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Relationship among body condition score, some biochemical parameters and uterine involution in dairy cow

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Abstract

The objective of this study was to identify the relationship among body condition score (BCS) at the time around parturition, some indicators of biochemical status and the uterine involution. The BCS was measured once a month and the cows were divided into groups according to their BCS at calving and after calving. The Blood content creatinine and phosphorus was measured the day of calving, 30 days and 60 days postpartum and the Blood content creatine kinase was measured the day (d) of calving, 15 days, 30 days and 45 days postpartum. The data set was analyzed by the Student test comparison of two means using statistical program XL stat. Cows with lower BCS at calving showed a raise blood phosphorus (88.015 mg / l) and a raise blood créatinine (15.415 mg / l) and significantly ($P < 0.05$) differed from those detected in cow with the highest BCS level and the cow with average BCS level. No differences significant was found between the concentration blood creatine kinase at calving (160.70 IU) and at fifteenth days of postpartum (PP) (142.91 IU) in cow with lower BCS. In conclusion, we can say that the lean cow use the phosphagen source to ensure the smooth progress of uterine involution after parturition

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Introduction

Postpartum in dairy cows is a period or the transition state of gestation than lactation too often disastrous, as the expression of potential dairy, at this time; causes a metabolic burden. Because during this period there is an increase nutritional requirements which are tripled for glucose and doubled for amino acids, this increase comes at a time or capacity ingestion is the weakest. A negative energy balance is systematic in early lactation (Drackley, 1999 and Salat, 2005). The dairy cow is forced to mobilize body reserves to cope with this sudden increase in demand (Drackley et al., 2001, Ingvarsten et al., 2000) and body condition gives a clue to this energy reserve available to the animal for future use (Edmonson, 1989). Identification of animals having problems with adaptation is desirable, and several blood tests have been proposed for this (Jorritsma *et al.*, 2003 and Hachenberg *et al.*, 2007).

Furthermore, in studies in which BCS has been reported to affect reproduction, there have been inconsistencies in the reported effect. For example, Waltner *et al.* (1993), Gillund *et al.* (2001) and Buckley *et al.* (2003) reported the absence of the effect of BCS at calving on reproductive performance, whereas others (Markusfeld *et al.*, 1997 and Jilek *et al.*, 2008) reported a significant effect.

However, no analysis of the relationships between the BCS changes in the first 8 weeks of lactation, some biochemical parameters (changes in blood levels of creatine kinase, creatinine and phosphorus) and uterine involution has yet been performed, and, therefore, such an analysis was the objective of this study.

Materials and methods

This study was conducted during September 2010 until September 2011 on 30 dairy cows belonging to two farms located in a department of western Algeria, Sidi M'hamed Benali wilaya RELIZANE. The cows with an average age of 3.9 ± 1.6 year, were studied during 8 week postpartum. 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 in (1989). Four blood samples were performed to evaluate creatine phosphokinase (CK) the day (d) of calving, 15 days, 30 days and 45 days postpartum in order to follow uterine involution and also assess creatinine and phosphorus the day of calving, 30 days and 60 days postpartum. Blood samples were collected via jugular venipuncture and placed in heparin tubes. For all measurements, plasma was prepared by centrifugation (20 min, $3,000 \times g$, 4°C) of blood and stored at -20°C until analysis. Plasma concentrations of creatinine and creatine kinase (CK) were measured using a kinetic colorimetric test kit from Biomaghreb (tunis) (kit Ref 20151, kit Ref 200071) respectively. Phosphorus was measured using a colorimetric kits from Biomaghreb (kit Ref 20083). The assays were carried out using a multi-analyzer spectrophotometer (ERMA, Japan). The animals were retrospectively grouped, according to the results from the BCS scoring and the blood concentrations of metabolites. All statistical analyses were performed with the "XL stat" program, by applying the Student test (comparison of two means).

Results and discussion

Statistical analysis from data allowed an estimate of the average with an interval of 95% credibility. Our results showing the comparison of mean values of CK for the four periods of calving and for each type of cow that there's a significant difference between the average CK of d0, d15, d30 and d45 for all categories of cow with a value of $P < 0.05$ see (Table 1, 2 and 3), except for lean cow comparing the mean value of CK at calving with that of the fifteenth day of the calving shows that there no significant difference that is to say that the value of CK in thin cows remains high at 15 days after calving.

The data also show that the value of CK the day of calving is more important than other days of the calving for three types of cow at a rate of (195, 186.05, 160.7) IU for fatty cow, lean and mean cow, respectively, and it tends to decrease during the postpartum. It was also noted that the lean cows at

calving have an hypercréatinémie with a rate of 15.41 mg / l compared to the fatty cows (9.79 mg / l) with a $P < 0.0001$, the rate tends to decrease towards the second month of calving to reach a value that does not differ from the other categories of cows at a rate of 9.6 mg / l. See (Table 4 and 5). In addition, the lean cow at calving have an hyperphosphatemia due to 88.01 mg / l compared to the fatty cow and the mean that have a phosphatemia of 63.57, 56.70 mg / l respectively, this difference is highly significant with a $P < 0.05$. The rate drops at first month of postpartum to reach a value of 63.92 mg / l that stabilized during the second month of the calving, while fat and medium cows have a stable phosphatemia at calving and until second month of postpartum see (Table 6 and 7).

Table 1. Comparison of mean values of CK between the different periods of post partum in lean cow.

Period	do-d45	do-d30	do-d15
CK (UI)	160.70 - 59.17	160.70 - 89.57	160.70 - 142.91
to	8.987	6.761	0.709
tc	2.776	2.776	2.776
P	0.001	0.002	0.518

to = value observed by Student test; tc = Student critical value. No significant differences between CK at calving and 15 days of calving (do-d15) ($P > 0.05$)

Table 2. Comparison of mean values of CK between the different periods of post partum in mean cow.

Period	do-d45	do-d30	do-d15
CK (UI)	186.05 - 52.75	186.05 - 85.78	186.05 - 134.77
to	10.498	7.997	3.140
tc	2.074	2.074	2.074
P	< 0.0001	< 0.0001	0.005

to = value observed by Student test; tc = Student critical value.

Table 3. Comparison of mean values of CK between the different periods of post partum in fatty cow.

Period	do-d45	do-d30	do-d15
CK (UI)	195 - 54.3	195 - 91.38	195 - 142.96
to	14.748	10.604	2.922
tc	2.228	2.228	2.228
P	0.001	0.001	0.015

to = value observed by Student test; tc = Student critical value.

The serum concentration of CK usually rises to overcome the stress of the calving (Barnouin et al., 1994) and its fall after the calving is a sign of a good course of uterine involution (Sattler and Furl, 2004 and Azawi et al., 2008). This explain the elevation of CK at calving and her fall during post partum found in our results.

The metabolic profile in lean cows was incorrect, they presented a higher value of phosphoremia, creatinemia at calving and a higher value of CK in fifteen days of calving comparing with the other categorie of cows. It has been shown in cattle that chronically undernourished animals for several weeks alter the metabolic properties of muscles by reducing the enzymatic activities characteristic of glycolytic metabolism. (Cassar-Malek *et al.*, 2004) In addition the profile of thin cows have low lipid reserves (Dram, 1999) which worsens the energy deficit during the first month of calving, hence the need to use creatine phosphate stored in muscle (Wyss and Kaddurah-Daouk, 2000) to ensure uterine involution.

Conclusion

It can be concluded that the monitoring of BCS after parturition can be used as a management tool to prevent reproduction problems especially in top production dairy herds and that Biochemistry has given some interesting elements to explain the profile of lean body condition, it has broadened the scope of possible etiologies in revealing the role of phosphagen sources in cows with an energy deficit to ensure uterine involution.

Table 4. Comparison of the average blood creatinine (mg/l) of lean cows and fatty cows during post partum.

Parameter	Calving time			Standard
	At calving	1 month	2 month	
Lean cow	X=15,415 V=3,302 E=1,817	X=11,500 V=1,967 E=1,402	X=9,600 V=1,634 E=1,278	10-15(Lorin <i>et al.</i> , 2009)
Fatty cow	X=9,797 V=2,020 E=1,421	X=10,090 V=2,213 E=1,488	X=10,353 V=1,445 E=1,202	
P	<0,0001	0,111	0,360	
to	-5,302	-1,690	0,951	
tc	2,064	2,120	2,179	

x = mean; v = variance; E = standard deviation; to = value observed by Student test; tc = Student critical value.

Table 5. Comparison of the average blood creatinine (mg/l) of lean cows and mean cows during post partum.

Parameter	Calving time			Standard
	At calving	1 month	2 month	
Lean cow	X=15,415 V=3,302 E=1,817	X=11,500 V=1,967 E=1,402	X=9,600 V=1,634 E=1,278	10-15(Lorin <i>et al.</i> , 2009)
Mean cow	X=11,000 V=17,642 E=4,200	X=9,708 V=3,513 E=1,874	X=10,395 V=3,999 E=2	
P	0,306	0,125	0,523	
to	1,364	1,676	-0,653	
tc	4,303	2,228	2,120	

x = mean; v = variance; E = standard deviation; to = value observed by Student test; tc = Student critical value.

Table 6. Comparison of the average blood phosphorus (mg/l) of lean cows and fatty cows during post partum.

Parameter	Calving time			Standard
	At calving	1 month	2 month	
Lean cow	X=88,015 V=2,668 E=1,633	X=63,928 V=41,647 E=6,453	X=63,070 V=18,484 E=4,299	40-86 (Verriél and Bedouet, 1999)
Fatty cow	X=63,757 V=114,631 E=10,707	X=61,426 V=29,204 E=5,404	X=60,088 V=10,710 E=3,273	
p	0,005	0,444	0,167	
to	-3,138	-0,786	-1,430	
tc	2,074	2,120	2,074	

x = mean; v = variance; E = standard deviation; to = value observed by Student test; tc = Student critical value.

Table 7. Comparison of the average blood phosphorus (mg/l) of lean cows and mean cows during post partum.

Parameter	Calving time			Standard
	At calving	1 month	2 month	
Lean cow	X=88,015 V=2,668 E=1,633	X=63,928 V=41,647 E=6,453	X=63,070 V=18,484 E=4,299	
Mean cow	X=56,703 V=1,410 E=1,187	X=60,356 V=7,710 E=2,777	X=62,386 V=62,734 E=7,920	40-86 (Verriél and Bedouet, 1999)
P	< 0,0001	0,177	0,888	
to	27,534	1,443	0,143	
tc	2,776	2,201	2,120	

x = mean; v = variance; E = standard deviation; to = value observed by Student test; tc = Student critical value.

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