J. Product. & Dev., 12(2): 497– 507(2007)

PLASMA PROGESTERONE LEVEL AND OTHER REPRODUCTIVE ASPECTS IN NEW ZEALAND RABBIT DOES AS AFFECTED BY FEEDING LEVEL

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ABSTRACT

The present study was carried out to investigate the influence of feeding levels from mating to day 10 of pregnancy on progesterone hormone concentration, gestation length, fertility rate, litter traits and milk yield. Twenty seven New Zealand White (NZW) rabbit does, aged from 5.5 to 6.0 months with an average initial body weight (3.00±0.25 kg), were used in the present work. The rabbit does were divided into three feeding level groups 9 in each. Rabbits were fed a pelleted diet containing 2800 kcal /kg and 18% crude protein. The first group (G1) was kept as a control group and received 140g/day ration during the experimental period. The second group (G2) and third group (G3) received 70g and 280g/day ration, representing 50and 200 % of feed level as compared with control group, respectively .

The results revealed that, plasma progesterone hormone levels at 3 ,7 and 14 days of mating differed significantly (P<0.05) and (P<0.01) among the three feeding level groups, respectively . The level of progesterone hormone was the highest in G2, G1 and G3, respectively. Fertility rate was affected significantly (P<0.01) by the feeding levels, being higher (P<0.01) in G2, then G1 and G3, respectively. Gestation length, litter size and weight at birth, 1, 2, 3 and 4 weeks of age were insignificantly affected. The highest (P<0.05 or 0.01) values of milk yield at 1st and 2nd weeks were recorded in does in G1, while at 3rd and 4th weeks of lactation in G3 . Distinctively, milk yield increased gradually reaching the peak at 3rd week of lactation in all feeding level groups . The differences were significant by (P<0.01) between the 1st and 2nd weeks of lactation.

It could be concluded that rabbit does under fed restricted diet conditions up to 50% of control diet from mating to 10 day of pregnancy improved their reproductive efficiency in NZW.

Keywords: Rabbits, NZW, progesterone hormone, reproductive performance, feeding level .

INTRODUCTION

It is well established that a range of 20 to 30 % of fertilized ova die during the first week of pregnancy (Edey, 1969). High mortality rate could be due to viability of embryos or their position in the uterine horns (Hafez and Hafez, 2000). Progesterone

hormone is one of the essential factors for maintaining pregnancy (Ruckebusch *et al.,* 1991). Progesterone hormone regulates the ova movement through the oviduct and particularly prepares the uterus to receive the blastocyste by inducing the development of complicated glands' structures in the proliferating endometrium (Blunt, 1972 and Hafez and Hafez, 2000). Moreover, low progesterone hormone concentration have also been shown to be associated with a low rate of embryos viability (Cumming, 1972; Parr *et al*., 1982 and Parr, 1992).

Nutrition in early pregnancy and peripheral plasma progesterone hormone concentrations are inversely related (Parr *et al*., 1982; Williams and Cumming 1982; Parr *et al*., 1987 and Parr ,1991). Therefore, Kemp *et al.* (2004) observed that restricted feeding for pregnant rabbits improved number of live born kids, weight at 1st kindling, and litter growth in the first parity. Nagwa Ahmed *et al.* (2005) reported that using feeding programs on NZW rabbits before the 1st insemination, especially short feeding programs (feed 65% from requirement for 15 days period before insemination), improve reproductive performance, litter size, weight at birth and weaning, milk production and progesterone levels at mating and half pregnancy.

Therefore, the present study aimed to determine the effects of different feeding levels from mating to 10 days of pregnancy on progesterone hormone concentration, gestation length, fertility, litter traits and milk yield of NZW rabbits under Sharkiya Governorate conditions.

MATERIALS AND METHODS

The present study was carried out in the Private Rabbit Farm , Sharkiya Governorate, Egypt, during the period from February to May, 2006.

Experimental animals:

The total numbers of twenty seven New- Zealand (NZW) rabbit does, aged in a average from 5.5 to 6.0 months and 3.00±0.25 kg average initial body weights, were used in the present study. The sex ratio was one male per four to five females throughout the experimental period. The rabbit does were housed individually in wooden cages provided with galvanized steel feeders and nest boxes and automatic nipple drinking system. A cycle of 16 hours light 8 hours dark was used throughout the experimental period. protein**.** All rabbits were kept under the same managerial conditions.

Feeding level groups:

One experimental pellet diet was formulated to cover all essential nutrient requirements for the rabbit does according to De Blass (1986) and Irlbeck (2001) as shown in Table 1. Twenty seven NZW rabbit does were divided into three feeding level groups (9 each) and randomly assigned to three groups.

Group 1: The average amount of feed per doe during the experimental period in the first group (G1) was 140g per day (4 -5 % of body weight), according to Irlbeck, (2001) and served as a control group.

Group 2: The average amount of feed per doe in the second group (G2) was 70g/ day (2.0-2.5% of body weigh) according to Jenkins, (1999). The daily feed intake in this treatment represented 50% as compared to (G1), and this group served as the restricted feeding group.

Group 3: The average amount of feed per doe in the third group (G3) was 280g/day, daily feed intake in this feeding level represented 200% as compared to G1.

All treatments started after the first natural insemination and continued ten days after mating. The rabbit does were tested for pregnancy by abdominal palpation after 10 days of mating to determine the fertility percentage. Two parities from each doe during the experimental period. All pluriparous does were re-mated in day 10 after parturition. Litters of each rabbit does were kept in the same housing model till weaning (4 weeks of age).

Table 1. Composition and chemical analysis of the experimental diet.

Ingredients	**(%)**
Berseem hay	25.2
Wheat bran	23.2
Barley	28.3
Soybean meal	20.4
Bone meal	0.2
Limostone	1.8
Methionine	0.2
Salt	0.3
Premix*	0.3
Anti-coccidia	0.1
Total	**100**
Chemical analysis as DM)	**(%)**
Dry matter	93.1
Ash	10.3
Crude protein	17.81
Digestible energy (kcal/kg)	2701
Crude fiber	12.18
Ether extract	2.07
N-free extract	57.64
Methionine	0.56
Lysine	0.94
Calcium	1.10
Phosphorous	0.63

One Kilogram of vitamins and minerals premix contains : Vit. A; 2.000,000 IU , Vit. D3; 150,000 IU, Vit E; 8.33g, Vit. K; 0.33g, Vit B1; 0.33g Vit. B2; 1.00g, Vit B6; 0.33g, Vit. B9; 8.33g Vit. B12; 1.7mg, Pantothianic acid; 3.33g, biotine; 33mg, Folic acid; 0.38g, Choline chloride; 200g, Zn; 11.7 g, Fe; 0.5g, Cu;12.5g, Se; 1.3mg, and Mn 66.7g

Measurements:

Litter size and weight were recorded at birth and weekly till weaning (4 weeks). Gestation length was also recorded for does in each treatment. Conception rate (%) was calculated according to the following equation: Conception rate (%) = (Number of pregnant does from one service) / (the total number of rabbit does). Milk yields were estimated weekly at 8:00 morning from parturition up to weaning by determining the variation of kids weight before and after suckling. Blood samples were taken from the marginal ear vein at 1, 3, 7 and 14 days after mating and kept in heparinzed test tubes. Plasma was separated by centrifugation of blood samples for 20 minutes at 3000 rpm, and the plasma was kept at -20^{o}C until analysis to determine the progesterone hormone concentration using radioimmunoassay technique with commercial kits purchased from Diagnostic Product Corporation, Los Angeles, USA.

Statistical analysis:

The data were analyzed using the GLM procedure of SAS (1990). Reproductive traits were analyzed by a randomized complete block model. Parameters regarding lactating does were analyzed by a linear model including effects of treatment. Differences between each two means for all traits studied were tested by Duncan Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Progesterone hormone concentrations (ng/ml):

Results of progesterone hormone concentrations of NZW rabbit does fed different feeding levels are shown in Table 2. Progesterone concentrations at days 3, 7 and 14 after mating showed significant by ($P<0.05$ or 0.01) differences among feeding levels groups. The highest ($P<0.01$) values of progesterone hormone were recorded in rabbit does fed restricted feed (G2) at different times after mating. These results indicated that progesterone concentration increased with advancement of gestation period. From these results the high plasma progesterone concentrations a good indication for pregnant does. This trend was similar to that obtained by El-Maghawry *et al.* (1994), who indicated that the level of progesterone hormone progressively increased ($P<0.05$) with the progress of gestation period reaching the maximum level in the 3rd and 4th weeks of pregnancy.

Parr (1992) concluded that a sudden increase in feed intake during early pregnancy leads to reduced rates of progesterone. So, an increase of feed intake causes an elevation of blood flow through the gastrointestinal tract and liver, and progesterone in this blood is almost completely metabolized after one passage through the gut and liver. In addition, it is also probable that corpus luteum is not able to change its rate of progesterone secretion to maintain homeostasis. This probably explains the present results in which progesterone level was the highest in the second group (G2) that was fed a restricted diet in a similar trend. Solouma *et al.*, (2006) observed that serum progesterone hormone concentration was slightly higher in ewes fed maintenance requirement compared to those fed double maintenance. Also, other

Table 2. Means of plasma progesterone hormone concentration (ng/ml) after mating as affected by feeding levels in NZW rabbit does.

Items	Feeding levels			Significant test
	Group 1	Group 2	Group 3	
Day of mating:				
1	1.11±0.14	1.57±0.15	1.29±0.14	**NS**
3	2.74±0.25 ^{b}	3.54±0.25^{a}	2.9±0.25 $^{a\,b}$	*
7	5.35±0.35 $^{a\,b}$	6.24±0.35 ^{a}	4.51±0.35 ^{b}	**
14	6.87±0.36 ^{b}	8.25±0.36^{a}	7.31±0.36$^{a\,b}$	**

a,b, Means bearing different superscripts within the same row differ significantly (P< 0.01).
NS=Not significant, * = (P<0.05) ** = (P<0.01)

authors reached the same observations (Williams and Cumming, 1982 and El-Barody *et al.,* 1993). In addition, Abd El Moty (1991) observed an increased level of cholesterol; the main source of steroid hormones, in NZW males that were fed restricted diet (10% of the *ad libitum*) as compared to *ad libitum* group.

2- Gestation length and fertility percentage:

Data presented in Table 3 shows that the fertility significantly (P<0.01) higher in the rabbit does restricted feed (G2) than those of either G1 or G3, however the differences among feeding level groups in gestation length were not significant.

Table 3. Means of fertility (%) and gestation length (days) as affected by feeding levels in NZW rabbit does (9 does in each group).

Items	Feeding levels			Significant test
	Group1	Group2	Group3	
Fertility (%)	62.0±0.09 ^{b}	69.0±0.09 ^{a}	60.0±0.09 ^{b}	**
Gestation length (days)	29.39±1.20	32.48±1.22	30.47±1.21	**NS**

a,b,. Means bearing different superscripts within the same row differ significantly (P<0.01)
NS= Not significant, * * = (P<0.01)

Rabbit does restricted in feed G2 increased conception rate and reproductive performance by central effects on gonadotropin secretion and local effects on ovarian function (Gosalvez *et al*., 1994). The same authors added that better fertility rate can be explained by the older does and favorable influence of flushing on ovulation. Moreover, Peltoniemi *et al.* (1997) reported that the increase in conception rate of nulliparous restricted does could be due to LH hormone secretion, which related to metabolic changes in early pregnancy. Similar results were obtained by Bonanno *et al.* (2004) who found that rabbit does fed restricted feed showed a tendency towards a higher fertility by +5.6%. Nagwa Ahmed *et al.* (2005) added that the highest

(P<0.05) value of conception rate was found in does of restricted in long feeding program (65% of the nutritional requirement for 50 days before insemination) followed by does in short feeding program (65% of the nutritional requirement for 15 days before insemination) and then does of control group. The high conception rate in restricted group (G2) compared to G1 and G3 may be due to the highest level of progesterone concentration (Table 2). This may clarify that the increased level of progesterone is related to the high conception rates (69%) in G2 vs. 60% in G3 and 62% in G1 (Table 3), which may be due to the effect of the high level of progesterone on embryo implantation.

3. Litter traits:

The effect of feeding levels on litter size from birth , 1st, 2nd , 3rd and to 4th weeks of age (weaning age) is presented in Table 4. Rabbit does of G1 had the highest litter size at birth. However, the differences among feeding levels groups were not significant throughout the experimental period. The same trend was observed in litter size at 1, 2, 3 and 4 weeks of age. The present results (Table 4**)** revealed that the litter size, at birth and at weaning, was not affected by different treatments. Brecchia *et al.* (2004) found that the long food deprivation markedly decreased litter size at birth. Similar results were obtained by Xiccato *et al.* (1992) and Tawfeek (1996).

Table 4: Mean of litter size from birth to 4 weeks of age as affected by feeding levels in NZW rabbit does.

Items	Feeding levels			Significant test
	Group1	Group 2	Group 3	
Litter size at:				
Birth	5.55±0.32	5.34±0.33	5.38±0.33	NS
1 week	5.10±0.33	4.88±0.34	4.63±0.34	NS
2 week	4.77±0.33	4.72±0.33	4.35±0.33	NS
3 week	4.66±0.31	4.59±0.31	4.25±0.31	NS
4 week	4.44±0.25	4.29±0.25	3.38±0.25	NS

NS : Not significant

Data in Table 5 shows that litters weight at birth, first, second, third and forth weeks of age differ insignificantly among different treatments, without definite trend, except G3 gave the least values of litter weight in different studied intervals. These results are in agreement with those obtained by Bonanno *et al.* (2004) who observed that weight of a live born was not affected by using restricted feed, while litter size at birth was higher by 0.7 kid in does fed restricted feed, however, the differences were not significant. Similar results were obtained by Nagwa Ahmed *et al.* (2005). Generally, litter size at birth depends on the number of ova shed at ovulation

Table 5 . Means of litter weight from birth to 4 weeks of age as affected by feeding levels of NZW rabbit does.

Items	Feeding levels			Significance test
	Group1	Group 2	Group 3	
Litter weight at:				
Birth	275.9±16.6	261.0±16.9	256.5±16.8	NS
1Week	495.9±34.3	466.3±35.0	457.3±34.7	NS
2 Week	862.4±70.1	875.4±71.6	771.7±71.0	NS
3 Week	1237.2±87.0	1294.0±89.1	1110.0±88.9	NS
4 Week	1643.0±99.5	1621.1±101.4	1543.0±100.6	NS

NS : Not significant

(El-Fouly *et al.*, 1977), and it is controlled by genetic factors (Helmy, 1991) and non genetic factors **(**Azoz, 2001).

4. Milk yield:

Milk yield increased significantly (P<0.05) with the different lactation periods reaching the peak at 3rd week of lactation in all treatment groups (Table 6). Milk yield at 1st and 2nd weeks of lactation showed significant differences (P<0.05), where does of G1 recorded the highest milk yield values, while those fed the high amount of feed in (G3) or the restricted feed in group G2 recorded a lower values in milk yield at 1st and 2nd weeks of laction. However, the differences in milk yield between G2 and G1 were not significant in the first two weeks. In contrary, at 3rd and 4th weeks of lactation, G3 showed the highest (P<0.05) values of milk yield followed by G1 and G2. However, the differences between G2 and G3 were significant. Similar results were reported by Blas and Galves (1973).

Table 6. Means of milk yield during the different periods of lactation as affected by feeding levels of NZW rabbit does

Items	Feeding levels			Significant test
	Group1	Group 2	Group 3	
Milk yield at:				
1 Week	66.00±1.48 ^{a}	63.50±1.50 $^{a\ b}$	60.70±1.50 ^{b}	*
2 Week	79.25±1.83 ^{a}	78.68±1.87 $^{a\ b}$	72.96±1.85 ^{b}	*
3 Week	439.29±77.17 $^{a\ b}$	371.74±79.25 ^{b}	455.00±82.85 ^{a}	**
4 Week	426.42±79.18 $^{a\ b}$	350.86±81.31 ^{b}	442.96±85.00 ^{a}	**

a,b,. Means bearing different superscripts within the same row differ significantly ((P<0.05),
* = (P<0.05) ** = (P<0.01).

The good feeding program, consequently good body condition of does led to improving intrauterine rearing ability and milk production (Eiben *et al.,* 2001). Similar results were obtained by El-Maghawry (1993) and Nagwa Ahmed *et al.* (2005) who indicated that the rabbits of the restricted feed secreted more milk.

Conclusively, restricting feed up to 50% of requirement improved their fertility rate, litter traits and milk yield in NZW rabbit does from mating to 10 days of pregnancy These results should be explained by increasing progesterone level that was positively affected by restricted diet. It could be concluded that rabbit doe could be fed restricted diet up to 50% of requirements from mating to day 10 of pregnancy without reducing the reproductive performance, under Sharkiya Governorate conditions .

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أثر مستوى التغذية على بروجستيرون البلازما وبعض خصائص التناسل الأخرى في إناث الأرنب النيوزيلندي

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استخدمت في هذه الدراسة سبعة و عشرون أم من الأرنب النيوزيلندي الأبيض تراوحت أعمارها من ٥.٥ إلى ٦ شهور و متوسط أوزانها ٣.٠٠ ± ٠.٢٥ كجم وذلك لدراسة تأثير مستوى النغذية من يوم التلقيح حتى اليوم ١٠ من الحمل على مستوى هرمون البروجسترون ومعدل الخصوبة وطول فترة الحمل وحجم البطن وانتاج اللبن.
قسمت الأمهات إلى ثلاثة مجاميع ٩ أمهات في كل مجموعة .المجموعة الأولى التي حصلت في اليوم على ١٤٠جرام عليقة (التي تمثل من ٤-٥ % من وزن الجسم) ثم المجموعة الثانية محددة كمية الغذاء (٧٠جرام/يوم) ٥٠% من المجموعة الأولى .بينما المجموعة الثالثة فقد غذت ضعف العليقة الأولى ٢٨٠جرام يوم. المعاملة الغذائية كانت تبدأ من يوم التلقيح حتى عشرة أيام منه وكان يتم تشخيص الحمل في الامهات بواسطة الجس البطني في اليوم العاشر من التلقيح وفى حالة عدم الحمل يعاد التلقيح مرة أخرى و كانت جميع الأمهات تعرض على الذكور بعد عشرة أيام من الولادة تم الحصول على عدد أثنين بطن من كل الأمهات وتم تسجيل عدد التلقيحات لكل أم . ثم دراسة النتاج حتى الأسبوع الرابع من العمر وحساب طول فترة الحمل وكذلك تم تقدير مستوى هرمون البروجستيرون في بلازما الأمهات في اليوم الأول و الثالث و السابع و الرابع عشر من التلقيح.
ويمكن تلخيص النتائج المتحصل عليها فيما يلي :
١- سجلت المجموعة الثانية محددة الغذاء أعلى تركيز لمستوى هرمون البروجستيرون في اليوم الثالث و السابع و الرابع عشر عن المجاميع الأخرى وكانت الاختلافات معنوية بين المجاميع و لم تسجل اختلافات معنوية في اليوم الأول بين المجاميع.
٢- سجلت المجموعة الثانية محددة الغذاء أعلى نسبة مئوية في معدل الخصوبة و كانت الفروق معنوية بين المجاميع
٣- سجلت المجموعة الثانية محددة الغذاء أطول فترة حمل ولكن الفروق غير معنوية
٤- سجلت المجموعة الأولي أعلى قيم في حجم ووزن البطن تليها المجموعة الثانية محددة الغذاء ثم الثالثة و لكن الفروق غير معنوية
٥- المجموعة الأولى سجلت أعلى انتاج للبن في الأسبوع الأول و الثاني وكانت الاختلافات معنوية ثم سجلت المجموعة الثالثة أعلى إنتاج للبن في الأسبوع الثالث و الرابع وكانت الاختلافات معنوية.

خلصت هذه الدراسة إلى أن تعرض الأرنب لنقص الغذاء (٢.٥-٢% من وزن الجسم) من يوم التلقيح وحتى اليوم العاشر من الحمل يودى إلى رفع الخصوبة بدرجة معنوية بدون التأثير على باقي الصفات التناسلية الأخرى وان العلاقة بين مستوى هرمون البروجستيرون في الدم و مستوى التغذية علاقة عكسية.