BENHA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

BENHA VETERINARY MEDICAL JOURNAL

EFFECT OF LITTER SIZE ON POST WEANING INGESTIVE BEHAVIOUR, MORTALITY RATE AND PRODUCTIVE PERFORMANCE OF RABBIT'S KITS

Sherif Z. El kholya
Animal .Husbandry and Wealth Development. Fac. Vet. Med., Damanhour University.

A B S T R A C T

A total population of 65 New Zealand White rabbits (40 does and 15 bucks) was used to estimate the effect of litter size on the post weaning ingestive behaviour, performance and mortality rate of litters from weaning till 70 days under Egyptian conditions. The increased litter size was associated with lowering in ingestive behaviour. The mean feed intake from weaning till 70 days had a highly significant difference between the small litter size group and both medium and large litter size groups. The overall mean during the period from weaning till slaughtering showed that litters born in small litter sized groups had significantly higher ($P<0.01$) body weight gain (37.64±0.53 g/day) than medium or large litter sized groups (34.45±0.28 and 34.86±0.31 g/day, respectively). The pre-weaning litter losses increased with the increase of litter size at birth. Rabbits born in litters of 3-5 litters had the lowest mortality rate (0.02 %) compared to those born in litters of 6-8 litters (0.21%) or those born in litters more than 8 litters (0.51%), so it would be better for the female rabbits when they produce large number of litters to let them rear only small number of litters (3-5) and then the extra number could be fostered to other does. This practice would save large number of litters from death and offering great profits to the rabbit's breeders.

KEY WORDS: Ingestive, Mothering ability, New Zealand White rabbits, Weaning.

(BVMJ 22(2): 161-168, 2011**)**

1. I N T R O D U C T I O N

Several studies were carried out to estimate the factors that could influence the pre- and post-weaning performance of rabbits. Breed, season of birth, sex of litters and dam line affect the growth rate, feed efficiency and carcass traits during weaning and market ages [3].

Production of much litter size is not considered an indicator to the ability of mother to spare a good maternal environment for them. Moreover, the competition for nursing between litter could affect both time of nursing and amount of milk suckled by each litter during the pre-weaning period, this could affect development of the digestive system of the litter and so the post-weaning ingestive behaviour, performance, and survival percentage. The litter size at birth as a main effect was observed to affect the pre-weaning losses in rabbits, where, the larger the number of young that doe kindles, the greater mortality rate. Reducing the size of the nursing litter through cross fostering to a maximum of nine kits per litter could reduce pre-weaning mortality [2, 6, 8, 12]. Moreover, litter size was found to affect the body weight and weight gain, where, the increase in litter size was observed by decrease in body weight and weight gain [1, 17].

Mothering ability is the ability of dam to suckle considerable numbers of litters, maintain their life, provides care for such litters to lesser extent of mortality rate and

provides better extent of growth. Moreover, as the measuring of ingestive behaviour carried out by three different measures which are: a) The total amount of food consumed, b. The total amount of feeding in 30 minutes trial period and the average amount of food consumed per feeding bout, and c) by using indirect measures as time spent with head in trough [4, 10].

The aim of this investigation was to survey the effect of litter size for each doe on the post-weaning ingestive behaviour by the total amount of food consumed, performance and mortality rate of litters from weaning till 70 days under Egyptian conditions.

2. MATERIAL AND METHODS

This study was carried out on a population of New Zealand White rabbits (40 does and 15 bucks) reared in multi decked cages belongs to private farm, Alexandria governorate, Egypt. The recording of maximum and minimum degree of temperature was carried out by thermometers hanged between cages. Moreover, gas heaters were used in winter to provide a range of 20-25°C. In Spring and Autumn seasons, the temperature was naturally maintained within this range through ventilation with side windows and rotatory fans when necessary.

Does were mostly bred in the morning through natural mating. Pregnancy diagnosis was practiced two weeks after mating. They received pelted diet contain 18.09% crude protein and 12.15% crude fibre. Feed and water offered *ad libitum* through feeders and water valves connected to cages.

Weaning took place by separation of litters from their dams at 28 days of age at which off springs were identified by ear tags, then sex and weight were recorded. Litter size was arranged into small (3-5), medium (6-8) and large (9-11) according to the number of litters born at birth for each doe.

Individually body weight and feed consumption of young rabbits were recorded bi-weekly up to 70 days of age (at 42, 56 and 70 days of age), to estimate the body weight gain and feed conversion during 28-42, 42-56 and 56-70 days of age. Moreover, pre-weaning mortality was calculated for each doe as follows:

$$\text{Mortality rate \%} = \frac{\text{No. of young a tbirth} - \text{No. of young a live}}{\text{No. of young born}} \times 100$$

The percent of litters lost at 28 and 72 day were subjected to arcsine transformation before being analysed by general linear model procedure of the statistical analysis system (16) was utilised to analyse the obtained data based on the following model:

$Y_{ijk} = \mu \pm A_i \pm A\,(B)_{ij} \pm e_{ijk}$

Where: Y_{ijk} = An observed value, μ = Overall mean, A_I = Fixed effect due to Litter size (i= Small 3-5, medium 6-8 and large size9-11), $A(B)_{ij}$= A nested effect of the sex within the litter and e_{ijk} = Random error.

3. RESULTS AND DISCUSSION

The data presented in table (1) showed that increased litter size was associated with reduction in ingestive behaviour, where litters between 28-42 day of age exhibited highly significantly less ($P<0.01$) feed intake in large litter size group (73.67±0.74 g/day) than medium litter size groups (86.16±0.99 g/day), while, the small litter size group exhibited much feed intake (106.00±2.88 g/day).

Reduction in ingestive behaviour of litters was continued between 42-56 day (123.21±2.97, 127.23±3.35 and 133.13± 3.08 g/day, respectively) and between 56-70 day of age (140.41±1.17, 142.67±1.00 and 161.65±2.91 g/day, respectively). Moreover, the mean feed intake from weaning till 70 days had a highly significant difference ($P<0.01$) between small litter size group (133.59±3.51 g/day) and both medium and large litter size groups (118.69±1.56 and 112.43±2.20 g/day, respectively). This could be attributed to the chance of suckling which

was greater for the small litter sized groups and the development of their digestive tract which was established during pre-weaning period. Also could be attributed to mothering ability of the doe to care her litters which depend up on variation in the physiological efficiency of the doe, especially those related to milk production which is affected by litter size and parity and the ability of the doe to nurse the newly born litters [9]. Moreover, females litters, in small and large litter sizes, ate more feed during the period between 28-70 days, than those in medium size groups, however, this differences was of no significant importance. On the other hand, the males of medium litter sized group ate much feed than females (Table 1).

The feed conversion ratio was significantly ($P<0.01$) higher in small litter sized groups than medium or large litter sized groups after weaning between 28-42 days of age (2.75±0.09, 2.35±0.03 and 2.13±0.05, respectively) and between 56-70 days of age (4.88±0.21, 4.79±0.09 and 4.36±0.09, respectively). Moreover, between 28-70 days small litter size groups had significantly ($P<0.01$) higher feed conversion ratio than medium or large litter sized groups (3.23±0.03, 3.45±0.03 and, 3.55±0.06 respectively). Within each litter size group the differences between the male and female were observed to be variable and with no significant difference (Table 2).

The data presented in table (3) indicated that production to much litters at birth was associated with significantly lowered body weight at weaning (762.10±19.52, 609.41 ±17.82 and 533.11±12.35 g for small, medium and large litter sized groups respectively). Similarly, there was a significant ($P<0.01$) effect of litter size on the body weight after weaning at 42 days (1301.41±22.68, 1121.78±10.26 and 1016.95±10.35 g, respectively), besides, at 56 day (1879.24±26.34, 1639.16±11.92 and 1456.25±14.60 g, respectively) and at 70 days of age as well (2343.10±31.17, 2056.11±14.81 and 1997.08±16.43 g, respectively). This could be attributed to small size of litters at birth when dam give birth to much number of litters compared with those of small litters size also could be attributed to less chance of nursing in large litter size group than those of small litter size group [6]. The body weight of males within each group was higher than females except for the small litter sized groups where the body weight of males at 28 and 42 days was lowered, however, the trend was reversed thereafter (Table 3).

Table 1 Effect of litter size and sex on feed intake of rabbits' litters

Item	The feed intake (g / day) during the period between			
	28-42 day	42-56 day	56-70 day	28-70 day
Small (3-5)	106.00±2.88^{A}	133.13±3.08^{A}	161.65±2.91^{A}	133.59±3.51^{A}
Medium (6-8)	86.16±0.99^{B}	127.23±3.35^{AB}	142.67±1.00^{B}	118.69±1.56^{B}
Large (9-11)	73.67±0.74^{C}	123.21±2.97^{B}	140.41±1.17^{B}	112.43±2.20^{B}
Litter size (Sex)				
Small: male	103.56±5.27^{a}	132.52±3.48	161.56±4.74	132.55±2.18
female	107.60±3.33^{a}	133.53±2.83	161.71±3.73	134.28±2.06
Medium: male	88.85±1.44^{b}	129.38±3.30	144.55±1.41	120.93±2.47
female	83.39±1.33^{b}	125.01±3.39	140.72±1.42	116.37±4.94
Large: male	73.17±0.92^{c}	122.65±3.06	139.98±1.44	111.93±3.28
female	74.28±1.20^{c}	123.88±2.87	140.93±1.92	113.03±3.21
S.O.V.	---------- Means squares errors ----------			
Litter size	27613.10**	2629.86**	11187.44**	13810.13**
Litter size (Sex)	1092.73*	629.870	439.900	720.833
Experimental error	277.720	640.010	364.080	427.270

Table 2 Effect of litter size and sex on feed conversion of rabbits' litters

Item	Feed conversion ratio			
	28-42 day	42-56 day	56-70 day	28-70 day
Litter size				
Small (3-5)	2.75±0.09^{A}	3.23±0.14^{B}	4.88±0.21^{A}	3.55±0.06^{A}
Medium (6-8)	2.35±0.03^{B}	3.44±0.15^{A}	4.79±0.09^{A}	3.45±0.03^{A}
Large (9-11)	2.13±0.05^{C}	3.26±0.16^{B}	4.36±0.09^{B}	3.23±0.03^{B}
Litter size (Sex)				
Small: male	2.69±0.15	3.16±0.19	4.83±0.36	3.49±0.11
female	2.79±0.11	3.27±0.10	4.91±0.26	3.59±0.07
Medium: male	2.43±0.05	3.58±0.15	4.74±0.12	3.52±0.04
female	2.27±0.05	3.30±0.14	4.85±0.12	3.37±0.05
Large: male	2.15±0.08	3.25±0.15	4.23±0.11	3.20±0.04
Female	2.11±0.05	3.28±0.17	4.53±0.14	3.26±0.05
S.O.V.	---------- Means squares errors ----------			
Litter size	7.676**	3.140**	14.733**	2.635**
Litter size (Sex)	0.386	1.880	0.923	0.571
Experimental error	0.465	0.410	2.307	0.285

Means within the same column carry different capital superscripts are significantly differ at level P<0.01.** Highly significant difference at level P<0.01, S.O.V. = Source of variance.

Table 3 Effect of litter size and sex on body weights of rabbits' litters.

Item	Body weight / litter (g) at age of			
	28 day	42 day	56 day	70 day
Litter size				
Small (3-5)	762.10±19.52^{A}	1301.41±22.68^{A}	1879.24±26.34^{A}	2343.10±31.17^{A}
Medium (6-8)	609.41±17.82^{B}	1121.78±10.26^{B}	1639.16±11.92^{B}	2056.11±14.81^{B}
Large (9-11)	533.11±12.35^{C}	1016.95±10.35^{C}	1546.25±14.60^{C}	1997.08±16.43^{B}
Litter size (Sex)				
Small: male	754.64±22.08	1294.08±39.58	1882.12±41.79	2350.44±46.32
Female	767.00±17.92	1306.24±27.53	1877.34±34.37	2338.26±42.22
Medium: male	626.57±17.83	1137.93±13.64	1643.49±15.81	2070.81±20.28
Female	591.76±17.60	1105.16±15.31	1634.72±17.93	2040.97±21.61
Large: male	539.00±12.55	1016.03±14.96	1545.15±21.20	2008.73±22.44
Female	525.93±12.09	1018.07±14.04	1547.60±19.67	1982.94±24.13
S.O.V.	---------- Means squares errors ----------			
Litter size	1344279.12**	2133998.745**	2750330.618**	2947232.061**
Litter size (Sex)	18474.956	28224.453	2272.265	2046.447
Experimental error	16371.780	32494.582	50475.224	71610.533

The higher body weight of the males were obvious than females at the slaughter weight in small (2350.44±46.32 vs. 2338.26±42.22 g), medium (2070.81± 20.28 vs. 2040.97 ±21.61 g) and in large litter sized group (2040.97±21.61 vs. 2008.73±22.44 g). The effect of sex of rabbits on weaning weight was non-significant (Table 3). Moreover, McNitt and Lukefahr [14] observed that male rabbits had slightly better gains but the differences between the two sexes were non-significant. Sex differences in post-weaning body weights and weight gain during all intervals were very small and non-significant at 42, 56 and 70 days of age (Table 3&4). These results are in agreement with those reported formerly [1,

5, 7, 13]**.** On the other hand, other studies [15, 18] reported that sex of rabbits had a significant effect on body weight.

The small litter sized groups were significantly higher (P<0.01) in weight gain than medium or large litter sized groups during the period between 28-42 days (38.52±0.68 vs. 36.60±0.84 and 34.56±0.89 g/day, respectively), similarly, during the periods between 42-56 days (41.27±0.90 vs. 36.96±0.43 and 37.81± 0.51 g/day, respectively) and from 56-70 day (33.13±1.25 vs. 29.78±0.53 and 32.20±0.62 g/day, respectively). The overall mean during the period from weaning till slaughtering showed that litters born in small litter sized groups had significantly higher (P<0.01) body weight gain (37.64±0.53 g/day) than medium or large litter sized groups (34.45±0.28 and 34.86±0.31 g/day, respectively). The effect of sex within each litter sized group was found to be non-significant.

The effect of litter size on body weight and weight gain was observed to be highly significant (Table 3&4). Where, the body weights and weight gain of small litter size groups were significantly higher (P<0.01) than medium or large litter sized groups. This could be attributed to the greater body weight at weaning and the higher weight gain of new born litters from birth till weaning in such animals. Similarly, previous authors [1, 17] found that litter size affect both body weight and weight gain, where, the increase in litter size resulted in a decrease in body weight and weight gain. The pre-weaning litter losses increased with the increase of litter size at birth. Rabbits born in litters of 3-5 litters had the lowest mortality rate (0.02 %) compared to those born in litters of 6-8 litters (0.21%) or those born in litters more than 8 litters (0.51%). Similarly, former studies [1, 11] found that the pre-weaning litter losses increased with the increase of litter size at birth. However, some studies [2, 12] showed that pre-weaning litter losses increased with the increase in litter size but the differences were not significant. Moreover, El-Sheikh [8] reported that litter size at birth have a highly significant increase (P<0.01) on pre-weaning mortality rate with the increase of litter size at birth. The data presented in table (5) showed that there was a highly significant effect (P<0.01) of the litter size on the mortality percentage.

Table 4 Effect of litter size and sex on average daily gain (g) of rabbits' litters.

Item	The average daily gain (g /day)at the period between			
	28-42 day	42-56 day	56-70 day	28-70 day
Litter size				
Small (3-5)	38.52±0.68^{A}	41.27±0.90^{A}	33.13±1.25^{A}	37.64±0.53^{A}
Medium (6-8)	36.60±0.84^{B}	36.96±0.43^{B}	29.78±0.53^{B}	34.45±0.28^{B}
Large (9-11)	34.56±0.89^{C}	37.81±0.51^{B}	32.20±0.62^{A}	34.86±0.31^{B}
Litter size (Sex)				
Small: male	38.53±0.71	42.00±1.65	33.45±2.07	38.00±0.79
Female	38.52±0.67	40.79±1.03	32.92±1.59	37.41±0.71
Medium: male	36.53±0.73	36.11±0.57	30.52±0.76	34.39±0.38
Female	36.67±0.94	37.83±0.63	29.02±0.72	34.51±0.40
Large: male	34.07±0.98	37.79±0.71	33.11±0.82	34.99±0.41
Female	35.15±0.75	37.82±0.75	31.10±0.95	34.69±0.45
S.O.V.	---------- Means squares errors ----------			
Litter size	490.943**	507.392**	557.304**	350.410**
Litter size (Sex)	17.856	85.061	14.382	2.106
Experimental error	44.935	62.654	96.037	24.525

Means within the same column carry different capital superscripts are significantly differ at level p<0.01.** Highly significant difference at level P<0.01

The mortality rate at weaning time reached 0.51, 0.21 and 0.02% in large, medium and small litter sized groups, respectively. From weaning till slaughter weight the mortality percentage was found to be of non-significant although however, medium and small litter sized groups had higher mortality percentages than large litter sized groups (0.05, 0.03 and 0.01%, respectively). The effect of sex on the mortality was found to be of no significant importance within each litter sized group (Table 5). Litter size at birth found to have a highly significant effect (P<0.01) on pre-weaning mortality.

4. CONCLUSION

It would be better for the female rabbits when they produce large number of litters to let them rear only small number of litters (3-5) and then the extra number could be fostered to other does or subjected to artificial rearing. This practice would save large number of litters from death and offering great profits to the rabbit's breeders.

Table 5 Effect of litter size and sex on mortality percentages or rabbits'litters.

Item	At 28 day	From 28-70 day
Litter size		
Small (3-5)	0.02 ± 0.01^{C}	0.03±0.005
Medium (6-8)	0.21 ± 0.01^{B}	0.05±0.007
Large (9-11)	0.51 ± 0.01^{A}	0.01±0.001
Litter size (Sex)		
Small: male	0.02±0.02	0.05±0.003
Female	0.02±0.02	0.02±0.005
Medium: male	0.22±0.02	0.03±0.003
Female	0.23±0.02	0.04±0.006
Large: male	0.51±0.01	0.01±0.001
Female	0.51±0.01	0.02±0.002
S.O.V.	--------- Means squares errors --------	
Litter size	8.531**	1.146
Litter size (Sex)	0.000	0.019
Experimental error	0.034	0.041

Means within the same column carry different capital superscripts are significantly differ at level p<0.01. **Highly significant difference at level P<0.01

6. REFERENCES

1. Afifi, E.A. and Emara, M.E. 1990. Breed group and environmental factors influencing postweaning daily gain in weight of pure-bred and crossbred rabbits. *J. Appl. Rabbit Res.* **13**: 114-118.
2. Afifi, E.A. and Khalil, M.H. 1990. Observations on pure-bred and crossbred litters of Giza White and Gray Giant Flander rabbits in Egypt. *J. Appl. Rabbit Res.* **12**: 273-277.
3. Chiericato, G.M., Rizzi, C. and Rostellato, V. 1996. Growth and slaughtering performance of three rabbit meat production. 1. Body weight, feed efficiency and mortality. *J. Anim. Sci.* **46**: 573-577.
4. Clayton. D.A. 1987. Socially facilitated behaviour. *Q. Review, Biol.* **53**: 373-390.
5. DeBlas, J.C., Perez, E., Fraga, M.J., Rodriguez, J.M. and Galvez, J.F. 1981. Effect of diet on feed intake and growth of rabbits from weaning to slaughter at different ages and weights. *J. Anim. Sci.* **52**: 1225-1232.
6. Elmaghraby, M.A., Mahrous O.E. 2007. Influence of some pre-weaning factors and crossfostering on market traits of New Zealand White rabbits. *Benha Vet. Med. J.* **18**: 269-285.

7. El-Qen, R.N. 1988. Genetical and environmental studies on rabbits. M.Sc. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ.
8. El-Sheikh, A.I. 2000. Evaluation of some rabbit breeds and their crosses for pre-weaning mortalities under Egyptian environment
9. El-Sheikh, A.I., Mandour, M.A., Abd Allah, G.A., Yousrya Affify, K. 1999. Pre- and post-weaning performance of rabbits as affected by breed, crossbreeding and other non-genetic factors. The third Scientific Conference for Vet. Med. Researches, Fac. Vet. Med., Alex. Univ.
10. Keeeling, L.G. and Hurnik, J.S. 1993. Chickens show socially facilitated feeding behaviour in response to video-image. *Appl. Anim. Behav. Sci.* **36**: 223-231.
11. Khalil, M.H. 1980. Genetic and environmental studies on some productive traits in rabbits. M.Sc. Thesis, Fac. Agric. Sci., Zagazig Univ.
12. Khalil, M.H., Afifi, E.A. and Emara, M.E. 1987. Doe litter performance and weaning for two breeds of rabbits with special emphasis on sire and doe effects. *J. Appl. Rabbit Res.* **10**: 12-18.
13. Kosba, M.A. and Abo El-Ezz, Z.R. 1988. Some factors affecting body weight and dressing out percentage in two breeds of rabbits. 4th Congress of World Rabbit Sci., Assoc. October 10-14, 1988 Budapest, Hungary.
14. McNitt, J.I., and Lukefahr, S.D. 1993. Breed and environmental effects on postweaning growth of rabbits. *J. Anim. Sci.* **71**: 1996-2005.
15. Ristic, M. 1989. Effect of sex and final fattening weight on the carcass value of young rabbits. 6 Arbeitstagung Pelztier Kaninchen Und Heimtier Production, 2-4, Celle, 1989. Pp. 81-88.
16. SAS 1996. Statistical Analysis System. User's Guide, SAS Institute Inc., Cary, NC, USA.
17. Zaghlool, Y.F.A 1997. Effect of crossbreeding on the performance of rabbits. M.V.Sc., Fac. Vet. Med., Alex. Univ.
18. Zimmermann, E., Jaitner, J. and Dempfle, L. 1988. Relation between litter size (number weaned) and later body weight gain in the New Zealand White rabbits. 4th Cong. of the World Rabbit Sci. Assoc., October 10-14 1988, Budapest, Hungary, Vol. 1. Pp. 209-214.

مجلة بنها للعلوم الطبية البيطرية
BENHA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

تأثير حجم الخلفة على سلوك تناول الغذاء، معدل النفوق و الأداء الأنتاجى لصغار الأرانب بعد الفطام

شريف زكريا الخولية

قسم رعاية الحيوان وتنمية الثروة الحيوانية – كلية الطب البيطرى – جامعة دمنهور

الملخص العربى

أجريت هذه الدراسة على مجموعة من (40 أنثى و 15ذكر) من الأرانب النيوزيلاندى البيضاء لتقدير تأثير عدد الخلفة لكل أم على سلوك تناول الغذاء والأداء الأنتاجى ومعدل نفوق الصغار من الفطام حتى 70 يوما فى مزرعة خاصة تتبع محافظة الأسكندرية. وأظهرت النتائج المتحصل عليها أنخفاض فى معدلات تناول الغذاء فى المجموعات ذات عدد خلفة كبير فى الفترة من 28–42 يوم (73.67 ± 0.47 جم/يومى) عن المجموعات ذات عدد خلفة متوسط (86.16±0.99 جم/يومى) بينما كانت المجموعات ذات حجم ولدة صغير هى ذات معدلات مرتفعة معنوياً (P<0.01) بمعدل أستهلاك علف 106.00 ± 2.88 جم/يومى. أظهرت صغار الأرانب معدلات تحويل غذائى أفضل فى المجموعات ذات حجم خلفة قليل (3.23±0.03) عن المجموعات ذات معدل حجم خلفة متوسط (3.45±0.03) وعن المجموعات ذات معدل حجم خلفة كبير (3.55±0.06). أرتفعت أوزان صغار الأرانب عند اليوم 70 من عمر الأرانب حيث كان معدل وزن الأرانب فى المجموعات ذات حجم خلفة صغير أكبر (2343.10±31.17 جم) عن تلك ذات حجم خلفة متوسط (2056.11±14.81) والمجموعات ذات حجم خلفة كبير (1997.08±16.43 جم). كانت الزيادة فى وزن الأرانب عند اليوم 70 من العمر راجعة الى مستوى أعلى من الوزن المكتسب منذ الفطام (28 يوم) حتى اليوم 70 وذلك بفرق عالى المعنوية فى المجموعات ذات حجم خلفة صغير أكبر (37.64±0.53 جم/يومى) عن تلك ذات حجم خلفة متوسط (34.45±0.28جم/يومى) والمجموعات ذات حجم خلفة كبير (34.86±0.31 جم/يومى). كذلك كانت معدلات النفوق أعلى ما يكون فى صغار الأرانب من المجموعات ذات خلفة كبيرة (0.51٪) بالمقارنة بالصغار الموجودة فى مجموعات ذات الخلفة الصغيرة (0.02٪). مما سبق يتضح أنه سيكون من الأفضل بالنسبة لاناث الأرانب التى تنتج عددا كبيرا من الصغار أن يتم توزيعهم على أمهات بديلة وهذا سيؤدى الى حفظ عدد كبير من الصغار من النفوق وتقديم أرباح كبيرة لمربى الأرانب.

(مجلة بنها للعلوم الطبية البيطرية: عدد 22 (2)، ديسمبر 2011: 161–168)