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LITTER AND MEAN BUNNY WEIGHTS AS AFFECTED BY NEW ZEALAND WHITE RABBIT DOE AGE / WEIGHT AT KINDLING UNDER SEMI-ARID ENVIRONMENT OF ISMAILIA PROVINCE

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ABSTRACT

Data of this work were collected on Doe-records (235 litters) from NZW rabbits raised at the experimental Rabbitery, Faculty of Agriculture, Suez Canal University, Ismailia Governorate. Egypt, to investigate the maternal effects of the rabbit does (i.e. doe weight and age at kindling) on litter and mean bunny weights at birth, 7, 14, 21 days and at 2, 3 months of age. Doe-weight-at-kindling was classified into four categories, the first was less than 3000, the 2nd 3000-3500, the 3nd 3500-4000 and the 4th greater than 4000 g. with an average 3482 ± 21.068 g. Doe-age-at-kindling (in days) was grouped into four classes the first was less than 380 days, the 2nd 380-560, the 3nd 560-740 and the 4th greater than 740 days, with an average of 491 ± 10.945 days.

Tests of significance revealed that doe-weight-at-kindling affected litter weight significantly at early age stages (till 14 days of bunny ages) while the results revealed highly significant doe-weight-at-kindling effect on mean bunny weight only at birth. Age-of-doe-at-kindling proved significant effects on litter weight at birth and at 14 days post kindling, and on mean body at birth and mean body weight at birth and at 7 days post kindling. The effects of both studied factors (as they constitute fragment or subdivision of the maternal effect of the doe) were more profound at birth and faded thereafter as bunnies advance in age. Generally, the results showed that post kindling litter, and to some extent mean bunny, weights change positively as New-Zealand White rabbit does' weight and age at kindling increases especially in younger ages. This may spot light on the pivot role played by does' weight and age at kindling in the ability of these does to support the maternal performance on the produced young.

Keywords: Weight and age of doe at kindling; litter and mean bunny weight.

INTRODUCTION

New Zealand White (NZW), as a worldwide commercial medium meat rabbit breed is remarkably participating nationwide in increasing meat production as for its fast growing and prolific features in addition to its high mothering abilities and therefore fecundity capabilities. Reproductive and productive traits are largely controlled by two different sets of genetic and non-genetic factors and their interaction. The productive capacity of a rabbit doe depends extensively upon litter traits (i.e. litter size and weight) which constitute important economic composite traits in rabbit production. In this respect, Lukefahr *et al.* (1990) reported that litter weight at weaning is a composite trait of litter size, individual weight of rabbit per litter, doe milk production, post-natal mothering ability and growth and survival of young from birth up to weaning. Xiccato, (1996) reported that does suffer from a severe loss of body energy during lactation, resulting in subsequent high replacement rate of young does. Therefore, at the same age, heavy does can benefit from the extra amount of body weight at the end of rearing to withstand the energy deficit during lactation period.

Therefore, the objectives of the present study were the investigation of the effects of weight (DWK) and age of doe (ADK) at kindling affecting litter and mean bunny weight traits in New Zealand White rabbits.

MATERIALS AND METHODS

Data of the present study for litter (LW) and mean bunny (MBW) weight traits were field data collected during the period extended from 2010 till 2011 on 235 litters from New-Zealand White Rabbit does (NZW). These records were belonging to the experimental Rabbitery flock of the Faculty of Agriculture, Suez Canal University, Ismailia, Egypt.

Does were housed in individual cages provided with nest boxes, feeders and automatic drinkers and fed on a commercial pelleted diet containing approximately 16.1% protein, 2.39% crude fat, 12.8% crude fiber and 2500 kcal DE/kg diet, digestible energy. Feed and water were provided for *ad libitum.* At the beginning of the experimental work does were randomly ranked into groups of five to six according to the available numbers, to each a buck of the same breed was assigned as a rule indiscriminately, with just a restriction of avoiding parent-offspring and sib mating. Random mating was held approximately 7 days after kindling at when does were transferred to the cage of its assigned buck to be mated. Pregnancy was determined by palpation 10 days following mating. Females that failed to conceive were returned to the same assigned buck to be re-bred. All thorough the entire period of the study, each buck was allowed to sire all his litters from its own

assigned female group. Does which failed to become pregnant three times progressively were culled.

Light was allowed 14-16 hr. per day during the period of the study using ordinary light bulb lamps, which were distributed to provide an approximately light intensity of 4.5 watt/M. Animals were contemporaneous to each other and they have been subjected to the same managerial and environmental conditions.

Litter (LW) and mean bunny (MBW) weights were almost recorded weekly from birth to 21 days post kindling and afterward at 2, 3 months of bunnies' age. Doe-weight-at-kindling (in grams) was classified into four categories, the first was less than 3000, the 2nd 3000-3500, the 3rd 3500-4000 and the 4th greater than 4000 g. with an average 3482 ± 21.068 g. Doe-age-at-kindling (in days) was grouped into four classes the first was less than 380 days, the 2nd 380-560, the 3rd 560-740 and the 4th greater than 740 days, with an average of 491 ± 10.945 days. Data of does' LW and MBW traits for NZW rabbits were analyzed using SAS 8 (1999). The linear fixed model adopted for the analysis comprised the effects of weight and age of doe at kindling. The basic form of the general linear mathematical model is:

$$Y = X\beta + e$$

Where: Y = An (n x 1) observational column vector, X = Incidence matrix of zeros and ones which relating records to the appropriate fixed effects, ß = The vector of unknown fixed effects, e = The vector of random error.

Because of too many empty cells of the cross effect between doe weight and age at kindling, it was not possible to account for the interaction between the two studied factors.

RESULTS AND DISCUSSIONS

Doe-weight and age-at-kindling Effects:

Tests of significance revealed that doe-weight-at-kindling affected litter weight significantly ($P < 0.05$; $P < 0.01$ & $P < 0.0001$) at early age stages (till 14 days of bunny ages) while the results revealed highly significant doe-weight-at-kindling effect on mean bunny weight only at birth (Tables 1& 2). Age-of-doe-at-kindling proved significant effects ($P < 0.05$; $P < 0.01$; $P < 0.001$ & $P < 0.0001$) were detected on on litter weight at birth and at 14 days post kindling, and on mean body at birth and mean body weight at birth and at 7 days post kindling (Tables 3 & 4). The effects of both studied factors (as they constitute fragment or subdivision of the maternal effect of the doe) were more profound at birth and faded thereafter as bunnies advance in age (Tables 1 through 4).

Table (1). Effect of different classes of New-Zealand rabbit does' weight at kindling on litter weight (g.) from birth (LWB) till the 3rd month (LW3M) post kindling.

Trait	Sig.	WDK	_FREQ_	Ls-Means	STDERR	CV
LWB	****	**Overall**	**235**	**366.1**	**7.6**	**31.8**
		1	20	301.0	22.2	33.0
		2	105	321.0	10.2	32.7
		3	99	397.8	11.4	28.6
		4	11	446.1	49.2	36.6
LW7	*	**Overall**	**235**	**604.6**	**13.9**	**35.3**
		1	20	532.4	30.1	25.3
		2	105	578.5	21.6	38.2
		3	99	617.9	20.9	33.6
		4	11	689.6	82.1	39.5
LW14	**	**Overall**	**235**	**977.8**	**21.5**	**33.7**
		1	20	885.2	47.3	23.9
		2	105	955.6	32.2	34.6
		3	99	1001.1	33.4	33.2
		4	11	1069.1	124.4	38.6
LW21	ns	**Overall**	**235**	**1343.9**	**28.6**	**32.6**
		1	20	1208.5	62.8	23.2
		2	105	1263.0	42.6	34.5
		3	99	1322.9	45.2	34.0
		4	11	1581.1	132.8	27.9
LW2M	ns	**Overall**	**235**	**4745.3**	**139.6**	**45.1**
		1	20	3944.1	378.5	42.9
		2	105	4833.7	208.5	44.2
		3	99	4733.1	219.2	46.1
		4	11	5380.5	682.9	42.1
LW3M	ns	**Overall**	**235**	**6393.7**	**233.9**	**56.1**
		1	20	4937.2	675.5	61.2
		2	105	6709.9	350.1	53.5
		3	99	6194.8	352.2	56.6
		4	11	7706.5	1324.6	57.0

CV = coefficient of variability;
Classes of weight of does at kindling (the 1st = less than 3000, the 2nd = 3000-3500, the 3nd = 3500-4000 and the 4th = greater than 4000 g).

Table 2. Effect of different classes of New-Zealand does' weight and age at kindling on mean bunny weight (g.) from birth (MBWB) till the 3rd month (MBW3M) post kindling.

Traits	Sig.	WDK	_FREQ_	Ls-Means	STDERR	CV
MBWB	****	**Overall**	**235**	**57.7**	**0.9**	**23.3**
		1	20	55.8	3.9	31.2
		2	105	54.3	1.1	21.3
		3	99	61.3	1.4	22.2
		4	11	60.5	4.2	22.8
MBW7	**ns**	**Overall**	**235**	**118.8**	**2.3**	**29.2**
		1	20	115.1	6.6	25.7
		2	105	113.1	3.1	28.5
		3	99	123.1	3.6	29.0
		4	11	133.9	12.6	31.3
MBW14	**ns**	**Overall**	**235**	**206.1**	**4.0**	**29.6**
		1	20	203.4	15.5	34.0
		2	105	195.0	5.5	28.8
		3	99	213.2	5.9	27.6
		4	11	239.5	24.6	34.1
MBW21	**ns**	**Overall**	**235**	**300.3**	**6.5**	**33.2**
		1	20	293.5	26.7	40.7
		2	105	285.3	9.9	35.5
		3	99	309.8	8.9	28.5
		4	11	355.9	41.2	38.4
MBW2M	**ns**	**Overall**	**235**	**1223.5**	**17.5**	**21.9**
		1	20	1147.1	63.1	24.6
		2	105	1207.8	25.3	21.4
		3	99	1252.1	28.0	22.3
		4	11	1234.9	61.4	16.5
MBW3M		**Overall**	**235**	**1958.4**	**23.4**	**18.3**
		1	20	1860.9	60.2	14.5
		2	105	1977.4	30.1	15.6
		3	99	1964.5	43.0	21.8
		4	11	1901.9	55.6	9.7

CV = coefficient of variability;
Classes of weight of does at kindling (the 1st = less than 3000, the 2nd = 3000-3500, the 3nd = 3500-4000 and the 4th = greater than 4000 g).

Lukefahr *et al.,* (1983) detected significant differences due to Age-of-doe-at-kindling (ADK) on litter weight at birth. On the contrary, Ahmed (1997) and Amin *et al.,* (2005) at birth and at weaning and Nofal *et al.* (1999) at 6 and 10 weeks of age; were not capable to reveal a significant effect for age-of-doe-at-kindling on litter weight.

Rommers *et al.,* (2002) reported that heavy does compared medium and small does had a higher litter weight at 16 days of lactation ($P < 0.05$) and without significant at 30 days of lactation and showed that no differences in mean kit weight at weaning due to the does weight groups. Kumar *et al.,* (2001) was able to report significant effect for doe-weight-at-kindling on the weight of her kits up to 11th week of age.

Litter weight:

Least squares Means (Table 1) of the effects of different classes of New-Zealand White rabbit does'-weight-at-kindling *on litter weights* from birth till the 3rd month post kindling (Tables 1), and the effects of different classes of New-Zealand White rabbit does'-age-at-kindling *on litter weights* from birth till the 3rd month post kindling (Tables 3) showed a general trend of alteration towards being heavier with advance in does' weight or age at kindling. However, the effect of does' weight was somewhat obvious and comprehensible. Such effect was not statistically justifiable at late stages of kits' life.

Rommers, *et al.,* (2002) reported that heavy does compared to medium and small does had a higher litter weight at 16 days of lactation ($P < 0.05$) and without significant at 30 days of lactation and showed that body weight group affect productive performance where occurs improve with heavy doe weight compared to other doe weight classes. Furthermore, Xiccato, (1996) reported that does suffer from a severe loss of body energy during lactation, resulting in subsequent high replacement rate of young does, so the heavier does might be able to benefit from the extra amount of body weight to overcome the energy deficit during lactation period. In the same pattern, Rommers *et al.,* (2001) showed that heavier does had larger uterine horns and more corpora lutea on the ovaries compared with small does.

Afifi *et al.*(1982) ascribed the differences in litter weight with age of doe to pre- and post-natal mothering ability. Khalil, (1989) was able to reveal that significant changes in litter weight due to age of the at kindling may be due to the perplexity and confounding between age of doe and parity rank.

This may indicate that, judging from New-Zealand White rabbit does' weight and age at kindling, does weight plays a pivot role in the ability of these does to support the maternal performance on the development of the produced young. However, taking into account the Standard errors of the least squares Means of the New-

Zealand White rabbit does' weight or age at kindling, the homogeneity of these litters ruptured upward in the two extreme weights, but rather high in those with maximum weights. This relatively high variability in outcomes of the two extremities may reveal that the effects are multi-factorial and not necessarily produced the alleged results. However, this variability is not that clear when considering the coefficient of variability (CV).

Mean bunny weight:

Tables (2 & 4) represent Least squares Means of the effects of different classes of New-Zealand White rabbit does'-weight (Table 2) and –age (Table 4) -at-kindling on mean bunny weights from birth till the 3rd month post kindling. In most ages the changes in mean bunny weight traits follow a trend of higher doe weight or age classes gave better performance than that given by the lower two doe weight or age classes.

Rommers, *et al.* (2002) reported that medium and heavy does tended to have heavier kits at 16 days of lactation and it is not only the higher milk production that results in a heavier weight of the kits at weaning. Rojan, *et al.* (2013) reported that the highest significant least squares means were detected at tenth and twelfth week body weights of kits born out of dams weighing three kilograms or more. Form another hand, Parigi-Bini *et al.* (1992) and Xiccato *et al.* (1995) showed that Kits of small does may have compensated for the lower amount of milk available to them by consuming more pelleted feed. Rojan, *et al.* (2013) showed that higher mean body weights detected from 4 to 12 weeks of age for kits born out of dams ageing from 1000 to above 2000 days with significant effect at 4, 6 and 8 week of age

In other words, the larger the does' weight or age -at-kindling, the larger the mean body weight of its bunnies, with the effect being more pronounced starting from 3500 g kindling-weight or 560 days kindling-age of the does. This may indicate that judging from the field data of New-Zealand White rabbit does' and semi-desert environment of Ismailia Provence, does weight and to a lesser extent age plays a pivot role in the ability to support the maternal performance of these does on the produced broiler young rabbits.

Conclusion

Using heavy doe weight may improve litter and mean bunny weight of broiler New-Zealand White rabbits. This effect was more pronounced and verified statistically at younger ages rather than at marketing ages at two- or three-months of growing rabbit kits.

Table 3. Effect of different classes of New-Zealand White does' age at kindling on litter weight (g.) from birth (LWB) till the 3rd month (LW3M) post kindling.

Traits	Sig.	ADK	FREQ	Ls-Means	STDERR	CV
LWB	****	**Overall**	**235**	**366.1**	**7.6**	**31.8**
		1	71	352.3	13.4	32.1
		2	85	379.1	12.5	30.5
		3	59	369.2	14.4	30.0
		4	20	351.5	33.2	42.2
LW7	**	**Overall**	**235**	**604.6**	**13.4**	**33.9**
		1	71	583.9	24.9	35.9
		2	85	617.0	21.7	32.4
		3	59	653.7	26.8	31.5
		4	20	555.9	51.2	41.2
LW14	ns	**Overall**	**235**	**977.8**	**21.5**	**33.7**
		1	71	923.2	36.9	33.7
		2	85	1011.8	34.3	31.3
		3	59	1027.5	44.8	33.5
		4	20	887.2	89.1	44.9
LW21	ns	**Overall**	**235**	**1343.9**	**28.6**	**32.6**
		1	71	1283.9	45.9	30.1
		2	85	1399.6	48.6	32.0
		3	59	1380.4	61.3	34.1
		4	20	1206.3	103.9	38.5
LW2M	ns	**Overall**	**235**	**4745.3**	**139.6**	**45.1**
		1	71	4415.0	216.4	41.3
		2	85	4900.9	234.0	44.0
		3	59	4961.8	321.3	49.7
		4	20	4683.6	521.4	49.8
LW3M	ns	**Overall**	**235**	**6393.7**	**233.9**	**56.1**
		1	71	5779.7	365.6	53.3
		2	85	6757.6	403.3	55.0
		3	59	6710.7	510.9	58.5
		4	20	6167.1	844.4	61.2

CV = coefficient of variability;
Classes of weight of age at kindling (1= less than 380 days, the 2^{nd} = 380-560, the 3^{nd} = 560-740 and the 4^{th} = greater than 740 days).

Table 4. Effect of different classes of New-Zealand White does' age at kindling on mean bunny weight (g.) from birth (MBWB) till the 3rd month (MBW3M) post kindling.

Traits	Sig.	ADK	_FREQ_	Ls-Means	STDERR	CV
MBWB	***	**Overall**	**235**	**57.7**	**0.9**	**23.3**
		1	71	56.6	1.4	20.5
		2	85	51.0	1.1	19.6
		3	59	56.9	1.6	22.0
		4	20	66.0	5.2	35.5
MBW7	ns	**Overall**	**235**	**118.8**	**2.3**	**29.2**
		1	71	111.6	4.1	30.6
		2	85	114.0	3.5	28.7
		3	59	116.1	4.1	27.3
		4	20	133.2	11.8	39.5
MBW14	*	**Overall**	**235**	**206.1**	**3.8**	**28.2**
		1	71	195.2	7.4	32.0
		2	85	203.0	6.1	27.5
		3	59	207.1	5.9	21.9
		4	20	219.4	16.4	33.4
MBW2M	ns	**Overall**	**235**	**300.3**	**6.5**	**33.2**
		1	71	311.5	13.5	36.5
		2	85	298.2	9.9	30.6
		3	59	284.4	10.8	29.0
		4	20	314.3	27.9	39.7
MBW3M	ns	**Overall**	**235**	**1958.4**	**23.4**	**18.3**
		1	71	1993.2	44.9	19.0
		2	85	1931.7	39.5	18.8
		3	59	1937.5	41.2	16.3
		4	20	2013.1	75.0	16.7

CV = coefficient of variability;
Classes of weight of age at kindling (1= less than 380 days, the 2nd = 380-560, the 3nd = 560-740 and the 4th = greater than 740 days).

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تأثير وزن وعمر الأم عند الولادة على كل من وزن خلفة البطن ومتوسط وزن الخلفة بالبطن للأرانب النيوزلندى الأبيض تحت الظروف البيئية شبه الجافة لمحافظة الإسماعيلية

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تم تجميع البيانات الحقلية للبحث من عدد ٢٣٥ بطن ناتجة من أرانب النيوزيلندي الأبيض المرباة فى المزرعة التجريبية لكلية الزراعة جامعة قناة السويس بمحافظة الإسماعيلية، مصر. وذلك لتقدير التأثيرات الأمية لإناث الأرانب والمتمثلة في كل من وزن وعمر الأم عند الولادة على كل من وزن خلفة البطن ومتوسط وزن الخلفة بالبطن عند كل من الميلاد ، ٧، ١٤، ٢١ يوم وكذلك عند عمر ٢، ٣ شهور. تم تقسيم أوزان الأمهات عند الميلاد لأربعة أقسام ، الأولى كانت لأقل من وزن ٣٠٠٠ جم والثانية ما بين ٣٠٠٠-٣٥٠٠جم والثالثة مابين ٣٥٠٠-٤٠٠٠ جم والرابعة كانت للأمهات الأعلى من ٤٠٠٠جم وذلك بمتوسط ٣٤٨٢ ± ٢١,٠٦٨ جم . كذلك تم تقسيم مجاميع

الأمهات تبعا للعمر عند الولادة لأربعة مجاميع: كانت المجموعة الأولى للأمهات ذات الأعمار أقل من ٣٨٠ يوم وتراوحت أعمار المجموعة الثانية ما بين ٣٨٠-٥٦٠ يوم والمجموعة الثالثة ما بين ٥٦٠- ٧٤٠ يوم والمجموعة الرابعة كانت لأوزان الأمهات الأعلى من ٧٤٠ يوم وذلك بمتوسط ٤٩١ ± ١٠,٩٤٥ يوم.

أوضحت اختبارات المعنوية أن لفئات وزن-الأم-عند-الميلاد تأثيرا معنويا على وزن الخلفة بالبطن خلال فترة العمر الأولى (حتى اليوم ١٤ بعد الولادة)، بينما أوضحت النتائج تأثيرا عالي المعنوية لعمر-الأم-عند-الميلاد على متوسط وزن الخلفة بالبطن فقط عند الميلاد وعند ٧ أيام.

هذا وتأثير كلا العاملين المدروسين (واللذان يشكلان مركزان هامين للتأثير الأمي) كان أعلى ما يمكن عند الميلاد ثم بدآ بضمحلال بعد ذلك مع تقدم الخلقة في العمر. وبصفة هامة فقد أظهرن النتائج أن وزن خلفة البطن وبدرجة أقل متوسط وزن خلفة البطن كانت فى الأرانب النيوزلندي كانت تظهر تغيرا موجبا مع الزيادة فى وزن وعمر-الأم-عند-الميلاد وبصورة أكثر وضوحا في الأعمار الصغيرة. وربما يلقى هذا الضوء على الدور المحوري والهام الذي يلعبه العاملان المدروسان على قدرة هذه الأمهات على دعم قدراتها الأمية لرعاية خلفاتها خاصة في أعمارها الأولى.

أما بالنسبة لفئات عمر-الأم-عند-الميلاد فقد أظهر تأثيرا معنويا وزن الخلفة بالبطن معنويا عند الميلاد وعند ١٤ يوم بعد الولادة.