

EFFECTS OF DIET SUPPLEMENTATION WITH ANIONIC SALTS ON PRODUCTIVE PERFORMANCE OF DAIRY COW

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Abstract. This research proves the effects of Calving Care on reproductive performance in dairy cow, during three successive lactations, on a group of 10 Holstein Friesian cows, using the method of period research. Group M1 / 2014 of 10 cows was considered the control group in which Calving Care was not administered, monitoring its reproductive performance throughout the lactation of 2014. Group E / 2015 was the experimental group, they got Calving Care 300 g / cow / day, 21 days before calving, homogenized in the TMR. The calculated cation-anion difference (DCAD) was -15.28 mEq / 100 g dry matter. Group M2 / 2016 was the second control group, without Calving Care, but the reproductive performance in the following lactation was monitored. After calving, each group was monitored for milk production per 305 days lactation, the total amount of milk fat and milk protein respectively.

Keywords: Close-up, Dietary Cation-Anion Difference (DCAD), anionic salts, milk yield, milk protein, milk fat

INTRODUCTION

Numerous studies have highlighted that low blood Calcium level immediately after calving, combined with high blood concentrations of ketone bodies and non-esterified fatty acids are associated with low productive and reproductive performances (Chapinal et al., 2012). In the same time, these parameters correctly interpreted in the farm are indicators that can predict the incidence of metabolic diseases postpartum and the extent of culling rate (Seifi et al., 2011).

Adding anionic salts in the total mixed ratio (TMR) for 21-42 days before calving leads to the reduction of the dietary cation-anion difference (DCAD), but also induces a tendency to reduce lipid accumulations in the liver, with direct effect in postpartum regulation of dry matter, Calcium homeostasis and milk production (Weich et al., 2013).

There are studies that correlate the reduction of the cation-anion difference from + 30 mEq / 100 g dry matter to 0 mEq / 100 g dry matter with a reduction of milk fever incidence from 16,4% to 3,2 %, however while dry matter intake was reduced by 11,4% (Charbonneau et al., 2006). This reduction in cation-anion difference increases the level of ionized calcium in the blood, both before and after calving, being associated with a reduction of urinary pH from 8,1 to 7, sodium bicarbonate and carbon dioxide in the blood, suggesting a mild metabolic acidosis with respiratory compensation (Mellau et al., 2004).

MATERIAL AND METHOD

Calving Care is an anionic salt complex designed by Alltech Biotechnology Company for postpartum metabolic disorders limitation in dairy cows. The product contains calcium chloride and magnesium chloride, with a DCAD value of -9.366,16 mEq/kg. This

value, along with the fact that the salts are coated, make this product applicable in doses up to 300 g/cow/day without affecting total mixed ratio's (TMR) palatability.

The experiment was conducted in Lacto Agrar Farm in Vaidei, Hunedoara County, for three consecutive years: 2014, 2015 and 2016, on a group of 10 Holstein Friesian cows, all animals being in lactation 2 or 3. The cows have been monitored individually during the three years, the research groups being constituted as follows:

- ✓ Group M1 / 2014, control group no. 1, with 10 Holstein Friesian cows, no DCAD calculation of the TMR and no Calving Care. Monitored period: 01.01.2014 - 31.12.2014
- ✓ Group E1 / 2015, experimental group, with the same 10 Holstein Friesian cows as in previous group. DCAD was calculated at -15.28 mEq / 100 g dry matter and Calving Care was added in the TMR, 300 g/cow/day during Close-up period, 21 days before calving. Monitored period: 01.01.2015 - 31.12.2015
- ✓ Group M2 / 2016, control group no. 2, with the same 10 Holstein Friesian cows as in previous two groups. DCAD was calculated at +5.55 mEq / 100 g dry matter, no Calving Care was added in the TMR. Monitored period: 01.01.2016 - 31.12.2016

In the experimental group E/2015, 300 g of Calving Care / cow / day were fed, via TMR between March 1st 2015 and March 31st 2015, during the Close-up period. For each cow, the following parameters were monitored:

- ✓ Milk production, standard lactation 305 days, expressed in kg / cow / lactation 305 days. Milk production monitoring was done using the milking parlor program, which is a Dairy Master
- ✓ Milk fat and milk protein were determined with Dairymaster Swiftflo Revolver software, which is also responsible for calibrating daily samples
- ✓ Fat corrected milk production 4%, for standardizing milk production for comparisons between cows (Michael, 2014), using formula

$$4\% FCM = (0,4 \times MY) + (15 \times MF)$$

Where 4%FCM means fat corrected milk 4%, MY means milk yeald in kilograms and MF means milk fat in kilograms

RESULTS AND DISCUSSIONS

Milk production is one of the main, if not the most important, criteria for dairy farm performance evaluation of both cows and nutrition management (Ming-Jia et al., 2011).

In this context, we monitored milk production for each of the 10 cows studied, for three consecutive years, from 2014 to 2016. Because the length of a lactation is variable, we took into account a standard 305 day lactation period so that productive performance is only influenced by cow's health and nutrition management rather than by number of days in milk. Also, for a correct assessment of milk production, regardless fat and protein level at one time, we have standardized the estimation method by expressing data in energy corrected milk at 4% fat (table 1).

Thus, it can be seen that the average milk production level was 8.001 kg / cow / lactation in 2014 when the Close-up diet and transition to a new lactation was not quantified by calculating the cation-anion difference in ration (DCAD).

By comparison, in 2015, when DCAD in Group E/2015 was calculated at -15.28 mEq / 100 g of dry matter and when Calving Care was added in Close-up TMR, the average milk yield was 8.406 kg / cow / lactation, meaning an increase of 5,05%. This demonstrates that postpartum Calcium homeostasis, using anionic salts to obtain a negative DCAD in the

last three weeks of gestation, directly influences the productive performance of cows, similar results being also obtained by other researches, performed by Razzaghi et al. in 2012, DeGroot et al. in 2010 or Shire et al. in 2013.

Table 1

4% energy corrected milk yield, between 2014 and 2016

Cow ID	2014	2015	2016
	kg		
1245	7.510	8.609	8.388
1067	7.956	8.917	9.145
1241	8.272	8.397	8.504
90	8.057	8.480	8.602
1162	7.906	8.284	8.359
667	8.164	8.352	8.415
113	8.228	8.355	8.436
146	7.898	8.101	8.282
767	8.061	8.308	8.401
163	7.962	8.255	8.308
Average	8.001 ± 68,51	8.406 ± 71,00	8.484 ± 79,00

In this respect, we monitored both the total milk fat production (table 2) and the milk protein production (table 3) for three consecutive years, for the monitored cows: Group M1/2014, Group E/2015 and Group M2/2016 respectively.

Table 2

Milk fat yield between 2014 and 2016

Cow ID	2014	2015	2016
	kg		
1245	298,90	345,37	336,86
1067	318,24	357,38	366,89
1241	334,15	335,56	339,49
90	325,16	339,53	343,74
1162	320,28	333,33	335,68
667	331,03	335,75	336,60
113	332,35	333,52	333,68
146	319,63	325,02	332,27
767	324,66	332,67	336,04
163	321,01	330,85	331,97
Average	322,54 ± 3,17	336,90 ± 2,83	339,32 ± 3,25

This study reveals that there are very significant differences regarding milk yield improvement in Group E / 2015 compared to Group M1 / 2014, this trend being continued in Group M2 / 2016. A good nutritional management during Clode-up period, where a negative cation-anion difference is achieved by using Calving Care, creates the premises of a superior health status in next lactation.

However, not only milk yield is higher after application of anionic salts in Close-up diets but also milk solids. There are significant differences in fat content about 4,45% in Group E / 2015 comparing to Group M1 / 2014 and 5,2% in Group M2 / 2016 (table 4).

Table 3

Cow ID	2014	2015	2016
	kg		
1245	241,39	275,95	270,99
1067	255,39	288,93	300,43
1241	264,06	273,33	272,11
90	259,97	272,64	275,68
1162	255,92	266,83	265,06
667	261,47	266,11	260,02
113	259,39	269,00	272,78
146	247,48	256,47	264,66
767	253,67	262,98	265,47
163	253,35	262,54	266,24
Average	255,21 ± 2,14	269,48 ± 2,83	271,34 ± 3,56

Table 4

Specification		Groups					
		Group M1/2014 n=10		Group E/2015 n=10		Group M2/2016 n=10	
		X ± S _x	V %	X ± S _x	V %	X ± S _x	V %
Milk yield	kg	8001,4±68,519	2,71	8405,8±71,002***	2,67	8484,0±79,009***	2,94
	%	100,00 %		105,05 %		106,03 %	
Milk fat	kg	322,541±3,176	3,11	336,898±2,830**	2,66	339,322±3,253**	3,03
	%	100,00 %		104,45 %		105,20 %	
Milk protein	kg	255,209±2,147	2,66	269,478±2,835**	3,33	271,344±3,560**	4,15
	%	100,00 %		105,59 %		106,32 %	

***-p<0,001 very significant differences

** -p<0,01 significant differences

Group M1/2014, no DCAD* calculation, no Calving Care

Group E/2015, with DCAD* calculation, with Calving Care

Group M2/2016, with DCAD* calculation, no Calving Care

*DCAD: Dietary cation-anion difference

CONCLUSIONS

1. Using Calving Care 300 g/cow/day in Close-up diet in Group E / 2015 of for 21 days before calving, led to an increase in milk production of 5,05% comparing with Group M1 / 2014. This proves the achievement of an optimal postpartum Calcium homeostasis by reaching a cation-anion difference of -15,28 mEq / 100 g dry matter.

2. Not only total milk yield increased in Group E / 2015 but also fat corrected milk 4% production. Total milk fat production in Group E/2015 increased by 4,45% compared to Group M1 / 2014, this trend being maintained in Group M2 / 2016, where milk fat production was 5,2% higher than the beginning of the experiment.

3. Milk protein yield followed the same pattern as milk fat, being 5,59% higher in Group E / 2015 compared to Group M1 / 2014 and 6,32% higher in Group M2 / 2016. This demonstrates that high milk yield and high milk solids content are the results of an optimal long-term ruminal metabolism.

4. Calving Care is regulating parathormone hormone activity, which is positively influencing the cow's performances. Better metabolic status is reflected not only in the first lactation after treatment, but also in the next one, highlighting the relevance of high value diets in Close-up period.

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