EFFECT OF A LIGHT STIMULATION ON THE REPRODUCTIVE PERFORMANCE OF RABBIT DOES

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ABSTRACT

In order to replace the PMSG treatment used for oestrus synchronisation, the effects of the increased lighting from 8 to 16 hours were examined. The experiment was carried out at the University of Kaposvár using Pannon White rabbit does. Prior to the experiment does were kept using a 16L:8D lighting program and each doe had 2-3 parturitions. The does were randomly housed in two identical rooms. Rooms differed only in lighting regime. In the first room a 16L:8D lighting regime was used throughout the experiment (16-16L group). In the other room a lighting system of 8L:16D was used during the days (lighting: between 6.00 and 14.00) after parturition, then the light period was increased to 16 hours per day 8 days prior to insemination (lighting: between 6.00 and 22.00). After insemination the lighting period was modified to 8 hours per day (8-16L group). Light intensity measured in the cages at the height of rabbit does ranged between 40 and 70 lux. In the 16-16L and 8-16L groups, 153 and 154 inseminations (94 and 111 parturitions) of 55 and 54 rabbit does were evaluated, respectively. Based on the results, the increased lighting period prior to insemination favourably affected pregnancy rate (16-16L: 61.4% vs. 8-16L: 72.0%, $P<0.05$). Although the differences were not significant, number of kits born alive and litter size at 3 weeks of age were higher in the 8-16L group, while slightly higher individual and litter weights were recorded at the age of three weeks in the 16-16L group. No differences were found for mortality between the groups. Comparing the pooled results per 100 inseminations, the 8-16L does produced 16% more kits alive at birth (620 vs. 522, $P<0.05$). Light stimulation could be an alternative to PMSG treatments. Nevertheless, further experiments will be necessary to determine the cause of the decreased rabbit weight when applying longer daily lighting program and to test the durability of the positive effects.

Key words: Rabbit does, Lighting program, Reproductive performance.

INTRODUCTION

In rabbit breeding the 42-day reproduction rhythm (inseminating the does 11 days after kindling) is wide-spread. During the increasing stage of lactation the hormones regulating milk production prevent the production of hormones regulating reproduction resulting weak receptivity (Theau-Clément, 2007). For this reason generally PMSG treatment is applied for oestrus synchronisation. PMSG treatment of rabbits does has not yet been banned in the EU, nevertheless its judgement from the consumers' viewpoint is not favourable. Repeated treatments can have antigenic side-effects causing lower pregnancy and higher culling rates (Canali, 1991). Nowadays several investigations are being conducted in order to find natural methods replacing hormone treatments. These methods are called biostimulation.

It is well established that in spring the longer light period favourably affects the reproduction of the European wild and domesticated rabbits. This observation induced to analyze the effects of longer lighting (biostimulation) prior to insemination (Vodermayer, 1989; Maertens and Luzi, 1995; Mirabito *et al*., 1994; Theau-Clément *et al*., 1990). Favourable results were achieved when 8 days prior to the insemination (11 days *post partum*) the daily light period suddenly increased from 8 hours to 16 hours (Theau-Clément *et al*., 1990). However, with the increasing reproductive performance the body weight of the suckling kits generally decreased (Mirabito *et al*., 1994).

The objective of this study was to evaluate the effect of the longer daily lighting before the insemination on the rabbit does' production and on young growth.

MATERIALS AND METHODS

The experiment was carried out at the University of Kaposvár using multiparous Pannon White rabbit does. The rabbit house was climatized and heated during summer and winter, respectively, thus the room temperature was stable (18-23°C). The cages had a basic area of 580x385 mm, the size of the nest-box was 260x385 mm. The rabbits were fed with a commercial pellet (11 MJ DE/kg, 17% crude protein, 15.5% crude fibre) *ad libitum*. Drinking water was available from nipple drinkers. Prior to the experiment does were kept using a lighting program of 16L and each doe had 2-3 parturitions.

The does were randomly housed in two identical rooms. Rooms differed only in lighting regime. In the first room a 16L:8D lighting regime (lighting: between 6.00 and 22.00) was used throughout the experiment (16-16L group). In the other room a lighting system of 8L:16D (lighting: between 6.00 and 14.00) was used during the days after parturition then the light period was increased to 16 hours (lighting: between 6.00 and 22.00) per day 8 days prior to insemination. The light period was modified to 8 hours per day at the day of insemination (lighting: between 6.00 and 14.00; 8-16L group). Luminous intensity measured in the cages at the height of rabbit does ranged between 40-70 lux. In the 16-16L and 8-16L groups 153 and 154 inseminations (94 and 111 parturitions) of 55 and 54 rabbit does were evaluated, respectively.

The does were inseminated with fresh diluted semen at 11 days after kindling. The non-pregnant does were inseminated again 3 weeks after the first AI. Simultaneously to insemination the does were injected with 1.5 μg GnRH-analogue (Ovurelin). Cross fostering was used equalizing the litters to 8-9 kits. The kits were weaned at 35 days of age.

Production was monitored at each parturition. In the first and the third kindlings of the experiment body weight of does and kits (individual and litter weight) were measured every 4 days (16-16L group: 33 does; 8-16L group: 48 does) together with feed consumption to calculate the weight gain of the litters and feed conversion ratio between day-2 and day-16 *post partum*.

Production data were evaluated by means of analysis of variance, T-test and Chi^2-test (pregnancy rate, mortality) using SPSS 11.5 software package. Parity was included in the model as a random effect.

RESULTS AND DISCUSSION

The light stimulation significantly increased the pregnancy rate with more than 10% (72.0 vs. 61.4%, P=0.05, Table 1).

Table 1: Effect of lighting schedule on reproductive performance

Traits		Lighting		SE	P
		16-16L	8-16L		
Pregnancy rate (%)		61.4	72.0		0.05
Litter size	total	8.68	9.04	0.16	0.33
	alive	8.50	8.61	0.15	0.82
	reared	8.49	8.56	0.07	0.69
	3 weeks old	7.94	8.05	0.08	0.59
Litter weight at the age of 3 weeks (g)		3411	3352	43.2	0.38
Individual weight at the age of 3 weeks (g)		432	420	4.70	0.17
Mortality during suckling (%)		6.5	6.0		0.67

Similar results were reported by Maertens and Luzi (1995), Mirabito *et al*. (1994) and Theau-Clément *et al*. (1990). Differences for the number of kits born alive and for the litter size at 3 weeks were not significant. In accordance with Mirabito *et al*. (1994), the litter weight as well as the individual weight at the age of 3 weeks was slightly decreased under a 8L:16D photoperiod, but the difference was not significant. In a same way, no significant differences were found for the kits' mortality. Comparing the pooled results per 100 inseminations the 8-16L does produced 16% more kits born alive (620 vs. 522, $P<0.05$).

In order to determine the effect of the longer lighting regime on the does' milk production and on the kits' growth at two kindlings (first and third kindling of the experiment) more frequent data recording was accomplished. Based on these recording it could be established that the body weight of the 8-16L does was about 100 g larger compared to the 16-16L does, but the difference was not significant (Table 2).

Table 2: Effect of lighting schedule on the body weight of does, litter size (alive) and litter weight

Age	Lighting		SE	P
	16-16 L	8-16 L		
Body weight of doe (g):				
Day 2	4203	4331	47.2	0.19
Day 4	4455	4567	42.5	0.20
Day 8	4531	4670	41.8	0.10
Day 12	4606	4709	40.2	0.20
Day 16	4696	4800	44.8	0.26
Litter size:				
Day 2	8.42	8.31	0.12	0.67
Day 4	8.33	8.27	0.13	0.81
Day 8	8.00	8.21	0.13	0.44
Day 12	7.82	8.13	0.14	0.29
Day 16	7.82	8.10	0.14	0.37
Litter weight (g):				
Day 2	566	573	11.5	0.76
Day 4	743	739	16.0	0.91
Day 8	1245	1268	27.7	0.69
Day 12	1779	1817	38.0	0.63
Day 16	2357	2345	46.3	0.90

So the difference does not seem to be related to the lighting program. No significant differences were found in litter size. Between the 4^{th} and 8^{th} days mortality increased in the 16-16L groups (Table 3) but this could not be the result of the lighting regime as the number of lighting hours was constantly 16 hours. In the *post partum* period, no significant differences were observed for the litter weight (Table 2). The small differences between the daily feed consumptions were not significant (Table 4). Weight gains of the litter between day-12 and day-16 tended to be higher for group 16-16L group (144 vs. 132 g, $P=0.07$, Table 4). Examining the whole period feed consumption and litter weight gain were not significantly different between the groups. Feed conversion ratio was significantly weaker in the 8-16L group between day-12 and day-16 (3.2 vs. 3.5, $P=0.02$) which can be explained by the different weight gain of the litters in the different groups. On the contrary no significant differences were found analysing the whole period.

Table 3: Effect of lighting schedule on suckling mortality

Age	Lighting		P
	16-16 L	8-16 L	
Days 2-4	1.15	0.50	0.350
Days 4-8	4.26	0.76	0.002
Days 8-12	2.43	1.02	0.160
Days 12-16	0.00	0.26	0.430
Days 2-16	7.66	2.51	0.002

Table 4: Effect of lighting schedule on feed consumption, litter daily weight gain and feed efficiency

Age	Lighting		SE	P
	16-16 L	8-16 L		
Feed consumption (g/day):				
Days 2-4	311	325	6.47	0.30
Days 4-8	366	381	5.93	0.24
Days 8-12	416	414	6.23	0.89
Days 12-16	447	452	3.44	0.73
Days 2-16	387	403	6.04	0.20
Weight gain of the litters (g/day):				
Days 2-4	88.5	83.0	4.98	0.28
Days 4-8	129	132	3.41	0.70
Days 8-12	134	137	3.69	0.62
Days 12-16	144	132	3.45	0.07
Days 2-16	130	127	3.11	0.54
Feed conversion ratio (g/g):				
Days 2-4	3.51	3.91	0.91	0.31
Days 4-8	3.07	2.97	0.07	0.51
Days 8-12	3.31	3.34	0.19	0.95
Days 12-16	3.20	3.51	0.06	0.02
Days 2-16	2.98	3.17	0.10	0.90

CONCLUSIONS

Nevertheless, based on these results, a light stimulation (from 8 hours to 16 hours) 8 days before insemination (at 11 days after parturition) increased the pregnancy rate and consequently does' productivity by 16%. This method could be an alternative to hormonal treatments to induce rabbit does' receptivity.

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