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EFFECTS OF SIMULTANEOUS PREGNANCY AND LACTATION IN PRIMIPAROUS RABBIT DOES ON WEIGHT AND COMPOSITION OF NEW BORN RABBITS

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SUMMARY - The aim of this experiment was to study the effects of a nutritional deficit during pregnancy, induced by lactation, on weight and composition of new born rabbits. Sixty two females were remated the day of their first parturition. In the group L (lactating, n=32) the does were allowed to suckle 10 young. In the group NL (non lactating, n=30) the litter was removed at birth. At the second parturition, the new born rabbits (n=273 and 278 in groups L and NL, respectively) were weighted and slaughtered in order to study body composition. At birth, the weight of rabbits was 2.1% lower in the group L than in the group NL (P=0.019). The lipids content (4.1 vs 6.1 %, P<0.001), the proteins content (11.6% vs 11.9%, P=0.052) and the energy content (5.3 vs 5.6 MJ/100g, P<0.001) of the new born rabbits were lower in the group L than in the group NL (P<0.001). On the opposite, the water content (81.8% vs 79.6%, P<0.001) and the ash content (2.55 vs 2.48%, P=0.055) of the new born rabbits were higher in the group L than in the group NL. These results showed that a nutritional deficit occurring during pregnancy affect both weight and composition of the new born rabbits.

Key words : lactation, gestation, body composition, foetal growth, energy deficit

RESUME - L'objectif de ce travail est d'étudier les effets d'un déficit énergétique au cours de la gestation, engendré par la lactation, sur le poids et la composition corporelle des lapereaux à la naissance. Soixante deux femelles ont été saillies le jour de leur première mise bas. Dans le groupe L (femelles allaitantes, n=32) les femelles ont allaité une portée de 10 lapereaux. Dans le groupe NL (non allaitantes, n= 30) la portée a été retirée à la naissance. Au moment de la seconde parturition, les lapereaux nouveau-nés (n=273 et 278 dans les groupes L et NL, respectivement) ont été pesés puis sacrifiés afin d'étudier leur composition corporelle. A la naissance, le poids des lapereaux était plus faible (2,1%, P=0,019) dans le groupe L que dans le groupe NL. Les teneurs en lipides (4.1% vs 6.1 %, P<0.001), en protéines (11,6% vs 11,9%, P=0.052) et en énergie (5.3 vs 5.6 MJ/100g, P<0.001) des lapereaux nouveaux-nés étaient plus faibles dans le groupe L que dans le groupe NL. A l'opposé, la teneur en eau (81,8% vs 79,6%, P<0.001) et la teneur en minéraux (2.55% vs 2.48%, P=0.055) des lapereaux à la naissance étaient plus élevées dans le groupe L que dans le groupe NL. Ces résultats démontrent qu'un déficit nutritionnel au cours de la gestation affecte le poids et la composition corporelle des lapereaux à la naissance.

Mots clés : gestation, lactation, croissance foetale, composition corporelle, déficit énergétique

INTRODUCTION

During pregnancy, energy requirements of the rabbit does are increased to supply needs for foetal growth. Consequently, voluntary feed intake increases during the beginning of pregnancy which permits to maintain a positive energy balance. On the opposite, feed intake decreases sharply during the days just before parturition and body reserves are depleted to maintain an optimal foetal growth (Oger *et al.*, 1978 ; Parigi-Bini *et al.*, 1990).

Under hot temperature, the voluntary feed intake of the does is lowered (Barreto and De Blas, 1993) which could induce a nutritional deficit. In the same way, in simultaneously pregnant and

lactating females, energy and protein requirements are very high and despite an increase in feed intake, the energetic balance is negative and body reserves are mobilized to a great extent (Parigi-Bini *et al.*, 1992). Energy deficit of simultaneously pregnant and lactating does impairs foetal growth (Fortun-Lamothe, 1998). However, effect of energy deficit on weight and composition of rabbits at birth is less known.

The aim of this experiment was to study the influence of energy deficit during pregnancy, induced by concurrent lactation, on weight and composition of new born rabbits.

MATERIAL AND METHODS

Sixty two primiparous crossbred does (INRA line A1066 x INRA line A2077) were mated within 24 hours after parturition. After mating, the females were allocated to experimental groups according to their litter size and body weight. In the L group (lactating females, n=32), females were allowed to suckle 10 young rabbits and were weaned on day 28 of lactation. In the NL group (non lactating females, n=30), the litter was removed at birth. Females of both groups have free access to a commercial diet (17.5% of proteins and 2400 Kcal DE/kg). At the second parturition, new born rabbits (n=273 and 278 in L and NL groups, respectively) were individually weighted and slaughtered. After slaughter, the milk was removed from the stomach and weighted. Litters were then frozen and stored at -20°C until analyses. Representative samples of ground matter were freeze dried and analysed for dry matter (24 hours at 103°C), protein (Nx6.25), ash (incineration for 6 hours at 550°C) and energy (adiabatic calorimeter). Lipid percentage was estimated by difference.

Analysis of variance were performed on data using the general linear model procedure (GLM ; SAS, 1990). Live weight of new born rabbits were analysed according to a split plot design including the effect of treatment and the effect of rabbit does within treatment (error to test the treatment effect) as fixed effect, as well as the litter size as a covariable. For body composition of rabbits (one data per litter), the treatment was the main effect of the model.

RESULTS

At the beginning of the experiment (1st parturition), the females had similar live weight (3680 ± 44 g) and litter size (10.0 ± 0.3 rabbits born alive) in both groups. On the opposite, females were lower in the L than in the NL group at the 2nd parturition (3590 ± 56 g vs 3867 ± 65 g; $P < 0.01$). The litter size at the 2nd parturition was not significantly different between the two groups (8.5 ± 0.4 vs 9.3 ± 0.4 , in the L and NL group). However, the number of females which had a litter of small size (≤ 7) tended to be higher in the L than in the NL group (11/32 vs 5/30 ; $P = 0.11$). In the L group, litter size at weaning was 9.4 ± 0.2 rabbits and the live weight of weaned rabbits was 523 ± 8 g.

Table 1. Effect of concurrent pregnancy and lactation on weight and composition of new born rabbits

| | L group | | NL group | | Prob |
|----------------------------------|---------|------|----------|------|--------|
| | mean | SEM | mean | SEM | |
| No. of rabbits | 273 | | 278 | | |
| Weight at birth ¹ (g) | 51.8 | 0.54 | 52.9 | 0.63 | 0.019 |
| Milk weight in the stomach (g) | 4.62 | 0.18 | 3.99 | 0.17 | NS |
| No. of litters | 32 | | 30 | | |
| Water (%) | 81.77 | 0.15 | 79.56 | 0.20 | <0.001 |
| Proteins content (%) | 11.60 | 0.08 | 11.87 | 0.11 | 0.052 |
| Lipids content (%) | 4.09 | 0.10 | 6.10 | 0.13 | <0.001 |
| Ash content (%) | 2.55 | 0.03 | 2.48 | 0.02 | 0.055 |
| Energy content (MJ/100g) | 5.32 | 0.29 | 5.60 | 0.45 | <0.001 |

¹ Live weight - milk weight contained in the stomach

The empty weight of new born rabbits (live weight - milk present in the stomach) was 2.1% lower in the L than in the NL group ($P=0.019$, table 1). Stomach contained similar weight of milk in both groups (4.35 ± 0.1 g). The lipids content (-33.1%), the proteins content (-2.3%) and the energy content (-4.8%) were lower, while the water content (+2.8%) and the ash content (+2.8%) of the new born rabbits were higher in the group L than in the group NL (table 1).

DISCUSSION

The voluntary feed intake of simultaneously pregnant and lactating primiparous rabbit does is insufficient to supply needs for both foetal growth and milk production. Therefore, the nutritional balance is negative and body reserves must be mobilized (Parigi-Bini *et al.*, 1992 ; Xiccato, 1996). Our results showing lower live weight at the second parturition for lactating does than for non lactating does support this latter assertion, even if live weight is not the best indicator for body reserves.

Effects of concurrent pregnancy and lactation on litter size at birth are sometimes controversial. However, as a general rule, lactation during pregnancy leads to a lowered litter size at birth (Fortun-Lamothe and Bolet, 1995). In the present study, the litter size at birth was not significantly affected by lactation. However, the number of litter with a small size tended to be higher in the group of lactating does.

When does are concurrently pregnant and lactating a competition for nutrient supply occurs between mammary gland and uterus leading to a lower foetal weight on day 28 of pregnancy (-19.6% ; Fortun *et al.*, 1993). When females are mated at the first day *post partum*, milk production is spontaneously stopped on day 28 of lactation (Lebas, 1972) and the most often suckling rabbits are weaned at that time. Present data shown that at subsequent parturition, 3 days latter, the weight of new born rabbits from simultaneously pregnant and lactating does was only 2.1% lower than young rabbits of pregnant non lactating does. Therefore, a catch-up growth occurred between the birth and the weaning of the previous litter which permitted to compensate the greater part of the foetal growth delay. However, the body composition of new born rabbits was greatly affected by the nutritional deficit suffered *in utero* when the mother was concurrently pregnant and lactating. Indeed, dry matter, proteins, lipids and energy content of rabbits from lactating does were reduced compared to rabbits from non lactating does. This is in agreement with results of Parigi-Bini *et al.* (1992). In the same way, energy, lipids and/or proteins content of the litters from pregnant rabbits submitted to feed restriction were lower compared to litters from pregnant does given *ad libitum* feeding (Hafez *et al.*, 1967; Fortun *et al.*, 1994).

As a general matter, it seems that physiological maturation of youngs suffering *in utero* nutritional deficit is delayed. Indeed, Gondret *et al.* (1997) demonstrated that the simultaneous pregnancy and lactation in the doe delays the maturation of the muscular fibres in the youngs. Additionally, Fortun-Lamothe and Mariana (1998) have shown that puberty is delayed in daughters from lactating mothers compared to daughters from non lactating mothers. Finally, Hudson and Hull (1975) have shown that the weight of brown adipose tissue was lower in light than in heavy new born rabbits. Therefore, it could be hypothesized that rabbits suffering nutritional deficit *in utero* had lower brown adipose tissue reserve. As brown adipose tissue is implicated in thermogenesis, the viability of rabbits suffering nutritional deficit *in utero* could be impaired due to deficient thermoregulation after birth. This hypothesis remains to be validated.

CONCLUSION

The present results indicate that concurrent pregnancy and lactation in primiparous rabbit does affect both weight and composition of new born rabbits. Consequences of such an alteration on youngs survival remains to be elucidated.

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