SCA was calculated as follows: SCA_{ij}= cross effect- (GCA_i + GCA_j), where the cross effect = certain trait mean of given cross-overall mean of certain trait, GCA_j = the GCA for line j (SS and GG Genotypes) (Odeh et al., 2003). The SCA for (S×G) calculated from formula as:- SCA for (S×G) = {[(S×G) –1/4*[(SS) + (GG) +(S×G) + (G×S)]}-[(GCA for SS+ GCA for GG)]

5- **Expected of hybrid performances:**

The expected full-sib family (cross) mean is the sum of four components were μ = overall mean for given trait estimated from all four diallel crosses, GCA for male, and for female, and SCA for male and female (Gowda et al., 2012). Hybrid mean for (S×I) calculated from the formula as:-

$\overline{x}_{S \times I}$ = μ + GCA for (SS) + GCA for (GG) + SCA for (SG)

6- Expected breeding value (BV):

Breeding value of a parent or half-sib family is 2 times of its general combining ability. BV = 2GCA.

7- Expected genetic value (GV):

Any cross between two parents has an expected breeding value, which is the sum of the GCA of male and female. BVFM = GCAF + GCAM.

The expected full-sib family (cross) mean may deviate from above sum. This deviation is called specific combining ability (SCA) of two parents. The sum of three components is called genetic value of the cross:

GV = GCAF + GCAM + SCAFM.

Where, GCAF, GCAM, and SCAF mean general combining ability of female, male and the specific combining ability of the cross between both sexes (Isik, 2009).

RESULTS AND DISCUSSION

1-Effect of diallel crossing on body weight at different ages:

Results in **Table (2)** showed that, at hatch the heaviest chicks were for S×G cross (41.91 g.) follow by Sasso (SS) chicks (40.91g.) with no significant difference between them, while, the lightest chicks were for Gimmizah (GG) (36.94g.) and there were no significant difference between (GG) and G×S cross (37.23g.).

At 4 wks of age, highly significant ($P<0.001$) differences were found among the different genotypes, where SS chicks were the heaviest (586.8g.) and follow by chicks of S×G cross (458.22g.), G×S cross (404.15g.), while the lightest chicks were for GG (239.94g.).

Concerning body weight at 8 wks (BW8) and at 12 wks (BW12) of ages, the same trend that highly significant differences among different genotypes were found. The (SS) chicks were the heaviest (1787.2 and 2792.4g.) for BW8 and BW12, respectively, while the lightest chicks were for GG strain (457.4 and 1016.4 g.) for BW 8 and BW12, respectively. For crosses, chicks of S×G cross were significantly ($P<0.001$) heavier than its reciprocal G×S

cross (1844.4g vs.1224.6) and (1564.9g vs.1093.0) at 8 and 12 wks of ages, respectively.

Within pure breed mating, (SS) chicks were superior at the different studied ages compared to (GG) chicks. Within crosses mating, S×G cross chicks were superior at the different studied ages compared to G×S cross chicks.

Males were heavier significantly ($P<0.01$ or $P<0.001$) than females at the different studied ages.

Similar results were obtained by Nawar et al. (2003), Amin (2015) and Soliman et al. (2016) who reported that Sasso chicks were significantly the heaviest compared to other developed local strains at different ages and males of the crossbreeds were heavier than females at different ages for most of the genotypes.

Also, significant differences in body weight among purebreds and crossbreds were reported by many investigators (Razuki and AL-Shaheen, 2011; Abou El-Ghar et al., 2012; Amin et al., 2013; Lalevet al., 2014).

2-Heterosis estimates (H %) of cross and reciprocal cross:

Results of heterosis estimates (H %) for body weight at the different studied ages were presented in **Table (3)**. Crossing between Sasso males with Gimmizah females have positive and high H% estimates for BW at hatch, BW4 and BW8. Although, S×G cross H% for BW12 was negative (-3.15%) but it was better than the reciprocal cross where (H%= -17.83%) at the same age.

Most of H% estimates for BW at different ages for both sexes of S×G cross were positive and high, while the reciprocal cross (G×S) had negative estimates for most of the studied ages. These results indicate that S×G cross was better than G×S cross for body weight at different studied ages. Several studies obtained different estimates of heterotic effects on body weights for both sexes at different ages (Sabri and Hataba, (1994); Iraqi et al., (2002); Saadey et al., (2008) and Amin (2015)). They reported that positive and high H% estimate for BW at different ages, while Nawar et al. (2003) reported that progeny which produced from Sasso with Gimmizah strains mating or reciprocal between Sasso and other developed local strains showed negative estimates of H% for BW at different ages. Percentage of heterosis recorded by Khalil et al. (1999) and Sabri et al. (2000) were lower than those obtained in this study. Inversely, Hanafi and Iraqi (2001) found non-significant heterotic effects on body weight at 8 wks of age. Razuki and AL-Shaheen (2011) found highest positive heterosis occurred in crosses of Brown line x New Hampshire and New Hampshire x White Leghorn, whereas, the other crosses ranged from negative sign to positive sign between one day old to 112 day of ages.

3-Reciprocal and direct additive effects:

The results of reciprocal and direct additive effects for BW at the different studied ages showed in Table (3). The cross S×G surpassed its reciprocal (G×S) for males and females BW at the different studied ages. These reciprocal effects were positive 2.34, 27.04, 65.80 and 139.76 g. for BW overall means at hatch, 4, 8 and 12 wks of ages, respectively.

The reciprocal effects were higher for females BW at the different studied ages than males expect at 12 wks of age which the reciprocal effect was higher (125.60 vs. 75.61g.). These results indicated that males of S×G cross were heavier than males of reciprocal cross (G×S) at 12 wks of age, and these reciprocal effects were more than the corresponding effects for females at the same age.

Positive effects for all direct additive of Sasso recorded for BW at the different studied ages. Contrary, GG chicks had negative effects for all direct additives of the same traits.

The results of reciprocal and direct additive effects may be achieve to make a succeed crossing by only using Sasso strain as a sire parent and Gimmiza strain as a dam parent for improvement BW.

Similar results were obtained by Khalil et al. (1999) who found that direct additive effect ranged from 4.9 to 10.2% for body weights, also, Iraqi (2008) showed that direct additive effect for growth traits was significant for all body weight. Amin et al. (2013) studied a 2x2 diallel mating using two local strains (Egg line and Meat line) and found that estimates of direct additive and direct maternal genetic effect for BW at hatch were – 0.71 and 0.44, respectively, while opposite trend was found for BW at 4 wks and at 8 wks of ages. All direct additive and maternal effect estimates had highly significant values. Also Amin (2015) found that values of maternal additive and direct additive effects showed superiority of SS and Italian strains (II) as sires which suggest that using of this variety as a sire breed in crossbreeding programs including Mandarah (MM) dams would be beneficial for improving the BW in males and females.

4-General and specific combining abilities (GCA and SCA):

Results of general and specific combining abilities (GCA and SCA) for body weight at different ages are presented in Table (4). The values of GCA for purebreds SS and GG help to identify the desirable combiners that may be utilized to exploit heterosis. All values of GCA for SS strain were positive and high compared to GCA for GG strain. These results indicated that Sasso strain is better than Gimmiza for crossing for improving body weight at different ages. Also, GCA showed the importance of additive gene effects of Sasso strain on body weight at different ages.

The values of SCA for the two crosses (SG and GS) indicated the importance of non-additive genetic components on body weight at different ages. The cross of SG had high and positive SCA values compared to GS cross. These results may be due to a hybrid vigor in SG cross.

The differences in BW among these genotypes give good chance to select among them for improving growth trait. Significant GCA of BW was found by Razuki and Al-Soudi (2005) and Saadey et al. (2008). Razuki and AL-Shaheen (2011) found that the GCA of BW in New Hampshire breeds was positive and significant at all ages, while, the White Leghorn and Brown line genotypes had significant and negative GCA. The non additive genetic effects (SCA) being involved in the inheritance of body weights was also reported by Shebl et al. (1990) and Mohamed et al. (2005). Amin (2015) found that GCA of BW in males of both of SS and II strains were positive and highly significant at all ages. The MM strain had significant negative GCA. The SS strain had the highest value compared to the other genotypes followed by II one but the MM strain had the lowest negative values for GCA for all previous traits. The SCA was the best for S×I followed by I x S at all ages studied and the worst combinations were for I×M and M×I crosses. Many reports showed that general combining ability (additive genetic effects) had a high and important as well as specific combining ability (non additive effects that involve dominance and epitasis) for improving body weight at different ages (Mohamed et al., 2005; Amin, 2007 and 2015; Saadey et

al., 2008; El-Bayomi et al., 2009; Razuki and AL-Shaheen, 2011; Lalev et al., 2014).

5-Using general and specific combining abilities to expect of hybrid performance (Ỹi), breeding (BV) and genetic (GV) values:

Expected hybrid performance, breeding and genetic values (BV & GV) of BW at the different studied ages for diallel crossing of SS and GG are presented in Table (5). The expected full-sib family (cross) mean is the sum of four components were μ = overall mean for given trait estimated from all four diallel crosses, GCA for males, and for females, and SCA for males and females (Gowda et al., 2012). No differences (g) between the actual and expected BW at all ages studied for all genotypes were found. Similar results were obtained by Amin, (2015) who fund that differences (g and %) for the actual and expected all genotypes were generally small and ranged from -0.05 to 1.11g. and from -0.04 to 0.00% for the actual performance and the percentage difference (in relation to Actual Y%), respectively. The small difference may be due to figures rounded entering in the prediction equations. According to (Sprague and Tatum, 1942), GCA is due to genes which are largely additives in their effect and the SCA is due to genes with dominance or epistatic effect. Combining ability provide useful information on the best line, breed or strain combinations necessary for optimal performance of crossbred animals (Razuki and AL-Soudi, 2005).

The highest positive breeding values of BW at the different studied ages were for Sasso strain. Considering different studied ages, breeding values (BV) of males were higher than those of females. However, the GG strain had the lowest negative values for BW at different studied ages. These results indicated that Sasso strain is more benefited to use in crossbreeding programs compared to GG strain. That may be due to high positive general combining abilities and expected breeding values for Sasso strain. Also, expected genetic values for crosses results showed that the progeny of S×G cross had the highest positive values for BW in males and females for studied ages. Contrary, the G×S reciprocal cross had the lowest negative values for BW at most of studied ages. These results indicated the superior of S×G cross in genetic values for BW of both of males or females at different ages.

Similar results were obtained by Amin (2015), who reported that SS had the highest breeding values for BW in males for different ages compared to the other genotypes. Moreover, it had highest breeding values for BW in females at 12 weeks of age, while the MM strain had the lowest negative values for the former traits. Similar results were obtained by Nawar et al. (2003) and Soliman et al. (2016) who fund that crossing between Sasso sires and dams from developed local breed improved significantly body weight at different ages.

IN CONCLUSION

crossing between Sasso sires (exotic standard meat type strain) and Gimmiza dams (Egyptian local breed) realized significant improvement of body weight at different ages compared to that of the pure mating of Gimmiza or the reciprocal cross (G×S). Thus, it could be recommended that using Sasso strain as a sire parent in crossbreeding programs to improve body weight of local breeds which used as a dam parent and exploit hybrid vigor of body weight from one-day to 12 wks of ages in their resulting cross.

Table (1): Experimental mating design

Females / Males*	SS	GG
Sasso (SS)	S×S	S×G
Gimmizah(GG)	G×S	G× G

* Male parent was given the first letter.

Table (2): Means± SE for actual (Y) of males and females body weight at the different studied ages from the diallel crossing of Sasso (SS) and Gimmizah (GG) strains.

Genotype	**Sex**	**Body weight at different ages (wks)**			
		Hatch	**4**	**8**	**12**
SS	Male	41.02±0.26	696.10±5.58	2056.5±30.9	3122.38±24.6
	Female	40.85±0.22	525.95±2.66	1637.0±9.03	2608.58±17.8
	Overall mean	40.91^{a}±0.17	586.84^{a}±4.88	1787.2^{a}±16.0	2792.45^{a}±19.0
GG	Male	37.20±0.22	257.33±5.48	536.38±8.93	1368.86±11.34
	Female	36.86±0.12	234.59±1.78	433.09±3.71	907.81±5.23
	Overall mean	36.94^{b}±0.11	239.94^{d}±1.93	457.42^{d}±4.05	1016.40^{d}±10.1
S×G	Male	39.81±0.22	521.02±5.16	1390.35±14.05	2091.09±23.53
	Female	45.18±5.43	360.61±9.79	967.05±13.54	1461.02±16.13
	Overall mean	41.91^{a}±2.13	458.22^{b}±7.31	1224.62^{b}±17.41	1844.41^{b}±26.3
G×S	Male	37.00±0.27	491.83±8.65	1351.10±19.34	1839.9±23.69
	Female	37.43±0.30	322.76±6.81	853.61±9.45	1309.8±12.60
	Overall mean	37.23^{b}±0.20	404.15^{c}±8.63	1093.03^{c}±22.33	1564.9^{c}±24.76
Overall mean	Male	39.07±0.15	504.50^{A}±8.14	1376.35^{A}±28.4	2185.1^{A}±33.38
	Female	39.07±0.58	350.55^{B}±4.86	919.58^{B}±19.12	1553.7^{B}±27.45
Significance					
Genotype		***	***	***	***
Sex		NS	***	***	***

Different letters within the same column significantly different,
* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$, NS: not significant.

Table (3): Heterosis percentages, reciprocal and direct additive effects of body weight for males and females at the different studied ages from the diallel crossing of Sasso (SS) and Gimmizah (GG) strains.

Genotype & Sex		**Hatch**	**4**	**8**	**12**
Heterosis percentage					
S×G	Male	1.79	9.29	7.24	-6.88
	Female	16.28	-5.17	-6.57	-16.90
	Overall mean	7.67	10.84	9.12	-3.15
G×S	Male	-5.4	3.17	4.22	-18.07
	Female	-3.67	-15.12	-17.53	-25.50
	Overall mean	-4.35	-2.24	-2.61	-17.83
Reciprocal effect					
SG	Male	1.41	14.60	19.36	125.60
	Female	3.88	18.93	56.72	75.61
	Overall mean	2.34	27.04	65.80	139.76
Direct additive effect					
SS	Male	2.0	126.8	408.8	496.4
	Female	4.6	82.2	327.5	426.1
	Overall mean	3.1	112.2	393.4	527.2
GG	Male	-2.2	-116.9	-834.0	-589.7
	Female	-3.8	-95.0	-369.0	-550.3
	Overall mean	-2.8	-106.3	-381.2	-593.8

Table (4): General and specific combining abilities of males and females body weight at the different studied ages from the diallel crossing of Sasso (SS) and Gimmizah (GG) strains.

Genotype	**Age** / **Sex**	**Hatch**	**4**	**8**	**12**
General Combining Ability (GCA)					
SS	Male	0.52	78.08	265.73	245.57
	Female	1.07	42.03	179.78	221.33
	Overall mean	0.77	60.78	227.72	262.71
GG	Male	-0.75	-68.18	-240.97	-238.94
	Female	-0.26	-54.99	-221.44	-345.59
	Overall mean	-0.55	-54.85	-215.54	-329.30
Specific combining ability(SCA)					
SG	Male	1.29	19.55	32.01	78.91
	Female	4.28	12.49	35.93	13.48
	Overall mean	2.45	30.00	71.88	106.46
GS	Male	-1.5	-9.6	-7.2	-172.3
	Female	-3.5	-25.4	-77.5	-137.7
	Overall mean	-2.2	-24.1	-59.7	-173.1

Table (5): Prediction of breeding values, genetic values and hybrid performance for body weight of males and females at the different studied ages from the diallel crossing of Sasso (SS) and Gimmizah (GG) strains.

Genotype	Age / Sex	Hatch	4	8	12
Breeding values					
SS	Male	1.04	156.16	531.47	491.13
	Female	2.15	84.62	359.73	442.66
	Overall mean	1.54	121.57	455.43	525.43
GG	Male	-1.51	-136.35	-481.95	-677.88
	Female	-0.51	-109.98	-442.88	-691.19
	Overall mean	-1.11	-109.70	431.09	-658.61
Genetic values					
SG	Male	1.1	29.5	56.8	-14.5
	Female	5.1	-0.4	-5.6	-110.8
	Overall mean	2.7	35.9	84.1	39.9
GS	Male	-1.8	0.3	17.5	-265.7
	Female	-2.7	-38.2	-119.1	262.0
	Overall mean	-2.0	-18.1	-47.5	-239.6
Expected of hybrid performances					
SG	Male	39.8	521.0	1390.4	2091.1
	Female	45.2	360.6	967.1	1461.0
	Overall mean	42.5	440.8	1178.7	1776.1
GS	Male	37.0	491.8	1351.1	1839.9
	Female	37.4	322.8	853.6	1309.8
	Overall mean	39.4	407.3	1084.4	1574.9

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الملخص العربى

استخدام قوة التوافق العامه والخاصه للتنبوء بالقيم التربويه و الوراثيه وأداء الخليط في الدجاج

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تم خلط أباء سلالة لحم مستوردة (ساسو) مع سلالة محليه محسنة (جميزة) في تجربة خلط تبادلي 2×2 وتم قياس تأثير الخلط (التأثير الأبوي و قوة الهجين و قدرة التوافق العامه والخاصه) علاوه على أستخدام قوة التوافق العامه والخاصه للتنبوء بالقيم التربويه والقيم الوراثيه وأداء الخليط لصفة وزن الجسم لأربع تراكيب وراثيه (2 نقي و 2 خليط) لكل من الذكور والأناث من عمر الفقس وحتى عمر12 أسبوع وأظهرت النتائج ما يلى:-

- تفوق سلالة الساسو في مختلف الأعمار التي تم دراستها على سلالة الجميزة . بينما تفوق الخليط ساسو×جميزه على الخليط العكسى جميزه ×ساسو في كل الأعمار التى تم دراستها.
- معظم قياسات قوة الهجين لوزن الجسم عند مختلف الأعمار لكلا الجنسين للخليط ساسو×جميزه كانت موجبه ومرتفعه مقارنة بالخليط العكسي جميزه ×ساسو حيث كانت معظمها قيم سالبه .
- تأثير الخلط العكسي كان موجبة (2.34 و04 .27 و 65.8 و193.76 جرام) لكل متوسطات وزن الجسم عند الفقس ، 4 ، 8 و 12 أسبوع من العمر علي الترتيب .
- دلت النتائج ان الخليط ساسو×جميزه افضل من الخليط العكسي جميزه×ساسو عند مختلف أعمار الدراسة. وكل قيم قدره التوافق العامه لسلاله الساسو كانت عاليه وموجبه مقارنه بسلاله الجميزه وفى نفس الاتجاة كانت قيم قدرة التوافق الخاصه للخليط ساسو× جميزه عالية وموجبة مقارنه بالخليط جميزه ×ساسو.
- القيم التربويه المتنبأ بها لصفه وزن الجسم لسلاله الساسوكانت أعلي و موجبه عند مختلف الاعمار التى تم دراستها.
- القيم الوراثيه المتوقعه لنسل الخليط ساسو× جميزه كانت أعلي وموجبه لوزن الجسم للذكور و الإناث عند مختلف الأعمار التى تم دراستها. كما لا يوجد فروق بين وزن الجسم الفعلي ووزن الجسم المتنبأ به لكل من الذكور والإناث عند كل الأعمار التى تم دراستها.

ويمكن تلخيص النتائج أن الخلط بأستخدام الساسو كذكور (سلاله لحم مستورده) مع سلاله الجميزه كأم (سلاله محليه محسنة) أدي لتحسين معنوي في وزن الجسم عند مختلف الأعمار التى تم دراستها مقارنه بأستخدام الجميزه كخط أبوى.