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IMPACT OF IMMEDIATE POSTNATAL SUCKING ON MORTALITY AND GROWTH OF SUCKLINGS IN FIELD CONDITION

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Abstract: Viability and growth of 191 kits born alive from 33 does from a local population was studied in tropical conditions (Benin) in relation to achieving the initial sucking. After observing the state of the kit's belly at the first control, each kit was weighed and classified as suckled (S) or non suckled (NS), and returned to it's mother's nest box. On average 34% of kits were considered to be in the NS group. The proportion ranged from 15% in very small litters (2-3 born alive) to 42% in the largest litters observed (8-9 born alive). Apparent live weight of NS kits was significantly lower than that of S kits: 40.4 *vs.* 53.6 g. The weight difference was not related to litter size. Birth to weaning mortality (0-35 d.) was significantly higher for NS kits than for S kits: 36.9% *vs.* 13.5%. But of those kits which died during the lactation period, the proportion of deaths during the first week of life was almost identical for NS and S kits: 66.7% and 64.7%. Birth weight of non suckled kits which died before weaning was significantly smaller than that of non suckled kits alive at weaning time: 37.6 *vs.* 42.0 ± 7.9 g without any significant interaction with litter size. However, for suckled kits, the corresponding difference was smaller and non significant: 51.4 *vs* 53.9 ± 8.0g again without interaction with litter size. The average 0-35 days growth rate was not affected by the initial sucking (NS 12.23 and S 12.21 g/d). Nevertheless an interaction with litter size was observed (P=0.091): in small litters (2-5 kits born alive) NS kits had a lower growth rate than those of the S group (12.8 *vs.* 14.2 g/day), while in larger litters (6-9 kits) the reverse was observed (12.1 *vs.* 11.1 g/day). Careful observation of newborn kits would allow stockbreeder to reduce mortality among young rabbits in a critical situation.

Key Words: rabbit, sucking, mortality, growth.

INTRODUCTION

Rabbit production in Benin is on the increase thanks to the combined efforts of the "*Centre cunicole de recherches et d'information*" (CECURI) and the local breeders association (ABeC). Nevertheless, this advance had to overcome many problems, including excessive mortality during the lactation period. Different authors such as Djago and Kpodékon (2000), Leone-Singer and Hoop (2003) or Marlier *et al.* (2003) have recently identified the main causes of this high mortality rate. Some years ago Lebas (1974) and Coudert *et al.* (1984) demonstrated that the highest mortality in suckling rabbits's is observed during the first week of life, underlining the importance of this period. More recently, Coureaud *et al.* (2000a and b) demonstrated the importance of the first sucking on kits postnatal survival in temperate breeding conditions. The purpose of this study is to determine the impact of the first milk intake of young rabbits on their subsequent viability and growth in tropical conditions.

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MATERIAL AND METHODS

Animals and housing

The experiment was carried out in the CECURI facilities located 30 km north of the Atlantic coast in Benin. Breeding does of a local population (2.8-3.0 kg adult weight) were housed in wire mesh cages (77 × 46 cm, h 50 cm) placed in a building with natural ventilation. Cages were arranged on a flat deck. Three days before each expected parturition a nest box (25 × 45 cm, h 25cm) filled with wood shavings was placed in front of the cage.

Does were fed *ad libitum* a complete dry food and received daily fresh palm tree leaves, as is normal practice in Algeria (Djago and Kpodekon, 2000). Water was provided *ad libitum* by automatic nipple drinkers. The non pelleted food was based on palm kernel meal (39.5%), soya meal (2.5%) cottonseed meal (5.0%), wheat bran (40%), oyster shells (2.5%) common salt (0.4%) and l-lysine (0.1%).

Experimental rabbits and controls

On the day of birth, all live kits from 33 litters were individually weighed (± 0.1 g) and observed for initial milk intake. Controls for kindling in the rabbitry were performed at least 3 times per day during the open hours (7:00-19:30), or until the observation of all kindling expected for the day. This meant that most of the initial kit controls were performed within 2-4 hours following birth with a maximum of 12 hours for those born during the night (less than 10% of the kindlings). Kits with a more or less swollen but whitish belly were considered to have achieved their initial colostrum intake (suckled or S kits in the text). They received an individual within-litter colour mark on the right ear. The others were considered as non suckled kits (non suckled or NS kits in the text) and received an individual within-litter colour mark on the left ear. After this control, all kits were returned to the nest box and were reared by their own mothers, whatever their initial colostrum intake.

All litters were born in January-February 2004. The 33 mothers were 7 months old on average (primi- and multiparous does). After the initial control, all kits were individually numbered and weighed once a week until weaning at 35 days. Nest boxes were removed when kits were 21 days old.

Statistical analysis

All experimental data were analysed with the SAS software (SAS, 1986). Weights were analysed with the GLM procedure, according to a factorial design with 2 main factors with interaction (initial sucking, Yes or No × litter size, small [2-5 born alive] or large [6-9 born alive], or litter size shared out in 4 classes). Proportions were analysed with the FREQ procedure and the Fischer's exact test was considered (corrected for small numbers). Dispersion of values was expressed as standard deviation or coefficient of variation.

RESULTS

Litters at birth

A total of 191 kits were observed, corresponding to an average litter size of 5.79 kits born alive. The minimum was 2 and the maximum was 9 kits born alive. Distribution of litter size is given in Figure 1. On average, 34% of the kits were not suckled at birth. This proportion increased with litter size as shown in Figure 2. Due to the relatively small number of rabbits involved in the experiment, only the difference between small litters (2-5 kits – 24.6% NS) and large litters (6-9 kits – 38.1% NS) was significant ($P = 0.050$).

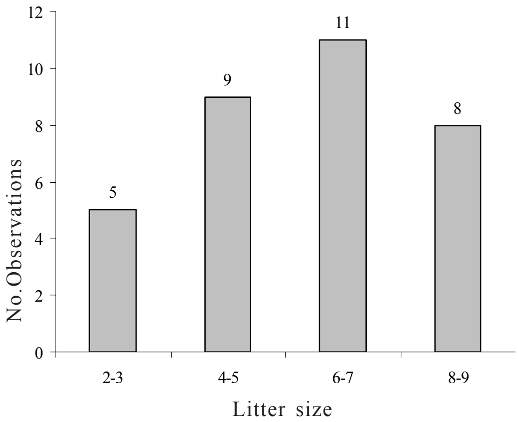

Figure 1: Size distribution of the 33 experimental litters.

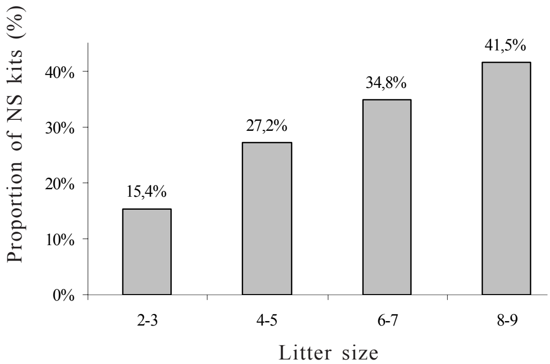

Figure 2: Proportion of Non Suckled kits in litters, according to litter size.

The average birth weight was significantly higher (P<0.001) for suckled than for non suckled kits: 53.6 ± 9.0 *vs.* 40.4 ± 8.5 g. The difference was significant for each class of litter size (Table 1).

The significant interaction corresponds to the fact that the effect of initial sucking on apparent birth weight is greater for 2 classes of litter size (2-3 and 6-7 kits/litter) than for the 2 others.

Birth to weaning mortality

The average birth to weaning mortality was 13.5% for the suckled rabbits and significantly higher (P<0.001) for non suckled *i.e.* 36.9%. This mortality was distributed in the same manner for suckled and non suckled kits between the first and subsequent weeks (Table 2).

In large litters (6-9 kits) the average birth to weaning mortality was significantly higher (P=0.03) than in small ones (2-5 kits): 24.4% *vs.* 12.3%. For both litter size classes, mortality was higher for non suckled than for suckled kits *i.e.* 28.6% *vs.* 7.0% (P=0.05) in small litters and 39.2% *vs.* 16.9% (P<0.01) in large litters.

On the whole, apparent birth weight of non suckled kits that died before weaning was lower than that of non suckled kits alive at weaning time: 37.6 *vs.* 42.0±7.9 g (P=0.043) without any significant interaction with litter size. But for suckled kits, the corresponding difference was smaller and non significant: 51.4 *vs.* 53.9±8.0 g (P>0.10) again without interaction with litter size.

Table 1: Average birth weight of suckled and non suckled kits, according to litter size.

		Litter size (LS)				Average	
Type of kits (TK)	Born alive	2-3	4-5	6-7	8-9	5.79	Average significance
Suckled	No. kits	11	32	45	38	126	LS
	Weight (g)	63.5	58.3	51.4	49.6	53.6	P<0.001
Non suckled	No. kits	2	12	24	27	65	Interaction LSxTK
	Weight (g)	33.0	48.2	36.5	40.9	40.4	P=0.002
Significance of initial sucking		P=0.024	P<0.001	P<0.001	P<0.001	P<0.001	

Table 2: Mortality of kits between birth and weaning.

		Suckled kits	Non suckled kits	Significance
1st week	Initial No.	126	65	
	Mortality, %	8.7	24.6	**
2nd- 5th week	Initial No.	115	49	
	Mortality, %	5.2	16.3	*
Birth to weaning	Initial No.	126	65	
	Mortality, %	13.5	36.9	***
Proportion of kits dead during 1st week	Total No. birth-weaning dead kits	17	24	
	% dead during 1st week	64.7	66.7	NS

Birth to weaning growth

During the first week after birth, whatever the litter size, average daily growth was significantly lower for non suckled than for suckled kits (Table 3). After this period, the average daily gain increases more rapidly for NS than for S kits. Between the 1st and the 5th week of life, the average daily gain was multiplied by 2.04 for non suckled kits and only by 1.53 for the S group (P=0.001). The final result for the whole suckling period was an average birth to weaning daily growth identical for both groups of kits.

The average effect of litter size on growth was, as has been classically described, a higher individual growth rate in small litters (Table 3) than in large ones. But it must be pointed out that, in large litters, the average 0-35 d daily gain and the final weight (Figure 3) tended to be higher for the NS kits than for the S ones. The reverse was observed in small litters (P=0.091).

DISCUSSION

On average, one third of newborn kits were not “able” to drink an appreciable quantity of milk during the mother’s parturition or immediately after and were classified as non suckled kits. Their apparent weight at that time was 13.2 g lower (-25%) than that of the suckled kits, with no fixed relation to litter size. This difference can be supposed to be partly the consequence of the absence of milk and represents a total of 50 g per litter. The milk production on 1st day of lactation of does was not estimated in the present study. But for does of Algerian local population with similar adult weight and litter size it was estimated at about 40-45 g by Zerrouki and Lebas (2004), corresponding to about 7-8 g of milk per kit. Thus in the present case, it can be supposed that the main reason for the difference between S and NS kits was the absence of milk in the kits’ stomach and consequently the real difference in kits true live weight could be estimated at about 5-6 g. This estimated weight difference was far smaller than the 10-20 g observed between kits within a litter or between litter sizes, as measured in the present case or in general in the Rabbit (Bruce and Abdul Karim 1973; Lebas 1974 and 1982; Bolet, 1998). For this reason the slightly lower true birth weight of non suckled rabbits should not be considered as a handicap by itself.

The higher proportion of non suckled rabbits in large litters than in small ones must be considered as a combination of at least 2 independent factors: competition for nipples access (due to the number of kits) and a reduced aptitude in some kits for nipple localization, as suggested by Coureaud *et al.* (2000a). The latter factor is most probably the main explanation for the absence of initial milk intake in small litters.

Table 3: Average daily gain and live weight of young rabbits alive at weaning in relation with to their initial colostrum sucking and the initial litter size.

	Small Litters		Large litters		Average		Residual CV (%)	Significance		
	Suckled	Non Suckled	Suckled	Non Suckled	Suckled	Non Suckled		Initial sucking	Litter size	Interaction
Daily gain, g/d										
0-7 d	10.8	7.7	9.2	8.1	9.8	8.0	35.9	**	ns	ns
7-14 d	13.0	9.7	10.1	10.1	11.2	10.8	38.6	ns	ns	*
14-21 d	13.4	15.6	9.6	11.4	11.0	12.4	37.7	*	***	ns
21-28 d	16.8	14.9	12.7	13.4	14.2	13.8	46.8	ns	*	ns
28-35 d	16.9	16.0	13.8	16.3	14.9	16.2	46.6	ns	ns	ns
0-35 d	14.2	12.8	11.1	12.1	12.21	12.23	27.4	ns	**	+
Weights, g										
Birth	59.4	48.2	50.8	40.0	54.0	42.0	15.1	***	***	ns
Weaning	555	496	438	462	481	470	24.8	ns	**	+

ns: $P>0.10$; +: $P<0.10$; *: $P<0.05$; **: $P<0.01$; ***: $P<0.001$.
CV= Coefficient of variation.

The absence of milk as a source of nutrients for the first hours of life is probably not the initial reason for the higher mortality of non suckled kits. Indeed, the proportion of kits that died during the first week of life in comparison with those which died later until weaning is the same (two thirds) for suckled and for non suckled kits. Thus, the reason for the high mortality during the first week of life is probably not, or is only partly, a consequence of nutritional distress during the first hours, in disagreement with the generally proposed explanation (Djago and Kpodékon, 2000; Marlier *et al.*, 2003; Coureaud *et al.*, 2003). The cause-effect relation must probably be reversed: because some kits are in a critical situation or have partial lack of some receptors (true reason not yet defined) they are not able to suckle from their mother immediately after birth. The competition in large litters worsens this situation. In other words: the absence of colostrum intake is not the main cause of the higher mortality of non suckled rabbits, but it is a practical way of identifying kits in distress at the time of birth and also the frailer kits in the litter. Nevertheless, it must be pointed out that our observations and conclusions were made in tropical conditions where the lowest day temperature was always above 22°C. In such conditions, newborn rabbits have enough energy reserves at birth to be able to wait safely for the next sucking without temperature stress (Heim and Kellermayer, 1967; Papp *et al.,* 1987).

This higher frailty of non suckled rabbits seems to be quite permanent. In fact, it must be emphasised that for kits born and reared in large litters, birth-to-weaning growth rate of non suckled kits still alive at weaning was similar (even a little higher) to that of suckled ones. In the case of the survivors at weaning, the absence of initial colostrum intake is probably the consequence of the 2 factors: competition and real frailty. In the conditions of the experiment the non suckled group includes some kits which were not able to suckle exclusively because of the competition (normal kits) and some true “frail” kits On the other hand, in small litters, where competition could not be invoked to explain the absence of initial sucking, the non suckled group includes exclusively “frail” kits. The average birth-to-weaning daily growth is lower for these non-suckled rabbits than for those which were able to achieve the initial sucking. This indicates the intrinsic lower vitality of non suckled rabbits even if they survive all the lactation period.

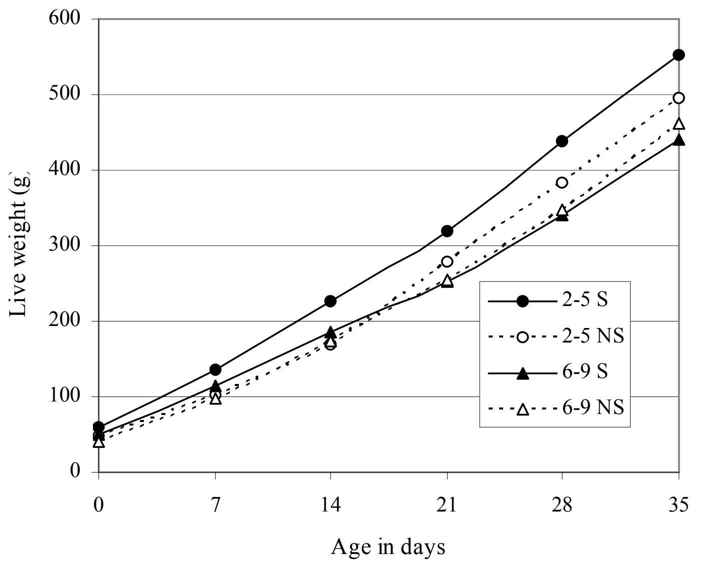

Figure 3: Evolution of live weight of kits reared in small (2-5) or large litters (6-9) and which have achieved the initial colostrums sucking (S) or not (NS).

CONCLUSION

In conclusion, these results confirm that when the hygienic conditions are satisfactory, a large part of the mortality before weaning is more related to a biological weakness than to a specific pathology. In a tropical environment about one third of the newborn kits did not suckle at birth and one third of these non suckled kits died before being weaned. These ratios were higher when the litter size was large. Careful observation of kits at birth and the transfer of those which did not suck to does with small litters, would allow stockbreeders to reduce the mortality of young rabbits in a distressed situation.

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