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Effect of cross between Pekin and Sudani (Egyptian Muscovy) duck on the growth performance

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Abstract

This experiment was carried out at private farm in Egypt (Fayoum governorate). At 32 wks of age, the Pekin (P) males allow to natural mating with Sudani (S) female. Body weight was recorded according to the marketing age of each strain and the cross, body weight gain; growth rate and feed conversion ratio were calculated weekly. Body measurements were measured from the second week of the age. Results showed that the PS cross had significantly heaviest body weight compared to their parents at all ages. Concerning feed conversion ratio, Sudani and Pekin duck had better feed conversion ratio compared to their cross from 2-4, 6-8 and 2-8 weeks of age. The PS cross had significantly higher body measurements at 2, 4, 6 and 8 weeks of age compared to Sudani and Pekin one. Finally, the PS cross recorded negative heterosis at one day old of body weight, however, there was positive heterosis at all ages. With respect to growth rate, the heterosis was positive at all ages except from 2-3 and 7-8 wks of the age.

Keywords: Phenotypic parameters, Growth parameters, Body measurements, Sudani, Pekin duck, Cross, Heterosis.

Introduction

Sudani duck has many names in Egypt like native duck or Egyptian Muscovy. They have lower growth performance, although, Sudani ducks have higher carcass quality and immune response, however, Pekin ducks are rapidly growth compared to Sudani duck (El-Soukkary *et al.*, 2005; Galal *et al.,* 2011 and Makram *et al* 2016a and b). The crossbred between the Muscovy drakes (*Cariaina moschata*) and the Pekin ducks (*Anas platyrhynchos*) is the mule ducks (Anas sterilis) has been popular for many years ago and are used for meat and liver production (Akinlade and Sonaiya, 1994; Adenowo *et al*., 1999 and Adeyeye *et al*., 2012). The duck hybrid called a "Mulard" is obtained by crossing a female domestic duck and a Muscovy male. It is a sterile hybrid because of the difference in chromosome sizes between the two parents (Gallantly *et al.,* 2006). Chipchiryuk (1986) crossed Muscovy drakes with Pekin ducks (at one month before the onset of egg production). He obtained the live body weight of hybrid 4, 8 and 10 wks of the age which averaged 1030, 2240 and 2980g, respectively. The average body weights of crossbreeds (Muscovy ♂ x Pekin ♀) may vary from 2600 g to 3900 g (Wilkiewicz-Wawro, 1994; Retailleau, 1997; Mazanowski and Bernack, 2000; Wawro *et al*., 2001) or even over 4000 g (Baeza *et al*., 2000) depending on sex and age at slaughter (10-12 weeks). This indicates that the experimental crossbred ducks aged 12 wks were characterized by mean body weights. This experiment was designed to evaluate phenotypic parameters among Pekin, Sudani and their cross. The objective of this study increase the growth performance of Sudani ducks by crossing with Pekin ducks.

Materials and Methods

This experiment was carried out at private farm in Fayoum Governorate. At 32 wk of the age, the Pekin (P) males (8 ♂♂) allow to natural mating with Sudani (S) females (32 ♀♀) (Photo 1). A total of 281 hatching eggs from the cross between Pekin (P) males with Sudani (S) females, total 74 ducklings (PS) hatched, also total number 275 (150 Sudani and 125 Pekin) one day old un-sexed duck strains were used. They were reared under similar environmental, managerial and hygienic conditions from one day old to the end of the experiment. The feed and water

were supplied *ad libtium*.. The composition, calculated chemical analysis distribution and of the experimental diets are summarized in Table (1).

Measurements and observations

Growth parameters: Body weights and body weight gain were recorded according to the marketing age of each strain (1-8, 1-9 and 1-14 wks) for Pekin, the PS cross and Sudani duck strains, respectively. Growth rate was calculated **(Brody, 1945)**. Feed consumption and feed conversion ratio were calculated

Body measurements: Body measurements were measured include shank length (from the top of hock joint to the foot pad), keel Length (the keel bone length that breast meat gathering upon it forming breast fillet) with digital caliper, breast circumference (taken under the wings at the edge of the sternum) and body Length (longitude body beginning from beak to termination bird foot) was measured by meter.

The crossbreed effect or heterosis (Hybrid vigor) was calculated by the following formula:

$$\text{Heterosis \%} = \frac{\text{Mean cross breed (XC)} - \text{Mean pure breed (XP)}}{\text{Mean pure breed (XP)}} \times 100$$

Statistical analysis: data were subjected to a analyzed using one-way Analysis of variance with the strain effect using General Linear Model (GLM) procedure of SAS (2001). According to the following model (I); **$Yij = \mu + Si + eij$**

Where; Yij= Trait measured, μ = Overall means, Si = Strain effect, eij = Experimental error

Results and Discussion

Body weight & Body weight gain: Body weight and body weight gain of Sudani, Peking and their cross are presented in Tables (2and 3). The PS cross had significantly lower body weight compared to their parents at one day old. Opposite trend was noticed at all ages from 1 - 8 wks of the age, the PS cross was significantly higher body weight compared to Sudani and Pekin one. Similar trend was noticed for body weight gain, generally, the PS cross had significantly higher body weight gain compared to Sudani one, however the Peking duck had intermediate. Wawro *et al.* (2004) reported that body weight for male and female were 4451, 2397 for Muscovy duck, 3008, 2726 for Peking duck (A-44 strain) while, the cross body weight was 2983 gm. Pekin crosses grew faster than Muscovy crosses but after 17 wks of the age there was no significant difference in the weight (Balai, 1983).

Growth rate: The growth rate of Sudani, Peking and their cross is presented in figure (1). The present results showed that the PS cross had significantly higher growth rate from 0 - 2 wk of the age compared to their parents. From 2 - 3 wks of the age, Peking strain was significantly higher growth rate compared to Sudani or PS cross one. From 4- 5 wks of the age the Sudani duck had significantly higher for growth rate compared to Peking or PS cross. From 5 - 6 wks of the age, the PS cross had significantly higher growth rate compared to their parent. Opposite trend was noticed from 7 - 8 wks of the age. Growth in any trait is a result of the genetic potential of the individual and genetic x environment interaction (Kor *et al.,* 2006). Body growth in livestock may be evaluated with body components such as live weight and body measurements (Wolanski *et al.,* 2006; Saatci and Tilki, 2007). The mule ducks show an intermediate growth rate (Sandip, 2010).

Feed consumption and feed conversion ratio: Feed consumption and feed conversion ratio of PS cross and their parent is presented in Table (4). The Peking duck had significantly consumed more feed from 2-4 wks of the age compared to Sudani one, however the PS cross was intermediate. From 4 -6 , 6-8 and 2 - 8 wks of the age, the Peking duck and PS cross had significantly consumed more feed compared to Sudani one. Sudani and Pekin duck had better feed conversion ratio compared to their cross from 2-4, 6-8 and 2-8 wks of the age. Our results are disagreed with the findings of (Balai, 1983) who reported that Muscovy crosses generally utilized feed more efficiently than White Pekin crosses at all ages. When Pekin, Muscovy and mule ducks were feed efficiency measured at the same age, mule ducks was intermediate feed efficiency when compared to their parental strains (Guy *et al*., 1999; Baeza, *et al.,* 2005). Although there have been no studies on FCR in the common strain (Klemm, 1995) to reduce the feed conversion ratio of mule duck progenies (Larzul *et al*., 2004).

Body measurements: The shank length, keel length, body circumference and body length of PS cross and their parents are presented in Table (5). It could be noticed that the PS cross had significantly higher body measurements at 2, 4, 6 and 8 wks of the age, compared to Sudani and Peking one. A number of researchers have reported positive correlation between body weight and body measurement (Tang *et al.,* 1994 and Wang *et al.,* 2004). Body conformation type and meatiness of the ducks could better be assessed using massiveness, stockiness, long leggedness and condition index. These principal selection indices state the ratio of measurements

that characterizes the proportionality of bird's body (Fox *et al*., 1992; Oblakova, 2007).

Heterosis: Effect of heterosis on body weight and growth rate of PS cross is summarized in Table (6). Concerning body weight, negative heterosis at one day old was observed, however, there was positive heterosis at all ages. With respect to growth rate, the heterosis was positive effect at all ages except from 2-3 and 7-8 wks of the age. Heterosis origins from non-additive genetic effects (domination, over domination, epistasis). Higher values of the hetrosis effect should be expected in inter specific hybrids than inter strain ones (Wawro *et al*., 2004). Rouvier *et al.* (2007) reported that maternal hetrosis was in general significant and favorable it was 8.5% for birth weight, about 4% for growth traits and weight, 6.2% for fatty liver weight and -2.8% for fat release rate. A crossbreeding system between a heavier Pekin breed and Tsaiya would be worth considering to improve the fatty liver production of mule ducks.

Photo 1: PS cross at one day old and the marketing age.

Table (1): The Composition and chemical analysis of experimental diets.

Ingredient	Diets			
	Starter	**Grower**	**Finisher 18%**	**Finisher 16%**
Yellow corn	58.74	67.00	73.44	73.53
Soybean meal 44%	30.40	24.00	16.00	13.50
Corn gluten meal 60 %	7.50	6.04	7.60	5.00
Wheat bran	0.00	0.00	0.00	5.00
Limestone	0.65	0.55	0.55	0.55
Die calcium phosphate	1.50	1.20	1.20	1.21
Salt	0.3	0.30	0.3	0.30
Vit.-Min. Mex*	0.5	0.50	0.50	0.50
Methionine	0.01	0.01	0.01	0.01
Dry Yeast	0.1	0.10	0.10	0.10
Dry mulases	0.1	0.10	0.10	0.10
Trigonella	0.1	0.10	0.10	0.10
Chamomile	0.1	0.10	0.10	0.10
Total	100	100	100	100
Calculated chemical analysis	**Starter**	**Grower**	**Finisher 18%**	**Finisher 16%**
Crude protein, %	23.07	20.04	18.00	16.08
ME, kcal/kg	2972.50	3006.60	3100.10	3016
Calcium, %	0.75	0.62	0.60	0.59
Avail.Phosphorus, %	0.41	0.34	0.33	0.32
Methionine, %	0.42	0.37	0.35	0.31
Lysine, %	1.05	0. 88	0.70	0.64
Fiber, %	3.53	3.23	2.83	3.18
	The distribution of experimental diets			
Strain	**Starter**	**Grower**	**Finisher 18%**	**Finisher 16%**
Pekin	0-2wk	-----	-----	2-8wk
Sudani	0-4wk	4-8wk	8-14wk	-----
PS cross	0-4wk	4-7wk	7-9wk	-----

Table (2): (Means ± SE) Body weight of parent's ducks strain and PS cross at marketing age.

Age (Week)	Strain			Level of significant
	Peking (P)	**Sudani (S)**	**PS**	
0	51.76^{a} ±1.11	44.30^{b} ±0.36	39.70^{c} ±1.719	**0.0001**
1	110.80^{b} ±2.03	71.07^{c} ±0.99	128.40^{a} ±10.06	**0.0001**
2	224.05^{b} ±5.70	140.92^{c} ±2.57	289.40^{a} ±34.94	**0.0001**
3	514.84^{a} ±2.96	291.34^{b} ±6.281	495.80^{a} ±38.19	**0.0001**
4	844.95^{a} ±22.48	535.10^{b} ±11.06	858.50^{a} ±41.97	**0.0001**
5	1243.23^{a} ±109.56	807.67^{b} ±16.69	1211.50^{a} ±84.00	**0.0001**
6	1646.20^{b} ±41.34	961.66^{c} ±25.18	1885.00^{a} ±51.53	**0.0001**
7	2060.86^{b}±24.678	1191.18^{c}±33.17	2409.00^{a} ±62.26	**0.0001**
8	2346.65^{a} ±39.29	1491.21^{b} 43.00	2548.52^{a} ±85.86	**0.0001**

$^{a, b \text{ and } c}$ Means within the same row with different letters are significantly differed.

Table (3): (Means ± SE) Body weight gain of parents duck strain and PS cross at the marketing age.

Age (Week)	Strain		PS	Level of significant
	Peking (P)	Sudani (S)		
0 - 1	60.73[b] ±1.26	26.72[c] ±0.67	87.15[a] ±5.43	**0.0001**
1 - 2	108.67[b] 3.94	68.63[c] ±1.62	154.75[a] ±16.03	**0.0001**
2 - 3	267.00[a] ±7.61	144.54[c] ±3.57	211.40[b] ±15.38	**0.0001**
3- 4	361.94[a] ±9.22	239.85[b] ±5.16	354.00[a] ±8.39	**0.0001**
4- 5	243.22[b] 13.78	274.60[b] ±5.56	360.69[a] ±14.04	**0.0001**
5 - 6	540.20[b] 18.46	152.59[c] ±10.70	679.50[a] ±27.69	**0.0001**
6- 7	329.86[b] ±6.64	173.55[c] ±13.29	516.50[a] ±12.40	**0.0001**
7 - 8	276.47[a] 17.29	253.83[a] ±9.62	147.50[b] ±10.40	**0.0001**
0 - 8	2286.94[b] 38.54	1433.87[c] ±41.9	2512[a] ±36.10	**0.0001**

[a, b and c] Means within the same row with different letters are significantly differed.

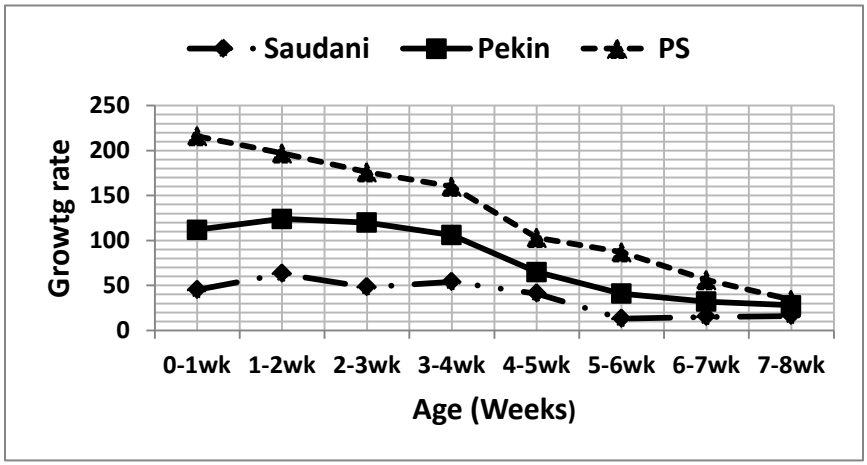

Fig. 1: Growth rate of Sudani, Pekin duck strains and their cross from 0- 8wk

Table (4): (Means ± SE) Feed consumption and feed conversion ratio of parents duck strain and PS cross at marketing age (offspring flock).

Period (Week)	Strains		PS	Level of Significant
	Peking (P)	Sudani (S)		
Feed Consumption (g)				
2-4	1786.40[a]±118.56	909.80[c]±82.08	1402.08[b]±85.22	**0.0001**
4-6	2471.80[a]±162.17	1506.20[c]±131.61	2593.40[a]±201.22	**0.0002**
6-8	2638.20[a]±237.58	1679.20[b]±89.71	3007.75[a]±132.41	**0.0001**
2-8	6896.20[a]±352.58	4095.20[b]±141.49	6880.50[a]±231.69	**0.0001**
Body weight gain (g)				
2-4	846.60[a]±109.68	401.20[b]±30.64	550.80[b]±22.09	**0.0002**
4-6	858.60[a]±174.23	620.80[b]±56.87	1029.60[a]±30.64	**0.009**
6-8	808.60[a]±86.26	506.40[b]±35.82	824.60[a]±31.03	**0.009**
2-8	2513.20[a]±363.11	1528.80[b]±69.54	2404.60[a]±31.59	**0.02**
Feed Conversion ratio				
2-4	2.22[b]±0.24	2.28[b]±0.16	2.55[a]±0.147	**0.05**
4-6	3.19±0.43	2.50±0.28	2.51±0.16	**NS**
6-8	3.34[b]±0.35	3.35[b]±0.17	3.74[a]±0.18	**0.05**
2-8	2.89±0.27	3.01±0.21	2.86±0.27	**NS**

[a, b and c] Means within the same row with different letters are significantly different, NS = Non-significant

Table (5): (Means ± SE) Body measurements of parents duck strain and PS cross at the marketing age (offspring flock).

Strains	2wk	4wk	6wk	8wk
	Shank Length (ShL) (cm)			
Peking	4.82 [a] ±0.06	5.32 [b] ±0.06	6.65 [b] ±0.11	6.65 [b] ±0.09
Sudani	3.32 [c] ±0.04	4.00 [c] ±0.08	5.44 [c] ±0.11	6.60 [b] ±0.15
PS	4.33 [b] ±0.8	6.34 [a] ±0.09	7.15 [a] ±0.13	7.11 [a] ±0.12
Level of Significant	**0.0001**	**0.0001**	**0.0001**	**0.05**
	Keel Length (KL)(cm)			
Strains	**2wk**	**4wk**	**6wk**	**8wk**
Peking	4.02 [a] ±0.05	4.73 [b] ±0.13	8.34 [b] ±0.12	9.88 [b] ±0.11
Sudani	3.36 [b] ±0.04	3.75 [c] ±0.12	6.16 [c] ±0.13	8.45 [c] ±0.21
PS	4.16 [a] ±0.08	7.21 [a] ±0.18	10.89 [a] ±0.18	13.03 [a] ±0.26
Level of Significant	**0.0001**	**0.0001**	**0.0001**	**0.0001**
	Body circumference (BC) (cm)			
Strains	**2wk**	**4wk**	**6wk**	**8wk**
Peking	14.31 [b] ±0.18	22.89 [b] ±0.53	32.45 [b] ±0.43	32.88 [b] ±0.30
Sudani	11.80 [c] ±0.16	17.95 [c] ±0.23	25.38 [c] ±0.48	30.10 [b] ±0.60
PS	22.50 [a] ±0.27	32.22 [a] ±0.40	39.75 [a] ±0.68	47.22 [a] ±0.86
Level of Significant	**0.0001**	**0.0001**	**0.0001**	**0.0001**
	Body Length (BL) (cm)			
Strains	**2wk**	**4wk**	**6wk**	**8wk**
Peking	35.13 [b] ±0.38	51.55 [b] ±0.54	68.50 [b] ±0.62	74.90 [b] ±0.60
Sudani	26.51 [c] ±0.22	42.03 [c] ±0.45	56.78 [c] ±0.67	64.83 [c] ±0.95
PS	48.83 [a] ±2.59	63.96 [a] ±2.14	76.88 [a] ±1.41	85.46 [a] ±0.43
Level of Significant	**0.0001**	**0.0001**	**0.0001**	**0.0001**

[a, b and c] Means within the same row with different letters are significantly differed

Table (6): Effect of heterosis (%) on body weight and growth rate at difference age for MS cross.

PS cross			
Age wk	**Body Weight**	**Age wk**	**Growth rate**
0	-36.55	**0-1**	66.21
1wk	12.87	**1-2**	3.71
2wk	11.47	**2-3**	-23.51
3wk	18.76	**3-4**	1.76
4wk	24.44	**4-5**	14.08
5wk	18.14	**5-6**	91.61
6wk	10.20	**6-7**	43.05
7Wk	18.85	**7-8**	-59.38
8Wk	6.30		
Marketing age (9 wk)	14.47		

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