Economic Effects of Dairy Cow's Diet Supplementation with Anionic Salts

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Bulletin UASVM Animal Science and Biotechnologies 75(2)/ 2018

Print ISSN 1843-5262; Electronic ISSN 1843-536X

DOI:10.15835/buasvmcn-asb: 2018.0020

Abstract

This research proves the economic effect of Calving Care performance in dairy cow feeding, on Holstein Friesian cows. Group M1 / 2014 of 10 cows in second lactation are the control group in which Calving Care was not administered, monitoring performances throughout the lactation of 2014. Group E / 2015 is the experimental group, where the same cows received Calving Care 300 g / cow / day, 21 days before calving. Dietary cation-anion difference was -15.28 mEq / 100 g dry matter. Group M2 / 2016 was the second control group, without Calving Care, productive performance in the following lactation was monitored. After calving, each **cow** has been monitored for Fat corrected milk (FCM) production per 305 days lactation and dry matter intake, ratio between these parameters being expressed as milk production efficiency. Milk efficiency was 1.25 in Group M1/2014, 1.3 in Group E/2015 and 1.28 in Group M2/2016 respectively.

Keywords: Close-up, anionic salts, milk yield, milk protein, milk fat, milk efficiency

INTRODUCTION

Numerous researches have been conducted worldwide regarding the influence of anionic salts on the incidence of postpartum metabolic disorders in cows, with a direct influence on economic efficiency of milk production (Razzaghi *et al.*, 2012). The principle upon all of this research is based on that the maintaining parathyroid hormone (PTH) activity during the dry period takes place under mild metabolic acidosis induced by a negative dietary cation-anion difference (DCAD) (Block, 1984).

Postpartum metabolic diseases are extremely negative to the economical management of dairy cows. Approximately 25% of the cases of cows that are culled within the first 65 days after calving have as their primary cause one or more metabolic disorders (Warren, 2016).

The most important economic impact is because of diseases that are directly related to the adequate functioning of smooth muscles right after calving: retained placenta, hypocalcemia,

metritis and displaced abomasum (Hayton *et al.*, 2012). In table 1 the maximum admissible limits of metabolic diseases incidence in dairy farms are highlighted in close correlation with the production level of the herd.

In quantifying the costs of each metabolic disease, it must be taken into account not only the direct costs associated with the treatment of metabolic diseases. The related losses are as important as direct losses and those result from the reduction in milk production, culled cows, the discarded milk and, last but not least, the reduction in reproductive performance generated by high open days (Warren, 2016) (Table 2).

MATERIAL AND METHOD

Calving Care is an anionic salt complex designed 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

Table 1. Maximum admissible limits of metabolic diseases incidence in dairy farms (Hayton *et al.*, 2012)

Disease	Maximum recommended levels, %
Retained placenta	<5%
Hypocalcemia	<5%
Metritis	5-10% below 8.000 kg milk yield 7,5-10% at 8.000-10.000 kg milk yield 10-15% over 10.000 kg milk yield
Displaced abomasum	0% below 8.000 kg milk yield <2% at 8.000-10.000 kg milk yield <3% over 10.000 kg milk yield

Table 2. Economic impact of metabolic diseases incidence in dairy farm (Warren, 2016)

Specification	Hipocalcemia	Retained placenta	Ketosis	Displaced abomasum
Mortality (%)	4	1,5	0,5	2
Culling rate (%)	5	6	5	8
Open days	13	15	10	12
Discarded milk (kg)	0	145	0	135
Milk production loses (kg)	286	550	506	880
Average cost per case (\$)	181	206	151	312
Average cost per case (lei)*	1.144	824	604	1.248

*1 dollar = 4 lei

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. 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:
- Fat corrected milk production, standard lactation 305 days, expressed in kg / cow / lactation 305 days. Milk production monitoring was done using the Dairy Master milking parlor program.
- Dry matter intake, calculated based on mixing wagon delivery TMR and deducting daily refusals
- Cost of kilogram of dry matter
- Cost of kilogram of milk

Based on these data I calculated milk production efficiency using formula:

$$\text{Milk efficiency} = \frac{\text{Milk production (kg FCM)}}{\text{Dry matter intake (kg)}}$$

Table 3. Milk production efficiency in experimental groups between 2014 and 2016

I.D.	2014			2015			2016		
	FCM (kg)	Dry matter (kg)	Efficiency	FCM (kg)	Dry matter (kg)	Efficiency	FCM (kg)	Dry matter (kg)	Efficiency
1245	7,510	6,405	1.17	8,609	6,497	1.33	8,388	6,619	1.27
1067	7,956	6,405	1.24	8,917	6,497	1.38	9,145	6,619	1.38
1241	8,272	6,405	1.29	8,397	6,497	1.30	8,504	6,619	1.28
90	8,057	6,405	1.26	8,480	6,497	1.31	8,602	6,619	1.30
1162	7,906	6,405	1.23	8,284	6,497	1.28	8,359	6,619	1.26
667	8,164	6,405	1.27	8,352	6,497	1.29	8,415	6,619	1.27
113	8,228	6,405	1.28	8,355	6,497	1.29	8,436	6,619	1.27
146	7,898	6,405	1.23	8,101	6,497	1.25	8,282	6,619	1.25
767	8,061	6,405	1.26	8,308	6,497	1.28	8,401	6,619	1.27
163	7,962	6,405	1.24	8,255	6,497	1.28	8,308	6,619	1.26
Average	8,001	6,405	1.25	8,406	6,497	1.30	8,484	6,619	1.28

Table 4. Comparative milk production efficiency in monitored cows, in two consecutive intervals: 2015 vs. 2014 and 2016 vs. 2015

ID no.	2015 vs. 2014	2016 vs. 2015
1245	13,54%	-4,81%
1067	11,02%	0,20%
1241	0,56%	-1,06%
90	4,25%	-0,89%
1162	3,79%	-1,42%
667	1,34%	-1,57%
113	0,59%	-1,35%
146	1,61%	-0,12%
767	2,10%	-1,22%
163	2,69%	-1,68%
Average	4,15%	-1,39%

RESULTS AND DISCUSSIONS

The efficiency of milk production is the evaluation of the nutritional management performance on the farm, comparing the ratio between milk production and dry matter consumption, i.e. how many kilograms of milk are produced per kilogram of dry matter (Cardoso, 2017). Values between 1.2 and 1.7 with an average of 1.48 are considered optimal in large dairy cows.

Taking into account the total dry matter intake of the group for the whole lactation, we reported it to fat corrected milk production at 305

days and we obtained an average of 1.25 in the group M1 / 2014 and 1.30 in the group E / 2015 (Table 3). In group M2 / 2016, milk production efficiency declined to 1.28, as Calving Care has been eliminated from Close-up group cows.

The E / 2015 group efficiency was 4.15% higher than in the M1 / 2014 group, indicating a superior metabolic status in the subsequent lactation of Calving Care usage in Close-up cows diets (table 4).

After eliminating Calving Care from ration, the level of efficiency decreased in the M2 / 2016

Table 5. Average margin in 2015, for M1/2014 group

2014							
Cow ID.	Milk yield, kg/305 days	Milk price, lei/kg	Dry matter, kg/305 days	Cost, lei/kg dry matter	Cost, lei/dry matter/305 days	Income, lei/305 days	Profit, lei/cow/305 days
1245	7,510	1.33	6,405	0.81	5,188.05	9,989	4,801
1067	7,956					10,581	5,393
1241	8,272					11,002	5,814
90	8,057					10,716	5,528
1162	7,906					10,515	5,327
667	8,164					10,858	5,670
113	8,228					10,943	5,755
146	7,898					10,504	5,316
767	8,061					10,721	5,533
163	7,962					10,590	5,402
Average	8,001					10,642	5,454

Table 6. Average margin in 2016, for E/2015 group

2015							
Cow ID.	Milk yield, kg/305 days	Milk price, lei/kg	Dry matter, kg/305 days	Cost, lei/kg dry matter	Cost, lei/dry matter/305 days	Income, lei/305 days	Profit, lei/cow/305 days
1245	8,609	1.33	6,497	0.81	5,262.17	11,449	6,261
1067	8,917					11,859	6,671
1241	8,397					11,169	5,980
90	8,480					11,278	6,090
1162	8,284					11,018	5,830
667	8,352					11,108	5,920
113	8,355					11,112	5,924
146	8,101					10,775	5,587
767	8,308					11,050	5,862
163	8,255					10,979	5,791
Average	8,406					11,180	5,992

group by 1.39% compared to the E / 2015 group. Analysis of milk production efficiency is not only useful in reporting the quantity of dry

matter per liter of milk but in particular in assessing the production costs that underpin the economic sustainability of any farm.

Table 7. Average margin in 2017, for M2/2016 group

2016							
Cow ID.	Milk yield, kg/305 days	Milk price, lei/ kg	Dry matter, kg/305 days	Cost, lei/ kg dry matter	Cost, lei/dry matter/305 days	Income, lei/305 days	Profit, lei/ cow/305 days
1245	8,388	1.33	6,619	0.81	5,360.99	11,156	5,968
1067	9,145					12,163	6,975
1241	8,504					11,311	6,123
90	8,602					11,441	6,253
1162	8,359					11,117	5,929
667	8,415					11,192	6,004
113	8,436					11,220	6,032
146	8,282					11,015	5,827
767	8,401					11,173	5,985
163	8,308					11,049	5,861
Average	8,484					11,284	6,096

Determining milk production efficiency is an important tool in assessing farm profitability, in addition to actual feed costs.

In order to evaluate these parameters, the individual milk production corrected to 4% fat at 305 days for all three monitored groups has been calculated, as well as the cost of feeding on dry matter basis. Afterwards, this cost was reported to earnings resulting gross profit.

An objective assessment of the impact of Calving Care on the profitability of the farm had to take into account the reduction as far as possible of the variable parameters in the calculation.

Thus, it was taken into account that the cost of the kilogram of dry matter was 0.81 lei for all three groups, and the 4% fat corrected milk price was 1.33 lei / kg. The variables were consumption of dry matter per lot and individual milk production at 305 days, resulting in feed costs and individual profits and then average per lot. The average profit in 2015 of the M1 / 2014 group was 5,454 lei, taking into account only the costs of feeding (Table 5).

In E / 2015 group, where Calving Care was fed in Close-up period, the average profit increased to 5.992 lei, both in terms of improving milk production and dry matter intake efficiency (Table 6).

The increase of the average profit to 6,096 lei in group M2 / 2016 may be the result of a higher health status of the cows, compared to group M1 / 2014 or may be a consequence of the fact that the cows in this group have moved into a group upper lactation (table 7).

CONCLUSIONS

There is a direct connection between cow's health status and milk production efficiency. As long as all physiological functions are well recovered after calving, both production and reproduction are expressed on highest potential (Chapinal *et al.*, 2012). Because there is a strength connection between rumen function activity and smooth muscle activity, it is obviously that a good activity of Parathyroid Hormone is influencing direct the dry matter intake postpartum (Shire *et al.*, 2013).

This study results confirm the direct link between the health status, reproductive performances and financial efficiency and they were demonstrated also by Nemeckova *et al.*, in 2015. They calculated that a too long calving interval (> 440 days) led in 131.77 euros / lactation loss. However, a calving interval too short (<399 days), due to a short voluntary waiting period, resulted

in a loss of 53.39 euro / lactation, reported to a moderate calving interval of 400-439 days.

In the same time Hutjens (1998) calculated 10: 1 return of investment, by introducing 200-250 g of anionic salts into the Close-up cow's diet. This profit is induced by both the increase in milk production in the subsequent lactation and by the improvement of reproductive indexes, as a result of a negative dietary cation-anion negative difference (Weich *et al.*, 2013).

REFERENCES

1. Block, E., 1984. Manipulating dietary anions and cations for prepartum dairy cows to reduce incidence of milk fever. *Journal of Dairy Science*, 67, 2939-2948
2. Cardoso, P., 2017. 10 steps for a successful transition period. *Progressive Dairyman*, Issue 9, May 25, 2017, pag. 48-49
3. Chapinal N., M. E. Carson, S. J. LeBlanc, K. E. Leslie, S. Godden, M. Capel, J. E. Santos, M. W. Overton, T. F. Duffield, 2012. The association of serum metabolites in the transition period with milk production and early-lactation reproductive performance. *Journal of Dairy Science*, 95 (2012), pag. 1301-1309
4. Hayton, A., Husband, J., Vecqueray, R., 2012. Nutritional management of herd health. *Synergy Farm Health*, West Hill Barns, Evershot, Dorset, UK
5. Hutjens, F., M., 1998. Dry cow transition rations. *Dairy Cattle Illinois Livestock Trail*, August 6, 1998. <http://livestocktrail.illinois.edu/dairynet/paperDisplay.cfm?ContentID>
6. Nemeckova, D., Stadnik, L., Citek, J., 2015. Associations between milk production level, calving interval length, lactation curve parameters and economic results in Holstein cows. *Mljekarstvo* 65 (4), 243-250 (2015)
7. Razzaghi A, H. Aliarabi, M. M. Tabatabaei, A. A. Saki, R. Valizadeh, P. Zamani, 2012. Effect of dietary cation-anion difference during prepartum and postpartum periods on performance, blood and urine minerals status of holstein dairy cow. *Asian-Australasian Journal of Animal Sciences*, 25(4): 486-495
8. Shire J. A., D. K. Beede, 2013. DCAD revisited: Prepartum use to optimize health and lactational performance. *Southwest Dairy Nutrition and Management Conf.*, pages 1-11; Feb. 21, 2013, Tempe, AZ
9. Warren, H., 2016. The high cost of metabolic diseases in dairy cattle. <http://www.wattagnet.com/articles/25057>
10. Weich W., E. Block, N. B. Litherland, 2013. Extended negative dietary cation-anion difference feeding does not negatively affect postpartum performance of multiparous dairy cows. *Journal of Dairy Science*, Vol. 96, Issue 9, pag. 5780-5792