EFFECT OF SHORT FAST-REFEEDING AND LIGHT PROGRAM ON RABBIT DOE REPRODUCTION

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ABSTRACT

The reproduction of 1-14 day controlled nursing rabbits subjected to light stimulation (L) or fast-refeeding plus light stimulation (FL) before AI (on day 11) was compared in two reproduction cycles in winter in Galgamácsa rabbit farm. On day 8 before AI the daily 9 h and 50 lux LED lighting was increased to 16 h and 100 lux that was gradually set back until day 5 after AI. The L rabbits were fed *ad libitum*. As nutritive stimulus, the FL rabbits received the same diet but they had a 24 h water-only fast and 48–50 h *ad libitum* re-feeding before AI. Fast-refeeding plus light stimulation did not further improve doe reproduction. Sexual receptivity, pregnancy and kindling rates of the FL and L does did not differ significantly in the first cycle (FL: 44, 91 and 86%; L: 42, 90 and 85%) nor in the second reproduction cycle (FL: 44, 92 and 89%; L: 51, 91 and 86%). With refeeding plus light stimulation the number of live born kits per litter hardly changed in the first cycle (FL: 9.07 and L: 9.28) but seemed to decrease (P=0.056) in the second cycle (FL: 9.69 and L: 10.2). Compared to the L rabbits (789) the productivity (number of live born kits per 100 AI) of the FL rabbits was similar in the first cycle (784) but 2.0% lower (881 vs 863) in the second cycle. In conclusion, the productivity of light-stimulated rabbits cannot be further increased with fast-refeeding combined with light stimulation.

Key words: Feed restriction, Photostimulation, Controlled nursing, Sexual receptivity, Productivity

INTRODUCTION

In rabbit even a short-term change in nutrient supply can influence doe hormonal status and reproduction (Boiti, 2004; Daoud *et al*., 2012; Menchetti *et al*., 2015). Food deprivation prior to artificial insemination (AI) affects the level of such metabolites and hormones which act as metabolic signal or directly impact receptivity and fertility (Brecchia *et al.*, 2006; García-García *et al.*, 2011; Sirotkin *et al.*, 2014, 2017). Metabolic signals caused by the lack of food can modify the responsiveness of the pituitary to GnRH action, enhancing the gonadotropin release at refeeding (Parillo *et al.*, 2004). Lactation induces anestrus (García-Dalmán and González-Mariscal, 2012). Based on earlier results (Brecchia *et al.*, 2006; Daoud *et al*., 2012; Eiben *et al*., 2008, 2013) the effect of short fast depends on its level, duration, timing, refeeding and the nursing method used. Altered nursing causes a higher activity of a specific brain region (González-Mariscal *et al*., 2015) and affects feed intake (Schuh *et al*., 2005). Lighting influences nursing behavior (Matics *et al*. 2013, 2016) and doe live weight (Sun *et al*., 2017). The change of lighting before AI modifies doe receptivity (Theau-Clément, 2007, 2016; Gerencsér *et al*., 2012; Szendrő *et al.*, 2016; Eiben *et al*., 2016, 2018). Melatonin acts as metabolic signal and indicates the annual reproduction cycle (Cipolla-Neto *et al*., 2014). The energy balance is regulated by the interaction of melatonin and leptin (Buonfiglio *et al.*, 2018) and leptin mediates the effects of melatonin on reproduction (Lv *et al*., 2019).

This work aimed to try the short-term fast with refeeding before AI combined with light program, i.e. increased duration and intensity of lighting before AI as a dual biostimulation not yet studied.

MATERIALS AND METHODS

The trial was conducted at rabbit farm of S&K-Lap Ltd in Galgamácsa. Multiparous Hycole rabbits with litters standardized to ten kits were divided into two groups (L and FL) based on doe live weight at kindling. Artificial insemination (AI) was done on 2 and 23 of January 2015 (1st and 2nd reproduction cycles, n=294 and 294, respectively). Controlled nursing was used by opening the metal-sheet nest door from 9 a.m. to 10 a.m. from postpartum day 1 to 14 and free nursing thereafter.

There was no hormonal oestrus synchronization but from day 8 before AI the duration and intensity of daily lighting were increased in both groups as photostimulation. In the buildings, the dimmable cold-white multichip four-die LED lamps (15x20 cm) provided the daily 9 h and 50 lux basic illumination. On day 8 before AI, the 9 h L (8 a.m. to 5 p.m.) was increased by 7 hours to 16 h L (6 a.m. to 10 p.m.). The lighting was reduced by 2 hours on days 3 and 4 after AI (14L, 6 a.m. to 8 p.m. and 12L, 8 a.m. to 8 p.m.) and by 3 hours on day 5 after AI, returning to the 9 h (8 a.m. to 5 p.m.) daily lighting. To increase light intensity, the LEDs were set to 100 lux from day 8 before AI to day 3 after AI. On day 4 after AI the light intensity was reduced to 80-90 lux and then back to 50 lux.

Rabbits were fed the same diet (10.0 MJ/Kg DE, 17.5% CP, 3.80% EE, 14.9% CF, 7.7% ash) and it was *ad libitum* in only-light stimulated group (L). In group stimulated with fast-refeeding plus lighting (FL) the does were subjected to a 24 h water-only fast between days 8 and 9 and a 48-50 h *ad libitum* re-feeding before AI. In our earlier studies (Eiben *et al.*, 2008, 2013) the feeder was removed (total fast). Now the automatic feeder was closed at Monday night. At 8 a.m. on Tuesday morning about 380-400 g feed remained in the collective feeder supplying four does. The feeder was reopened at 2 p.m. on Wednesday and thereafter there was *ad libitum* feeding (AI on Friday between 10 and 12 a.m.).

AI was done on postpartum day 11 with heterospermic pooled semen from Hycole bucks (0.5 mL/doe) within three hours after nursing. Two-third of rabbit does were induced to ovulate by i.m. administration of 0.2 mL GnRH analogue (Receptal®, 0.84 µg buserelin acetate/doe) and one-third by intravaginal via 0.5 mL semen extender (MRAbit®, 25 µg GnRH analogue [des-Gly10, D-Ala6]-LHRH ethyl amid/doe). To access the effect of GnRH treatment was not aimed here. At AI does with red / violet and turgid vulvas were judged to be receptive. Pregnancy was checked on day 14 after AI by abdominal palpation. In air conditioned (18-20°C) building the rabbits were housed in wire-net breeding cages (80 x 53 cm with 90 cm height) equipped with a plastic mat, an elevated platform (40 x 53 cm) at 25 cm height, a gnawing stick and an outer nest (23 x 53 cm) with metal sheet walls.

The effects of light program or fast-refeeding plus light program on receptivity, pregnancy and kindling rates were evaluated by the chi-squared test and on the number of kits born by ANOVA using the Statgraphics 6.0 (1992) statistical software. Productivity was calculated as the number of live born kits per 100 AI.

RESULTS AND DISCUSSION

With fast-refeeding plus light program (FL) the ratio of rabbits with red vulva seemed to decrease only at the 2nd reproductive cycle. In FL rabbits, the occurrence of white vulva seemed to increase while violet to decrease (Figure 1, P>0.05). The proportion of FL rabbits with turgid vulva was slightly lower than in merely light stimulated L rabbits (Table 1, P>0.05). This trend was observed by Gómez *et al.* (2004) with 24 h fasting without refeeding in nulliparous rabbits where the ratio of rabbits having white vulva increased and those with red vulva decreased.

The ”dual” stimulation decreased the visual signs of sexual receptivity but pregnancy and kindling rates seemed to improve (Table 1). In the study of Daoud *et al.* (2012) feed restriction with refeeding increased the number of quality oocytes and GDF-9 gene expression responsible for fertility supporting our results. The total born kits per litter was the highest in L rabbits at the 2nd reproductive cycle when the best receptivity was found. However, the number of live born kits per litter seemed to

decrease at the 2nd reproductive cycle in FL rabbits (9.69 vs 10.2; P=0.056, Table 1). The "dual" stimulation could impair prenatal life. Feeding can affect embryonic development (Lorenzo *et al*., 2014; Naturil-Alfonso *et al*., 2016, 2017). Feed restriction can alter the sensitivity to hormones and hormonal effects (Harrath *et al*, 2017; Sirotkin *et al*., 2017). The productivity with only light program was 2% better at the 2nd reproductive cycle than with the fast plus light program (881 vs 863 rabbits, Table 1). In this cycle the kindling rate of the FL rabbits was vainly 3% higher, because of the less number of live born kits, the productivity reduced.

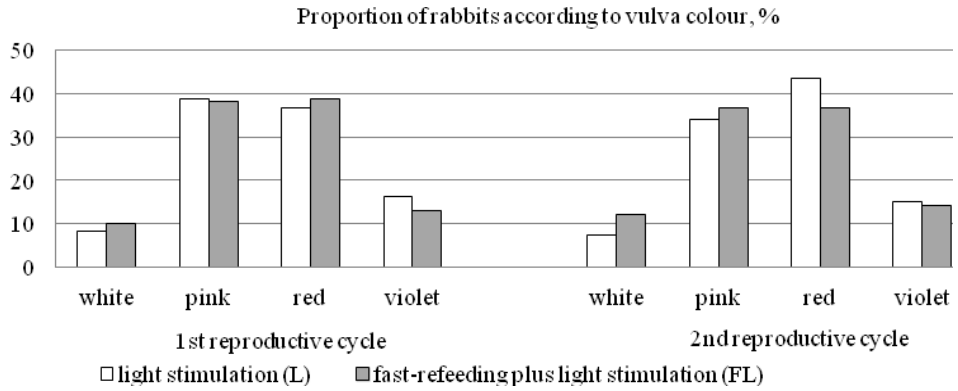

Figure 1: Effect of light program (L) or fast-refeeding plus light program (FL) on vulva colour

Table 1: Effect of light stimulation (L) or fast-refeeding plus light stimulation (FL) on reproduction

	1st reproduction cycle			2nd reproduction cycle		
Groups	L	FL	Prob.	L	FL	Prob.
	n=147	n=147		n=147	n=147	
Red-violet vulva, %	53.1	51.7	NS	58.5	51.0	NS
Turgid vulva, %	59.9	57.1	NS	65.3	56.5	NS
Sexual receptivity, %	42.2	44.2	NS	51.0	44.2	NS
Pregnancy rate, %	89.9	90.5	NS	90.5	91.8	NS
Kindling rate, %	85.0	86.4	NS	86.4	89.1	NS
No. of born kits per litter	10.8±0.2	10.6±0.2	NS	11.2±0.2	11.1±0.2	NS
No. of live born kits	9.28±0.2	9.07±0.2	NS	10.2±0.2	9.69±0.2	0.056
Productivity	789	784	-	881	863	-

NS: P>0.05

CONCLUSIONS

The productivity of light-stimulated rabbits cannot be further increased with fast-refeeding combined with light stimulation.

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