

EFFECTS OF DIET SUPPLEMENTATION WITH ANIONIC SALTS ON BREEDING 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 the service period length, calving interval, service per conception rate and voluntary waiting period. Calving interval has been reduced from 455,2 days in Group M1 / 2014 to 403,9 days in Group E / 2015 ($\pm 3,497$) and to 400,9 days in Group M2 / 2016 ($\pm 4,750$). Service per conception and voluntary waiting period had also significant differences between groups, suggesting that postpartum health is a direct factor in influencing reproductive performance.

Keywords: Close-up, anionic salts, service period, calving interval, service per conception, voluntary waiting period, dietary cation-anion difference (DCAD)

INTRODUCTION

Poor fertility has a multifactorial causality. Deficient feeding during dry period and immediately after the calving leads to a reduction in glucose and insulin as a growth factor (IGF-I) levels, simultaneously with high amount of ketone bodies and non-esterified fatty acids (Roche, 2006). Consequently, the ovarian follicles are unable to produce sufficient estradiol and to induce ovulation. As such, there are frequent cases where reproductive indexes are directly correlated with the incidence of postpartum metabolic disorders.

Subclinical hypocalcaemia detection is not easy because the cows do not show hypocalcemia symptoms, so prevention is the safest yet effective option to reduce the direct or related effects of low blood calcium level (Oetzel and Miller, 2012). It is estimated that the clinical incidence of milk fever is about 3,5% in North America, Asia and Australia and about 6,2% in Europe (DeGaris and Lean, 2008). For at least 50% of the cows in the second lactation or higher, the serum calcium level is reduced below the physiological limit of 6,8 mg / dl, the value considered as the threshold under which hypocalcemia begins (Reinhardt et al., 2011).

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 of 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:

- *Service period (SP)* - is the period between date of calving and date of successful conception. The optimum service period helps the animal to recover from the stress of calving and also to get the reproductive organs back to normal. For cattle, the optimum service period is 60-90 days. If the service period is too prolonged the calving interval extends, less number of calves will be obtained in her lifetime and ultimately less lifetime production (*Animal Husbandry, 2014*). If the service period is too short, the animal will become weak and persistency of milk production is poor due to immediate pregnancy.
- *Calving interval (CI)* - this is the period between two successive calving. It is more profitable to have one calf yearly in cattle, otherwise if the calving interval is higher, the total number of calving in cow's lifetime will be decreased and also total life production of milk decrease (*Animal Husbandry, 2014*). Ideal, calving interval should be between 365 days and 410 days
- *Services per conception rate (SPC)* - measures the number of services required to achieve a pregnancy. Number of services per conception is frequently used as an indicator of fertility and the optimum value is considered to range between 1,6 and 1,8. (*Siatka si col., 2017*). Service per conception rate is calculated based on the formula:
$$\text{SPC} = \text{NS}/\text{NP}$$
 - ✓ SPC = Services per conception
 - ✓ NS = Number of services
 - ✓ NP = Number of pregnant cows
- *Voluntary waiting period (VWP)* - is defined as the interval during the postpartum period in which farmer decides not to breed the cow even if estrus occurs. In general, dairy cows should not be inseminated before 50 to 60 days after calving because their uterine tract is not fully recovered from previous calving and conception results are normally poor (*Ricardo, 2008*).

RESULTS AND DISCUSSION

One of the main criteria in the evaluation of reproductive performance in dairy cows is *Service Period*, especially as its length is directly influenced by the quality of feed and management during the Close-up period (Robinson et al., 2000). To evaluate the efficiency of Calving Care administration during the Close-up period, the *Service Period* values of all cows in the experiment were monitored for three consecutive years: 2014, 2015 and 2016 respectively (table 1).

Table 1

Service Period length of the monitored cows between 2014 and 2016			
Cow ID	2014	2015	2016
	days		
1245	77	72	75
1067	80	78	79
1241	83	77	81
90	85	81	84
1162	80	77	79
667	78	79	75
113	86	80	87
146	89	79	82
767	91	85	93
163	89	88	89
Average	83,7 ± 1,53	79,7 ± 1,46	82,3 ± 1,89

Cows in Group M1 / 2014 had a rather high service period with a group average of 83,8 days. No Calving Care was added in the diet during Close-up period, so the recovery of postpartum uterine function was delayed due to the difficulty of returning to normal of Calcium homeostasis. On the other hand, a significant decrease of service period length in Group E / 2015 is been noticed, with an average of 5,01%. This confirms that a negative cation-anion difference enhances the positive effect of anionic salts over the parthormone, which was also demonstrated by the fact that in the M2 / 2016 Group, where Calving Care was no longer used, the average length of service period increased to 82,3 days / group, being 3,51% higher than in Group E / 2015.

The average calving interval decreased by 11,2% in Group E / 2015 compared to Group M1 / 2014 and by 11,8% in Group M2 / 2016 compared to 2014 (figure 1). Adjusting of diets in Close-up group to reduce the cation-anion difference and using of Calving Care in Group E / 2015 have influenced the reduction of subclinical hypocalcemia after calving, which improved uterine recovery and reproductive functions.

Regarding the average services per conception values, there is a reduction from 2,75 in Group M1 / 2014 to 2,17 in Group E / 2015, followed by a slight increase in Group M2 / 2016, to 2,21 (figure 2).

Service per conception index improvement by 21,09% in Group E / 2015 is explained by the fact that Calving Care, added in Close-up diets has improved Calcium homeostasis followed by a reduction in subclinical hypocalcemia which has resulted in an improvement of reproductive functions. Withdrawal of Calving Care in Group M2 / 2016 led to an increased service per conception rate by 1,85% compared to Group E / 2015, as a result of slightly deficient parthormone activity in the postpartum period.

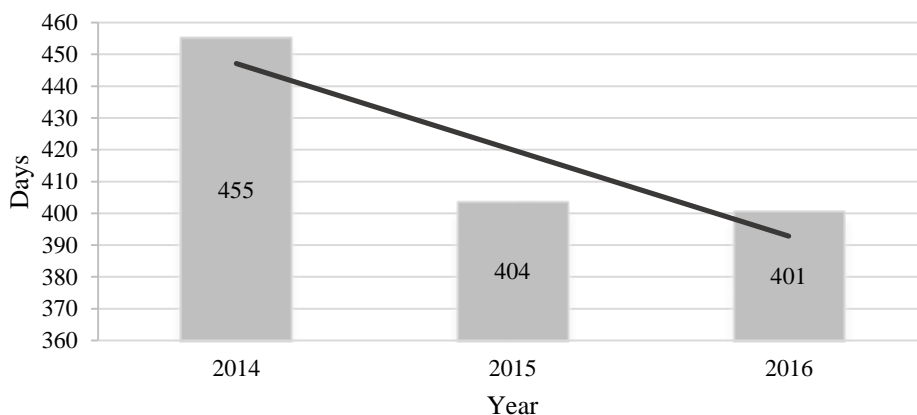


Fig. 1. Average calving interval length between 2014 and 2016

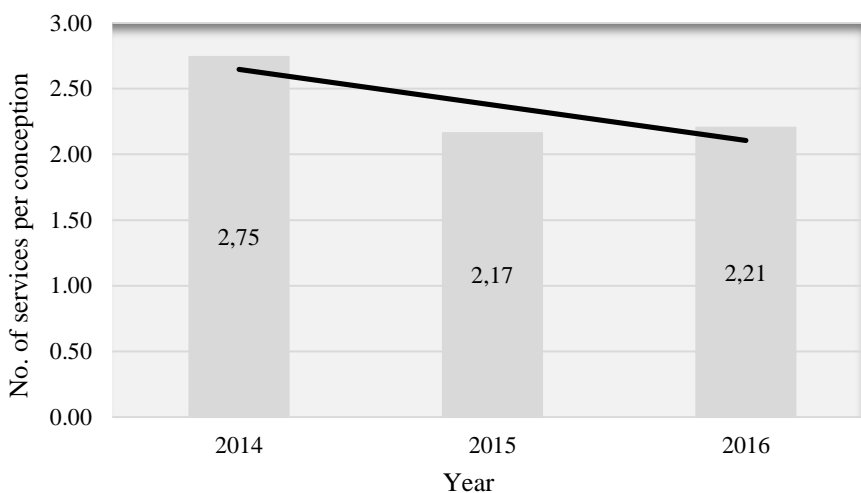


Fig. 2. Average service per conception index between 2014 and 2016

Individual cow monitoring revealed a reduction of voluntary waiting period in Group E / 2015, with an average 8 days / group compared to Group M1 / 2014. However, in Group M2 / 2016, from which TMR Calving Care was withdrawn, the voluntary waiting period increased over the experimental group with an average of 1,5 days.

Only one cow maintained the downward trend of voluntary waiting days, the other 90% showing a tendency to increase this interval after the elimination of Calving Care. This proves that a good involution of the uterine tract after calving is directly influenced by parathormone function at the time of calving, with the effect of maintaining optimal physiological limits of Calcium blood level and muscular activity.

Table 2

Average reproductive index values and their variability between 2014 and 2016

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 %
Calving interval	days	455,2±3,881* **	2,70	403,9±3,497	2,74	400,9±4,750	3,75
	%	100,00 %		88,73 %		88,07 %	
Service per conception	dose	2,75±0,1147	13,20	2,17±0,0831***	12,11	2,21±0,2807* **	12,70
	%	100,00 %		78,91 %		80,36 %	
Voluntary waiting period	days	73,3±1,136	4,90	65,3±1,096***	5,31	66,8±0,8406* **	3,98
	%	100,00 %		89,09 %		91,13 %	
Service period	days	83,7±1,535	5,80	79,7±1,469	5,83	82,3±1,892	7,27
	%	100,00 %		95,22 %		98,33	

***-p<0,001 very 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

From statistical point of view, there were very significant differences regarding the evolution of reproductive indexes. The most important improvement was the calving interval reduction from 455,2 days in Group M1 / 2014 to 403,9 days in Group E / 2015 ($\pm 3,497$) and to 400,9 days in Group M2 / 2016 ($\pm 4,750$). Service per conception rate and voluntary waiting period also have values with very significant differences between the three groups, suggesting that postpartum health is a direct factor which influences reproductive performance (table 2). A similar conclusion was highlighted by Radzikowski, 2017, who pointed out that the use of anionic salts in Close-up diets has a positive effect on cow's health and reproduction.

CONCLUSIONS

1. Adding anionic salts in Close-up diets supports an optimal Calcium homeostasis after calving, contributing to a faster recovery of the reproduction tract.
2. Out of four reproduction indexes analyzed, i.e. calving interval, service period, voluntary waiting period and service per conception, the improvements were found without exception. Significant and very significant differences have been noticed in all the parameters of Group E / 2015 compared to Group M1 / 2014. These differences were also maintained in Group M2 / 2016, as a result of the positive health trend.
3. By reducing the cation-anion difference in Close-up diets, a better parathormone function is provided, with a direct impact on the uterine muscular motility after calving, so that the voluntary waiting period can be reduced even by 10,91%.
4. A shorter voluntary waiting period leads to a shorter calving interval, the experiment showing an improvement of 11,2% for Group E / 2015 and 11,86% for Group M2 / 2016 compared to Group M1 / 2014

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