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GENETIC AND NON-GENETIC FACTORS AFFECTING WEANING AND POST-WEANING GROWTH TRAITS IN BAUSCAT AND BALADI RED RABBITS AND THEIR CROSSES.

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ABSTRACT

A total of 823 weaned rabbits of Bauscat (B) and 561 of Baladi Red (BR) were used to evaluate genetically their weaning and post-weaning growth performance. Weaning weight at four weeks, post-weaning body weights (BW) at 6, 8, 10, 12 and 14 weeks of age and weight gains (DG) at the intervals of 4-6, 6-8, 8-10,10-12, 12-14 and 4-14 weeks were studied. Means of body weight for Bauscat rabbits were to some extent superior to Baladi Red for some growth traits. In general CV Percentages of BW and DG traits decreased with advance of age. Year of birth effect was significant (P ≤0.05, P ≤0.01or P ≤0.001) on BW at 4, 10, 12 and 14 weeks of age in B rabbits and at 4 and 6 weeks of age in BR ones. Year of birth effect on DG was significant (P≤0.05, P≤0.01or P≤0.001) during the intervals of (6-8) and (4-14) weeks of age in B rabbits, while during the intervals (4-6) weeks in BR rabbits. Season of birth had a significant (P ≤0.01or P ≤0.001)) effect on BW at 12 and 14weeks of age in B rabbits, and at 4 and 12 weeks of age in BR rabbits. Season of birth was significant (P ≤0.05, P ≤0.01or P ≤0.001) effect on DG during the intervals (4-6), (10-12), (12-14) and (4-14) weeks in B rabbits. Body weights of rabbits was found to differ significantly (P ≤0.05, P ≤0.01or P ≤0.001) with parity effect at 4, 6, and 12 weeks of age in B rabbits and (P ≤0.001) at 4 weeks of age in BR rabbits. Differences in average DG due to parity effect were significant (P ≤0.05 or P ≤0.001) during the age intervals of (4-6) weeks of age in B rabbits and (6-8) weeks in BR. Sex effects on BW and DG of the two studied breeds were slight and not significant at all ages studied. Litter size at birth had a significant effect (P ≤0.05 or P ≤0.001) at all ages in B rabbits and at 4, 6, 8 and 14 weeks of age in BR rabbits. Litter size at birth effects on DG were also significant (P ≤0.05, P ≤0.01or P ≤0.001) during the gain-intervals of (10-12) and (4-14) weeks in B rabbits and those interval of 6-8, 8-10 and 10-12 weeks in BR rabbits. Effects of breed group were non-significant on BW and DG except that for DG during interval of 8-10 weeks of age which was significant (P ≤0.05). Sire effect was significant (P ≤0.05, P ≤0.01or P ≤0.001) on BW and DG at different ages for both breeds, except BW at 14 weeks of age in B rabbits, while at 10 and 12 weeks of age in BR rabbits. For DG Sire effects were significant (P ≤0.05, P ≤0.01or P ≤0.001) during the age intervals of (6-8) and (8-10) weeks in B rabbits, and those of (6-8), (8-10), (10-12), (12-14) and (4-14) weeks intervals in BR rabbits. Variance components due to sire effect were found to be higher for most traits studied in BR than in B rabbits.

Estimates of heritability using Henderson III method for BW and DG in BR rabbits are in general, substantially higher than in Bauscat rabbits.

Keywords: Rabbits, body weight, post-weaning growth, sire, variance component, heritability.

INTRODUCTION

Post-weaning body weights in broiler rabbits are important since heavier marketable body weight controls the economics of rabbit farms. Daily gain is an expression of rabbit's growth. The economics of a given meat

rabbit breed is greatly determined by its growth rate and fecundity (Afifi and Emara, 1990).

Many investigators worked on size inheritance in rabbits and indicated that body weight and daily gain are influenced by many different non-genetic factors (e.g. Afifi and Emara, 1990; Hilmy, 1991; Youssef, 1992; El-Maghawry, 1993; Attalah, 1995 and Ahmed, 1997). The objective of the present study was to quantify effect of some non-genetic (year and season of birth, parity, sex, Litter size at birth and all available interactions) and some genetic factors (breed effect, sire variance components and heritability effect) on weaning and post-weaning growth traits (body weight and daily gain) in Bauscat and Baladi Red rabbits.

MATERIALS AND METHODS

The experimental work of this study was carried out in the Experimental Rabbit flock maintained by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University in Nasr City, Cairo, Egypt during three consecutive years of production starting in September1998 till October 2001, used local Egyptian breed of rabbits (Baladi Red, BR) and one exotic breed (Bauscat, B). Does and bucks of the exotic breeds used were descendents of the (Bauscat) were descendents of the B rabbits raised under the Egyptian condition. According to the breeding plan, bucks were assigned at random to breed the does with a restriction to avoid full-sib, half-sib and parent offspring mating. Rabbits were raised in a semi-closed rabbitry. Breeding does and bucks were housed separately in individual wired-cages with standard dimensions arranged in double-tier batteries of type. Cage of each doe was provided with a metal nest box for kindling. Each buck was mated to 3-4 does of the same breed. Does were mated from bucks of the sam breed which arehoused in individual cages. Each doe was palpated 10 days thereafter to determine pregnancy. Those which failed to conceive were returned to the same mating buck at the day of test. At weaning occurred (28 days) after birth, and young rabbits were sexed and tattooed and transferred to another batteries to be housed in groups of 3 to 4 individuals in standard progeny wire cages equipped by feeding hoppers and drinking nipples. The rabbits were fed ad-libitum on commercial pelleted ration, which could provide 16.3% crude protein, 13.2% crude fibers and 2.5% fat. Rabbits were kept under the sam mangerial, hiegynic and inveromental conditions.

Data and models of analysis:

Data of Growth traits were collected at weaning, 6, 8, 10, 12 and 14 weeks of age and daily gain at intervals from 4 - 6, 6 - 8, 8 - 10, 10 12, 12 -14 and 4-14 weeks of age for both two breeds.

Data were analyzed using the mixed model of the Least-Squares and Maximum Likelihood Program (Harvey 1990).

Data of growth traits (body and daily gain weight) were analyzed for each breed separately using the following mixed model:

$$Y_{klmnopq} = \mu + S_k + Y_l + Se_m + P_n + Ls_o + Sx_p + (SeY)_{ml} + (PY)_{nl} + e_{klmnopq} \quad \text{(Model 1)}$$

Where:

μ = overall mean, common element to observations;

S_k = random effect of k^{th} sire;
Y_l = fixed effect of the l^{th} year of kindling;
Se_m = fixed effect of the m^{th} season of kindling;
P_n = fixed effect of the n^{th} parity;
Ls_o = fixed effect of the o^{th} litter size at birth;
Sx_p = fixed effect of the p^{th} sex;
$(SeY)_{ml}$ = fixed effect of interaction between the m^{th} season and l^{th} year of kindling;
$(PY)_{nl}$ = fixed effect of interaction between the n^{th} parity and lth year of kindling and
$e_{klmnopq}$ = random deviation of the q^{th} individuals growth traits assumed to be independently randomly distributed, i.e. N.D (0, $\sigma^2 e$).

Data of growth traits (body and daily gain weight) of both breeds were analyzed to study the effect of breed using the following mixed model:

$$Y_{iklmnjop} = \mu+B_i+S_{ik}+Y_l+Se_m+P_n+Ls_o+Sx_p+(SeY)_{ml}+(PY)_{nl}+e_{iklmnopq} \quad \text{(Model 2)}$$

Where:
$Y_{iklmnopq}$ = the observation on the iklmnopqth individuals growth traits;
μ = overall mean, common element to all observations;
Bi = fixed effect of the i^{th} breed;
S_{ik} = random effect of k^{th} sire nested within the fixed effect of the i^{th} breed
$e_{iklmnopq}$ = random deviation of the q^{th} individuals of the i^{th} breed, assumed to be independently randomly distributed, i.e. N.D (0, $\sigma^2 e$).

The other symbols of the mixed model were as those mentioned previously in model 1.

Heritability estimates of growth traits were computed for each breed separately using paternal half-sib relationship, as four times the intra-class correlation coefficient between sire groups (Harvey, 1990).

$$h^2_s = 4\,\sigma^2 s / (\sigma^2 s + \sigma^2 e)$$

The standard errors of heritability estimates were calculated according to Swiger *et al.*. (1964) and Harvey, (1990) as follow:

$$S.E.\ (h^2_s) = 4\ \{[2(n.-1)(1-t)^2[1+(k-1)t]^2\}/\{k^2(n.-s)(s-1)]\}^{0.5}$$

Where:
n. = total number of observations.
t = interaclass correlation.
k = value sire weighing factor.
s = number of sires.

RESULTS AND DISCUSSION

Number of observations, actual means, standard deviations (SD) and coefficients of variability (CV) of individuals body weight (BW) and daily gain (DG) for Bauscat and Baladi Red rabbits are presented in table (1).

Actual means of body weight recorded herein for different ages were relatively lower than those of B rabbits reported by Attalah (1995) and Afifi and Farid (2001), while were some what larger than those of BR rabbits reported by Afifi and Farid (2001), Galal (2002) and Youssef (2004). Means of daily gain in both breeds were within ranges reviewed by (Youssef, 1992; Afifi and Farid, 2001) for both breeds of rabbits.

Results of coefficient of variations (CV%) for progeny traits (body weight and daily gain) in Bauscat and Baladi Red rabbits (Table, 1). The results showed a general trend indicating that percentages of variation of a certain breed groups of rabbits decreased with advance of age.Similar results were also reported by Ahmed (1997); Abd El-Aziz (1998); Gad (1998) and Afifi and Farid (2001). This trend may be due to the consequence of the expression of combination of non-genetic maternal environment and the genetic factors (Falconer, 1989). However, Khalil *et al.*, 1987d, concluded that as bunnies advances in age they would become progressively less sensitive to the non-genetic maternal effect.

Table1. Actual means, standard deviations (SD) as well as coefficients variation (CV%) of body weight and daily gain traits in Bauscat and Baladi Red rabbits.(Model 1).

Traits	Bauscat			Baladi Red		
	No	Means ± S.D.	CV %	No	Means ± S.D.	CV %
Body weight						
4 W	823	373.17 ± 083.13	20.4	591	366.53 ± 080.55	20.2
6 W	725	634.15 ± 124.47	18.3	506	611.11 ± 114.63	18.0
8 W	657	938.14 ± 459.19	48.0	433	897.06 ± 148.63	16.1
10 W	593	1199.45 ± 191.75	15.4	389	1202.98 ± 176.45	44.9
12 W	555	1489.81 ± 258.35	16.7	381	1481.29 ± 190.44	12.3
14 W	551	1757.93 ± 203.74	10.3	362	1757.31 ± 187.82	10.0
Daily gain						
4-6W	720	18.3 ± 6.17	32.1	500	17.5 ± 6.04	33.9
6-8W	642	19.9 ± 6.49	31.8	424	19.8 ± 5.55	27.2
8-10W	575	19.6 ± 5.87	29.6	383	21.1 ± 5.93	27.3
10-12W	539	19.5 ± 5.39	26.9	376	19.7 ± 5.22	25.8
12-14W	531	19.5 ± 6.55	32.0	360	19.4 ± 6.46	33.0
4-14W	531	19.7 ± 2.38	11.2	360	19.8 ± 2.48	11.8

W= weeks.

Non-genetic effects:

Year of birth effect on body weight (g.) was found to be significant (P ≤0.05, P ≤0.01or P ≤0.001) at 4, 10, 12 and 14 weeks of age in B rabbits, while at 4 and 6 weeks of age in BR rabbits (Tables 2,3), similar conclusions were also, reported by Ahmed, 1997 and Abd El-Aziz, 1998. On the contrary, year of birth effect on body weight was found to be non-significant at 6 and 8 weeks in B rabbits while at 8, 10, 12 and 14 weeks of age for BR rabbits. Similarly, Hilmy (1991), and Gad (1998) on different breeds of rabbits evidenced that year of birth had non-significant effect on growth traits.

For daily gain, year of birth effect was found to be significant (P ≤0.05, P ≤0.01or P ≤0.001) source of variation 6 to 8 and from 4 to 14 weeks of age in B rabbits, while from 4 to 6 weeks of age for BR ones. The same findings were also observed by, Hanna (1992), Abd El-Raouf (1993) and Gad (1998).

On the contrary, year of birth effect on daily gain in weight was found to be non-significant from 4 to 6; 8 to 10; 10 to 12 and from 12 to 14 weeks of

age in B rabbits, from 6 to 8; 8 to 10; 10 to 12; 12 to 14 and from 4 to 14 weeks of age for BR rabbits. Similar findings were also observed by, Youssef (1992), Ahmed (1997) and Abd El-Aziz (1998) on different breeds of rabbits.

Results presented in (Table, 2). Revealed that season of birth had generally a significant (P ≤0.01or P ≤0.001) effect on body weight of rabbits (12 and 14weeks of ages in B rabbits and 4 and 12 weeks of ages in BR rabbits). Season of birth was affected significantly (P ≤0.05, P ≤0.01or P ≤0.001) daily gain during the intervals (4-6), (10-12), (12-14) and (4-14) weeks of age in B rabbits only (Table, 3). In agreement with these results most Egyptian studies, Youssef (l992), Abd El-Raouf (1993) El-Raffa (1994). On the contrary, season of birth effect on body weight was found to be non-significant at 4, 6, 8and 10 weeks in B rabbits and at 6, 8, 10 and 14 weeks in BR rabbits . Season of birth effect was found to be non-significant on daily gain (6-8) and (8-10) weeks in B rabbits and from during all studied intervals in BR rabbits. These results, are agreement with those of Youssef (1992) on daily gain from 10 to 12 weeks and Abd El-Aziz (1998) on body weight and daily gain recorded at different ages. Many studies reported a general trend indicated that body weight of rabbits increased from autumn to the winter then decreased thereafter from spring and till the end of year of production (summer), (Ahmed, 1997; Abd EL-Aziz, 1998 and Enab *et al.*, 2002). Ahmed (1997) reported that the effect of season of birth on body weight might be a reflection of the changes in temperature, feed quality and differences in milk production of doe from one season to another.

Parity:

Rabbits body weights of the present study was found to differ significantly (P ≤0.05, P ≤0.01or P ≤0.001) with parity at 4, 6, and 12 weeks of age in B rabbits while at 4 weeks of age in BR rabbits. However, body weight variations due to parity effect were not significant at 8, 10 and 14 weeks of age in B rabbits and at 6, 8, 10, 12 and 14 weeks of age in BR rabbits.

Attalah (1995), Ahmed (1997) and Abd El-Aziz (1998) reported a significant effect of parity on body weight in B and BR rabbits. On the contrary, Youssef (1992), Gad (1998), Hassan *et al.* (1999) and Afifi and Farid (2001) reported that parity had no significant effect on most body weight traits.

Parity effects on daily gain were not significant during some age intervals Gad (1998) and Afifi and Farid (2001) found no significant effect of parity on daily gain calculated at different post-weaning age intervals. In the present study, no clear trend could be observed for the effect of parity on progeny traits (body weight and daily gain in weight) recorded at different ages from weaning up to 14 weeks of age (Tables, 2, 3). According to the cited literature, some studies showed inconsistent trend for the effect of parity on body weight and daily gain weight (Youssef, 1992; Abd El-Aziz, 1998 and Gad, 1998).

Sex:

Sex differences in body weight and daily gain in each of the two breeds between male and female rabbits were slight and not significant at all ages and age stages studied (Tables 2, 3).

Table 2. F-ratios of least-squares analysis of variance for body weight (BW) at different studied ages in Bauscat and Baladi Red rabbits. (Model 1)

Source of variation		Body weight F-ratio at					
	d.f	4w	6w	8w	10w	12w	14w
Bauscat							
Sire	14	4.36^{***}	3.64^{***}	2.18^{**}	2.51^{***}	2.40^{**}	1.29^{ns}
Year of birth (YB)	2	4.42^{***}	1.99^{ns}	1.11^{ns}	5.58^{**}	7.38^{***}	8.82^{***}
Season (SE)	3	034^{ns}	1.28^{ns}	1.83^{ns}	0.53^{ns}	2.58^{*}	4.41^{**}
Parity (P)	8	4.11^{**}	4.24^{***}	1.55^{ns}	0.79^{ns}	1.84^{*}	0.71^{ns}
Sex	1	0.03^{ns}	0.08^{ns}	2.11^{ns}	0.34^{ns}	1011^{ns}	0.90^{ns}
Litter size at birth	7	7.11^{***}	3.75^{***}	2.25^{*}	3.74^{***}	2.72^{**}	6.29^{***}
SE x YK	6	8.12^{***}	4.53^{***}	2.81^{**}	3.74^{***}	1.54^{ns}	5.84^{***}
Remainder d.f	781		983	615	551	513	509
Remainder mean squares.		5805.81	13412.26	203007.20	34273.18	61851.95	33093.50
Baladi Red							
Sire of doe	14	6.01^{***}	4.31^{***}	2.77^{***}	1.30^{ns}	1.25^{ns}	1.98^{*}
Year of birth (YB)	2	10.76^{***}	8.72^{***}	2.71^{ns}	1.85^{ns}	1.57^{ns}	1.27^{ns}
Season (SE)	3	8.04^{***}	2.09^{ns}	1.43^{ns}	2.52^{ns}	4.53^{**}	2.22^{ns}
Parity (P)	8	3.83^{***}	0.86^{ns}	10.2^{ns}	$.059^{ns}$	0.47^{ns}	0.27^{ns}
Sex	1	0.72^{ns}	0.99^{ns}	0.96^{ns}	1.07^{ns}	2.56^{ns}	0.22^{ns}
Litter size at birth	7	11.54^{***}	2.02^{*}	2.28^{*}	1.92^{ns}	1.57^{ns}	2.34^{*}
SE x YK	6	1.57^{ns}	1.19^{ns}	1.77^{ns}	1.98^{ns}	2.41^{*}	3.29^{**}
Remainder	520		465	392	348	340	321
Remainder mean squares.		5468.48	12103.78	20929.66	291617.37	33159.61	31173.45

w=weeks.*= significant at P≤ 0.05or **= significant at P≤ 0.01or ***= significant at P≤ 0.001,^{ns}=Non-significant.

Table 3. F-ratios of least-squares analysis of variance for daily gain calculated at different age intervals up to 14 weeks in Bauscat and Baladi Red rabbits. (Model 1)

Source of variation	d.f	F-ratio					
		DG 4-6w	DG 6-8w	DG 8-10w	DG 10-12w	DG 12-14w	DG4-4w
Bauscat							
Sire of doe	14	1.62^{ns}	1.78^{*}	1.69^{*}	0.76^{ns}	1.58^{ns}	1.17^{ns}
Year of birth (YB)	2	0.35^{ns}	5.45^{**}	1.82^{ns}	0.93^{ns}	1.81^{ns}	7.04^{***}
Season (SE)	3	2.78^{*}	2.10^{ns}	2.14^{ns}	3.24^{*}	4.34^{*}	5.61^{***}
Parity (P)	8	5.94^{***}	1.55^{ns}	0.73^{ns}	1.23^{ns}	1.15^{ns}	0.97^{ns}
Sex	1	0.07^{ns}	1.90^{ns}	0.19^{ns}	0.15^{ns}	0.08^{ns}	0.88^{ns}
Litter size at birth	7	1.85^{ns}	1.47^{ns}	1.11^{ns}	2.04^{*}	1.01^{ns}	4.09^{***}
SE x YK	6	1.65^{ns}	3.76^{***}	2.43^{*}	1.95^{ns}	3.92^{***}	6.01^{***}
Remainder d.f	781	678	600	533	497	489	489
Remainder mean squares.		34.55	40.02	33.69	27.61	39.07	4.88
Baladi Red							
Sire of doe	13	3.28^{***}	1.68^{ns}	2.67^{***}	2.98^{**}	1.84^{*}	1.79^{*}
Year of birth (YB)	2	4.16^{**}	0.68^{ns}	1.21^{ns}	0.14^{ns}	0.63^{ns}	0.87^{ns}
Season (SE)	3	0.68^{ns}	0.55^{ns}	2.08^{ns}	0.93^{ns}	1.91^{ns}	1.10^{ns}
Parity (P)	8	1.27^{ns}	2.17^{*}	1.10^{ns}	1.69^{ns}	1.71^{ns}	0.73^{ns}
Sex	1	0.08^{ns}	0.48^{ns}	0.52^{ns}	1.39^{ns}	1.79^{ns}	0.02^{ns}
Litter size at birth	7	1.30^{ns}	2.72^{**}	2.61^{**}	2.44^{*}	0.75^{ns}	1.71^{ns}
SE x YK	6	2.95^{**}	3.03^{***}	3.17^{**}	0.46^{ns}	1.96^{ns}	3.89^{***}
Remainder	520	459	383	342	335	319	319
Remainder mean squares.		35.22	29.05	33.13	25.85	40.88	5.47

DG = daily gain, w = weeks, *= P≤ 0.05or **= P≤ 0.01or ***= P≤ 0.001, ^{ns}=Non-significant.

The same findings were observed by many investigators (Ahmed, 1997; Abd El-Aziz, 1998 and Abd El-Ghany *et al.*, 2000b) on different breeds of rabbits.

On the other hand, Abd El Raouf (1993), El-Raffa (1994), Attalah (1995) and Gad (1998) on different breeds of rabbits evidenced a significant effect ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$) of sex on body weight at some ages.

Litter size at birth:

Results of body weight of rabbits in the present study were found to differ significantly ($P \leq 0.05$ or $P \leq 0.001$) with litter size at birth at all ages for B (Tables, 2, 3) rabbits and at 4, 6, 8 and 14 weeks in BR rabbits. Similarly, Tawfeek (1995), El-Deghadi (1996), Ahmed (1997) on different breeds of rabbits observed that letter size constituted a significant ($P \leq 0.01$ or $P \leq 0.001$) source of variation on body weight at birth and 6 weeks of age. On the other hand, Khalil *et al.* (1987a) reported that litter size at birth had a non-significant effect on body weight at 8, 10 and 12 weeks of age.

Litter size at birth effects on daily gain in weight was significant ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$) during the intervals (10-12) and (4-14) weeks for B and during the intervals (6-8), (8-10) and (10-12) weeks for BR rabbits. El-Maghawry (1993) and El-Deghadi (1996) noted that the average daily gain varied significantly ($P \leq 0.01$or $P \leq 0.001$) with litter size at birth without any consistent trend.

Interactions:

Results obtained in tables (2, 3) showed that the effects of interactions between season and year of birth were found to be significant ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$) on body weight at 4, 6, 8, 10 and 14 weeks of ages for B but at 12 and 14 weeks of age for BR rabbits. Effects of interactions between season and year of kindling was significant ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$) on daily gain weight during intervals (6-8), (8-10), (12-14), and (4-14) weeks of age for B but (4-6), (6-8), (8-10) and (4-14) weeks of age for BR rabbits.

Genetic Aspects:

Results obtained in table 4. showed that the effects of breed was found generally to have non-significant effect on body weight and daily gain at all ages and age stages studied. The same results was obtained by Abd El-Aziz (1998), Hassan *et al.* (1999) and Abdel-Ghany *et al.* (2000a) at different ages. However, results in tables (2, 3) revealed also that the sire effect was significant ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$) on body weight and daily gain at different ages for both breeds, except body weight at 14 weeks for B rabbits, while 10 and12 weeks in BR rabbits and daily gain during the intervals (4-6), (10-12) and (12-14) weeks in B rabbits, and (6-8) weeks in BR rabbits. Simiarly, El-Deghadi (1996), Ahmed (1997) and Afifi and Farid (2001) reported that the effects of sire on body weight and daily gain in weight at different ages were significant ($P \leq 0.05$, $P \leq 0.01$or $P \leq 0.001$ or $P \leq 0.0001$). *Contrarily, some studies reported non-significant sire effect on growth traits in rabbits (Abd El-Raouf, 1993; El-Fiky et al., 1996) on different breeds of rabbits. Estimated of sire variance components using Henderson III method for growth traits (body weight and daily gain) at different stages of age in B and BR rabbits are presented in table (5).*

Table 4. F-ratios of least-squares analysis of variance for body weight and daily gain calculated at different age in Bauscat and Baladi Red rabbits. (Model 2)

Source of variation	d.f	F-ratio					
		BW 4 w	BW 6w	BW 8w	BW 10w	BW 12w	BW 14w
body weight							
Breed	1	0.135^{ns}	0.974^{ns}	2.075^{ns}	0.279^{ns}	0.249^{ns}	0.154^{ns}
Sire/ Breed	27	4.081^{***}	4.413^{***}	1.863^{**}	2.359^{***}	1.793^{**}	1.900^{**}
Year of birth (YB)	2	12.146^{***}	9.555^{***}	1.281^{ns}	6.524^{***}	8.347^{***}	10.077^{***}
Season (SE)	3	1.197^{ns}	4.229^{**}	2.732^{ns}	1.642^{ns}	7.007^{**}	6.480^{***}
Parity (P)	8	2.004^{*}	2.921^{**}	1.877^{ns}	0.579^{ns}	2.605^{**}	0.793^{ns}
Sex	1	0.867^{ns}	0.163^{ns}	1.049^{ns}	1.584^{ns}	0.24^{ns}	0.765^{ns}
Litter size at birth	7	11.100^{***}	5.473^{***}	1.404^{ns}	5.393^{***}	2.319^{*}	6.005^{***}
SE x YK	6	14.450^{***}	5.664^{***}	2.786^{**}	5.729^{***}	2.271^{*}	9.903^{***}
Remainder d.f	1328		1175	1034	926	880	857
Remainder mean squares.		5823.04	13228.80	133005.13	32322.03	50613.51	32429.21
		DG 4-6w	**DG 6-8w**	**DG 8-10w**	**DG 10-12w**	**DG 12-4w**	**DG 4-14w**
daily gain							
Breed	1	0.390^{ns}	0.000^{ns}	5.631^{**}	0.000^{ns}	0.079^{ns}	0.394^{ns}
Sire/ Breed	27	2.800^{***}	1.806^{*}	2.313^{***}	1.517^{*}	1.564^{*}	1.404^{***}
Year of birth (YB)	2	0.621^{ns}	2.786^{*}	2.741^{ns}	1.342^{ns}	1.616^{ns}	6.449^{***}
Season (SE)	3	2.813^{*}	0.959^{ns}	4.049^{**}	2.842^{*}	1.088^{ns}	6.841^{***}
Parity (P)	8	5.448^{***}	1.061^{ns}	0.416^{ns}	1.261^{ns}	1.446^{ns}	0.715^{ns}
Sex	1	0.011^{ns}	2.217^{ns}	$0,006^{ns}$	0.794^{ns}	0.497^{ns}	0.308^{ns}
Litter size at birth	7	0.871^{ns}	2.731^{**}	1.172^{ns}	$.850^{ns}$	0.470^{ns}	1.726^{ns}
SE x YK	6	1.126^{ns}	5.101^{**}	4.521^{***}	2.791^{**}	3.483^{**}	8.563^{***}
Remainder d.f	1328	1164	1010	902	859	835	835
Remainder mean squares.		36.10	36.35	33.75	27.33	40.49	

BW = Body weight, DG = daily gain, w = weeks, *= P≤ 0.05or **= P≤ 0.01or ***= P≤ 0.001, ^{ns}=Non-significant.

Table 5. Sire variance component estimates (σ^2_s), percentages of variance (V%), heritability estimates (h_s^2) and their standared errors (SE) for body weight and daily gain recorded at different ages in Bauscat and Baladi Red rabbits. (Model 1.)

Traits	Breed	Sire			Remaider			Heritability
body weight at		d.f	σ^2_s	V%	d.f	σ^2_e	V%	$h^2_s \pm SE$
4w	B	14	481.8	7.7	781	5805.8	92.3	0.31 ± 0.12
	BR	13	598.3	9.9	520	5468.5	90.1	0.39 ± 0.16
6w	B	14	1000.4	6.9	683	13412.3	93.1	0.28 ± 0.12
	BR	13	1631.9	12.3	465	12103.8	87.7	0.49 ± 0.19
8w	B	14	7523.8	3.6	615	203007.2	96.4	0.14 ± 0.09
	BR	13	1851.3	8.1	392	20929.7	91.9	0.33 ± 0.16
10w	B	14	1826.8	5.1	551	34273.2	94.9	0.20 ± 0.11
	BR	13	492.7	1.6	348	29617.4	98.4	0.07 ± 0.09
12w	B	14	3276.2	5.0	513	61852.0	95.0	0.20 ± 0.11
	BR	13	481.3	1.4	340	33159.6	98.6	0.06 ± 0.09
14w	B	14	362.0	1.1	509	33093.5	98.9	0.04 ± 0.06
	BR	13	1909.8	5.8	321	31173.5	94.2	0.23 ± 0.14
daily gain								
4- 6w	B	14	0.62	1.8	679	34.50	98.2	0.07 ± 0.06
	BR	13	3.44	8.9	460	35.14	91.1	0.36 ± 0.15
6- 8w	B	14	0.95	2.3	601	40.08	97.7	0.09 ± 0.07
	BR	13	1.00	3.3	384	29.01	96.7	0.13 ± 0.11
8- 10w	B	14	0.85	2.5	534	33.64	97.5	0.10 ± 0.78
	BR	13	3.23	8.9	343	33.08	91.1	0.36 ± 0.17
10- 12w	B	14	000	000	498	27.57	100	a
	BR	13	3.03	10.5	336	25.88	89.5	0.42 ± 0.19
12- 14w	B	14	0.91	2.3	490	39.00	97.7	0.09 ± 0.8
	BR	13	2.29	5.3	320	40.98	94.7	0.21 ± 0.14
4- 14w	B	14	0.03	0.7	490	4.88	99.3	0.03 ± 0.06
	BR	13	0.27	4.7	320	5.47	95.3	0.19 ± 0.13

B = Bauscat, BR = Baladi Red rabbits, w = weeks. a = Negative estimate of sier component of variance were set to be zero.

Estimates of percentage of variance components due to the sire effect in B and BR rabbits, ranged from 1.1 to 7.7% and from 1.4 to 12.3% for BW traits, while from 0.0 to 2.3% and from 3.3 to 8.9% for DG traits respectively. Variance components due to sire effect were somewhat low in both breeds. Similarly, El-Deghadi, (1996) and Ahmed, (1997) using Henderson III method with different breed groups observed low to moderate estimates of sire variance components for growth traits.

Estimates of heritability using Henderson III method for waning and post-weaning growth traits (BW and DG) ranged from 0.04 to 0.28 in B rabbits and from 0.06 to 0.49 in BR rabbits for BW traits, while from 0.03 to .10 in B rabbits and from 0.13 to 0.42 in BR rabbits for DG traits. Estimates of heritability for growth traits in Baladi Red rabbits are substantially higher than those in Bauscat rabbits. In Practice, these high estimates of h^2_s indicated the possibility for rabbit breeders in Egypt to improve body weight and daily gain of Baladi Red rabbits through selection.

Khalil *et al.*, (1987b) indicated that sire heritability estimates of body weights for local breeds (Giza White) were higher than those estimated for exotic breeds (Bauscat), which may be due to that local breeds were not subjected to any intensive program of selection, as that experienced in exotic ones.

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العوامل الوراثية و الغير وراثية آلتي تؤثر على صفات النمو عند و بعد الفطام في الأرانب البوسكات و البلدي الأحمر وخلطانهما.

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استخدمت بيانات ٨٢٣ أرنب مفطوم من البوسكات و ٥٦١ من البلدي الأحمر، لتقييم أداء هاتين السلالتين وراثيا لصفات النمو عند وبعد الفطام (وزن الجسم عند أعمار ٤ ،٦، ٨، ١٠، ١٢، ١٤ أسبوع وكذالك الزيادة اليومية في وزن الحسم خلال الفترات من(٤-٦)، (٦-٨)، (٨-١٠)، (١٠-١٢)، (١٢-١٤)، (٤-١٤) أسبوع.

- وأظهرت أرانب البوسكات تفوقا نسبيا على أرانب البلدي الأحمر في معظم صفات النتاج المدروسة.
- انخفاض معامل الاختلاف بتقدم العمر في صفات وزن الحسم والزيادة اليومية في وزن الجسم.
- أظهرت سنة الميلاد تأثير معنوي على أوزان الجسم عند الأعمار ٤ ،١٢،١٠، ١٤ أسبوع في سلالة البوسكات وعند وزن الميلاد، ٤، ٦ أسبوع في سلالة البلدي الحمراء ولم يظهرتاثيرمعنوي على بقية الصفات. أظهرت سنة الميلاد تأثير معنوي على مقدار الزيادة اليومية في الفترات المختلفة من العمر في سلالة البوسكات (٦-٨) و (٤-١٤) أسبوع من العمر. و الفترة (٤-٦) في سلالة البلدي الحمراء ولم تظهرتاثيرمعنوي على بقية الصفات.أظهر موسم الميلاد تأثير معنوي على أوزان الجسم عند الأعمار (١٢،١٤ أسبوع) في سلالة البوسكات و (١٢،٤أسبوع) في سلالة البلدي الحمراء.
- كان لموسم الميلاد تأثير معنوي على مقدار الزيادة اليومية في الفترات المختلفة من العمر في سلالة البوسكات (٤- ٦) و(١٠-١٢) و(١٢- ١٤) و (٤-١٤) أسبوع من العمر في سلالة البلدي الحمراء ولم تظهر تأثير معنوي لموسم الميلاد على كل الصفات.
- كان لترتيب الولادة تأثير معنوي على أوزان الجسم عند الأعمار آلاتية (٤، ٦ ، ١٢اسبوع) في سلالة البوسكات و عند (٤اسبوع) في سلالة البلدي الحمراء. كان لترتيب الولادة تأثير معنوي على مقدار الزيادة اليومية في الفترات المختلفة من العمر في سلالة البوسكات الفترة (٤-٦) أسبوع من العمر والفترة من (٦- ٨)أسبوع من العمر في سلالة البلدي الحمراء ولم يظهر لترتيب الولادة تأثير معنوي على بقية الصفات.
- لم يكن للجنس آي تأثير معنوي على صفات النمو محل الدراسة
- كان تأثير عدد الخلفة المولودة في البطن على صفات النمو المدروسة معنويا على كل صفات النمو في سلالة البوسكات وعلى وزن الجسم عند عمر٤، ٦، ٨، ١٤ أسبوع من العمر في سلالة البلدي الحمراء. كان تأثير عدد الخلفة المولودة في البطن على مقدار الزيادة اليومية معنويا خلال الفترات (١٠-١٢، ٤-١٤ أسبوع) في سلالة البوسكات و(٨-١٠، ١٠-١٢ ،١٢-١٤ أسبوع) في سلالة البلدي الحمراء.
- لم يكن للنوع تأثير معنوي على صفات أوزان الجسم عند الأعمار المختلفة ومقدار الزيادة اليومية في آلا وزان المختلفة من العمر باستثناء مقدار الزيادة اليومية في الفترة من ٨- ١٠اسبوع في كلا السلالتين.
- كان تأثير الأب معنوي بصفة عامة على جميع صفات أوزان الجسم عند الأعمار المختلفة والزيادة اليومية في الفترات المختلفة من العمر في كلا السلالتين ما عدا وزن الجسم عند عمر ١٤ أسبوع في سلالة البوسكات و وزن الجسم عند ١٠ و١٢ أسبوع في سلالة البلدي الحمراء و الفترات العمرية و من ٦ - ٨ و ٨ - ١٠ أسبوع في سلالة البوسكات و من ٦ - ٨، ٨ - ١٠، ١٠ -١٢، ١٢ - ١٤ و٤ - ١٤ أسبوع في سلالة البلدي الحمراء و غير معنوي خلال من ٤ - ٦، ١٠ - ١٢، ١٢ - ١٤ و ٤ - ١٤ أسبوع في سلالة البوسكات ومن ٦ - ٨ أسبوع في سلالة البلدي الحمراء.
- تراوحت قيم النسبة المئوية لمكونات التباين الوراثي الراجع للأب المقدرة بطريقة هند رسون(٣) في كلا السلالتين بين القيم المنخفضة و المتوسطة وان كانت قيم هذه النسبة في سلالة البلدي الحمراء أعلى منها في سلالة البوسكات لمعظم الصفات.
- كانت تقديرات المكافئ الوراثي لمعظم صفات أوزان الجسم المختلفة ومقدار الزيادة اليومية في سلالة البلدي الحمراء أعلي منها في سلالة البوسكات.
- وعلى ضوء نتائج تقديرات المكافئ الوراثي يمكن التوصية إمكانية تحسين هذه الصفات في الأرنب البلدي الحمراء لدى مربى الأرانب في مصر عن طريق الانتخاب.