Short Communication

Association of Phosphocalcic Metabolism and Body Condition Score after Parturition in High Producing Dairy Cows

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Rec. Date:	Oct 13, 2017 11:43
Accept Date:	Mar 29, 2018 17:21
DOI	10.5455/ijlr.20171013114335

Abstract

The aim of the present study was to investigate the relationship between different body condition scores and phosphocalcic metabolism during the postpartum period in high producing dairy cows. Fifty seven multiparous Holstein dairy cows were used in the present study. Blood samples were collected at calving and at one and two month of postpartum to measure serum calcium and inorganic phosphorus levels. The BCS was monitored monthly after calving. Cows with body condition scores less than three does not mobilise their phosphocalcic reserve, they showed an hypocalcemia and there was a significant ($P < 0.05$) fall in serum inorganic phosphorus levels from 88mg / l at calving at rate to 63mg / l in the second month of post partum. In conclusion, among the different indices defined by the phosphocalcic metabolism measurements and BCS in the present study, the lower BCS and stress metabolic were the main factors associated with phosphocalcic metabolism distrubance in high producing dairy cows.

Key words: Milk Yield, Nutrition, Reproduction

How to cite: Nassima, B., & Belmehel, B. (2018). Association of Phosphocalcic Metabolism and Body Condition Score after Parturition in High Producing Dairy Cows. International Journal of Livestock Research, 8(6), 328-331. doi: 10.5455/ijlr.20171013114335

Introduction

The peripartum represents a key moment in the life of the dairy cow the transition from gestation to that of lactation is too often disastrous for the dairy cow (Salat *et al.*, 2005 ; An Colak *et al.*, 2006 ; Contreras and Sordillo, 2011; Morgante *et al.*, 2012). The situation observed at the beginning of lactation on the energy and protein expenditure are very high compared to the capacity of ingestion of dry matter, implies that the cow must be equipped beforehand with sufficient but not excessive body reserves in order to correctly ensure the milk production (Drame *et al.*, 1999; Djoković *et al.*, 2017, Mishra *et al.*, 2016).

Many studies (Gerloff, 1987; Gearhart *et al.*, 1990; Islam *et al.*, 2012; Bouhroum *et al.*, 2016) have shown that overweight at calving and excessive mobilization of reserves during the first two months of

lactation, are associated with Metabolic, infectious and reproductive pathologies. Conversely, under-production and poor fertility are observed when cows presented poor body condition (Gerloff, 1987; Bouhroum *et al.,* 2013). Taking of bodily state thus becomes a major concern. The objective of this article is to analyze the evolution of the phosphocalcic balance as a function of body condition during the post partum in dairy cows in Sidi Mhamed Ben Ali.

Materials and Methods

This study was conducted during June, 2015 to September, 2016 on 57 Holstein dairy cows, belonging to three farms located in a department of western Algeria, Sidi M'hamed Benali wilaya Relizane. All the cows had an age between 3 and 10 years. Our animals were in hampered stabling received a ration composed of forages and concentrate. Concentrate was composed of maize, soya bean meal, bran and mineral-vitamin supplement, the ration was offered twice a day. Three blood samples were collected to evaluate (P, Ca) on the day (d) of calving, 30 days and 60 days postpartum via jugular venipuncture and these samples was placed in heparin tubes. For all measurements, plasma was prepared by centrifugation (20 min, 3,000 × g at 4°C) of blood and stored at −20°C until analysis. Plasma concentration of (calcium, phosphorus) was measured using colorimetric kits from Biomaghreb (Tunis). The assays were carried out by using a multi-analyzer spectrophotometer (ERMA, Japan). The assessment of energy balance and its variations peri-partum was based on five body condition scores. The scoring criteria used are those developed by Edmonson *et al.* (1989). The Animals were retrospectively grouped according to the body condition score. All statistical analyses were performed with the "XL stat" program, by applying the Student test (comparison of two means).

Results and Discussion

It was observed that cows with body condition score between (3 and 4, 5) after calving mobilize their phosphocalcic reserves. Cows with good body condition score (3-3.5), their serum calcium and inorganic phosphorus levels varies between (88.15-95.85) and (56, 70-60, 35) respectivly with a P <0.05 (Table 1&2). For cows with a body condition greater than 3.5, the serum calcium after calving varies between (90.39-101.48) with P <0.05 and serum phosphorus remains stable during the first two months of calving at the rate of 63.75 mg / l (Table 1& 2). The lean cows by contribution to the other cow categories do not mobilize its phosphocalcic reserves because a hypocalcemia was observed at 73.56 mg / l. This last value does not differ with the calcemia of the first and second months of calving for this catégorie of cows (Table 1), and there was also a fall in serum inorganic phosphorus levels from 88mg / l at calving at rate to 63mg / l in second months of calving with P <0,05 (Table 2).

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Table 1: Comparison of the average blood calcium (mg/l) between the different periods of post partum in (lean, mean and fatty) cow

Period	d0-d30	d0-d60	Standard mg/l
Calcemia of Fatty cow (mg/l)	90 .39-96.66	90.39-101.48	(80-120) (Verriel and Bedouet, 1999)
to	-1.37	-2.79	
tc	2.01	2	
p	0.17	0.007	
Calcemia of Lean cow (mg/l)	73,56- 90,76	73,56- 104,06	
to	-1.5	-2.43	
tc	2.26	3.18	
p	0.16	0.09	
Calcemia of Mean cow (mg/l)	88.15-96.43	88.15-95.85	
to	-1.93	-2.05	
tc	2.04	2.02	
p	0.06	0.04	

to = value observed by Student test; tc = Student critical value ; p<0,05 ; d0=day of calving ; d30= 1month of calving ; d60= 2 month of calving ; Fatty cow (BCS>3,5) ; Lean cow (BCS< 3) ; Mean cow (BCS= 3-3,5)

Table 2: Comparison of the average blood phosphorus (mg/l) between the different periods of post partum in (lean, mean and fatty) cow

Period	d0-d30	d0-d60	Standard mg/l
Phosphatemia of Fatty cow (mg/l)	63.57-61.42	63.57-60.08	(40-86) (Verriel and Bedouet, 1999)
to	0.75	1.5	
tc	2.03	2.02	
p	0.45	0.14	
Phosphatemia of Lean cow (mg/l)	88.01-63.92	88.01-63.07	
to	4.92	7.51	
tc	2.77	3.18	
p	0.008	0.005	
Phosphatemia of	56.70-60.35	56.70-62.38	
Mean cow (mg/l)			
to	-2.48	-1.4	
tc	2.2	2.11	
p	0.03	0.17	

to = value observed by Student test; tc = Student critical value. p<0,05 ; d0=day of calving ; d30= 1month of calving ; d60= 2 month of calving ; Fatty cow (BCS>3,5) ; Lean cow (BCS< 3) ; Mean cow (BCS= 3-3,5)

The body condition score reflects well the level of body reserves, which are constituted by lipids especially that are mobilized during the calving and the lactation period. Cows with an average body condition score have better production performance than those that are too lean or too fatty (Bouhroum *et al.*, 2016).

The results of the biochemical parameters show that lean cows do not mobilize their phosphocalcic reserves to meet the need for postpartum production. This is explained as follows ; Calving and the strong milk production are associated with metabolic stress (Salat, 2005; Faverdin *et al.*, 2006) aggravated by an

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emaciated state of the cows the organism in front of this situation will activate the hypothalamic-pituitary axis thus releasing ACTH and glucocorticoids (Beed and Collier, 1986). These hormones are antihypercalcemic which causes calcemia to fall (Hirsch *et al.*, 1998; Bouhroum *et al.*, 2014) and also cause a drop in serum phosphorus levels due to their phosphaturic effect (Delanaye and Krzesinski, 2005). To summarize, the results of the present study show that the body condition score is a good criterion to judge the a posteriori diet, the dietary level can be adapted according to this note.

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DOI 10.5455/ijlr.20171013114335