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EFFECT OF DIFFERENT PERCENTAGES OF SUCROSE IN DRINKING WATER ON REPRODUCTIVE PERFORMANCE AND ENERGY BALANCE OF PRIMIPAROUS LACTATING RABBIT DOES

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ABSTRACT

The feeding of a liquid sucrose was used to verify the energy intake and the reproductive performance of primiparous rabbit doe during the first 10 days of lactation. During lactation the groups received the same diet (DE 11.2 MJ/kg) supplemented or not with sucrose in the drinking water (0, 2.5, 5 and 10%). Dietary treatment did not affect the energy intake and reproductive performance of the does. The liquid diet reduced the voluntary intake of solid feed and the total DE intake (solid + water) was quite the same in all the groups (from 2738 to 3276 kJ/doe/d); however the calculated energy equilibrium showed a deficit ranging from -3.2 to 12.4%.

INTRODUCTION

During lactation rabbit does usually loose body energy, especially the highly productive commercial strains which produce a considerable amount of milk not compensated by feed intake (XICCATO, 1996). This metabolic unbalance is particularly relevant in primiparous does because energy requirement should contemporary sustain lactation, pregnancy and also body growth. Moreover, the voluntary feed intake of primiparous does is generally lower than that of multiparous (PARIGI BINI AND XICCATO, 1998).

To increase the energy intake during lactation diets with high starch content or added with fat have been used (PARIGI BINI et al., 1996; FORTUN-LAMOTHE, 1997). However, the higher daily energy intake of these enriched diets failed to improve the nutritional balance of the does as a consequence of the simultaneous increase in milk production (XICCATO et al., 1995). Recently, LUZI et al. (1999) investigated the effect of the flushing method, by adding 2% propylene glycol into drinking water during the four days before AI, to improve reproductive parameters of does raised under intensive commercial systems.

Our study was conducted to determine whether a sucrose supplementation in drinking water modifies the voluntary energy intake and the body energy balance during the first ten days of lactation, thus affecting reproductive and milking performance.

MATERIALS AND METHODS

Rearing Building and Equipment

The rabbits were raised in a building equipped with a forced heating system programmed to maintain a minimum temperature of 16 to 18° C. From 100 d of age, the rabbits were submitted to a constant photoperiod (16L:8D).

The animals were kept in individual cages for reproducing does (400 x 600 x 350 mm) equipped with an automatic drinker and a manual feeder. The nest (400 x 220 x 300 mm) had galvanized sheet walls and a double wire floor and a manual closure to allow for programmed lactation. The nest was prepared with wheat straw and attached to the front side of the maternal cage 3 days before kindling.

Animals and experimental design

Rabbits from a hybrid maternal line (Provisal, Molinella. Italy) were moved to the rabbitry at 100 d of age and fed ad libitum a commercial pelleted diet. The experiment started after 21 d of adaptation, when the does were artificially inseminated (AI) using a fresh semen pool from several Provisal bucks located in the same building. About 10 millions of motile spermatozoa were inoculated for each insemination (CASTELLINI C. AND LATTAIOLI P., 1999). Ovulation was induced by GnRH injection (10 μg of Receptal). At parturition litter size was equalized within the group to 7-8 youngs. Rabbits were then divided into 4 homogeneous groups of 50 animals each and given ad libitum access to a conventional diet for lactation having a gross energy of 18.2 MJ/kg and a Digestible Energy (DE) of 11.2 MJ/kg (Table 1). During lactation rabbits drank from individual bottles ad libitum water added with 0, 2.5, 5 and 10% sucrose (16.1 MJ/L), in control and treated groups, respectively. Rabbits were artificially inseminated on day 11 after kindling as described above. On the basis of vulva color two classes of sexual receptivity were established at the moment of AI: Receptive and not receptive does.

Table l. Nutrient composition of the diet

Composition	%	Composition	%
Dry matter %	89.4	NDF %	35.8
Crude protein %	18.9	ADF %	20.4
Ether extract %	4.6	ADL %	4.3
Crude fiber %	16.4	Starch %	12.0
Ash %	10.4		

Recorded parameters

During the first 10 days of lactation, milk production, feed and water intake were recorded daily. During the same time interval, milk production was measured by weighing the doe immediately before and after controlled suckling (PARTRIDGE AND ALLAN, 1983). The fertility rate (percentage of littering does/inseminated does) was determined on does that delivered offspring. Litter size was checked within maximum 14 h post parturition. The kits were weighed at 30 d and then weaned. Estimated DE requirement and energy output from dietary energy was calculated using the equation proposed by PARIGI BINI AND XICCATO (1998) as follows: Maintenance = 430 kJ day^{-1} kg live weight$^{0.75}$ + milk production (8.4 kJ x milk g/d divided by 0.63 the efficiency of DE utilization).

Statistical analyses.

Data were analyzed using the GLM procedure (SAS, 1995). The linear model included treatments and litter size as covariate. Significance of differences was tested with t-test. A regression between total DE intake and estimated energy output with milk was also analyzed.

RESULTS AND DISCUSSION

Productive performances are reported in Table 2. Treatments did not affect both sexual receptivity and fertility rate, even if does receiving water added with 5 and 10% sucrose showed a 20 and 8% increase of fertility over that of controls, respectively. Also litter size at the second parturition was not significantly affected by treatment.

Since a long time it is well established that the nutritional balance of animals may have important influence on its reproductive performance. In dairy cows, the delayed ovarian activity responsible of longer calving intervals has been associated to the negative energy balance during early lactation which by lowering glucose and insulin availability, may decrease LH pulsatility or hamper ovarian responsiveness to gonadotrophins (BUTLER AND SMITH, 1989). In rabbit does, LUZI et al (1999) failed to observe any beneficial effect in fertility rate, mortality rate at birth and at weaning in does supplemented with 2.5% propylene glycol in drinking water as an energetic source compared to control and PMSG treated does. The same findings were obtained by NELSSEN et al. (1985) which found that neither feeding frequency nor addition of sugar to the diet affected ED intake or reproductive performance of the sow during lactation.

Table 2. Effect of dietary treatments on reproductive performance

Reproductive Parameters		**Sucrose (%) 0**	**2.5**	**5**	**10**	**Pooled SE**
Sexual receptive does	%	38	34	42	38	0.2*
Fertility rate	%	54	56	74	62	5.4*
Milking pups	n	7.7	6.9	7.8	7.2	1.8
Weaned pups	n	7.1	6.4	7.2	6.8	2.0
Pre-weaning mortality rate	%	7.8	7.6	7.6	5.6	0.5*
Litter size II kindling	n	8.3	7.8	7.7	7.5	1.7

*Chi square value.

The effects of dietary treatments on milk production and DE balance are summarized on Table 3. No significant effect can be ascribed to the dietary treatments employed. In fact, all the primiparous does were in negative balance during the first 10 days of lactation. However, sucrose supplementation, independently on the concentrations used, did not improve total DE intake, but rather worsened it. The calculated deficit was higher in treated does, ranging from –12.4% to 4.8%, than in control (-3.2%). Daily water intake was negatively correlated to the concentration of sucrose added to the drinking water (Fig 1).

Fig. 1. Daily water intake of does

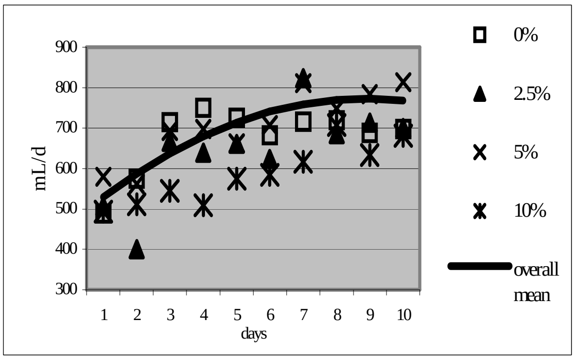
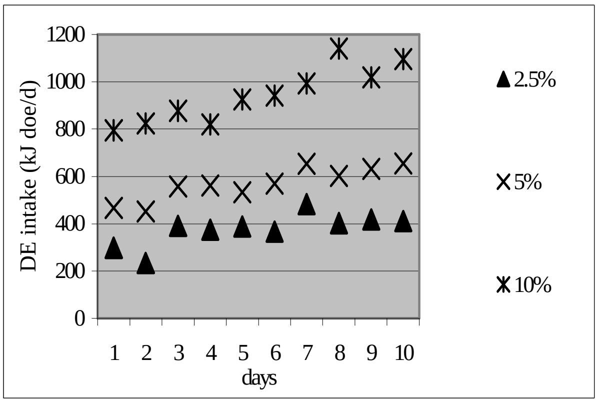


Fig. 2. Daily DE intake with sucrose



Therefore, the DE intake supplied by consumption of sugar-enriched water was significantly higher as the sucrose percentage increased (Table 3 - Fig. 2). Total DE intake, provided by water and feed, showed the same trend, because the does drinking water with higher sucrose concentrations also reduced (P< 0.01) their voluntary feed intake (Fig. 3). Similar results were also reported by MAERTENS (1998). Does fed a concentrated diet between days 8 and 11 of lactation reduced the feed intake compared to controls so that the daily DE intake was significantly lower, thus worsening the negative nutrient balance just in the 2nd week after parturition when AI is usually performed.

Fig. 3. Total Digestible Energy intake

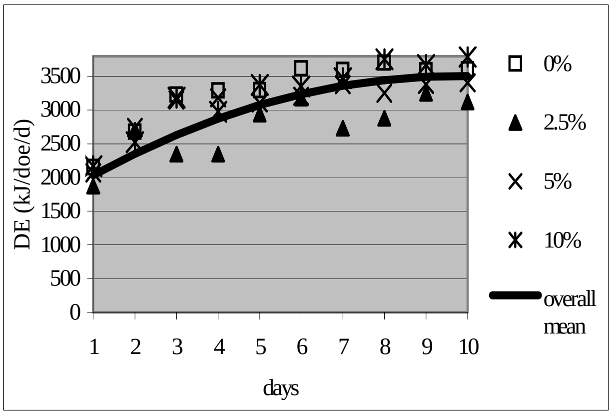
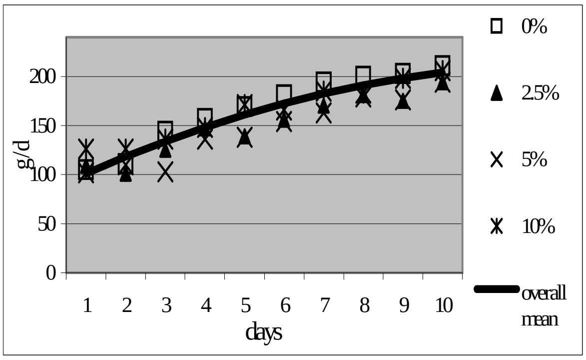


Fig. 4. Effect of treatments on the daily milk production



Daily milk production (Fig. 4) increased during the first 10 days of lactation (from 100 to about 200 g) not only in control rabbits, as expected, but also in treated does whose lactation curves overlapped those of controls without any significant differences due to sucrose supplementation.

Table 3. Effect of dietary treatments on DE intake and energetic balance of rabbit does

		Sucrose (%)				
Parameters		**0**	**2.5**	**5**	**10**	**Pooled SE**
Litter weight at 30 d	g	4310	3910	4400	4225	n.s
Milk output	g/d	167.0	150.5	158.7	164.0	48.2
Metabolic weight of doe	$kg^{0.75}$	2.7	2.6	2.6	2.8	0.2
DE intake						
Solid food	kJ/d/doe	3276B	2361A	2519A	2376A	350
Water	"	0A	377B	567BC	943C	28
Total	"	3276	2738	3086	3319	423
Total calculated (*)	"	3383	3125	3234	3440	-
Energetic Deficit	%	-3.2	-12.4	-4.8	-3.6	-

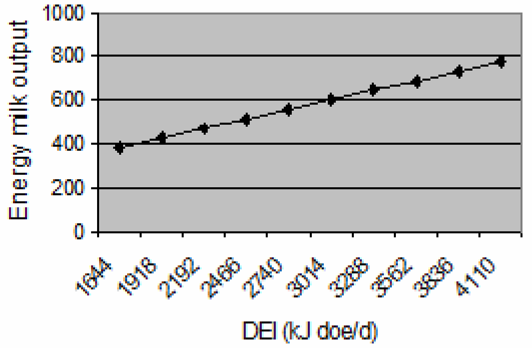
On the same row A..B: P<0.01.

(*) Calculated with the previous reported equation (PARIGI BINI AND XICCATO, 1998).

The increasing total dietary intake observed during the first 10 days of lactation failed to keep pace with rising milk production (Fig. 5). Although the slope of increase was slower than the value (0.434) reported by XICCATO (1996), the tendency was the same: an increase of 1 kJ in DE intake caused an increase in milk output of 0.20 kJ (data not shown). The DE intake agree with the findings of XICCATO et al. (1998) which estimated about 3280 kJ doe/d.

In conclusion, the feeding strategy here employed was not able to stimulate DE intake by means of sugar supplementation into drinking water because does regulate their voluntary intake on the basis of total DE of food (water and diet) as reported by other authors (PARIGI-BINI et al., 1996; FORTUN-LAMOTHE, 1997). Since nowday it is not possible to meet the high nutritional requirement of primiparous does, longer reproductive rhythms should be adopted if to reduce the antagonistic effect of lactation on reproductive performace (FORTUN-LAMOTHE and BOLET, 1995; FORTUN-LAMOTHE, 1997).

Fig. 5. Relationship between DE intake and energy milk production



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