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RELATIONSHIPS BETWEEN THE FSH LEVEL OF YOUNG RABBITS AND THE PERFORMANCE OF DOES*

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Introduction

The rabbit is not a spontaneous ovulating species. Ovulation in the rabbit occours only after induction by on external or internal stimulus such as mating or hormone treatment (artificial insemination). Two gonadotrophic hormones, LH and FSH, play the most important role in the complex neural--hormonal controlling procedure. Both hormones suddenly increase in the does after the coitus and immediately after a top level their amounts quickly decrease. Later the LH content will remain at the original level but the concentration of FSH will increase again, 10-12 hours after the mating. This second period lasts for 24-48 hours after the coitus (Meunier et al., 1983).

Some changes in the FSH level of young rabbits, too, can be observed (Blanc and Hulot, 1982). In the 4 week-old female rabbits the concentration of FSH starts to increase, it has a maximum value at the 7-8 week-old age and decrease to the original value by the 10-12 week-old age.

As the FSH plays a very important role in the reproduction, it was supposed that there is a relation between FSH content determined in young age and the reproduction of does. The correlations (r=0.64, 0.78, 0.71, 0.66, 0.70) between FSH content in 7, 8, 9, 10 and 11 week-old rabbits and number of corpus luteum in the adult female rabbits were close (Hulot, 1985). These correlations based on experiment with few animals (n=10).

The objective of our study was to determine the effect of the FSH level in 8 week-old rabbits on the age at the first parturition, days between two litters, number of inseminations per parturition, conception rate and

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litter size (total, alive and at 21 days of age).

Materials and Method

Two rabbit breeds, New Zealand White (NZW) and Californian (Cal), were studied in Kaposvár at the research rabbit farm of the Faculty of Animal Science, Pannon University of Agricultural Sciences.
To determine the FSH level, blood samples were taken from the aural vein of 8 week-old female rabbits at the same time of the day. The blood was centrifuged to separate the serum from the plasma and stored at -25 ^{o}C temperature.
Radioimmunassay method (RIA) was used to determine the FSH concentration. FSH level in the blood samples were determined at isothop laboratory of the local hospital. Method by Livesey et al. (1980) and Pharmacia FSH RIA kit were applied. On the basis of FSH values the female rabbits were divided into 3 various groups, as follows:

Groups (hormone level)	FSH concentration, mIU/ml	
	NZW	Cal
low	90-499	100-599
medium	500-999	600-1099
high	above 1000	above 1100

For breeding purposes 5-6 month-old female rabbits with body weight above 3.5 kg were housed in wire-mesh flat-deck cages. Nest boxes were suspended on the front of the cages 2-3 days before the expectable parturition and removed 3 weeks after the kindling. Rabbits were fed ad libitum a commercial pellet and hay placed on the top of cages. Water was provided by nipple drinker.
The female rabbits were inseminated artificially. Sperm from bucks was collected using an artifical vagina, analysed macroscopically and microscopically, diluted and inserted into the vagina near the cervix.
0.5 ml GnRH analogue(Ovurelin, Reanal^{R}) was given into the femoral muscle to induce ovulation. 10-14 days after insemination pregnancy was determined by palpation. If the doe was found to be empty (non-pregnant), it was inseminated again few days later. The pregnant ones were inseminated again 3 weeks after kindling.
Does which were not pregnant after 3 inseminations as well as the sick

animals were culled. During the experiment production data were observed, as follows: timing of insemination, data of examination of pregnancy, timing of kindling, litter size (total, alive, 21 day-old).

Data were calculated, as follows: age at first parturition, number of inseminations per kindling, conception rate, days between two litters.

Production data were collected during the first 5 kindlings (appr. 1 year production of the does). The analysis was performed on 43 and 55 does, and 131 and 144 litters in NZW and Cal stocks, resp.

Data were statistically analysed using variance analysis, t-test and chi^2-test.

Results and Discussion

Distribution of FSH levels in the 8 week-old female rabbits are given in Table 1. First it seems that there is only small difference in number and distribution of animals between the two breeds. However, more Cal rabbits are in the group of higher hormone level and fewer in the group of lower hormone level than NZW ones. This difference can be found mainly in the higher range. 8 Cal, but only 3 NZW rabbits show hormone level above 1400 mIU/ml. There is a definite difference in the mean FSH levels between the stocks, the mean hormone concentration was approx. 100 unit higher in case of Cal rabbits than in NZW ones. The mean values were 842 and 753 mIU/ml, resp. Therefore different limits were set up for the two breeds. 500-1000 mIU/ml and 600-1100 mIU/ml ranges for the NZW and Cal rabbits were considered to be the medium hormone level, resp.

The age at the first kindling and the days between two litters are given in Table 2, depending on the hormone level. No significant change could be observed in case of the NZW and the Cal rabbits. The Cal does with higher FSH concentration are older at first parturition and the interval between two litters are shorter in the NZW stock, but this tendency is supposed to be a random one.

Data relating to the number of inseminations per kindling and the conception rate were very similar (Table 3). Only the NZW does with hormone level above 1000 mIU/ml resulted better pregnancy. However, it can not be considered a significant difference because of few animals in this group.

Table 4 contains the experimental data relating to the relationship among the FSH levels and the litter size. Significant difference in total litter size was observed among the animals with high and low or high and medium

hormone levels in case of NZW breed. Figure 1 shows the distribution of litter size depending on the FSH levels. The shaded areas show that does with high FSH level have more frequently larger litters than rabbits with low FSH level. No significant difference in litter size at 21 days of age of NZW does and litter size (total, alive, 21 day-old) of Cal ones was found.

The FSH affects primarily the number of ova shed. That is why French scientists considered close correlation (Hulot, 1985). However, studying the futher events after the ovulation,because of embryonal mortality, rate of stillborn, mortality during the lactation period, the correlations will be less close. That is why poor correlation was observed between FSH level and the litter size (total and alive) of NZW rabbits. The mean values were already equalized by the 21 day-old age.

Experts in Toulouse found that in Cal strain more ova shed but the embryonal losses are definitely higher than for NZW one (Matheron, 1980, Holut and Matheron, 1981, Torres et al., 1984, Bolet et al., 1988). It is probably the reason that while significant differences were observed among the various FSH level groups of NZW does whereas the litter sizes of Cal rabbits are balanced because of higher embryonal mortality.

Total litter size of NZW does with high FSH level is 1.22 and 1.57 higher than rabbits with medium and low FSH level, resp. It seems to be a significant difference which should be considered during the selection. At one of the best breeding centre in France the litter size was increased in such extent only after 9 generations (Matheron and Poujardieu, 1984). But it should remind that this method improves primarily the potential prolification (number of ova shed) and the selection can be successful if we can decrease the mortality during pregnancy, and lactation as well.

Conclusions

On the basis of the results of our experiment and data of literature, it is possible to say the following:

- There is some difference in the FSH level determined at 8 week-old age among rabbit breeds (in our case between Cal and NZW ones).
- No correlation between FSH concentration determined at 8 week-old age and the age at first parturition, days between two litters, number of insemination per kindling,conceptions rate of does.
- Significant relation was observed only between FSH level and litter size.

The correlation is close in case of number of ova shed and becomes poorer after parturition. The longer the period after ovulation, the poorer the correlation.

- Correlation between the FSH level and litter size can vary on the breed (strain). Significant difference among the groups determined by the FSH levels, was observed only in NZW breed. No significant differences were found in Cal one.
- A preliminary examination seems to be essential before we decide how we consider the FSH level measured at 8 week-old age during the selection as a pre-selection factor to increase the litter size.

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Table 1

Distribution of NZW and Californian female rabbits on the basis of their FSH level determined at 8 week-old age

FSH level mIu/ml	New Zealand White			Californian		
	No. of anim.	Distribution per groups %	Distribution cumulative %	No. of anim.	Distribution per groups %	Distribution cumulative %
90- 199	4	9.3	9.3	2	3.6	3.6
200- 399	6	14.0	23.3	8	14.5	18.1
400- 599	6	14.0	37.3	9	16.4	34.5
600- 799	9	20.9	58.2	10	18.2	52.7
800- 999	6	14.0	72.2	12	21.8	74.5
1000-1199	6	13.9	86.1	6	10.9	85.4
1200-1399	3	7.0	93.1	-	-	85.4
1400-1599	-	-	93.1	3	5.5	90.9
1600-1799	2	4.6	97.7	1	1.8	92.7
1800-1999	-	-	97.7	-	-	92.7
2000-2199	-	-	97.7	3	5.5	98.2
2200-2399	-	-	97.7	-	-	98.2
2400-2599	1	2.3	100.0	-	-	98.2
2600-2799	-	-	100.0	-	-	98.2
2800-2999	-	-	100.0	1	1.8	100.0
Total:	43	100.0		55	100.0	
Mean FSH level: (mIU/ml)	753			842		

Table 2

The age at the first parturition and days between two litters depending on the FSH level determined at 8 week-old age

FSH level mIU/ml	Age at 1st kindling (days)			Days between two litters		
	n	$\bar{x}$	s	n	$\bar{x}$	s
	New Zealand White					
90- 499	15	186	18	34	79	27
500- 999	17	208	40	34	77	24
1000 above	11	188	29	20	74	25
	Californian					
100- 599	19	196	31	30	80	28
600-1099	26	201	30	41	89	33
1100 above	10	231	47	18	90	35

Table 3

Number of inseminations per kindling and conception rate depending on the FSH level

FSH level mIU/ml	No of inseminations per kindling			Conception rate %
	1	2	3	
	Distribution, %			
	New Zealand White			
90- 499	73.5	24.5	2.0	77.8
500- 999	72.6	23.5	3.9	76.1
1000 above	83.9	16.1	-	86.1
	Californian			
100- 599	77.6	18.4	4.0	79.0
600-1099	79.1	7.5	13.4	82.7
1100 above	71.4	21.4	7.2	73.7

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Table 4

Litter size of does depending on the FSH level

FSH level mIU/ml	Litter size: Total			Alive			at 21 days of age		
	n	$\bar{x}$	s	n	$\bar{x}$	s	n	$\bar{x}$	s
				New Zealand White					
90- 499	49	7.27[a]	2.69	43	7.33[a]	2.54	40	7.13[a]	2.49
500- 999	51	7.67[b]	2.36	50	7.60[ab]	2.40	48	6.85[a]	2.20
1000 above	31	8.81[c]	2.44	28	8.54[b]	2.33	26	6.85[a]	2.35
				Californian					
100- 599	49	8.59	2.37	47	8.43	2.37	43	7.56	2.31
600-1099	67	8.78	2.39	62	8.26	2.33	53	7.64	1.92
1100 above	28	8.96	2.49	27	8.85	2.67	25	7.16	2.76

Notes: The same letters indicate, no significant difference; significant difference at $P < 0.05$ level between a and b, $P < 0.001$ between a and c

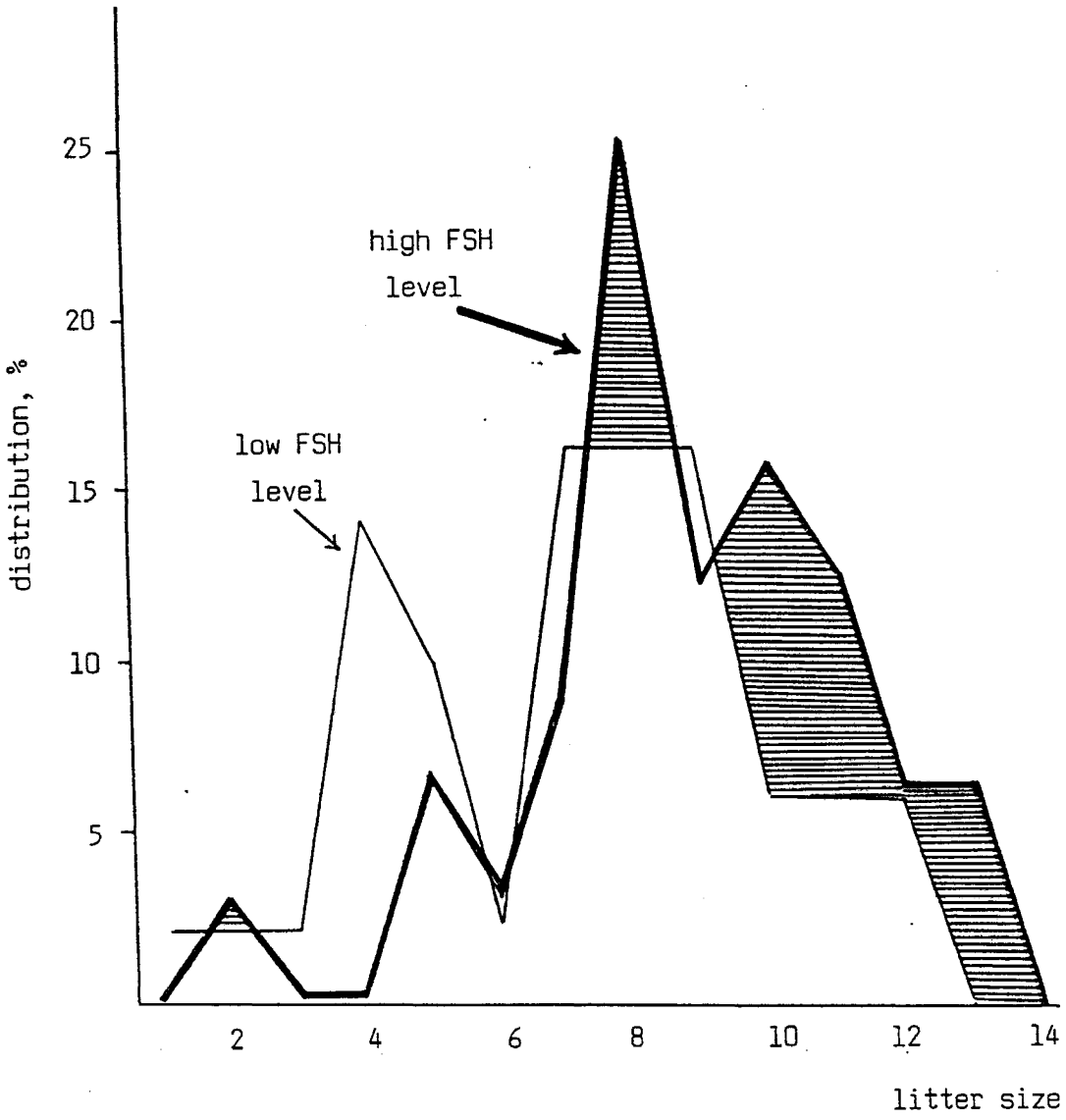

Fig. 1 Distribution of litter size of does in the groups of low and high FSH level determined at 8 week-old age