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OVULATION RATE IN LINES OF RABBITS SELECTED ON DIFFERENT CRITERIA[1]

Cifre, J.; Vicente, J.S.; Baselga, M.; García-Ximénez, F.
Departamento de Ciencia Animal
Universidad Politécnica de Valencia
46071 VALENCIA SPAIN

SUMMARY

Ovulation rate of several contemporaneous generations of three lines of rabbits selected for litter size at weaning or postweaning daily gain are analyzed. Some differences are observed between lines being the line selected for daily gain superior to one of the lines selected for litter size. Three different groups of hiperprolific (HH) females are compared in ovulation rate. There are not significant differences between criteria for sorting females as hiperprolific.

Key words: Ovulation rate, hiperprolific females, selection, rabbit.

INTRODUCTION

Litter size traits are very important in the economy of rabbit meat production (Armero y Blasco, 1992). These traits have been common objectives in programmes and experiments of rabbit breeding (Matheron and Rouvier, 1977; Estany et al., 1989).

Biological components of litter size are ovulation rate, fertilization rate (Bolet and Theau-Clément, 1994) and prenatal survival. Ovulation rate determines the limit of litter size and its genetic and phenotypic correlations with litter size and prenatal survival have been estimated in pigs (Cunningham et al., 1979; Neal and Johnson, 1986), rabbits (Blasco et al., 1993) and mice (Clutter et al., 1990). A positive correlation between ovulation rate and body size has been reported in rabbits either between breeds or within breeds (Hulot and Matheron, 1979).

Experiments of selection on ovulation rate have been succesful improving this trait but the correlated response on litter size has been negligible (Cunningham et al., 1979 and Johnson et al., 1984 in pigs, and Bradford, 1969 in mice). Selection on litter size in mice has very oftenly got response on litter size and ovulation rate (Falconer, 1960; Joakimsen and Baker, 1977; Bakker et al., 1978; Clutter et al., 1994), and in pigs an experiment of succesful selection on litter size has been reported in a line previously selected on ovulation rate (Lamberson et al., 1991).

The aim of this paper is to study the ovulation rate of three lines of rabbits undergoing each one its own method of selection along several generations and the ovulation rate of three groups of females classified as hiperprolific (HH) following different criteria.

MATERIALS AND METHODS

Ovulation rate has been recorded on does belonging to three lines of rabbits, named A, V and R and on does sorted as hiperprolific. Lines A and V are being selected for litter size at weaning under different methods: a family index (Baselga et al., 1984) for line A and a BLUP (repeatability animal model) for line V (Estany et al., 1989). Line R is selected for postweaning daily gain being the method, individual selection (Estany et al., 1992). The generations and number of does involved in the study are showed in **TABLE II**. The does named hiperprolific pertain to three groups called: single, accumulated or combined. A doe is sorted in the single group if the number of young born alive is either 16 or higher for the first parity or 17 or higher for any other. The criterium to be in the accumulated group is that the accumulated number of young born alive in all recorded parities of a doe reach the threshold, showed in **TABLE I**. The combined does are the ones that satisfy both criteria.

The ovulation rate has been estimated from the number of partially formed corpora lutea in does slaughtered three days after mating.

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The analysis of data has been carried out following the GLM procedure of SAS (1986) applied to a nested model of fixed effects. The main factor was line (A, V, R and HH females) and the nested factor was generation for lines A, V and R, or group (single, accumulated or combined) for the HH females.

TABLE I.- Accumulative criterium for the hiperprolific (HH) females.

Np[a]	1	2	3	4	5	6	7	8	9	10
NAc[b]	16	28	41	53	66	78	90	102	115	127

[a] : number of parities registered. [b] : accumulated number of born alive.

TABLE II.- Number of observations (**N**), maximum (**MX**), minimum (**MN**), average (**AVG**) and standard deviation (**STD**) for ovulation rate in each generation/group (**GEN**) in the three lines and the hiperprolific females(**HH**) studied.

LINE	GEN	OVULATION RATE				
		N	MX	MN	AVG	STD
V	11	40	21	11	15.0	2.66
	12	53	21	11	14.7	2.04
	13	60	19	8	13.4	2.53
	14	36	20	7	13.3	2.97
	15	41	17	8	13.3	2.54
	TOTAL	230	21	7	13.9	2.61
A	15	32	19	9	13.5	2.34
	16	43	22	8	14.6	2.84
	17	47	22	6	13.4	3.28
	18	30	18	7	13.0	2.95
	19	26	18	7	12.7	2.86
	TOTAL	178	22	6	13.5	2.94
R	3	42	22	10	15.7	2.96
	4	22	22	10	15.0	2.88
	5	21	19	9	13.8	3.09
	6	13	17	9	13.4	2.14
	7	26	19	10	14.3	2.48
	TOTAL	123	22	9	14.7	2.88
HH	SGLE[1]	43	22	10	15.1	2.55
	ACCM[1]	40	21	10	15.9	2.16
	COMB[1]	25	20	13	15.9	2.19
	TOTAL	108	22	10	15.6	2.34

[1].- Single (SGLE), accumulated (ACCM) or combined (COMB) group of HH females.

RESULTS AND DISCUSSION

Crude means, maximums, minimums and standard deviations of ovulation rate in generations of lines A, V and R, and in groups of HH females are shown in **TABLE II**. The maximum recorded has been 22 and it has been achieved in lines A, R and HH females. The minimum has been 6 and it has been observed in line A. The standard deviation range between 2.04 and 3.28.

The analysis of variance showed that line and generation/group within line are significant effects. **TABLE III** expresses that HH females had a significant higher ovulation rate than the lines A, V and R and line R was superior to line A. Taking into account that the combined and accumulated groups of HH females were selected as pointed out in **TABLE I** it is possible to compute its expected superiority over the average of their populations. This expected superiority is 0.69 ova when a phenotypic correlation of 0.07 (Hulot and Matheron, 1979) between born alive in a parity and ovulation rate in other, a standard deviation of 2.75 for number of born alive, a repeatability of 0.2 for this character, an average of four parities recorded for litter size at birth and a proportion selected of 0.01 were used. The relative higher ovulation rate of line R is in agreement with its higher body size (Hulot and Matheron, 1979).

TABLE III.- Ovulation rate in the three lines and in the hiperprolific females.

LINE	LSM[1]	SE
V	13.96[ab]	0.179
A	13.48[a]	0.204
R	14.49[b]	0.256
HH	15.67[c]	0.263

[1].- Least Squares Means.
[a b c].- LSMeans with different superscripts differ ($P < 0.05$).

TABLE IV.- Ovulation rate in the generations of line V.

GEN	LSM[1]	SE
11	15.00[a]	0.420
12	14.73[a]	0.365
13	13.41[b]	0.343
14	13.31[b]	0.443
15	13.34[b]	0.415

[1].- Least Squares Means.
[a b].- LSMeans with different superscripts differ ($P < 0.05$).

TABLE V.- Ovulation rate in the generations of line A.

GEN	LSM[1]	SE
15	13.56[abc]	0.470
16	14.63[c]	0.406
17	13.47[ab]	0.388
18	13.03[b]	0.486
19	12.73[b]	0.522

[1].- Least Squares Means.
[a b c].- LSMeans with different superscripts differ ($P < 0.05$).

TABLE VI.- Ovulation rate in the generations of line R.

GEN	LSM[1]	SE
3	15.71[a]	0.410
4	15.09[ab]	0.567
5	13.81[b]	0.580
6	13.46[b]	0.738
7	14.38[b]	0.521

[1].- Least Squares Means.
[a b].- LSMeans with different superscripts differ ($P < 0.05$).

The remarkable result here is the small differences in ovulation rate of lines A, V and R selected for a long time on different criteria. These lines are currently highly divergent in litter size (Torres et al., 1992).

TABLES IV, V and **VI** report the means in each generation and their significant differences for lines V, A and R respectively. Thus, generations 11 and 12 had an ovulation rate higher than generations 13, 14 and 15 in line V; ovulation rate in generation 16 of line A was superior to the one in generations 17, 18 and 19; and the same phenomenon occured when generation 3, is compared to generation 5, 6 and 7 in line R. This decline in ovulation rate in all lines has been an unexpected result because the expected correlated response on ovulation rate when selecting for litter size or daily gain is to increase ovulation rate (Cunningham et al., 1979 and Johnson et al., 1984 in pigs, and Bradford, 1969 in mice). The three lines are housed in the same building and have the same environment and husbandry. Thus a common environmental factor could be the most likely explanation for the observed decline in ovulation rate. There is a remarkable contemporaneity between generations of the three lines showing the declined ovulation rate.

Differences in ovulation rate of the three groups of HH females are given in **TABLE VII**. There were no significant differences but to determine if the criteria have the same value to detect HH females it will be necessary to study prenatal survival, ovulation rate and litter size in the progeny of these groups.

TABLE VII.- Ovulation rate in the HH females that pertain to the single (**SGLE**), the accumulated (**ACCM**) or the combined (**COMB**) group.

GROUP	LSM[1]	SE
SGLE	15.12[a]	0.406
ACCM	15.95[a]	0.420
COMB	15.96[a]	0.532

[1].- Least Squares Means.
[a].- LSMeans with different superscripts differ ($P < 0.05$).

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