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CORRELATED RESPONSE TO SELECTION FOR UTERINE CAPACITY ON TEAT NUMBER AND EFFECT OF TEAT NUMBER ON SURVIVAL RATE

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ABSTRACT

The objective of this work was to study the indirect response obtained in number of teats from two lines (High and Low Line) divergently selected for uterine capacity. The effect of number of teats on survival of young rabbits in the first week of age was also studied. The difference of litter size between the two lines was 3 young rabbits. Number of teats was significantly higher ($p<0.05$) in High Line than in Low Line (9.65 versus 9.17), being 2.8 times more probable to have 10 or more teats if female belong to High Line than to Low Line. These results seemed to indicate an indirect response in the number of teats when selecting for uterine capacity. The effect of number of teats on young rabbit viability at first week of age augmented as the difference between number of teats and number of born alive increased. When number of born alive was higher than number of teats in 3 or more than 3, number alive at the first week corrected for number of born alive were 7.13 and 6.18 respectively. Otherwise, number of born alive at the first week was about 8.

INTRODUCTION

Some authors have suggested that number of teats is one of the maternal traits that can influence survival of litters at lactation. The effect of number of teats seems to be important when suckling number is higher than number of teats (FLEISCHHAUER *et al*., 1985; TORRES and PLA, 1988 in rabbits; LIGONESCHE *et al*., 1995 in pigs). Adoptions try to solve this problem partially. Litter size is one of the selection objectives in the improvement programs and would be interesting to know if the number of teats is modified by selection. ROCHAMBEAU *et al*., (1988) found that number of teats increased in a population selected by litter size at weaning respect to a control population. The relationship between number of teats and litter size has been hardly studied in rabbit. SZENDRO and HOLDAS (1984) found that litter size at birth was higher in females that had a higher number of teats in the three studied lines. TORRES and PLA (1988) obtained a regression coefficient of 0.18 between the number of teats and the total number of born rabbits. The phenotypic correlations between both traits published for pigs are not significantly different from zero (HANSET and CAMERLYNCK, 1974; LIGONESCHE *et al*., 1995).

A divergent selection experiment on uterine capacity has been performed (BLASCO *et al*., 2000). The objective of this study is to know if divergent selection for uterine capacity has an effect on the number of teats. The second objective is to know if the number of teats has an effect on number of young rabbits alive at first week of age.

MATERIAL AND METHODS

Animals

A total of 165 females belonging to the 11th and 12th generation of an experiment of divergent selection for uterine capacity were used. Uterine capacity was estimated as litter size in unilaterally ovariectomized females. During the first 10 generations, the left ovary was removed before puberty and divergent selection for uterine capacity was performed. Females from 11th and 12th generation were intact and no selection was performed. The number of females which were examined was 71 from the Low Line and 94 from the High Line. The number of females examined per generation was 95 from the 11th generation and 70 from the 12th generation.

Traits

The following traits were recorded for all does in second parity: NBA (number of born alive), LS (litter size), N1wk (number alive at first week of age), Te (number of teats). Excess: with 5 levels ('0' when NBA£≤Te; '1' when NBA=Te+1; '2' when NBA=Te+2; '3' when NBA=Te+3; and '>3' when NBA=Te+4 or NBA=Te+5).

Statistical Analysis

Number of teats and Excess were analysed using a Chi-square test. The relationship between the number of teats and line was also analysed by logistic regression with factors line (High Line or Low Line) and generation (11th or 12th). For this last analysis, the number of teats was grouped in two levels: does with 10 or more teats (1) and does with less than 10 teats (2). The procedures FREC and LOGISTIC of SAS statistical package were used (SAS, 1997).

Phenotypic differences between High and Low Lines were analysed by least squares using GLM procedure of SAS statistical package (SAS, 1997) with generation and line as fixed effects. The traits analysed were (NBA), (N1wk), (LS) and (Te). To study the effect of number of teats on the number of alive rabbits at first week of age, N1wk was also analysed with a model with generation, line and excess as fixed effects and the covariate NBA.

RESULTS AND DISCUSSION

Divergence for litter size between Low and High Line was relevant after 10 generations of selection. Table 1 shows the results for generations 11 and 12, which agree with the response estimated by Santacreu *et al*. (2000) with all parities of 11th generation. The High Line showed a higher number of born alive and number alive at first week of age than the Low Line, the differences were 2.4 and 2 young rabbits, respectively.

Number of teats in the High Line was higher than in the Low Line, 9.64 and 9.16 respectively (Table 1). The distribution of number of teats in the High and Low Line is shown in figure 1. Females with 8 teats are more frequent in the Low Line than in the High Line, (25% versus a 7%). Moreover females with 10 teats are more frequent in the High Line (62%) than in the Low Line (43%). There were no females with 11 teats in the Low Line, a 5% were found in the High Line. These results are in accordance with those obtained in the logistic regression analysis. The Odds ratio was 2.8, meaning that it is 2.8 times more probable to have 10 or more teats if the females belong to the High Line than if they belong to the Low Line. These results seem to

indicate an indirect response in the number of teats when selecting by uterine capacity. Uterine capacity is just litter size in uterine overcrowding conditions, i.e., when the ovulation rate is not a limiting factor (BLASCO *et al*., 1994). The uterine capacity trait is genetically related to litter size in intact females (r_g= 0.96, ARGENTE *et al*., 2000). Then, an indirect response would mean that part of the genes which determine litter size at birth also determine number of teats.

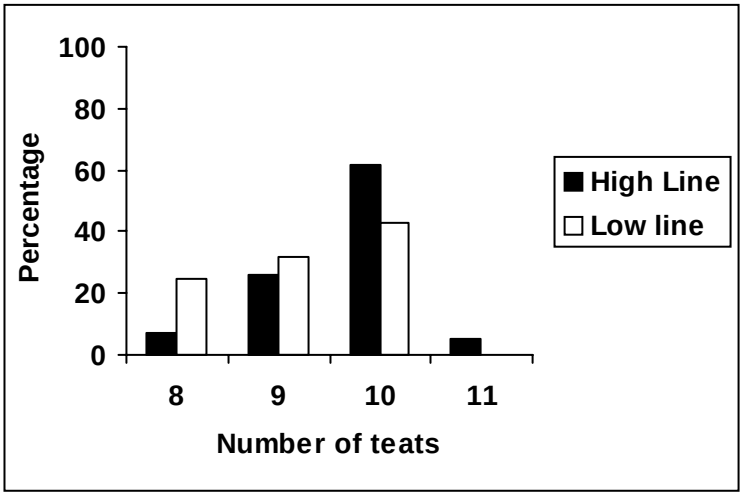

Fig.1. Distribution of the number of teats in Low Line and High Line. X^2 =15.9 P<0.05.

Table 1 : Number of data (N), Mean, and standard error (S.E).

	LOW LINE			HIGH LINE			
	N	LSMEAN	S.E	N	LSMEAN	S.E	Sig
Te	71	9.16	0.09	94	9.64	0.08	**
LS	71	7.3	0.3	94	10.5	0.29	**
NBA	71	6.91	0.37	94	9.33	0.32	**
N1wk	70	6.61	0.35	93	8.64	0.30	**

Te: number of teats. NBA: number of born alive. N1wk: number alive at first week of age. LS: litter size. **: P<0.01

There are few experimental results about the relation between litter size and number of teats in rabbits. Several authors found that does with a higher number of total born rabbits present a higher number of teats (SZENDRO and HOLDAS, 1984; TORRES and PLA, 1988). However, the estimated phenotypic correlations in pigs are close to zero (HANSET and CAMERLYNCK, 1974; LIGONESCHE *et al*., 1995).

ROCHAMBEAU *et al*., (1988) found an indirect response in the number of teats when comparing a line of rabbits selected by litter size at weaning respect to a control population. This potential indirect response could be partially explained if number of teats was related to the survival from birth until the moment of weaning. Several authors have stated that number of teats is determinant for survival when number of young rabbits is higher than number of teats (ROCHAMBEAU *et al*., 1988; FLEISCHAUER *et al*., 1985) and this is more likely to occur in a line selected by litter size.

A 36% of the females had a higher NBA than teats. This percentage is higher in the High Line, which was selected for increase uterine capacity (figure 2). When studying the effect of a higher number of born alive than available teats over survival, number of teats was a limiting factor when the number of born alive exceeds by three young rabbits the number of teats. The daily time that a doe takes to suckle its kids is very short, from 2.7 to 4.5 minutes (ZARROW *et al*., 1965 cited by PATTON N.M., 1994). In agreement with our results, FLEISCHAUER *et al*., (1985) suggested that number of teats is important because when it is lower than the number of born alive, it is not possible for all animals to reach a teat during the short suckling time they have each day, then the animals that did not suck are more and more weak and finally they die of hunger. Moreover ARGENTE *et al*., (1999) showed that rabbits which suckled within 24 h. after birth always had a higher probability of survival.

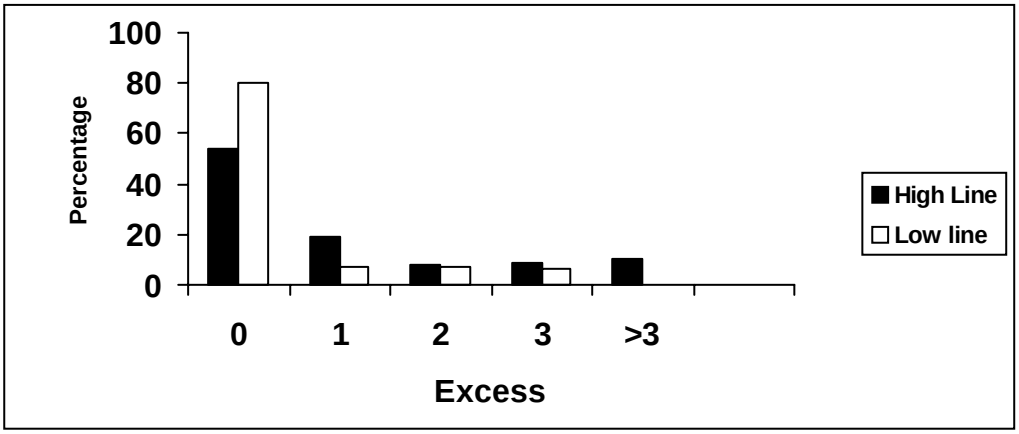

Fig.2. Distribution of Excess in Low Line and High Line. X^2 =16.5 P<0.05.

Table 2: Least square means of N1wk at different Excess levels. Number of data (N) and standard error (S.E).

Excess	N	N1wk	S.E
0	108	8.01[a]	0.09
1	23	8.04[a]	0.19
2	12	7.89[a]	0.26
3	12	7.13[b]	0.26
>3	10	6.23[c]	0.32

Different letters mean significant differences (P<0.05)

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REFERENCES

Argente M.J., Santacreu M.A., Climent A., Blasco A., 1999. Phenotypic and genetic parameters of birth weight and weaning weight of rabbits born from unilaterally ovariectomized and intact does. *Livestock Production Science 57: 159-167.*

Argente M.J., Santacreu M.A., Climent A., Blasco A., 2000. Genetic correlations between litter size and uterine capacity. *VII World Rabbit Congress, Valencia.*

Blasco A., Argente M.J., Haley C.S., Santacreu M.A., 1994. Relationships between components of litter size in unilaterally ovariectomized and intact rabbit does. *J. Anim. Sci. 72, 3066-3072.*

Blasco A., Ortega J.A., Santacreu M.A. 2000.Selection for uterine capacity: I Genetic trends and correlated response in components of litter size. 7th World Rabbit Congress. Valencia 4-7 July 2000

Fleishhauer H., Schlohaut W., Lange K. 1985. Influence of number of teats on rearing perfonmance of rabbits*. J. of Appl. Rabbit. Res., 8 (4), 174-176.*

Hanset R., Camerlynck R., 1974. L'heritabilite du nombre de mammelles chez le porc de Pietrain et le porc Landrace Belge. *Ann. Génét. Sél. Anim., 6, 91-101*

Ligonesche B., Bazin C., Bidanel J.P. 1995. Variabilité génétique du nombre de tétines chez le porc. Relations avec les caractères de production et de reproduction. *Journées Rech. Porcine en France., 27, 121-126.*

Patton N.M., 1994. *The Biology of the Laboratory Rabbit.* Chapter 2. Colony Husbandry., 27-45. Editors: Manning P.J., Ringler D.H.., Newcomer C.E.

Rochambeau, H. De., Tudela, F., Chabert, J. 1988. Some results about number of teats in 3 strains of rabbits*. IV World Rabbit Congress, Budapest, V, 261-267.*

SAS 1997. SAS /Stat *User`s Guide (Release 6.03). SAS Inst, Cary, NC.*

Szendro, Zs., Holdas, S., 1984. Relationship between the number of mammary glands and the production of female rabbits. *III World Rabbit Congress, Roma, Vol. II, 141-148.*

Santacreu, M. A., Argente M. J., Mocé M.L.. and Blasco A., 2000. Selection for uterine capacity. II Response to selection estimated with a cryopreserved control population. 7th World Rabbit Congress. Valencia, 4-7 July 2000.

Torres, C., Pla, M., 1988. Viabilidad de los gazapos durante la lactación y su relación con el número de pezones de la madre. *ITEA, 76, 26-33.*