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GROWTH TRAITS AS AFFECTED BY CROSSING BETWEEN SINAI, GIMMIZAH AND SILVER MONTAZAH CHICKEN STRAINS

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ABSTRACT: Aiming to study the effect of crossing between Sinai, Gimmizah and Silver Montazah chicken strains on growth performance of F_1 birds, a 3×3 partial diallel experiment was carried out in poultry research farm in Faculty of Agriculture – Shebin El-Kom during the period between October 2018 and December 2020. Three purebreds and four crossbred genotypes were obtained. Growth traits including: body weight at different ages; daily weight gain (DG); growth rates (GR%) have been recorded for all genotypes and the results summarized as follow: 1) Pure genotypes at the base generation showed significant differences in body weight at different ages, the same trend was also noticed at the F1 generation. 2) Gimmizah chicken strain was the heaviest birds at different ages (i.e., BWh, BW_4, BW_8, BW_{12} and BW_{16}) at the base generation while Sinai strain was the lightest birds for all studied ages. 3) Crossing Sinai males to Gimmizah females resulted in heavier birds comparing with other crosses and reciprocals until 12 weeks of age. However, crossing Sinai females to Gimmizah males resulted the heavier birds across all four crosses at 16 weeks of age. Sex has a significant effect on body weight at all investigated ages, except body weight at hatch for all genotypes in the recent experiment. Interaction effect between strain and sex was not significant for body weight at different ages.

Gimmizah strain recorded the highest cumulative daily gain (8.67 g/day) with no significant difference with the cross GS (Gimmizah males × Sinai females) which recorded 8.13 g/day (during the period from hatch to 16wks of age). At the F1 generation, differences between crosses, reciprocal crosses and pure strains were not significant according to ANOVA results, with one exception form 8-12wks of age there were significant differences in growth rate between the different genotypes. In conclusion, crossing Sinai chickens with Gimmizah and S. Montazah strains improved growth traits, and mating between Gimmizah males and Sinai females recommended for meat production purpose.

Key words: Growth traits, Sinai, Gimmizah, Montazah, Crossing effect

INTRODUCTION

Human population growing rapidly across globe including Egypt. Consequently, the need for different sources of protein increasing involving animal protein. Local chicken is considered one of the very important agricultural resources in Egypt and is characterized by many features that qualify it to be one of the pillars of the poultry industry in Egypt, such as good adaptation to the conditions of the Egyptian environment and its capabilities (Khalil *et al.*, 2018; El-Tahawy and Habashy 2021), in addition to the distinctive flavor, whether for meat or eggs, and we should work to improve the productivity of such breeds and strains maintaining it by taking care of it and applying effective improvement programs. Sinai chicken is one of the local breeds that is very distinguished in the characteristics of egg quality and heat stress tolerance, but egg production still needs to be improved.

Crossbreeding is one of the important tools that play a major role in the improvement of the chicken's performance. Crossbreeding plans used to evaluate the ability of a population to combine with other populations (Jakubec, *et al.,* 1987). One of the most known crossing designs is diallel cross (possible combinations between different populations, lines, strains or breeds). However, under experimental and field breeding conditions, not every crossbreeding effort produces desirable results. It is therefore important that an animal breeder knows what mating method to employ and what breeding goals to accomplish (Nwenya *et al.*, 2017).

The current experiment aimed to study the effect of crossing between Sinai chickens and two other local strains traits including Gimmizah and Silver Montazah on growth traits.

MATERIALS AND METHODS

The present study was carried out between October 2018 to December 2020 in poultry research farm, Faculty of Agriculture, Menoufia University. The study was conducted to examine effects of crossing between Sinai Bedouin fowls and some other local chicken strains on growth traits. A 3×3 partial diallel experiment (Figure, 1) including three local strains (Sinai, Gimmizah and Silver Montazah chicken strains) and three purebreds and four crossbred genotypes were obtained.

Flock history:

Sinai strain: Sinai chickens were characterized by laying fewer eggs which were smaller in weight. The first study was conducted by Arad *et al.* (1975) during the occupation of Sinai by Israel. Arad and Marder (1982) concluded that Sinai egg shell is thicker and stronger than that of the Leghorn. The result of Arad and Marder (1982) reported that Sinai breed was more resistant to the extreme conditions of desert environment. Soltan et al. (1985) gave an economical study for this breed. And he and his research team improved egg productions of this breed from 1985 till 2019 using different selection programs. Recently, egg number of this strain reached about 200 eggs per year. They indicated that means of egg number till 90 days of laying, egg weight, feed consumption (g/bird/day) and feed efficiency (g/g egg mass) were 20.7 eggs, 47.2 g, 85g and 6.34 g, respectively. Soltan and Ahmed (1990) showed that means of egg number, age at sexual maturity and egg weight of Sinai selected were 34.5 eggs, 186.6 days and 41.1 g. respectively. Corresponding values were 31.6 eggs, 211.9 days and 42.0 g for the control line. Mahgoub (2002) reported that Sinai breed is well adapted to high environmental temperature.

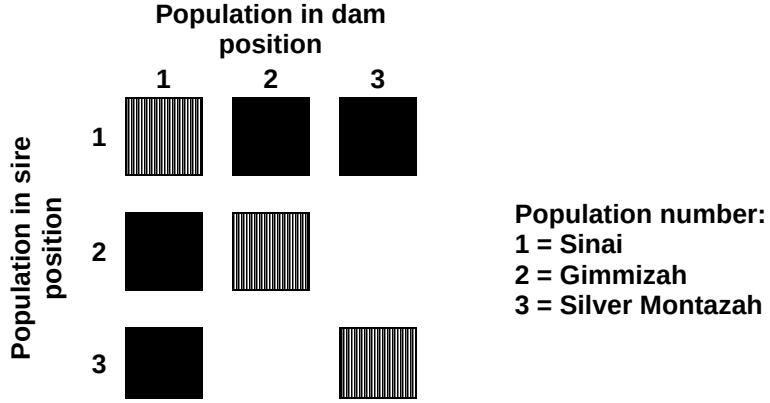

Figure (1): Partial diallel mating design used in current study to obtain the F1 birds.

Gimmizah strain: It is one of the local chickens that was developed as a result of crossing accompanied by selection of Dokki-4 and Plymouth Rock chickens by Prof. Dr. Taha Hussein Mahmoud and others. Gimmizah chicks are auto-sexing and are similar to Plymouth Rock chickens in terms of feather type. The egg production is 189 eggs, the average egg weight at the age of 12 months is 53g, and the average body weight for females at the end of the production period is 1830g. The fertility rate is 91%, total hatchability is 86%, and the production of chicks per mother is 145 chicks/52 weeks.

Sliver Montazah strain: Developed by crossing Rhode Island Red chicken and the Dokki-4 (Mahmoud et al., 1974). Silver Montazah chickens is predominantly grayish-white feather. The egg production is 200 eggs/year, the average egg weight at the age of 12 months is 56g, the average body weight of females at the end of the production period is 1730g, the fertility rate is 93%, the total hatchability is 85-86%, and the production of chicks per mother is 150 chicks/52wks. It is mainly an egg-producing synthetic strain.

Experimental conditions:

Chicks were brooded in floor brooder watered continuously and fed *ad libitum* during brooding period a diet containing 19.43 % crude protein and 2916 kcal/kg ME. kcal, then at 16 weeks the ration was changed by a layer ration containing 17.10 % crude protein and 2760 kcal/kg ME.

First generation (F_1):

The first generation included 7 genetic groups (Sinai strain, Gimmizah strain, Montazah strain, direct crosses between Sinai and either Gimmizah or S. Montazah (SG and SM) and their reciprocal crosses (GS and GM). The three parental strains of Sinai, Gimmizah and Silver Montazah were reared till 90 days of egg production (all traits where recorded) then were cross mated as planned.

Flock management:

All of the experimental parents and hatching chicks received the same managerial treatments. All trap nested egg produced from each breeding cage individually recorded according to the genetic group and collected daily for 7 days period. At hatch, the chick was pedigreed by wing banded and weighted. Brooders with the starting temperature of 32˚C for the first week after hatching and then decreased 2-3˚C each week thereafter. At eight week of age the chicks were sexed, weighed and moved to the rearing house.

Studies traits:

- **Body weight at different ages: Individual body weight was recorded (to the nearest gram) at hatch (BW0) four (BW4) eight (BW8) twelve (BW12) and sixteen (BW16) weeks of age for each sex and line.**
- **Daily weight gain (DG): Interval daily weight gain (DG) during the periods from day old to 4 weeks (DG 0-4), from 4 to 8 week (DG 4-8), from 8 to 12 weeks (DG 8-12), from 12 to 16 weeks (DG 12-16), from day to 16 weeks (DG 0-16) and the cumulative daily weight gain were calculated for each line using the following formula:**

Daily gain (gr/d) = (w2-w1)/ period

Where:

W1 = Weight at the beginning the period

W2 = Weight at the end of the period

- **Growth rates (GR%): Interval growth rate (GR%) during the period from day old to 4 weeks (GR 0-4), from 4 to 8 weeks (GR 4-8), from 8 to 12 weeks (GR 8-12), from 12 to 16 weeks (GR 12-16). The cumulative growth rate was calculated from day old to 16 weeks (GR0-16). All growth rates calculated according to the following equation:**

$$\text{Growth rate \%} = \frac{W_2 - W_1}{1/2\,(W_1 + W_2)} \times 100$$

W1 = weight at the beginning the period
W2 = weight at the end of the period

Statistical analysis:

Collected data were entered and computerized and the analysis of variance done according the following model (two-way) using SPSS-IBM program v. 26.0 (2019). Significant differences among means were detected by Duncan test procedure implemented in the SPSS-IBM software (2019). Correlations between some of economic important traits were analyzed by person correlation equations implemented in SPSS-IBM program.

$$Y_{ijk} = \mu + B_i + S_j + (B_i \times S_j) + e_{ijk}$$

Where:

Y_{ijk} **= the value of the trait (observation)**
μ **= the general mean of the trait**
B_i **= the fixed effect of *i*th strain on studied trait (*i*= Sinai, Gimmizah, S. Montazah).**
S_j **= the fixed effect of *j*th sex on studied trait (*j* = male, female)**
$(B_i \times S_j)$**= interaction effect of *i*th strain and *j*th sex.**
e_{ijk} **= residual effect.**

RESULTS AND DISCUSSION

Body weight at different ages:

Live body weights in the base and F1 generations for all investigated genotypes are shown in Table (1). Results showed that, pure genotypes at the base generation showed significant differences in body weight at different ages, the same trend was also noticed at the F1 generation. Gimmizah strain was the heaviest birds at different ages (i.e., BWh, BW4, BW8, BW12 and BW16) at the base generation as means of different strains tested by Duncan's test (implemented in IBM-SPSS program), Sinai strain was the lightest birds for all studied ages.

At the F1 generation, crossing between Sinai females and either Gimmizah or Montazah males didn't affected body weight at hatch significantly. On the other hand, crossing Sinai males to Gimmizah or Montazah females resulted in heavier birds than the pure Sinai birds at the same age (Table, 1), this may be attributed to the maternal effect on body weight at hatch. Significant differences between genetic groups in BWh has been recorded by Hasan (2019), in crossbreeding experiment included Alexandria, Gimmizah and Cobb chicken satins.

Body weight at 4 weeks of age didn't differed significantly between both 3 pure strains and 4 crosses, while, body weight at 8, 12 and 16 weeks of age showed the same trend as in base generation (Sinai was the lightest birds and Gimmizah was the heaviest ones). This result is in contrast with those obtained by Hasan (2019), he reported significant variation in body weight at hatch, 4, 8 and 12 weeks of age between crossbred lines and purebreds. However, the differences were not significant, crossing Sinai females to Gimmizah males resulted the heavier birds across all four crosses in the current experiment. El-Tahawy and Habashy (2021) found that body weight at hatch, 4, 8 and 12 wks of age differed significantly according to line effect in a diallel cross experiment (included Sinai and Lohman brown purebreds).

Analysis of variance revealed that, sex have a significant effect on BW at all investigated ages, except BWh (Table, 1) for all genotypes. Current results are fully agreed with those obtained by Hasan (2019) regarding the statistical effect of sex on body weight at different ages except BWh. Interaction effect between strain and sex was not significant in the base generation, except on BW12 and BW16, while, in F1 generation all interaction effects were not significant for body weight at different ages. Hasan (2019) observed non-significant generation × line × sex interaction in his crossbreeding research between Alexandria, Gimmizah and Cobb chicken strains except for BW4.

Table (1): Average body weight at different ages for different genotypes:

G	Genetic Group	Sex	BWh	BW4	BW8	BW12	BW16
1	Sinai	Female	29.3±0.3	141.7±2.5	341.7±4.7	547.6±7.5	737.2±9.4
		Male	29.5±0.4	147.1±3.2	408.5±7.4	685.4±11.6	958.4±20.3
		Pooled	29.4±0.2^{c}	144.0±2.0^{c}	370.5±4.9^{c}	607.1±8.7^{c}	832.6±13.7^{c}
	Gimmizah	Female	32.7±0.2	190.5±4.6	467.2±9.9	759.5±10.5	1042.8±14.1
		Male	32.8±0.2	208.1±4.4	511.9±10.7	889.0±14.3	1294.4±24.4
		Pooled	32.8±0.1^{a}	199.5±3.2^{a}	490.1±7.5^{a}	825.8±10.2^{a}	1171.6±17.2^{a}
	Silver Montazah	Female	31.0±0.4	180.0±4.6	429.7±8.7	736.5±12.7	987.9±16.8
		Male	31.1±0.3	188.1±4.2	451.4±10.8	812.5±14.0	1136.1±17.0
		Pooled	31.1±0.2^{b}	183.8±3.1^{b}	440.0±6.9^{b}	772.5±10.1^{b}	1058.1±14.1^{b}
2	Sinai	Female	31.4±0.4	159.2±9.3	328.8±12.0	595.6±23.1	822.0±21.6
		Male	32.1±0.6	144.1±9.0	347.6±18.1	630.1±29.7	879.6±50.4
		Pooled	31.8±0.4^{c}	151.0±6.5	339.0±11.2^{c}	614.3±19.2^{d}	853.2±29.1^{c}
	Gimmizah	Female	36.5±0.6	159.0±6.7	370.5±14.8	710.0±24.1	951.8±28.0
		Male	37.1±0.5	165.9±7.5	468.3±23.4	852.8±38.6	1042.1±41.6
		Pooled	36.9±0.4^{a}	163.2±5.2	431.0±16.6^{a}	798.4±26.9^{a}	1007.7±28.2^{a}
	Silver Montazah	Female	35.6±0.8	154.2±13.0	383.1±17.4	656.7±26.1	877.5±39.9
		Male	34.9±0.4	166.7±7.7	388.8±17.9	686.7±25.2	912.7±27.9
		Pooled	35.2±0.4^{b}	162.1±6.8	386.7±12.9^{b}	675.8±18.6^{bcd}	899.9±22.8^{bc}
	GS	Female	32.2±0.3	153.8±8.0	326.6±16.5	642.1±27.2	897.5±38.5
		Male	32.3±0.3	163.1±6.7	374.2±15.8	717.8±26.0	963.5±32.5
		Pooled	32.2±0.2^{c}	160.2±5.2	359.3±12.2^{bc}	694.1±20.1^{bc}	942.8±25.5^{ab}
	SG	Female	36.9±0.5	159.9±6.2	340.8±10.4	663.2±26.0	857.6±25.1
		Male	36.9±0.6	166.0±5.4	378.6±13.6	756.5±32.0	968.7±27.7
		Pooled	36.9±0.4^{a}	163.3±4.0	361.7±9.1^{bc}	714.8±21.9^{b}	919.1±20.2^{bc}
	MS	Female	32.1±0.6	144.5±5.7	340.2±11.2	664.2±22.1	831.9±29.5
		Male	31.5±0.4	153.9±5.2	372.6±11.8	712.3±20.3	951.8±20.3
		Pooled	31.8±0.3^{c}	150.1±3.9	359.5±8.5^{bc}	692.8±15.1^{bc}	903.2±18.1^{bc}
	SM	Female	33.1±0.9	148.2±5.9	341.8±12.8	602.6±22.0	845.2±24.3
		Male	35.1±0.6	161.0±5.9	373.6±14.3	678.1±27.0	885.0±34.1
		Pooled	34.3±0.5^{b}	155.7±4.3	360.3±10.0^{bc}	646.6±18.7^{cd}	868.6±22.4^{bc}
Analysis of variance results according to the source of variation (sex, strain and interaction)							
1	Strain		**	**	**	**	**
	Sex		NS	**	**	**	**
	Strain × Sex		NS	NS	NS	*	*
2	Strain		**	NS	**	**	**
	Sex		NS	NS	**	**	**
	Strain × Sex		NS	NS	NS	NS	NS

BWh = body weight at hatch; BW4, 8, 12 and 16 = body weight at 4, 8, 12 and 16 weeks of age; G1 = first generation; G2 = second generation; GS, SG, MS, SM = crosses and reciprocal crosses between S-Sinai, G-Gimmizah, M-Silver Montazah strains with sires in the first position; G1 = first generation; G2 = Second generation; ** = highly significant differences (P≤0.01); * = significant differences (P≤0.05); NS = not significant (no significances)

Findings from recent research regarding body weight at different studied ages are in harmony (within the range) with those reported previously (Iraqi *et al.,* 2000; El-Amawy and Elham 2004; Amin 2008; Kosba and Abd El-Halim 2008; Taha and Abd El-Ghany 2013; Amin 2014; Soltan and Hussein 2017) for local Egyptian chickens with very few exceptions.

Daily weight gain:

Average daily weight gain for all studied genotypes at different periods of life are represented in Table 2. The highest daily gain was recorded by Gimmizah birds (males and females) during all life periods until 16 weeks of age, while the lowest gain by the day recorded by Sinai chickens. Males acquired body weight gain more than females at the same measuring period and the same strain. In the base generation daily weight gain showed significant differences (P≤0.01) between all strains as well as between both sexes during all studied periods of life as shown in Table 2, in addition, interaction between strain and sex was significant in studied periods of life except during h-4wks and 8-12wks of age. The pooled means of daily weight gain from hatch to 16wks of age were 10.17, 9.17 and 7.17 g/day for Gimmizah, S. Montazah and Sinai chickens, respectively (Table, 2).

In F1 generation, daily weight gain didn't differ significantly between different genotypes (parental, crosses and reciprocal crosses) or sexes during the first 4 weeks of age, then statistical differences were observed between both strains and sexes but not interaction between strain and sex effects until 12wks of age (i.e., during 4-8 and 8-12wks of age). Similar trend was detected by El-Tahawy and Habashy (2021), they found highly significant differences due to line effect for daily weight gain in corresponding periods of life. Cumulatively, the daily weight gain from hatch until 16wks of age differed significantly (P≤0.01) according to strain and sex effects but not interaction between both effects. These results are adequately similar to those reported by Iraqi *et al.,* 2002 in crossbreeding report included two local strains (Mandarah and Matrouh), they didn't note significant differences between genetic groups in daily weight gain.

Gimmizah strain recorded the highest cumulative daily gain (8.67 g/day) with no significant difference with the cross GS (Gimmizah males × Sinai females) which recorded 8.13 g/day (during the period from hatch to 16wks of age) as represented in Table 2. The lowest daily gain during h-16wks period observed in Sinai pure strain as well as SM cross (Sinai males × S. Montazah females) 7.33 and 7.45 g/day, respectively. Other crosses don't show significant differences comparing with S. Montazah or Sinai pure strains (Table, 2). The estimates of body weight gain in different periods from recent study are lower than those found by other researchers worked on local chickens (El-Nahal 2011; Iraqi *et al.,* 2013; Taha and Abd El-Ghany 2013; Mahmoud and El-Full 2014; Hasan 2019), this could be due to the variations of genotypes, environmental conditions and design of the crossbreeding experiment.

Growth rates (GR%):

Average growth rates for all studied genotypes at different periods of life are represented in Table 3. Results revealed that, at base generation (parental) Gimmizah and S. Montazah strains achieved the highest significant growth rate comparing with Sinai strain during all periods of life except at the period from 4-8wks of age Sinai chicken's growth rate was statistically higher than both Gimmizah and S. Montazah chickens (Table, 3). There were significant differences according to strain and sex effect in growth rates during studied periods of bird's life in the current research. In addition, interaction between strain and sex reported to be insignificant at discrete periods of live but it was highly significant during

cumulative period from hatch till 16wks of age. Males always have the highest growth rate compared with females at all periods of life, and sex effect on growth rate was highly significant (Table 3).

Table (2): Average daily weight gain at different periods of different genotypes:

G	Strain	Sex	DG (h-4)	DG (4-8)	DG (8-12)	DG (12-16)	DG (h-16)
1	Sinai	Female	4.01±0.09	7.14±0.16	7.35±0.22	6.77±0.19	6.32±0.09
		Male	4.20±0.11	9.34±0.23	9.89±0.31	9.75±0.50	8.29±0.18
		Total	4.09±0.07^{c}	8.09±0.16^{c}	8.45±0.21^{b}	8.06±0.27^{c}	7.17±0.12^{c}
	Gimmizah	Female	5.64±0.16	9.88±0.27	10.44±0.28	10.12±0.28	9.02±0.13
		Male	6.26±0.16	10.85±0.32	13.47±0.41	14.48±0.45	11.26±0.22
		Total	5.95±0.12^{a}	10.38±0.21^{a}	11.99±0.28^{a}	12.35±0.31^{a}	10.17±0.1^{a}
	Silver Montazah	Female	5.32±0.17	8.92±0.24	10.96±0.41	8.98±0.27	8.54±0.15
		Male	5.61±0.15	9.40±0.37	12.90±0.42	11.56±0.36	9.87±0.15
		Total	5.46±0.11^{b}	9.15±0.22^{b}	11.88±0.31^{a}	10.20±0.26^{b}	9.17±0.13^{b}
2	Sinai	Female	4.60±0.32	6.02±0.33	9.53±0.58	8.08±0.66	7.06±0.19
		Male	4.04±0.30	7.23±0.46	10.09±0.55	8.91±0.94	7.57±0.45
		Total	4.30±0.22	6.68±0.30^{c}	9.83±0.40^{b}	8.53±0.59	7.33±0.26^{c}
	Gimmizah	Female	4.37±0.23	7.56±0.47	12.12±0.71	8.64±0.73	8.17±0.25
		Male	4.60±0.27	10.67±0.71	13.73±0.78	6.76±0.92	8.97±0.37
		Total	4.51±0.19	9.46±0.51^{a}	13.12±0.56^{a}	7.48±0.64	8.67±0.25^{a}
	Silver Montazah	Female	4.24±0.48	8.17±0.52	9.77±0.68	7.88±0.68	7.52±0.36
		Male	4.72±0.27	7.92±0.58	10.64±0.54	8.07±0.64	7.84±0.25
		Total	4.55±0.24	8.01±0.41^{b}	10.32±0.42^{b}	8.00±0.47	7.72±0.20^{bc}
	GS	Female	4.34±0.28	6.17±0.44	11.27±0.79	9.11±0.81	7.73±0.34
		Male	4.67±0.24	7.54±0.44	12.27±0.51	8.78±0.72	8.31±0.29
		Total	4.57±0.19	7.11±0.34^{bc}	11.96±0.43^{a}	8.88±0.55	8.13±0.23^{ab}
	SG	Female	4.37±0.21	6.48±0.38	11.51±0.81	6.94±0.68	7.33±0.22
		Male	4.61±0.19	7.59±0.44	13.50±0.79	7.58±0.64	8.32±0.25
		Total	4.50±0.14	7.10±0.30^{bc}	12.61±0.58^{a}	7.29±0.46	7.88±0.18^{bc}
	MS	Female	4.01±0.21	6.99±0.38	11.57±0.71	5.99±0.96	7.14±0.26
		Male	4.37±0.19	7.81±0.38	12.13±0.65	8.55±0.61	8.22±0.18
		Total	4.23±0.14	7.48±0.28^{bc}	11.90±0.48^{a}	7.52±0.54	7.78±0.16^{bc}
	SM	Female	4.11±0.21	6.91±0.38	9.31±0.51	8.66±0.56	7.25±0.22
		Male	4.50±0.21	7.62±0.44	10.88±0.65	7.32±1.01	7.59±0.30
		Total	4.34±0.15	7.33±0.30^{bc}	10.23±0.44^{b}	7.88±0.64	7.45±0.20^{c}
Analysis of variance results according to the source of variation (sex, strain and interaction)							
1	Strain		**	**	**	**	**
	Sex		**	**	**	**	**
	Strain × Sex		NS	**	NS	*	*
2	Strain		NS	**	**	NS	**
	Sex		NS	**	**	NS	**
	Strain × Sex		NS	NS	NS	NS	NS

GS, SG, MS, SM = crosses and reciprocal crosses between S-Sinai, G-Gimmizah, M-Silver Montazah strains with sires in the first position; G1 = first generation; G2 = Second generation; ** = highly significant differences (P≤0.01); * = significant differences (P≤0.05); NS = not significant (no significances)

Table (3): Average growth rates (%) at different periods of different genotypes:

G	Strain	Sex	GR (h-4)	GR (4-8)	GR (8-12)	GR (12-16)	GR (h-16)
1	Sinai	Female	130.2±1.2	82.7±1.55	46.1±1.13	29.5±0.79	184.4±0.2
		Male	131.9±1.3	94.0±1.58	50.5±1.35	32.4±1.58	187.6±0.3
		Total	130.9±0.9^{b}	87.6±1.2^{a}	48.0±0.88^{c}	30.8±0.8^{b}	185.8±0.2^{b}
	Gimmizah	Female	139.3±1.3	84.1±1.46	48.4±1.43	31.4±0.73	187.6±0.1
		Male	143.7±1.2	83.9±1.68	54.1±1.56	36.6±0.71	189.8±0.2
		Total	141.5±0.9^{a}	84.0±1.1^{b}	51.3±1.08^{b}	34.1±0.5^{a}	188.7±0.1^{a}
	Silver Montazah	Female	139.6±1.7	82.1±1.82	52.6±1.79	29.1±0.72	187.6±0.2
		Male	142.3±1.1	81.6±2.25	57.4±1.76	33.3±1.02	189.2±0.1
		Total	140.9±1.0^{a}	81.9±1.4^{b}	54.9±1.27^{a}	31.1±0.6^{b}	188.4±0.1^{a}
2	Sinai	Female	131.5±3.1	69.7±3.87	57.4±2.32	32.5±2.78	185.0±0.3
		Male	124.0±2.9	82.2±3.41	57.9±2.04	32.1±2.06	185.0±0.7
		Total	127.4±2.2	76.4±2.69^{b}	57.7±1.5^{bc}	32.3±1.68^{a}	185.0±0.4
	Gimmizah	Female	123.4±2.5	79.3±3.63	62.7±3.16	29.5±2.88	184.8±0.5
		Male	123.0±2.9	92.1±3.54	58.9±2.34	20.8±3.05	185.3±0.6
		Total	123.2±2.0	87.1±2.69^{a}	60.4±1.8^{abc}	24.1±2.24^{b}	185.1±0.4
	Silver Montazah	Female	117.4±6.5	87.2±5.70	52.7±3.45	28.1±1.98	183.7±0.8
		Male	127.1±3.1	77.3±5.62	56.7±3.29	28.8±2.20	184.7±0.5
		Total	123.6±3.1	80.9±4.15^{ab}	55.3±2.43^{c}	28.5±1.56^{ab}	184.4±0.4
	GS	Female	127.2±3.3	71.6±3.55	65.4±3.93	32.7±2.86	185.4±0.6
		Male	128.1±3.3	77.7±2.99	63.2±1.88	29.5±2.13	185.9±0.6
		Total	127.8±2.5	75.8±2.34^{b}	63.9±1.7^{ab}	30.5±1.72^{ab}	185.7±0.5
	SG	Female	123.1±2.3	72.4±3.56	63.0±3.48	26.2±2.53	183.1±0.5
		Male	125.5±2.4	77.2±3.07	65.4±2.33	26.1±2.53	184.9±0.5
		Total	124.4±1.6	75.1±2.33^{b}	64.3±2.0^{a}	26.2±1.78^{ab}	184.1±0.4
	MS	Female	124.2±3.4	80.7±3.47	63.7±2.98	20.4±5.42	182.8±2.3
		Male	128.8±2.5	80.6±4.96	62.4±3.33	29.6±2.13	186.9±0.3
		Total	126.9±2.0	80.6±3.25^{ab}	62.9±2.3^{ab}	25.9±2.56^{ab}	185.2±0.9
	SM	Female	125.2±2.7	78.8±3.19	55.1±2.16	33.9±2.25	184.6±0.6
		Male	126.5±2.2	79.2±2.97	57.0±2.38	26.0±3.62	183.9±0.7
		Total	126.0±1.7	79.0±2.17^{ab}	56.2±1.6^{c}	29.3±2.35^{ab}	184.2±0.5
Analysis of variance results according to the source of variation (sex, strain and interaction)							
1	Strain		**	**	**	**	**
	Sex		**	**	**	**	**
	Strain × Sex		NS	**	NS	NS	**
2	Strain		NS	NS	**	NS	NS
	Sex		NS	NS	NS	NS	*
	Strain × Sex		NS	NS	NS	*	NS

GS, SG, MS, SM = crosses and reciprocal crosses between S-Sinai, G-Gimmizah, M-Silver Montazah strains with sires in the first position; G1 = first generation; G2 = Second generation; ** = highly significant differences (P≤0.01); * = significant differences (P≤0.05); NS = not significant (no significances)

At the F1 generation, differences between crosses, reciprocal crosses and pure strains were not significant according to ANOVA results, with one exception form 8-12wks of age there were significant differences in growth rate between the different genotypes (Table 3). However, ANOVA results showed no significant variations between genotypes at the F1 generation, Duncan's multiple range test revealed some significances between genotypes under investigation (Table, 3). During the whole period (from hatch to 16wks of age) statistical analysis didn't reflect any significant differences between the different genotypes.

In agreement of recent base generation results but not for F1 generation Elnahal 2011 recorded statistical differences between different genetic groups in growth rate during first 4wks of life in his crossbreeding experiment. In addition, he found that during 4-8wks of age genetic groups differ significantly in growth rate. Moreover, recent study results adequately consisted with those found by Hasan (2019), except for growth rate during the first 4 wks of age. Moreover, estimates of growth rates during different periods of age under testing from current experiment falls within the previously reported values of local strains (Amin 2008; Amin *et al.,* 2013; Taha *et al.,* 2013; Abou El-Ghar 2014; Hasan 2019).

It could be concluded that, crossing Sinai chickens with the studied other strains (i.e., Gimmizah and S. Montazah) leads to improve growth traits in the obtained crosses and reciprocals. For meat production its recommended to mate Sinai females to Gimmizah males in order to achieve the highest value of growth traits resulted from crossing the studied local strains.

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تأثير الخلط بين سلالة سينا والجميزة والمنتزة الفضي علي صفات النمو

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الملخص العربى

تهدف التجربة الي دراسة تأثير التهجين بين سلالات دجاج البدو سيناء والجميزة و المنتزة الفضي على معدل النمو لطيور الجيل الأول ، أجريت تجربة خلط متبادلة جزئية ٣ × ٣ في مزرعة أبحاث الدواجن بكلية الزراعة – شبين الكوم خلال الفترة ما بين أكتوبر ٢٠١٨ وديسمبر ٢٠٢٠. تم الحصول على ثلاثة سلالات نقية وأربعة خلطان.

صفات النمو تضم: وزن الجسم في أعمار مختلفة ؛ معدل الزيادة اليومية في وزن الجسم (DG) ؛ معدلات النمو (GR٪) سجلت جميع الصفات لجميع الطرز الوراثية .

وقد كانت أهم النتائج كما يلي:

١) وأظهرت الأنماط الجينية النقية في الجيل الأساسى اختلافات كبيرة في وزن الجسم في مختلف الأعمار، كما لوحظ نفس الاتجاه في جيل الخلطان (أى في الجيل الاول) .

٢) كانت سلالة دجاج الجميزة أثقل الطيور في مختلف الأعمار (أي BWh ، BW4 ، BW8 ، BW12 و BW16) في الجيل الأساسي بينما كانت سلالة سيناء أخف الطيور لجميع الأعمار المدروسة.

٣) خلط ذكور سيناء إلى إناث الجميزة نتج عنه طيور أثقل مقارنة بالخلطان الأخري و الخليط العكسي وذلك حتى عمر ١٢ أسبوعًا. ومع ذلك ، فإن خلط إناث سيناء مع ذكور الجميزة انتجت أثقل الطيور عبر جميع الخلطان الأربعة في ١٦ أسبوعا من العمر.

للجنس تأثير كبير على وزن الجسم في جميع الأعمار التي تم دراستها ، باستثناء وزن الجسم عند الفقس لجميع الأنماط الجينية في التجربة الحالية. لم يكن تأثير التفاعل بين السلالة والجنس معنويا لوزن الجسم في مختلف الأعمار.

سجلت سلالة الجميزة أعلى زيادة يومية تراكمية (٨.٦٧ جم / يوم) مع عدم وجود فرق معنوي مع خليط GS (ذكور جميزة × إناث سيناء) الذي سجل ٨.١٣ جم / يوم (خلال الفترة من الفقس حتى ١٦ أسبوعًا من العمر). في الجيل الاول F_1 ، لم تكن الاختلافات بين الخلطان والخلطان العكسية والسلالات النقية معنوية وفقًا لنتائج ANOVA ، مع استثناء واحد عند عمر ٨–١٢ أسبوعًا ، كانت هناك اختلافات معنوية في معدل النمو بين الأنماط الجينية المختلفة.

في الختام ، فإن خلط دجاج سيناء مع سلالتي الجميزة و المنتزة الفضي أدى إلى تحسين صفات النمو وتوصى الدراسة بالخلط بين ذكور الجميزة وإناث سيناء لغرض إنتاج اللحوم.

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