RELATIONSHIP AMONG FEEDING LEVEL, CHANGE OF CAGE AND FASTING WITH VULVA COLOR AND SEXUAL RECEPTIVITY IN NEW ZEALAND WHITE AND CALIFORNIAN NULLIPAROUS DOES

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ABSTRACT

Data from 43 New Zealand White (NZB) and 46 Californian (CAL) nulliparous does, which included 142 records, were used to evaluate the relationship among feeding level (high *vs.* low), change of cage (yes *vs.* not), fasting (yes *vs.* not) and breed (NZB *vs.* CAL), with vulva color and sexual receptivity. Data analyses were performed using mixed models methodology. At the first mating, in the high feeding level 57 % of pink vulvas ($p<0.001$) and 12 % of red vulvas were observed. Does that fasted 24 hs before mating showed 51 % of pale vulvas ($p<0.001$). The interaction change of cage x breed affected doe's sexual receptivity. CAL does improved their receptivity when changed of cage ($p<0.001$). Also the interaction breed x feeding level x fasting affected ($p<0.003$) sexual receptivity at first mating . The highest percentage of receptivity, 78 %, was observed in NZW does in the high feeding level and no fasting; however, in CAL does this same receptivity was observed in the high feeding level but with fasting. The feeding level controlled through the amount of feed can affect vulva color and sexual receptivity in nulliparous does. Also, the change of cage 24 hs before mating can improve their receptivity.

Key words: reproduction, environment, management.

INTRODUCTION

With the purpose of improving the reproductive performance of the doe, several methods of synchronization of the reproductive cycle have been evaluated, such as cage change of the female and feeding level (THEAU-CLÉMENT *et al*., 1998). LEFEVRE and MORET (1978) and VERGA *et al*. (1978), observed that a sudden environmental change facilitates the appearance of estrus in nulliparous does, since the central nervous system is stimulated and a hormonal unloading to the blood stream of corticosteroids and prolactin is caused. PLÁ *et al.* (1984), mentioned that a relation between vulva color and receptivity of the doe exists, since high plasma estrogen levels act in the axis

hypothalamus-pituitary-ovaries, causing hyperemia in the vulva lips which intensifies their color. The increase in the availability and previous consumption of nutrients before the estrus –flushing- improves its appearance and the reproductive performance in does (THEAU-CLÉMENT and BOITI, 1998; RODRIGUEZ DE LARA, 2002). MANCHISI *et al*. (1988), when comparing two levels of feeding (*ad libitum* vs restricted) in nulliparous and primiparous does, observed that the feeding *ad libitum* increased the percentage of does that ovulated, because a better feeding provided important amounts of energy and protein that favor the metabolic activity of reproductive hormones. RODRIGUEZ DE LARA and FALLAS (1998), mentioned that there is a direct relation between concentration of estradiol in plasma and vulva color, and that vulva color is modified when there are nutrimental deficiencies or a restricted feeding (100 g d^{-1}). Those results suggest that the change of cage and feeding level are alternatives to improve the reproductive behavior of the doe in commercial farms. The objective of this study was to evaluate the relation of the feeding level, change of cage and fasting with vulva color and sexual receptivity in New Zealand White (NZW) and Californian (CAL) nulliparous does.

MATERIAL AND METHODS

Data from 142 reproductive records of 89 females, 43 NZW and 46 CAL, and 22 males, 10 NZW and 12 CAL, were used. The study was conducted in the Valley of Mexico, in a rabbitry with capacity of 142 cages, located at 19º 27' N and 98º 53' W and 2240 m above sea level. Climatic conditions are annual average temperature of 15 ºC and a rainfall of 645 mm. The rabbits were maintained in individual cages of 90 x 60 x 40 cm. Feeding was provided by a commercial granulated concentrate that contained at least 15.5 % crude protein and 15 % crude fiber. Before the experimental period, all does were between 125 to 140 days old, and restricted to 100 g d^{-1} of feed. Five days before the first mating attempt the does were assigned at random to two levels of feeding regimen, high 200 g d^{-1} and low 100 g d^{-1}. Twenty four hs before mating the does were assigned to two types of handling, change of cage (yes vs not) and fasting (yes vs not). All matings were performed in January. Also, vulva color, pale = 1, pink = 2, red = 3 and violet = 4, was determined by visual evaluation 24 hs before mating, at mating and 24 hs later (for does that required a second chance mating attempt); sexual receptivity was expressed as percentage. Red and pink colors were considered as indicative of a higher sexual receptivity. Turgenscency of vulva was not recorded and then not considered in this study. The experimental design was completely randomized with a 2^4 factorial arrangement, feeding levels, change of cage, fasting and breed. A mixed model was used, that in addition to the factors and their interactions, included the random effect of the doe and vulva color as covariate. Data analysis were performed using the MIXED procedure of SAS (SAS/STAT, 1999).

RESULTS AND DISCUSSION

The feeding level and fasting had an important effect ($p<0.001$) on vulva color at the first mating attempt and also 24 hs later at a second mating attempt. At the first mating, in the low feeding level does with pale vulva color, 59 %, prevailed, contrary to the high

feeding level in which does with pink vulvas were more frequent 57 %; in the high and low feeding level frequencies of red vulvas 12 % and 16 %, and violet 1 % and 4 % were similar, respectively. Similarly, at the second mating, in the low feeding level the pale vulva color was predominating with 51 % unlike the high level where 42 % of red vulvas were observed. Twenty four hs of fasting before mating attempts affected (p<.001) vulva color. Fifty-one percent of the does that fasted showed (Table 1) pale vulvas, whereas those that did not fast had only 30% of pale vulvas. MOODY and MCNITT (1988) found that vulva color is a good indicator of the stage of the estral cycle in the doe. THÉAU-CLÉMENT and ROUSTAN (1992) indicated that does with vulvas of pale, pink, red and violet color had a receptivity of 35 %, 55 %, 75 % and 40 %, respectively. MCNITT and MOODY (1989) mentioned that vulva color is associated with the receptivity of the doe, finding that a significant proportion of does with pink and red vulvas showed better receptivity than those with pale or violet vulvas.

Table 1. Vulva color of nulliparous does at mating fastening by 24 hs (%).

Vulva color	Fasting	
	Yes	Not
Pale	51[a]	30[b]
Pink	40[a]	47[a]
Red	9[a]	19[b]
Violet	0[a]	4[a]

a, b Values on the same row with no common letter are different (p<0.001)

Does receptivity at first mating was affected by the interaction change of cage x breed. The CAL does showed better receptivity (p<0.05) when they were changed of cage (Table 2). The change of cage did not modify the receptivity of NZW does (p>0.05). Rebollar *et al.* (1995) and RODRIGUEZ DE LARA *et al*. (2000) observed that a sudden change of environment facilitates the appearance of estrus in nulliparous does, due to the stimulation of the central nervous system and the activity of the axis hypothalamus-pituitary-ovary. CASTELLINI (1996), found in nulliparous does that a change of cage 48 hs before the service was an effective method to synchronize estrus. RODRIGUEZ DE LARA and FALLAS (1998) observed a positive response to estrus appearance in nulliparous does that were changed to another cage 8 hs before service.

Table 2. Interaction breed x change of cage on sexual receptivity at first mating of nulliparous does (%).

Breed	Change of cage		
	Yes	Not	Total
NZW	55[a]	60[a]	57
CAL	74[c]	42[b]	58
Total	64	51	57

a, b, c Values on the same row with no common letter are different (p<0.001).
NZW = New Zealand White. CAL = Californian.

An effect ($p<0.01$) of fasting was found on receptivity at the second mating attempt, with only 31 % does accepting service, unlike the 49 % receptivity for does that did not fast. The level of energy intake, among other nutrients, could influence these results. RODRIGUEZ DE LARA and FALLAS (1998), mentioned that when the feed consumption is restricted to 100 g d^{-1}, the sexual activity is reduced by the blockade of the GnRH in FSH and LH secretions. Nevertheless, MAERTENS (1988) found that in NZW does under flushing, with high energy diet level four days before the insemination, the sexual receptivity did not improve. Contrary, VAN DEN BROECK and CAMPO (1977) and GOSALVEZ *et al.* (1995), observed that nulliparous does under flushing, followed by a period of restriction, improved their receptivity.

The interaction breed x feeding x fasting affected ($p<0.003$) the receptivity of the doe at first mating (Table 3). The highest percentage of sexual receptivity, 78 %, was observed in NZW does in the high level of feeding and no fasting; however, in CAL does this same receptivity was observed in the high level of feeding but with fasting. In does under fasting the lowest receptivity levels were observed, 35% in the high level of feeding for NZW does and 32% in the low level for CAL does. The remaining combinations of level receptivity was near 60%.

Table 3. Interaction breed x feeding level x fasting on sexual receptivity at first mating of nulliparous does (%).

Breed	Fasting						
	Yes			Not			
	Feeding level		Sub Total	Feeding level		Sub Total	Total
	Low (100 gd^{-1})	High (200 gd^{-1})		Low (100 gd^{-1})	High (200 gd^{-1})		
NZW	62^{a}	35^{b}	48	53^{a}	78^{c}	65	56
CAL	32^{b}	78^{c}	55	57^{a}	61^{a}	59	57
Total	47	56	52	55	69	62	57

a, b, c Values with no common letter are different ($p<0.003$).
NZW = New Zealand White. CAL = Californian.

At the second attempt to mate, the higher percentage of receptivity, 68%, was observed, only in NZW does in the high level of feeding and without fasting (Table 4). Again, in females under fasting the lowest levels of receptivity were observed, 18 % in the high feeding level for NZW does and 14 % in the low feeding level for CAL does.

In the remaining combinations, a receptivity above 40% was observed, except in NZW does under no fasting and low feeding level, with a value of 31%. RODRIGUEZ DE LARA *et al.* (2000), observed that nulliparous does under different feeding levels, and flushing showed follicular growth and estrus synchronization. THEAU-CLÉMENT and BOITI (1998) and THEAU-CLÉMENT. e*t. al.* (1998), indicated that flushing increases the amount of energy available for the doe, which favors the reestablishment of the cycle hypothalamus-pituitary-ovaries.

Table 4. Interaction breed x feeding level x fasting on receptivity at second mating of nulliparous does (%).

Breed	Fasting						Total
	Yes			Not			
	Feeding level		Sub Total	Feeding level		Sub Total	
	Low (100 gd^{-1})	High (200 gd^{-1})		Low (100 gd^{-1})	High (200 gd^{-1})		
NZB	45^{b}	18^{d}	31	31^{c}	68^{a}	49	40
CAL	14^{d}	44^{b}	29	51^{b}	44^{b}	47	38
Total	29	31	30	41	56	48	39

a, b, c, d Values with no common letter are different ($p<0.001$).
NZW = New Zealand White. CAL = Californian.

CONCLUSIONS

In nulliparous does subjected to a low feeding level, a higher frequency of pale vulvas were observed at first attempt to mate. Similar results were observed for does under fasting for 24 hs previous mating. CAL does showed a better receptivity when moved of cage 24 hs before mating. However, interactions among doe's breed, feeding level and fasting affected sexual receptivity. NZW does showed a better receptivity, both at first and second attempt to mate, when subject to a high feeding level and no fasting. Does under fasting showed the poorest receptivity in NZW in the high feeding level and in CAL in the low feeding level.

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