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DOES RESTRICTED SUCKLING PATTERN INFLUENCES THE RATE OF LACTATION DECLINE IN SUCKLED AND MILKED COWS?

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[¿TIENE INFLUENCIA EL PATRON DE AMAMANTAMIENTO RESTRINGIDO SOBRE LA TASA DECLINE DE LA LACTANCIA EN VACAS AMAMANTADAS Y ORDEÑADAS?]

Sandoval Castro, C.A.[1], Leaver, J.D.[2] and Anderson, S[2].

[1] *Faculty of Veterinary Medicine and Animal Science- University of Yucatan, km. 15.5 carret. Xmatkuil. PO Box 4-116, Mérida, Yucatán, 97100, México, e-mail:*ccastro@tunku.uady.mx

[2] Wye College, Univ. of London, TN25 5AH.

RESUMEN

Ocho vacas Holstein-Friesian (HF) y 11 cruzadas con Zebú (Z) fueron empleadas en dos experimentos con diseño experimental de rectángulo latino, con 4 periodos de 3-semanas. Los tratamientos experimentales fueron los mismos en ambos grupos. (A) Ordeña una vez al día en la mañana y amamantamiento inmediatamente después de la ordeña, (B) Ordeña en la mañana y amamantamiento en la tarde, (C) Ordeña dos veces al día y amamantamiento sólo después de la ordeña matutina y (D) Ordeña y amamantamiento dos veces al día. El experimento 1 se realizó en UK y el experimento 2 en Yucatán México. No se encontró diferencias para producción total de leche (P>0.05) para vacas HF (media ± sed): 18.1, 18.2, 16.9, 19.8 kg/d (±1.11), A, B, C y D respectivamente. Sin embargo, hubo diferencias para vacas Z (P<0.01) 6.1c, 6.3bc, 7.1ab, 7.2a kg/d (±0.32). Ni hubo efecto de tratamientos ó especie (P>0.05) en la tasa de descenso de la producción de leche o producción de los constituentes mayores (grasa y proteína). La tasa de descenso en HF cows fué 0.07, -0.10, -0.09, 0.04 kg/d (±0.088) para leche; 2.5, -3.5, -2.9, 1.5 g/day (±3.37) para proteína y 2.7, -3.9, -3.9, 2.2 g/d (± 3.88) para grasa para los tratamientos A, B, C y D respectivamente. El descenso en vacas Z fué -0.02, -0.03, -0.01, -0.01 kg/d (±0.023) para leche; -0.6, -0.9, -0.1, -0.3 (±0.64) para poteína; y -0.7, -1.1, -0.1, -0.4 g/d (±0.75) para grasa en tratamientos A, B, C y D respectivamente.

Palabras clave: amamantamiento restringido, vacas doble propósito, *Bos indicus.*

SUMMARY

Eight Holstein-Friesian (HF) and 11 Zebu-cross (Z) cows were used in two experiments in which Latin rectangle designs with four 3-week periods were used. The same treatments were used in both experiments: (A) once-a-day milking, suckling immediately after morning (AM) milking, (B) once-a-day milking, suckling only in the afternoon, (C) twice-a-day milking, suckling only after AM milking, and, (D) twice-a-day milking suckling after each milking. Experiment 1 was carried out in the UK and experiment 2 was conducted in Yucatan, Mexico. For A, B, C and D respectively, no difference was found for TMY (P>0.05) for HF cows (means ± sed): 18.1, 18.2, 16.9, 19.8 kg/day (±1.11). However, there were differences for Z cows (P<0.01) 6.1c, 6.3bc, 7.1ab, 7.2a kg/d (±0.32). Treatments or species (P>0.05) did not affect milk yield and milk components rate of decline (fat and protein). Decline in HF cows was 0.07, -0.10, -0.09, 0.04 kg/day (±0.088) for TMY; 2.5, -3.5, -2.9, 1.5 g/day (±3.37) for Protein and 2.7, -3.9, -3.9, 2.2 g/day (± 3.88) for Fat yields for treatments A, B, C, and D respectively. Decline in Z cows was -0.02, -0.03, -0.01, -0.01 kg day (±0.023) for TMY; -0.6, -0.9, -0.1, -0.3 (±0.64) for Protein; and -0.7, -1.1, -0.1, -0.4 g/day (±0.75) for Fat for treatments A, B, C, and D respectively.

Keywords: restricted suckling, dual purpose, *Bos indicus.*

INTRODUCTION

Although restricted suckling is an important component of dual purpose (DP) systems, the understanding of the responses associated with this management system is incomplete. As different patterns of restricted suckling can be found in traditional farms, the working hypothesis was that the different patterns of milk removal (milking and suckling combinations) may cause a differential response in total milk yield and rate of lactation decline. Data from a previous work were re-analyzed in order to better understand the implications that restricted suckling has on the lactating cow. Results concerning animal performance and details on milk composition and yields are published elsewhere (Sandoval and Leaver, 1999).

MATERIALS AND METHODS

Eight Holstein-Friesian (HF) and 11 Zebu-cross (Z) cows were used in two experiments in which Latin rectangle designs with 3-week periods were used. The same treatments were used in both experiments:

(A) once-a-day milking, suckling immediately after morning (AM) milking,
(B) once-a-day milking, suckling only in the afternoon,
(C) twice-a-day milking, suckling only after AM milking, and,
(D) twice-a-day milking suckling after each milking.

Experiment 1 was carried out in the UK (HF cows) and experiment 2 was conducted in Yucatan, Mexico (Z cows). Milking was at approximately at 06:00 – 06:30 and 14:00 – 14:30 hours for AM and PM milkings. Milk yield was recorded every day throughout the experiment. Due to management facilities calves were present for milk let down stimulation (pre-milking suckling of approximately 30sec.) in experiment 2 but not in experiment 1. During the third week of each experimental period the calf's milk intake was measured by the weigh-suckle-weigh technique for three days. At this time milk samples were taken for laboratory analyses (fat, protein and lactose).

Data analyses

Total milk yield was taken as the result of both saleable and calf suckled milk. All data from each cow for total milk, fat and protein yield were taken and the rate of decline assessed via regression analyses. The resulting slopes (rate of decline) were compared by using the statistical software Minitab (Minitab Inc, 1980); each experiment was analyzed separately.

RESULTS

For A, B, C and D respectively, no difference was found for milk yield (P>0.05) for HF cows (means ± sed): 18.1, 18.2, 16.9, 19.8 kg/day (±1.11). However, there were differences for Z cows (P<0.01) in favour of twice daily milking 6.1c, 6.3bc, 7.1ab, 7.2a kg/d (±0.32). Treatments or species (P>0.05) did not affect milk yield and milk components rate of decline (fat and protein). Decline in HF cows was 0.07, -0.10, -0.09, 0.04 kg/day (±0.088) for milk yield; 2.5, -3.5, -2.9, 1.5 g/day (±3.37) for Protein and 2.7, -3.9, -3.9, 2.2 g/day (± 3.88) for Fat yields for treatments. Decline in Z cows was -0.02, -0.03, -0.01, -0.01 kg day (±0.023) for milk yield; -0.6, -0.9, -0.1, -0.3 (±0.64) for Protein; and -0.7, -1.1, -0.1, -0.4 g/day (±0.75) for Fat.

DISCUSSION

On the lactation persistency

The present results suggest that if proper stimulation is provided by the joint stimuli of milking and suckling (meaning similar levels of milk extraction), any rate of lactation decline will be an individual response and independent of the suckling pattern (1, 2 or more times a day).

In dairy breeds milking alone may provide enough stimulus for milk ejection and is probably oxytocin mediated in a pavlovian reflex-action (Goodman and Grosvenor, 1983). Thus, it has been suggested that the stimulus threshold for oxytocin release is not only low but in some cases unnecessary (Lefcourt and Akers, 1983). On the other hand, in *B. indicus* DP cows and their crosses the stimulus generated by milking is not enough to achieve a similar proportion of milk extraction. The net result is a reduced milk yield and shortened lactations (Alvarez, *et al*., 1980). Oxytocin release probably plays a more important role for this type of animal as the calf, rather than the milking stimulus probably triggers the oxytocin release. Oxytocin release conditioned either to suckling or milking has been demostrated (Schams *et al*., 1984; Bar-Peled *et al.,* 1995; Tancin *et al.,* 1995).

Lactation persistence in dairy cows rests upon the adequacy and efficiency of milk extraction (Wilde, *et al.,* 1987). This effect is achieved by increasing frequency of milking, although similar results are likely to arise from suckling in addition to milking (Bar-Peled *et al.,* 1995). Residual milk is itself alveolar milk and its amount is closely related to the efficiency of milk extraction. With dairy cows, the proportion of residual milk is on average around 15-20% of total yield (Lane, *et al*., 1970; Ugarte, 1977). Using this scenario the results from experiments 1 and 2 can be interpreted.

The results (Figure 1) show consistently that treatment B gave the lower yield of saleable milk, whilst treatment C had the highest being the patterns consistent across species. It might have been expected that treatment D would achieve a higher saleable yield, as the removal of cisternal milk twice daily would produce the highest total milk yield. However, the results do support the theory of the oxytocin effect on the removal of alveolar milk in DP cows. In agreement with the Feedback Inhibitor of Lactancy theory, treatment D achieved the highest total yields although this was not reflected in saleable milk due to the amount suckled. Calves in treatment D removed more milk than in treatment C and at similar levels as in treatment B. In the afternoon, milk to be removed the next morning has already started to accumulate in treatment C but not in treatment D resulting in a lower proportion of saleable milk.

It is also possible to further assume that any factor related with calf nutrition (health, supplementation and nutrient demands according to breed) may alter the proportions of milk suckled. The magnitude of this effect requires further study.

On the composition of milk

The rate of the milk components decline (fat and protein) was not affected by treatment and probably only reflected what occurred with milk yield. However the distribution of the milk fraction followed a similar pattern to milk yield and this observation has important implications.

Cisternal milk has a lower fat content than alveolar milk. The higher the milk is located in the alveolar system the higher the fat content (Adams and Allen, 1952). This is relevant in DP systems, milk ejection stimuli as influenced by suckling will not only affect milk yields, but also milk composition. When cisternal milk comprises most of the milk extracted in the parlour, the average fat content will be reduced. Thus, changes in milk composition at individual milkings can be explained by the degree of milk extraction, although generally there is not an increase in total fat yields. Suckling after milking will extract high-fat residual milk, effectively reducing the potential fat available for the next milking. However, there will be no difference in total fat yield per unit of time, if suckling and milking regimes provide similar levels of milk extraction. Similar results has been found when oxytocin has been used experimentally in dairy cows in order to reduce day to day variability in fat contents (Adams and Allen, 1952; Ballou, *et al*., 1993). Results from the present two experiments provide support for this theory.

CONCLUSIONS

The results of these experiments suggest that a ranking for total milk yield in DP cows under different milking and suckling patterns can be predicted when the joint effect of milking and suckling is accounted for.

Oxytocin release associated with the calf at milking time plays an important role in the extraction of alveolar milk, and might be essential in order to minimize the effect of the FIL factor and therefore to ensue a longer lactation.

Increasing the milking and suckling frequency will result in higher yields similar to the effect obtained by increased milking frequency in dairy cattle. However, the lactation decline will depend on individual (genetic) characteristics.

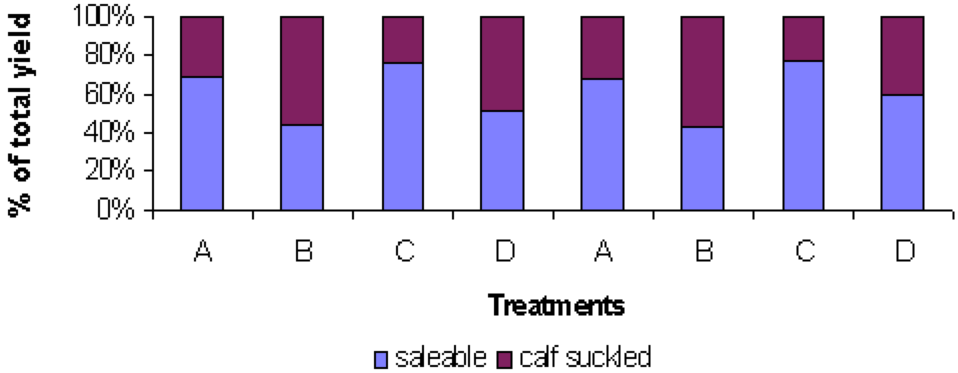

Figure 1. Milk distribution with different milking and suckling patterns (First four treatments correspond to experiment 1 and last four to experiment 2) .

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