EFFECTS OF PRENATAL ON POSTNATAL PERFORMANCE OF DOES

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Abstract - An experiment was carried out to quantify the effect of (prenatal) total litter weight on (postnatal) milk production of hybrid does and investigate whether it is advantageous to balance out litters completely. Litters from 250 does (ZIKA) were balanced out one day after the main synchronized parturition day (1) in order to get better estimates of the true milk production of does and (2) to provide equal rearing conditions for all kids. Litters were weighed at birth (LW*0*), immediately after balancing (LW*1*) and on day 21 after balancing (LW*21*). Furthermore individual neonatal body weight of kids (IWK) and total number of kids born (TNK) were recorded.
Highly significant positive correlations ($r_{LW1:LW21}$ =.31 to .49) indicated higher individual neonatal body weights resulted in higher body weights after 21 days of sucking, i.e. independent of milk production of the doe. However, formerly small litters were heavier at equal litter size after balancing than formerly large litters. Partial correlation analysis between LW*0* and LW*21* at a constant variance of LW*1* revealed clearly a positive relationship ($r_{xy:z}$ =.23 to .39). A higher prenatal performance (LW*0*) has a positive effect on milk production at a constant number of kids sucking. This will be of relevance to postnatal reproduction management.

INTRODUCTION

Synchronized parturition of large groups of does in intensive rabbit meat production is advantageous with respect to farm organization and marketing. Furthermore the opportunity of balancing out between large and small litters within one parturition group is given, thereby increasing the chances of survival for the offsprings from large litters, where the number of offsprings exceeds the number of teats of the does. Objective of the present study is to quantify the effect of (prenatal) total litter weight on (postnatal) milk production and investigate whether it is advantageous to balance out litters completely.

MATERIAL AND METHODS

In the present study data from 250 hybrid does (ZIKA) as part of a series of experiments were used. Does were fed *ad libitum* or restricted during the rearing period and inseminated for the first time at variable age (av. 115 days, i.e.16.5 wk). For technical reasons the animals had to be reared in groups and transferred to the breeding house at four weeks interval.
The postnatal performance, i.e. milk production of does can be estimated by body weight gain of the young ones as long as the latter do not consume solid feed. Since it is known that litter weight gain is significantly correlated to number of kids sucking, litters were balanced out (1st parity: 8 and following parities: 9 kids/litter) regardless of litter size at birth. The balancing took place at the end of day 33 after insemination (=1 day after the main parturition day). Does that did not give birth until noon on that day, parturition was induced by oxytocin injection. This was done (1) in order to get better estimates of the true milk production of does and (2) to provide equal rearing conditions for all young rabbits. Does were then inseminated at 42 day intervals. The rabbits were fed *ad libitum* commercial pelleted diet with 10.0 MJ ME/kg dry matter containing on average 17.0 % crude protein and 17.5 % crude fibre. The husbandry practise was according to modern german standards of intensive rabbit production in cage systems (3500 cm^2/doe) with nest boxes attached providing 14 hours light per day.

The following reproductive traits were analysed:

LW*0* =litter weight at birth (including deads at birth)
LW*1* =litter weight on the day of balancing out
LW*21* =litter weight on day 21 after balancing out
ΔLW =LW*21*-LW*1*
TNK =total number of kids born (including deads at birth)
IWK =individual neonatal body weight of kids (including deads at birth)

Prime interest of the present study is given to the correlations between pre- and postnatal performance of does. Simple and partial correlation analysis were performed. Only data from group 1 (no mortalities within 3 wk after balancing out) were used in this analysis.

RESULTS

Prenatal performance

The results of prenatal performance for the first four litters are given in table 1. The decline in number of litters (47.2 %) is mainly due to high mortality among does. Although unlikely it can not be ruled out completely that this resulted in unwanted selection of does on reproductive performance. Significant effects of parity on prenatal performance were found. Number of young born and individual neonatal weight were lower in the first parity compared to the following, resulting in an average litter weight at birth of 460 g. The total prenatal performance expressed as average litter weight at birth increased continuously with parity number showing the largest increase from the first to the second parity (+111 g/litter).

Table 1 : Prenatal reproductive performance of ZIKA-does for their first four litters

parity	total number of litters	reproductive performance per doe					
		TNK		IWK [1] in g		LW*0* in g	
		MEAN	SD	MEAN	SD	MEAN	SD
1	250	7,6	2,9	63,4	11,3	460	152
2	203	8,9	3,3	67,3	13,8	571	174
3	166	9,5	3,5	66,3	10,9	603	195
4	132	9,7	3,4	65,7	10,7	612	192

TNK =total number of kids born; IWK =individual neonatal body weight of kids; LW*0* =litter weight at birth; SD=standard deviation; [1] calculation based on litter means

Postnatal performance

The results of postnatal performance after balancing out of litters are given in table 2. Data are presented separately for (1) litters with no mortality up to day 21 after balancing out and (2) litters with one dead in the same period regardless of the day of death. Average individual body weight gain in 21 days (LW*21*-LW*1*) was 285, 322, 332 and 334 g in group 1 and 289, 328, 319, 322 g in group 2 for parity numbers 1 to 4 resp..Surprisingly there were no significant differences between these two groups, although litters in group 2 were temporary reduced by one and more milk should have been available for the remaining kids, especially since mortality occured more frequently in the first week *post partum.*

Table 2 : Postnatal reproductive performance of ZIKA-does for their first four litters

parity	litter weight in g									
	group 1: litters without mortality[1]					group 2: litters with one dead [2]				
		LW*1*		LW*21*			LW*1*		LW*21*	
	N	MEAN	SD	MEAN	SD	N	MEAN	SD	MEAN	SD
1	98	570	146	2852	398	66	550	73	2576	355
2	121	678	158	3577	428	42	650	97	3279	454
3	95	668	163	3655	452	41	657	102	3208	491
4	74	669	140	3690	450	28	629	75	3120	410

LW*1* =litter weight after balancing; LW*21* =litter weight on day 21 after balancing;
N =number of litters; SD= standard deviation
[1]-balancing out: 1st parity: 8 kids/doe, 2nd to 4th parity: 9 kids/doe
[2]-balancing out 1st parity: 7 kids/doe, 2nd to 4th parity: 8 kids/doe (deads excluded)

Correlations

Results of the correlation analysis between different traits of pre- and postnatal reproductive performance of does are given in table 3. The correlations between litter weight at birth (LW*0*), total number of kids born (TNK) and litter weight at day 21 after balancing out (LW*21*) were not significant for the average of all litters (table 3). In contrast highly significant negative correlations between both prenatal performance traits (TNK, LW*0*) and litter weight after balancing out (LW*1*) were found. It is well known, that individual neonatal body weight and litter size are negatively correlated. A highly negative correlation between TNK and LW*1* can be simply explained by the procedure of balancing litters. Only kids from large litters were transfered to does with small litters. This partially compensated the effect of balancing out as far as litter weight before (LW*0*) and after balancing out (LW*1*) are concerned, resulting in lower levels of (negative) correlations. However, formerly small litters were heavier at equal litter size after balancing than formerly large litters. Highly significant positive correlations ($r_{LW1:LW21}$) indicated higher individual neonatal body weights resulted in higher body weights after 21 days, i.e. independent of milk production of the doe.

Table 3 : Simple (r_{xy}) and partial ($r_{xy:z}$) correlation coefficients between different traits of pre- and postnatal reproductive performance of does

	parity	LW*1* r_{xy}	LW*21* r_{xy}	ΔLW r_{xy}	LW*21*(LW*1*=z) $r_{xy:z}$
LW*0*	1	-.38**	+.22*	+.30**	+.39**
	2	-.37**	+.16°	+.25**	+.39**
	3	-.27**	+.09°	+.15°	+.26*
	4	-.16°	+.02°	+.16°	+.23*
TNK	1	-.62**	+.13°	+.25*	+.43**
	2	-.60**	- .06°	+.06°	+.29**
	3	-.53**	- .06°	+.05°	+.28**
	4	-.48**	- .10°	-.01°	+.17°
LW*1*	1	-	+.31**	+.13°	-
	2	-	+.44**	+.26**	-
	3	-	+.49**	+.32**	-
	4	-	+.49**	+.33**	-

LW*0*=litter weight at birth; LW1= litter weight after balancing; LW*21*= litter weight on day 21 after balancing; ΔLW =LW*21*-LW*1*; TNK =total number of kids born; levels of significance: ** $p \leq 0.01$, * $p \leq 0.05$, ° $p > 0.05$

Table 4 : Effects of prenatal on mean postnatal performance of does

LW*0*	parity: 1				parities: 2-4 (average)			
(classes)	N	LW*1*	LW*21*	ΔL	N	LW	LW*21*	ΔL
< 200 g	8	627	2591	196	11	739	3410	2671
£ 350 g	7	611	2799	218	10	754	3548	2795
£ 500 g	32	588	2832	224	38	700	3553	2853
£ 650 g	38	545	2898	235	78	687	3683	2996
£ 800 g	13	546	2958	241	125	653	3678	3025
> 800 g	-	-	-	-	28	645	3743	3098

LW*0* =litter weight at birth; LW*1* =litter weight after balancing; LW*21* =litter weight on day 21 after balancing; ΔLW =LW*21*-LW*1*; N=number of litters

Partial correlation analysis between prenatal performance (LW*0*) and development of kids during the main phase of the sucking period (LW*21*) at a constant variance of LW*1* revealed clearly a positive relationship. A higher prenatal performance (LW*0*) has a positive effect on milk production at a constant number of kids sucking. The highest partial correlation coefficients were found for the first two parities, whereas other effects, e.g. previous performance or condition of the doe might be more important later. More details are given in table 4. Does were grouped in six classes according to litter weight at birth tabulating the results of parities 2-4 combined. Does with higher litter weights at birth (LW*0*) showed consistently higher litter weights at day 21 (LW*21*) compared to those with lower litter weights although mean LW*1* was lower. The postnatal performance trait litter weight gain (ΔLW) increased continuously with litter weight at birth, the effect being similar for young and old does.

DISCUSSION

In average kids from small litters were found to be heavier than the young ones from large litters which is in full agreement with the findings of VINCENTE et al. (1995). Genetic (-.69) and phenotypic correlations (-.51) between individual neonatal body weight and litter size were estimated by KROGMEIER et al. (1994). Correlations between individual neonatal and weaned bodyweight were estimated by the same authors to be .67 (r_g) and .44 (r_p). Since no balancing out between litters was performed in that study it was to be expected, that the kids from small litters were heavier after weaning. Eliminating the variance due to number of kids born from the data after KROGMEIER et al. (1994) by partial correlation analysis reduces the correlation coefficient to .21 (r_p). Indicating at a constant number of kids per doe, higher birth weight in average results in higher weaning weight. This result is confirmed in the present study. A positive correlation was found between litter weight after balancing out and weaning weight, the correlation coefficient increasing with the advancement of parity (table 3). Furthermore the present study revealed the importance of prenatal performance of the doe, i.e. litter weight at birth affecting weight gain of the young rabbits during the sucking period.

CONCLUSION

The higher the litter weight at birth the higher the body weight gain of the young rabbits during the main phase of the sucking period. Obviously milk production is influenced by prenatal reproductive performance of the doe. Consequently balancing out of litters should not only be orientated to the number of the doe's teats but also the litter weight at birth.

REFERENCES

KROGMEIER D., DZAPO V., MAO I.L., 1994. Additive genetic and maternal effects on litter traits in rabbits. *J. Anim. Breed. Genet.*, **111**, 420-431.

VICENTE J.S., GARCIA-XIMÉNEZ F., VIUDES-DE-CASTRO M.P., 1995. Neonatal performances in 3 lines of rabbit (litter sizes, litter and individual weights). *Ann. Zootech*, **44**, 255-261.