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Feed restriction of pregnant nulliparous rabbit does: consequences on reproductive performance and maternal behaviour

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ABSTRACT

An experiment was conducted to examine the effect of feed restriction of young pregnant rabbit does during early (10 days), mid (15 days), and late gestation (20 days) on progesterone level, feed intake, reproductive and productive performance and maternal behaviour. Forty nulliparous rabbit does were classified into four equal groups (10 does/group). The first group was the control group (C) the does were fed ad libitum from day of mating and throughout pregnancy. The other three groups were the restricted groups in which the does were restricted to 1.32 of maintenance requirements during the first 10 days (R10), the first 15 days (R15) and the first 20 days of pregnancy (R20). At the end of each restriction period does of R10, R15 and R20 returned to ad libitum feeding. Compared to control group does of R15 and R20 showed significantly ($P < 0.05$) increased voluntary feed intake during the last stage (21 days to kindling) of pregnancy (292 ± 16 g/day, 325 ± 12 g/day Vs 251 ± 14 g/day) which resulted in better preparturient maternal behaviour, heavier does at kindling (3025 ± 15 g, 2975 ± 14 g Vs 2796 ± 15 g) with heavier kits (49.79 ± 2.84 g, 54.45 ± 2.90 g Vs 43.93 ± 4.10 g) and litters (387 ± 14 g, 396 ± 19 g Vs 338 ± 28 g) at birth in addition to heavier litters at weaning (2570 ± 48 g, 2685 ± 65 g Vs 2235 ± 65 g). Results of R10 and C groups were comparable. No significant differences ($P < 0.05$) were recorded between control and the different restricted groups for progesterone level during pregnancy, fertility and kindling rates nor doe weight at end of lactation. In conclusion, restriction of young pregnant rabbit does for the first 15 or 20 days of pregnancy stimulated voluntary feed intake during late pregnancy and might improve their performance without adversely affecting progesterone level or embryonic mortality, however further investigations are needed to elucidate its effect on doe performance for more than one cycle and the effect of such prenatal restriction on the future performance of their kits.

1. Introduction

Rabbit does are either pregnant or suckling or frequently both functions at the same time. These two functions are very costly in terms of energy especially for young rabbit does which are still growing during their first pregnancy, consequently a negative energy balance could occur during late gestation and lactation periods which could affect body condition and reproductive performance of doe (Fernández-Carmona et al., 2000). A possible approach for prolonging the life span and reproductive performance of these does may be the elaboration of a good management strategy that implies stimulation of voluntary feed intake of them during these periods.

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In commercial rabbitries it is a common practice to feed rabbit does to appetite directly after mating and during gestation. However, high feeding levels of young rabbit does can decrease embryonic survival with subsequent reduction of the number of newborn rabbits, linked to excessive fatness of does (Fortun-Lamothe and Lebas, 1996). Moreover, ad libitum fed does show increased voluntary feed intake 25–50% (Fortun-Lamothe, 2006) during the first 3 weeks of gestation, however during the last week, the ingestion of feed declines sharply whereas the energy requirements for the growing foetus increase rapidly, this results in a negative energy balance over this period and a transfer of the body fat mass into the foetuses (Fortun Lamothe et al., 1994).

Voluntary feed intake is the main limiting factor in the energy balance of lactating (Xiccato, 1996) and gestating does, so stimulating voluntary feed intake during late gestation period may be a feasible approach towards reduction of the energy deficit and improvement of doe and kit performance.

Many researchers have demonstrated that after restricted feeding, the appetite of rabbits improves and a sharp increase for voluntary feed intake occurs by 40% more than ad lib fed rabbits (Rommers et al., 1999; Tumova et al., 2003, 2004). Therefore it is of interest to determine whether restricted feeding during different gestation periods could stimulate voluntary feed intake during pregnancy and subsequent lactation without adversely affecting doe and kit performance.

Rommers et al. (2004) found that, restricted feeding during early pregnancy "the first 10 days" did not affect kindling performance of young rabbit does, on the other hand, Coudert and Lebas (1985) recommended no feed restriction during the last third of pregnancy of rabbit does. However, to our knowledge, information on the effect of feed restriction during mid- and two-thirds of gestation on rabbit does and their litters, is not available.

Therefore, this experiment was performed to study the effect of feeding management of young pregnant rabbit does through restriction during different phases of gestation "early, mid and two third" on their progesterone level, voluntary feed intake during pregnancy and subsequent lactation, reproductive performance, maternal behaviour and litter and kit traits of young rabbit does with special reference to the economic aspect.

2. Materials and methods

The experimental procedures involving the use of animals were in compliance with the animal welfare requirements for care and management of laboratory animals.

2.1. Animals and husbandry

The experiment was conducted in the experimental animal unit, Department of Management and Vet. Hygiene, Faculty of Vet. Medicine, Cairo University. Forty nulliparous rabbit does of about 5-month age and average body weight 2.94 ± 0.16 kg were housed individually in flat deck cages (55 cm × 60 cm × 30 cm), equipped with automatic drinkers, feeding hopper and movable nest box, and submitted to 16 h photoperiod/day through both natural and fluorescent lighting.

Table 1
Chemical analysis of commercial feed pellet used (% dry matter).

Nutrient		Analysis
Dry matter	%	89
Crude protein	%	17.62
Ether extract	%	1.89
Total ash	%	4.5
Crude fibre	%	12.5
NDF	%	22.5
ADF	%	12.2
Nitrogen free extract	%	52.49
Digestible energy	kcal/kg	2590
Calcium	%	0.65
Phosphorus	%	0.50

Does were reared under similar management conditions and were fed with a standard commercial lactating pelleted diet containing 18% crude protein, 13% crude fibre and 2600 kcal/kg digestible energy (Atmida Feed Company, Egypt). The diet subjected to chemical analysis according to AOAC (1999). The analyzed content of nutrients percent of the feed mixture is given in Table 1.

2.2. Breeding

Does of all groups were mated naturally to fertile bucks "1–5 male: female ratio". Two to three mating was assured before removing the does to their cages again. 10–12 days later, does were palpated for pregnancy diagnosis, empty does were rebred soon. Four days before the expected kindling date, clean boxes and nesting materials were provided. Weaning of young rabbits was performed 30 days after kindling. Does were not remated after parturition until weaning of their young.

2.3. Nutritional treatments

Does were randomly assigned into four equal groups (10 does/group) according to their nutritional treatments which started for the different groups on day of mating as follows: The first group was fed ad libitum from the day of mating and served as a control group (C). The second (R10), third (R15) and fourth (R20) groups were restricted groups in which the does were restricted to 1.32 of the maintenance requirements based on the amounts recommended by Maertens (1993) during the first 10 days of pregnancy (R10), the first 15 days of pregnancy (R15) and during the first 20 days of pregnancy (R20). At the end of the restriction period for each group does of the restricted groups returned to ad libitum feeding.

2.4. Measurements

The following productive and reproductive parameters were recorded for all groups according to the recommendations of the IRRG (2005).

2.5. Productive parameters

Feed intake of each doe was determined weekly from day of mating until weaning of does' kits. Doe weight at mating, kindling and end of lactation were recorded. Litter and individual kit weight at birth and weaning, kit weight gain from birth till weaning, litter size at weaning and total preweaning mortality (%) were also monitored. Milk production was estimated by using the regression equation developed by De Blas et al. (1995), as follows: milk production (kg) = 0.75 + 1.75 LBW21 (kg); where LBW21 corresponds to live bodyweight of litter at 21 days of lactation which was also recorded.

2.6. Reproductive parameters

Fertility rate was calculated as the number of pregnant does divided by number of mated does × 100. Kindling rate was also estimated as the number of kindled does divided by the number of mated does × 100. After parturition, nest boxes were checked for live and stillborn kits, number and ratio of does with stillborn kits was recorded also the ratio of stillborn kits.

2.7. Behavioural measurements

Preparturient maternal behavioural patterns were recorded according to Denenberg et al. (1958) by daily observation of does behaviour after provision of nest boxes and nesting materials "on day 26th post-mating" for recording the time (day) for first occurrence of nest building (NB) and nest lining (NL).

For both parameters a score 0 was given when the newly born kits were first discovered with no nesting materials (NB) or no fur covering (NL) while a score 1 was assigned if the straw nest or the fur were observed only when the young were found. A point was added to the score for both parameters, for each day prior to parturition the nest or fur was discovered in nest building or lining respectively.

Postparturient nest quality traits were measured on the day of parturition according to Hamilton et al. (1997) by observing the nest box for recording the following parameters: Nest structure (NS), Fur placement (FP), and kit placement (KP) which were scored from 1 to 5 for the first two parameters and from 1 to 4 for the last one; the highest scores (5, 4) of these parameters indicate the best nest quality traits while the lowest score (1) indicate poor nests.

2.8. Hormonal analysis

To study the influence of treatments on mean plasma progesterone level blood samples were collected in all animals from the ear vein into sterilized tubes, and immediately centrifuged at 1000 × *g*, for 10 min, at 4 °C. Serum was stored at −20 °C until analyzed. The blood samples were collected at day of mating on the 16th (mid) and 28th (late) day of pregnancy for restricted and control does of the different groups.

Progesterone was assayed using a commercial ELISA kit produced by Immunospec Corporation (USA) according to Kakabakos and Khosravi (1992). The sensitivity of the assay is <0.4 ng/ml, the intra and inter assay coefficients of variation are 6.4 and 10.9 respectively.

2.9. Statistical analysis

All data were statistically analyzed using SPSS® version 11.0 software for personal computer (2005). Means were compared by the Post-Hoc test. The results were statistically analyzed by using one way ANOVA test; also *T* test completely randomized (Student–Newman–Keul Test) was used for comparing the difference between means. Results were presented as means ± SE. Non-parametric variables (fertility, kindling rate, does with stillborn and preweaning mortality) were analyzed with a chi-square test.

3. Results

3.1. Level of feed intake

Table 2 demonstrates that during feed restriction, does of C group consumed totally more ($P < 0.05$) on average feed/day than R10 (+13.9), R15 (+15.75) and R20 (+24.99) groups. However after restriction, does of restricted groups showed compensatory feed intake and consumed significantly ($P < 0.05$) more feed than control in the period from 11 to 20 days of pregnancy (R10), during the second half (16 day – kindling) of pregnancy (R15) and during the last third (21 day – kindling) of pregnancy (R20), meanwhile still totally lower than C does.

During lactation all does of restricted and control groups showed statistically ($P < 0.05$) similar trend in feed consumption (Table 2).

3.2. Doe body weight

Doe weight at mating was nearly similar among the different restricted and control groups. However, at kindling body weight of all restricted does were statistically ($P < 0.05$) different in comparison with the control group, does of R15 and R20 were the heaviest among the different groups. At end of lactation the weight of does of the different groups was non-significantly ($P < 0.05$) different (Fig. 1).

3.3. Progesterone level

No statistical differences ($P < 0.05$) were observed in serum progesterone level between does of the restricted and control groups at day 1, 16 and 28 of pregnancy (Fig. 2).

3.4. Reproductive performance

Data obtained in (Table 3) revealed that feed restriction of young pregnant rabbit does during the first 10, 15 and 20 days of pregnancy had no significant ($P < 0.05$) effect on fertility and kindling rates which recorded 90, 80, 90, 90% (for both parameters) in does of C, R10, R15, R20 respectively.

Total and alive litter size at birth were insignificantly ($P < 0.05$) higher in R15, R20 than either C or R10 groups.

Table 2
Average feed intake (g) of control and restricted does during gestation and lactation periods.

Feed intake during	Groups			
	C ($n=9$)	R10 ($n=8$)	R15 ($n=9$)	R20 ($n=9$)
Gestation period				
1–10 days	185 ± 5^a	111 ± 3^b	112 ± 5^b	112 ± 4^b
11–15 days	255 ± 10^a	290 ± 6^b	136 ± 5^c	138 ± 3^c
16–20 days	274 ± 11^a	302 ± 8^a	324 ± 11^b	140 ± 0^c
21 day – kindling	251 ± 14^a	265 ± 17^a	292 ± 16^b	325 ± 12^b
Average daily feed intake	243 ± 27^a	229 ± 21^b	227 ± 20^b	218 ± 22^c
Total feed intake	7292 ± 20^a	6900 ± 25^b	6820 ± 18^b	6542 ± 27^c
Lactation period				
1st week	275 ± 10	268 ± 14	278 ± 17	283 ± 12
2nd week	276 ± 13	276 ± 16	280 ± 13	275 ± 16
3rd week	277 ± 17	276 ± 14	277 ± 18	278 ± 15
4th week	276 ± 15	279 ± 17	276 ± 12	274 ± 15
Average daily feed intake	258 ± 20	256 ± 23	259 ± 25	259 ± 21
Total feed intake	7739 ± 27	7698 ± 31	7778 ± 30	7784 ± 40

Means in the same row with different letters are significantly different ($P<0.05$). n: the number of cases in each group. C: control does. R10: does restricted to 10 days. R15: does restricted to 15 days. R20: does restricted to 20 days.

Table 3
Fertility and kindling performance of control and restricted does.

Parameters	Groups				Significance
	C ($n=9$)	R10 ($n=8$)	R15 ($n=9$)	R20 ($n=9$)	
Fertility rate[a]	90	80	90	90	NS
Kindling rate[a]	90	80	90	90	NS
Total litter size at birth	7.56 ± 0.88	7.33 ± 0.65	8.00 ± 0.57	8.35 ± 0.79	NS
Alive litter at birth	7.22 ± 0.79	7.33 ± 0.65	8.00 ± 0.57	8.35 ± 0.79	NS
Ratio of stillborn kits	4.4	–	–	–	**
Ratio of does with stillborn	22.22	–	–	–	***

NS: non-significant at $P<0.05$. n: the number of cases in each group. C: control does. R10: does restricted to 10 days. R15: does restricted to 15 days. R20: does restricted to 20 days.

[a] The parameter studied on the total number of does (10/group).

** $P<0.01$.

*** $P<0.001$.

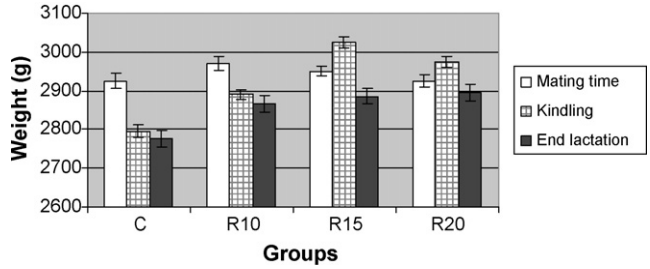

Fig. 1. Average body weight (g) of control and restricted does.

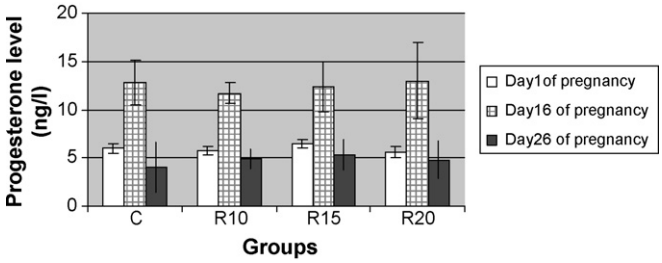

Fig. 2. Progesterone level (ng/l) of control and restricted does during pregnancy.

However, the number of does with still born also the percentage of still born kits in control group were 2/9 (22.22%) and 4.44% for both parameters respectively Vs (0%) in all restricted groups and the difference were statistically ($P < 0.05$) different (Table 3).

3.5. Maternal behaviour

When compared to control group does of restricted group showed statistically ($P < 0.05$) better preparturient maternal care in the form of earlier nest building (R15, R20), nest lining (R20) besides more dense fur covering (FP) (all restricted groups) for young kits. No significant differences were recorded between control and restricted groups in nest structure (NS) and kit placement (KP) scores (Fig. 3).

3.6. Litter and kit traits

Kit and litter weight of restricted groups were statistically ($P < 0.05$) different from those of control group. Kits and litters of R15, R20 were the heaviest at birth and weaning with no significant difference between both groups (Table 4).

Although litter weight at 21 day was statistically ($P < 0.05$) different, milk production and litter size at weaning showed no significant trend between restricted and control does (Table 4).

3.7. Economic analysis

Restricted does of the different groups consumed totally lower feed amounts from mating to weaning than control ones 14.6, 14.6, 14.3 and 15 kg in R10, R15, R20 and control groups respectively (Table 5). The total feeding cost/doe and the cost/kg of weaned rabbit were the least in does of R15 and R20 (29.20, 11.23 and 28.60, 10.60 LE) while the highest in C does (30, 13.36 LE). This in turn reflected in higher net profit for does of both groups than either C or R10 does (Table 5).

4. Discussion

4.1. Doe live body weight and feed intake

In spite of similarity of doe weight of control and restricted groups at mating time, the restricted does achieved heavier weight at kindling especially those of R15, R20 than C group. The increased body weight of R15 and R20 groups could be attributed to the significantly increased feed intake of both groups during the second half (R15) and last third (R20) of pregnancy which reflected in heavier does and kits at kindling.

Generally, restricted feeding depending on the amount received had negative effects on body weight gain of rabbits (Tacchini and Balmes, 1997; Manal et al., 2004). However the restricted feed amounts used in this study seemed to be sufficient for the requirements of these does that their weight were not negatively affected. Moreover, an increase in body weight occurred in the period immediately after restriction to the extent that, the control levels were even exceeded (as in R15, R20) to give heavier body weight at kindling.

Tumova et al. (2003) recorded a sharp increase in feed intake of quantitative restricted rabbits immediately in the period after restriction to the extent that, the daily gain is higher by 40% than ad lib fed control rabbits.

However, the reduced appetite and lower feed intake of C group during the last third of gestation is parallel to the period of maximal foetal growth (Hudson and Hull, 1975) so the does tended to mobilize her own body reserves (Parigi-Bini et al., 1990) to satisfy the needs of their own tissues and for foetal growth (Fortun Lamothe et al., 1994) which in turn results in lower live body weight at kindling. At the end of lactation, doe weight of the different groups were insignificantly different due to the generally increased feed intake of all groups during lactation, meanwhile restricted does were still heavier in comparison with control group.

4.2. Progesterone level

In most mammalian species and more especially in rabbits, progesterone levels must be sufficient to ensure a uterine environment favourable to the establishment and maintenance of pregnancy (Niswander and Nett, 1988). Therefore, low concentration of progesterone in pregnant rabbit does may be detrimental to foetal growth and survival (Fortun-Lamothe et al., 1999).

Results of this experiment revealed no significant differences between control and restricted groups in serum progesterone level at day 1, 16 (mid) or 28 (late) of gestation period. In contrary to this result, Fortun Lamothe et al. (1994) found increased plasma progesterone levels at day 17 of pregnancy in rabbit does fed to maintenance compared to those fed to appetite during gestation. The high feed intake caused an increase in the metabolic turnover rate of progesterone thus lead to lower progesterone level in ad libitum fed does as occurred in lactating ones (Fortun Lamothe et al., 1993). However, the restricted feeding level used in their experiment was lower than that used in this study and this may explain the lack of effect of feeding level "used in this study" on serum progesterone levels.

Interestingly, in spite of lack of difference in progesterone levels of restricted and control does, 22% of C does Vs 0% of restricted ones showed still born kits. This result supports the view of Rommers et al. (2004) who indicated that, in rabbits, the effects of progesterone level on embryo survival are limited or that other mechanisms prevail. In contrary, Hilliard (1973) recorded that plasma progesterone concentrations during early gestation are essentials for embryo survival. However the number of does gave stillborn kits is weak so further investigation is needed to elucidate this point.

4.3. Reproductive performance

Data obtained in this experiment indicated no significant effect for restricted feeding during pregnancy on fertility and kindling rate. Rommers et al. (2004) found insignificant effect of feeding level during early gestation (first 10 days) on both kindling rate and litter size at birth.

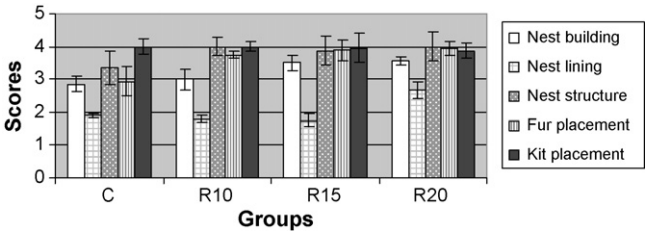

Fig. 3. Preparturient maternal parameters and post-parturient nest quality traits in control and restricted does.

Table 4
Litter and kit traits from birth to weaning in control and restricted does.

Parameters	Groups				Significance
	C ($n=9$)	R10 ($n=8$)	R15 ($n=9$)	R20 ($n=9$)	
Kit weight at birth (g)	43.93 ± 4.10^{a}	49.27 ± 2.41^{b}	49.79 ± 2.84^{b}	54.45 ± 2.90^{b}	**
Kit weight at weaning (g)	342 ± 12	354 ± 11	369 ± 24	380 ± 30	NS
Kit weight gain from birth to weaning (g)	298 ± 8	305 ± 9	319 ± 18	325 ± 16	NS
Litter weight at birth (g)	338 ± 28^{a}	360 ± 14^{c}	387 ± 14^{bc}	396 ± 19^{b}	**
Litter weight at weaning (g)	2235 ± 65^{a}	2466 ± 66^{ab}	2570 ± 48^{bc}	2685 ± 65^{c}	**
Litter weight at 21 days (g)	1266 ± 32 ^{a}	1348 ± 51^{ab}	1469 ± 26^{b}	1500 ± 55^{b}	*
Milk production (g)	2880 ± 120	3000 ± 140	3120 ± 160	3150 ± 145	NS
No. of weaned kits	6.56 ± 0.53	7.00 ± 0.40	7.00 ± 0.54	7.30 ± 0.51	NS

Means in the same row with different letters are significantly different ($P<0.05$). NS: non-significant at $P<0.05$. n: the number of cases in each group. C: control does. R10: does restricted to 10 days. R15: does restricted to 15 days. R20: does restricted to 20 days.
* $P<0.05$.
** $P<0.01$.

However, the insignificant increased alive litter size at birth of restricted Vs control does is similar to that, reported by Cervera et al. (2008) who observed that, the reproductive performance was not affected however the alive litter size was insignificantly higher for restricted Vs ad libitum does throughout pregnancy. Contrarily, Coudert and Lebas (1985) found that low feeding level during early gestation (13 days of pregnancy) reduced the number of live born kits, meanwhile, in their study, the nutritional treatment (75% of ad lib) started around the onset of puberty and could alter the ovarian development as demonstrated by Hulot et al. (1982).

The percentage of does with still born in C group may be attributed to the lower feeding level of this group "in comparison with does of other groups" during the last third of pregnancy. This result could be supported by the findings of many researchers who indicated that, low feeding level or low voluntary feed intake during the last half (Coudert and Lebas, 1985) or last week (Rommers et al., 2004) of pregnancy seemed to affect kit survival and resulted in higher foetal mortality.

4.4. Maternal behaviour

Rabbit exhibit unusual form of maternal care. At about day 26 of gestation rabbits start preparing nests from straw or other suitable materials "nest building" available to them. Two days before parturition they start plucking fur from their bodies and further prepare the nest "nest lining" for the coming kits (Negatu and McNitt, 2002).

Restricted does of the different groups exhibited better maternal care degree than control ones in the form of earlier nest lining besides more dense fur covering of young kits. Manal et al. (2004) recorded earlier nest lining and well constructed nests in premated restricted does than ad libitum ones.

The earlier nest lining of restricted does may be attributed to the favourable effect of flushing process on prolactin level of restricted does especially those of R15, R20 where flushing occurs during late pregnancy "the period of increased prolactin level concomitant to onset of maternal nest building activities". However this phenomenon needs further studies as in this experiment

Table 5
Profit potentials of restricted and control groups.

Parameters	Groups			
	C ($n=9$)	R10 ($n=8$)	R15 ($n=9$)	R20 ($n=9$)
Total feed intake/doe from mating to weaning (kg)	15.00	14.60	14.6	14.3
Total weaned rabbit weight/doe (kg)	2.20	2.47	2.60	2.69
Total feeding cost/doe from birth to weaning (LE)	30.00	29.20	29.20	28.60
Feeding cost/kg of weaned rabbit (LE)	13.63	11.82	11.23	10.60
Total price of weaned rabbit/doe (LE)	33.00	37.05	39.00	40.00
Net profit/doe (LE)	3.00	7.85	9.80	11.4

C: control does. R10: does restricted to 10 days. R15: does restricted to 15 days. R20: does restricted to 20 days. n: the number of cases in each group.

prolactin level was not estimated and at the same time progesterone level was statistically similar between the different groups.

González-Mariscal (2004) and González-Mariscal et al. (1996, 1998, 2003) recorded that maternal nest building activities expressed across the last third of pregnancy and is correlated with specific changes in plasma concentrations of steroid hormones and prolactin.

4.5. Kit and litter traits

Results obtained in this experiment showed better kit and litter weight at birth and at weaning for restricted Vs control does. The improved litter and kit birth weight of restricted does may be due to the increased compensatory feed intake after restriction, especially in R15, R20 where the realimentation process occurred during last half (R15) or last third (R20) of pregnancy which is the period of maximal foetal growth (Hudson and Hull, 1975). This resulted in statistically heavier litters and kits at birth. However, the lower feed intake of C does in comparison with R15, R20 groups during the same period of pregnancy (21 days – kindling) reflected in lower kit and litter birth weight.

These results support the view of Rommers et al. (2004) who noticed a compensatory feed intake during the 1st and 2nd weeks immediately after restriction of pregnant rabbit does and that, the level of feed intake in the last week of gestation seemed to affect kit survival and birth weight. Similar results obtained by Eiben et al. (2001) who recorded insignificant increase in litter size, weight and individual weight of progeny at birth, 21 and at 35 days of age in all restricted than control ones. Meanwhile, Fortun-Lamothe (1998) found no effect for feed restriction on litter size or weight at birth for primiparous rabbit does.

It is worth noticed that, the heavier birth weight of kits of restricted does together with their slightly improved milk production acted in combination to enhance growth performance of these kits and gave finally heavier kits and litters at 21 days and at weaning. As heavier kits at birth have an advantage over those of lower birth weight as they are stronger, thus have access to more milk and early solid feed intake.

Coureaud et al. (2000) recorded that, only d0-weight influenced pup weight again between d0 and 21. Moreover Szendro et al. (2006) and Vásquez et al. (1997) demonstrated that birth weight had a significant effect on subsequent body weight to end of the experiment (18 weeks). Additionally, Schulte and Hoy (1997) recorded a positive correlation between birth weight and weaning weight.

4.6. Economic analysis

Data obtained in this experiment revealed that restricted does consumed lower feed intake and recorded the least feeding coast from mating to weaning than control one. Does of R15 and R20 were the best in consuming the lowest feed amount/kg of weaned rabbits and gaining higher net profits than either C or R10 groups. These results are of high economic value.

5. Conclusion

Restriction of pregnant rabbit does for the first 15 or 20 days of pregnancy stimulate voluntary feed intake during late stage of pregnancy which lead to improvement of doe kindling performance and kit and litter traits from birth till weaning without adversely affecting progesterone level and embryonic mortality.

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