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LITTER WEIGHT IN LOCAL EGYPTIAN AND EXOTIC BREEDS OF RABBITS AND THEIR CROSSES

By

E.A. Afifi[1] and M. E. Emara[2]

University of Zagazig and Animal Production Research Institute, Ministry of Agriculture

Introduction

Litter weight is one of the most important elements that determine productivity in rabbit flocks. Little work was carried out to investigate this trait in Egypt. The objective of this work was to evaluate and study the effects of breed group and the environmental factors on litter weight at birth and at weaning in four pure breeds of rabbits and their crosses.

Materials and Methods

Data were collected during three years of production (1976/77, 1977/78 and 1978/79) on the rabbit flock raised at Dokki Experimental Station, Animal Production Research Institute, Ministry of Agriculture. Records were taken on 513 litters representing Bauscat (B), Giza White (G), White Flander (F) and Baladi Red (R) rabbits as well as their crosses in all possible combinations.

Complete information about breeding plan, feeding and management were given by Afifi and Emara (1983).

Statistical analysis was carried out according to the least squares procedures described by Harvey (1960). Heterosis percentages were calculated as the relative increase of the average superiority of each pair of reciprocal crosses over that of their mid-parents.

Results and Discussion

The mean weight of litters produced by rabbits involved in the present study was 352.7 gm at birth and 1876.0 gm at weaning at 5 weeks of age.

Among the 4 pure breeds used F litters recorded the heaviest weight at birth (323.5 gm) and at weaning (1776.8 gm), G litters showed heavier weights than both R and B litters (316.8 *vs.* 302.4 and 301.0 gm) and at weaning (1760.7 *vs.* 1734.5 and 1487.7 gm), while B litters were the lightest at both ages (Table 1).

The average litter weight at birth and at weaning for the 4 pure breeds differed from those previously reported for the same breeds at the same ages by different investigators (Afifi *et al.*, 1976; Khalil, 1980; Afifi *et al.*,

1) Department of Animal Production, Faculty of Agriculture at Moshtohor, Zagazig University, Banha Branch, Egypt.
2) Animal Production Research Institute, Ministry of Agriculture, Dokki, Cairo, Egypt.

1982a and Afifi et al., 1982b). This may be due to differences in managerial procedures and location as well as sampling effects. Differences in amounts and nutritive values of the feedstuffs used could be added as other causes in this respect.

Litter weight differed with breed group and the differences were highly significant ($P < 0.01$) at birth but non-significant at weaning (Table 2). On the contrary Afifi et al. (1976) with 3 breeds of rabbits and their cross found that breed group effects were not significant at birth and significant at weaning. However, Khalil (1980), Afifi et al. 1982a) and Afifi et al. (1982b) observed that the differences in litter weight due to breed group effects were non-significant at birth and at weaning.

Most of the crossbred litters were heavier than those of their parental purebred groups at birth and at weaning (Table 1). Heterosis percentages at birth and at weaning were positive and of considerable magnitude in most of the crossbred combinations (Table 3). Afifi et al. (1976) reported similar results on the crossbred combinations of three breeds of rabbits.

The average of litter weight means of the 12 crossbred groups exceeded that of their four parental pure breeds at birth (366.6 vs. 310.9 gm) and at weaning (1818.0 vs. 1689.9 gm). The same finding was noticed when dealing with the crossbred and purebred litters of B rabbits at birth (378.3 vs. 301.0 gm) and at weaning (1896.5 vs. 1487.7 gm), G rabbits at birth (350.0 vs. 316.8 gm) and at weaning (1855.1 vs. 1760.7 gm), R rabbits at birth (377.0 vs. 302.4 gm) and at weaning (1789.1 vs. 1734.5 gm) and F rabbits at birth only (361.2 vs. 323.5 gm). All those observations may lead to conclude that crossbreeding among B, G, F and R rabbits was associated with the increase in litter weight at birth and at weaning. Afifi and Emara (1983) reported similar conclusion for litter size. As for litter size (Afifi and Emara, 1983), BR group exhibited the best performance among all the crossbred groups for litter weight at birth and at weaning.

Maternal and sex-linkage effects (expressed in the differences between reciprocal crosses) on litter weight at birth and at weaning were in general, of limited magnitude and non significant (Table 1). Similar findings were reported by Afifi et al. (1976) with the reciprocal crosses of three breeds of rabbits.

The averages of litter weight means of the crossbred litters produced by B, G, F and R does at birth and at weaning show that R does had the best prenatal maternal effects while G does exerted the most superior postnatal maternal effects. When bearing in mind that litter weight at weaning is the final out put of the productivity of the doe, it could be stated that G does were the best performing for maternal abilities under the crossbreeding system of this study. They weaned the heaviest crossbred litters 1898.8 gm vs. 1827.2 in B, 1716.8 gm in F and 1829.2 gm in R).

Table 1 - Least squares constants of factors affecting littèr weight at birth and at weaning.

Classification	Litter weight at Birth N	Birth Const.±S.E.	Weaning N	Weaning Const.±S.E.
General mean	513	352.7±10.2	360	1786.0±82.1
Breed group:		[1]		
B	57	-51.7±17.6 a	40	-298.3±136.5 a
G	92	-35.9±14.9 a	66	-25.3±114.6 ab
F	23	-29.2±26.9 a	14	-9.2±220.3 ab
R	30	-50.3±23.5 a	18	-51.5±193.4 ab
BG	47	-4.5±18.8 a	35	244.9±141.8 b
GB	28	9.1±23.7 a	18	-5.1±190.7 ab
BF	13	26.0±34.0 a	10	-254.4±253.9 ab
FB	30	-7.0±22.9 a	20	1.9±180.6 ab
BR	17	134.2±30.0 b	12	548.8±232.37 b
RB	39	-4.0±21.0 a	26	126.9±164.9 ab
GF	15	32.5±32.0 a	14	268.7±217.2 ab
FG	40	-34.6±20.3 a	27	109.8±158.5 ab
GR	16	10.3±31.1 a	10	-187.4±255.7 ab
RG	41	-29.0±20.0 a	30	-16.2±154.2 ab
FR	14	2.2±33.2 a	10	-231.8±253.8 ab
RF	11	31.9±37.5 ab	10	-221.8±255.7 ab
Year:				
1976/77	222	1.6±11.9 a	156	-223.3±92.7 a
1977/78	209	9.5± 9.6 a	150	264.7±74.7 a
1978/79	82	-11.1±12.9 a	54	-41.4±102.5 a

Classification	Litter weight at N	Const.±S.E.	N	Const.±S.E.
Month of kindling:				
Sept. - Oct.	17	-47.3±27.4 a	10	-293.1±229.6 ac
Nov. - Dec.	90	-0.8±15.6 a	56	-151.8±128.7 ad
Jan. - Feb.	171	14.9±12.0 a	121	318.4± 96.9 bc
March - Apr.	136	16.7±12.9 a	106	410.3±103.1 bd
May - July	99	16.5±16.3 a	67	283.8±129.1 a
Age of doe:				
6 - 12 months	111	40.3±24.1 ac	78	-273.7±182.0 a
13 - 18 "	125	49.4±21.0 a	89	-81.5±161.2 a
19 - 24 "	80	18.4±17.1 ac	55	-152.9±129.4 a
25 - 30 "	64	-14.6±17.3 ab	46	70.2±133.3 a
31 - 36 "	71	-52.6±19.9 b	53	133.7±155.1 a
37 and more "	62	-40.9±22.9 bc	39	304.2±171.4 a
Parity				
1st parity	105	-47.1±27.3 a	72	162.8±208.0 ab
2nd "	94	-4.2±22.6 a	67	198.5±176.4 ab
3rd "	66	-22.1±17.6 a	46	92.4±136.0 ab
4th "	54	-11.4±18.8 a	34	240.2±152.8 a
5th "	50	25.5±19.2 a	40	260.7±143.2 a
6th "	43	14.2±21.2 a	35	-278.5±158.2 bc
7th "	35	47.3±23.9 a	26	-234.9±181.2 ac
8th "	66	-2.2±21.2 a	40	-441.2±158.0 bc

1) The appearance of the same litter with two constants within the same classification signifies that they do not differ significantly (5% level) otherwise they do.

Table 2 - Least squares analysis of variance at birth and at weaning.

Source of variation	Litter weight at			
	Birth		Weaning	
	d.f.	Mean squares	d.f.	Mean squares
Breed group	15	41901.8650**	15	218584.1290
Breed of buck	3	33698.4343	3	190812.3983
Breed of doe	3	54401.0063*	3	418345.4383
Breed of buck x breed of doe	9	51937.2666**	9	998624.1468
Year of production	2	9606.8788	2	4990302.4326**
Month of kindling	4	14701.8436	4	6152592.7816**
Age of doe	5	35839.3259	5	756812.1971
Parity	7	23363.0728	7	1330302.4724
Residual	479	16154.3524	326	669252.8719

* Significant at 5% level.

** Significant at 1% level.

Table 3 - Heterosis percentages in breed combinations

Breed combination	Heterosis % at Birth	Heterosis % at Weaning
B - G	14.9	17.3
B - F	16.0	1.7
B - R	38.5	31.8
G - F	9.8	11.7
G - R	10.9	-3.6
F - R	18.1	-11.2

Differences in litter weight due to year of production effects failed to prove significant at birth but were highly significant ($P<0.01$) at weaning (Table 2). Results of Khalil (1980) revealed that year of production effects on litter weight were nonsignificant at birth and highly significant ($P<0.01$) at weaning.

The average weight of litters both at birth and at weaning increased with the advance of months of kindling from September-October (the beginning of the year of production) to March-April at which it reached its peak and decreased again in May-July. Afifi et al. (1976) attributed such a trend to that during months of the beginning of year of production, the green fodder for the does is not available in enough quantities and of lesser nutritive values while as months of the year of production advance this fodder becomes more aboundant and of higher nutritive value and the weather becomes milder. During months of the end of the year of production, there is a lack in the green fodder and the weather becomes wormer and unfavourable.

Effects of month of kindling on litter weight were nonsignificant at birth and highly significant ($P<0.01$) at weaning (Table 2). This may lead to note that month of kindling effects constituted an important factor influencing litter weight at weaning. In agreement with these results, Casady et al. (1962) indicated that litter weight at weaning was affected by season of kindling. In this respect, Khalil (1980) showed that the effect of month of kindling on litter weight at birth and at weaning was highly significant ($P<0.01$) and that its magnitude at weaning was more than at birth.

Effects of age of doe contributed nonsignificantly to the total variance of litter weight either at birth or at weaning (Table 2). In agreement with these results, Casady et al. (1962) and Rollins et al. (1963) noted that age of doe had no significant effects on litter weight at weaning. Similarly, Afifi et al. (1976), Khalil (1980), Afifi et al. (1982a) and Afifi et al. (1982b)found that age of doe did not exert any significant effect on litter weight both at birth and at weaning. All these findings lead to note that age of doe effects on litter weight were limited.

Changes in litter weight at birth which occured with advance in age of doe seems to be a reflection of age changes in ovulation rate and in the ability of the doe to supply her offspring with nourishment during their prenatal growth. Changes in litter weight at weaning reflected by changes in age of doe refer mainly to that postnatal maternal abilities, specially those associated with milk production.

Litter weight at birth and at weaning changed with parity (Table 1). This change showed a general pattern indicating the increase in litter weight at birth with advance of parity from the 1st to the 7th and decreased thereafter. The same pattern was observed when considering litter weight at weaning, but the peak was reached by litters of the fifth parity. Rollins et al. (1963) and Afifi et al. (1982a) observed similar pattern but the peak was attained in different parities. Afifi et al. (1976) reported that the factor which played the role in expressing differences in litter weight between parities were more or less of nutritional and climatic origin. It is thought that those factors are not the sole causes of parity differences in litter weight at both ages, but changes in the physiological efficiency of the doe (specially those associated with the intra-utrine environment provided during pregnancy as well as milk production and the ability of the doe to nurse her young from birth till weaning which occur with advance of parity may be considered as other causes in this concern.

Effects of parity on litter weight were found to be nonsignificant at birth and at weaning (Table 2). Khalil (1980) reported similar findings. However, parity effects on litter weight were found to be significant ($P<0.01$ or $P<0.05$) at birth by Afifi et al. (1982b) and at weaning by Rollins et al. (1963) and by Afifi et al. (1982b).

When the variance in litter weight due to breed group was partitioned orthogonally into: due to breed of buck, breed of doe and the interaction between thme, the effects of breed of buck on litter weight at birth and weaning did not show significance, while those of breed of doe proved significant ($P<0.05$) only at birth (Table 2). Effects of breed of buck by breed of doe interaction were highly significant ($P<0.01$) at birth and nonsignificant at weaning. Accordingly effect of breed of buck on litter weight changed significantly with the change of breed of doe at birth but not at weaning. This can be ascribed to that the change of breed of doe means change in the intra-utrine environment supplied during pregnancy and in the number of youngs born which are main elements in determining litter weight at birth. At weaning many other external environmental factors can interfere with the effect of breed of doe on litter weight and therefore this would be the cause of the nonsignificant interaction effects obtained at weaning.

Data of litter weight were reanalysised for the same factors used in the first analyses in addition to the effect of litter size at birth when dealing with litter weight at birth and the effects of litter size both at birth and weaning when dealing with litter weight at weaning. It was observed that litter weight at birth increased significantly ($P<0.01$) with the increase of litter size at birth. Afifi et al. (1976) reported similar results. Also, Afifi et al. (1980) showed that litter weight was positively correlated with litter size, the correlation coefficients were significant and ranged between 0.809 and 0.989. Litter weight at weaning was found to increase significantly ($P<0.01$) with the increase of litter size at weaning. Litter size at birth was found to have no significant effects on litter weight at weaning. These results agree well with those of Afifi et al. (1976). Also, Afifi et al. (1980) reported positive significant ($P \angle 0.01$) correlation coefficients between litter size and litter weight at weaning (r ranged between 0.806 and 0.842).

Bibliography

Afifi, E.A., Galal, E.S.E., El-Tawil, E.A. and El-Khishin S.S. (1976). Litter weight in three breeds of rabbits and their crosses. Egypt. J. Anim. Prod., 16, No. 2, pp. 99-108.

Afifi, E.A., Galal, E.S.E. , El-Oksh, H.A. and Kadry, A.E. (1980). Inter-relationships among doe's weight, litter size, litter weight and body weight at different ages in rabbits. Egypt. J. Anim. Prod. 20, No. 2, pp. 127-136.

Afifi, E.A., Abdella, M.M.M., El-Sarafy, A.M. and El-Sayaad, G.A. (1982a). Litter traits as affected by feeding urea, breed group and other non-genetic factors. 7th International Congress for Statistics, Computer Science, Social and Demographic Research. 27 March - 1 April, 1982: 177-195.

Afifi, E.A., Galal, E.S.E., and Kadry, A.E. (1982b). The effect of breed and some environmental factors on litter traits in rabbits. 7th International Congress for Statistics, Computer Science, Social and Demographic Research, 27 March - 1 April, 1982: 311-330.

Afifi, E.A. and Emara, M.E. (1983). Litter size in local Egyptian and exotic breeds of rabbits and their crosses. (Under publication).

Casady, R.E., Rollins, W.C. and Sittmann, D.B. (1962). Effect of season and age of dam on individual weaning weight, number weaned and total litter weight of hutch-raised domestic rabbits. Small stock Magazine, 46 (11), 7, 23.

Harvey, W.R. (1960). Least squares analysis of date with unequal subclasses numbers. U.S.Dep. Agric. Res. Serv. ABS 20-8, Washington, D.C.

Khalil, M.H. (1980). Genetic and environmental studies on some productive traits in rabbits. M.Sc. Thesis, Faculty of Agricultural Science, Moshtohor, Zagazig Univ. A.R.E.

Rollins, W.C. Casady, R.B., Sittmann, K. and Sittman, D.B. (1963). Genetic variance component analysis of litter size and weaning weight of New Zealand White rabbits. J. Animal Sci., Vol. 22, No. 3, 654-657.

Summary

Data obtained from a diallel cross experiment carried out for three consecutive production years (1976/77-1978/79 inclusive) were used to study the effects of breed group and some non-genetic factors on litter weight in B,G,F,R rabbits and their crosses. Records of 513 litters were involved.

Litter weight averaged 352.7 gm at birth and 1786.0 gm at weaning. Among the four pure breeds used, F rabbits

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performed the best for litter weight at birth and at weaning. BR litters were the heaviest among all the crossbred litters obtained. Breed group effects were highly significant ($P < 0.01$) at birth and nonsignificant at weaning.

Crossbreeding was generally associated with the presence of heterotic effects on litter weight at birth and at weaning. Maternal and sex-linked effects on litter weight at birth and at weaning were not evident.

Year of production effects contributed insignificantly in litter weight variation at birth but significantly ($P < 0.01$) at weaning. Litter weight changed with month of kindling, the differences were nonsignificant at birth and highly significant ($P < 0.01$) at weaning.

Age of doe and parity effects were found to be nonsignificant source of variation in litter weight at both ages studied.

Effects of breed of buck on litter weight were nonsignificant at birth and at weaning, while those of breed of doe were significant ($P < 0.05$) only at birth. Effects of the interaction between breed of buck and breed of doe on litter weight proved significant ($P < 0.01$) only at birth.

Litter weight at birth increased significantly ($P < 0.01$) with the increase of litter size at birth. The same findings were obtained when considering effects of litter size at weaning on litter weight at weaning.

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Le résumé

Data qui est obtenu par l'experience d'un diallel crose qu avait lesion trois ans production alternative dans la duree (1976/77-1978/79 inclusive). La domaine de cette experience a ete oriente pour etudier las effects de group de sorte et les facteures non genetiques de poids du rejeton en B,G,F,R lapins et leurs crosses. Il enregistrait de 513 rejetons.

Le moyen de poids du rejeton etait 352.7 gm en accouchant et 1786.0 gm en sevrage. Dans la mesure de quatre sortes qui etaient pures. Flapins celle ci ont ete les mieux pour le poids du rejeton en accouchant et en sevrage. BR rejetons etaient les plus lords entre touts les rejetons on avait obtenu.

Les effets du groupe de sorte etaient augmente evidement ($P<0.01$) en accouchant et n'etait pas evidant en sevrage.

Generalement on peut dire que l'heberment est accompagne avec la presence de les effets heterotique pour le poids du rejeton en accouchant et en serrage. Le maternite et les effets de sex-linked sur le poids du rejeton en accouchant et en sevrage n'etaient pas evidents.

Les effets de l'annee de production n'ontete pas evidant sur le poids du rejeton en accouchant mais tres evidant ($P<0.01$) en sevrage.

Le poids du regeton est varie dans le mois d' acconchement. Le differences n'etaient pas evident en accouchant et tres evident ($P<0.01$) en servage.

Les effets de l'age de femin et l'aternative des rejetons n'etaient pas evidant soit sur le poids en accouchant et sur le poids du rejeton en servage.

Les effets de la sorte du male sur le poids du rejeton n'etaient pas evidant soit sur le poids du rejeton en acconchant et en servage mais au entraire ces effets de la sort de feminin ont ete evident ($P<0.05$) seulement en accouchant l'intervention de les effets entre le sorte de male et feminin sur le poids due rejeton ont ete evidant ($P<0.01$) seulement en accouchant.

Le poids du rejeton en accouchant augmentaient evidement ($P<0.01$) avec l'augmentation de nombre des rejetons en accouchant. On obtenu le meme resultat en appliquant les effets de nombre des rejetons en sevrage sur le poids du rejetons en sevrage.