

Effects of dietary L-Carnitine and Choline Chloride Compound on Reproduction Indices and Udder Immune System in Holstein Dairy Cattle

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Abstract—The aim of study was the determination of benefit effects L-carnitine and choline in pre and postpartum for reproduction indices and milk somatic cell count (SCC) of Holstein cows. In this study 4 groups contains 15 cattle were selected with 2-4 parity and the same of milk production. Protected choline (60 gm/daily/cow) was used and L-carnitine (50 gm/daily/cow) like to top dress with diet ration from 1 week pre calving probably to 4 weeks after parturition in control group (without supplement), choline, L-carnitine, choline + L-carnitine treatments. Milk sample was collected as weekly from the calving time to fourth weeks of postpartum. It was evaluated reproduction indices such as open days, calving to first visible estrus, calving to first service and service per conception. The results were showed the choline + L-carnitine treatment group was indicated significant decrease on rate of SCC and open days, calving to first visible estrus, calving to first service and service per conception compare to other groups. It was concluded that choline + L-carnitine combination has beneficial effect on improved reproduction indices and reduction of milk SCC than other treatment groups in Holstein Dairy cattle.

Key word: Choline, L-Carnitine, Reproduction, Dairy Cattle

I. INTRODUCTION:

L-carnitine, a vitamin-like quaternary ammonium compound is vitally important and endogenously synthesized from lysine and methionine in liver and kidneys. L-carnitine plays an important role in the production of energy via mitochondrial β -oxidation in cells. Carnitine is shown to have important functions in some metabolic processes such as oxidation of long-chain fatty acids, regulation of ketosis, support of the immune system, enhancement of the antioxidant system and improvement of reproduction. Researchers reported that L-carnitine regulates metabolic processes in high yielding lactating cows and also ewes in an advanced stage of pregnancy. Recent studies indicate that while supplemental L-carnitine in the diet is not required, its use is recommended in domestic animals especially in cattle to increase performance and to support medical treatment [1].

Choline is a vitamin-like compound whose metabolism interacts very closely with Met and vitamin B₁₂ metabolism [2]. Ruminally protected choline has improved growth performance of finishing cattle without negatively affecting carcass characteristics. Researchers observed an interaction between dietary fat and supplemental choline, but other

results contradicted this finding. The mechanism by which choline improves growth performance is unknown. Improvements may be due to alterations in lipid metabolism and/or transport. In dairy cattle, choline supplementation has improved lactation performance and fertility rate [3].

The objectives of the present study are to evaluate the effect of dietary L-carnitine and choline chloride supplement on reproduction indices and milk somatic count (SCC) in Holstein Dairy Cattle.

II. MATERIALS AND METHODS:

In this study, four groups of 15 teeth with a mean calving Holstein cows two to four were chosen, and suffered the same amount of milk production (high production) in close-up periods. L-carnitine (50 gm/daily/cow) [4] were used and protected choline (60 gm/daily/cow) [5] like to top dress along the road to the diet from one week to the probable date of calving to four weeks after calving in the control group (no supplement), choline, L-carnitine, choline + L-carnitine treatment groups. During the period of study was collected 10 ml cow milk sample as weekly from the calving time and up to four weeks of postpartum. Milk sample were estimated the amount of milk somatic cell count to assess mastitis (udder immune system) and reproductive indices such as open days, calving to first visible estrus, calving to first service and service per conception. The data was recorded in the computer software Excel and using the statistical package SAS (1997) the analysis was based on completely randomized design. Average treatments were compared by LSD multiple range test at 5% level.

III. RESULTS AND DISCUSSION:

In this study was evaluated milk SCC, open days, calving to first visible estrus, calving to first service and service per conception.

Milk SCC

In Table (1) with comparing data SCC that we observed in milk samples in first and third L-carnitine treatment group reduction than the other two groups, but this reduction was not statistically significant.

The highest decrease in the second sample in milk SCC was in the choline treatment groups and fifth sample (fourth

week after calving) had decreased in most treatment groups choline + L-carnitine than other groups. Overall, it was not significant difference between treatment groups in samples of first, second, third and fifth. These were time-consuming increasing choline + L-carnitine during sampling five times reduction in milk SCC levels. In the three treatment groups of choline, L-carnitine and choline + L-carnitine observed that the choline and L-carnitine or mix of them have a best effect on reducing milk SCC and followed has high udder immune system and decreased mastitis in dairy cattle.

Somatic cell count is a proper method for measure the quality of milk. Normally, in the safe milk are number of white blood cells and isolated cells from udder tissue. Trauma and penetration of bacterial was resulted of inflammation and increasing the number of SCC and followed them was estimated of mastitis and reduction quality of milk. Of course, researches in the fields of nutritional supplements, reducing of SCC and subsequently reduction of mastitis isn't as much as necessary. But

considering the results of this study, we observed that mixing the two complementary choline and L-carnitine was a positive effect on milk SCC. During the research on the effects of betaine on milk production and metabolism of goats was observed that betaine is oxidative products of choline and involved to choline have an influence on performance of amino acids, protein and energy metabolism. On the other hand, Methyl groups are required in immune system, nervous system, kidneys and heart vessels. Thus, under stress conditions (such as labor, lactation) or diseases, the methylation reactions are required for immune system and polyamide construction and followed decreased milk SCC. Polyamides major role is related to activities in tissue repair. Effect of trans-methylation reactions of betaine will produce substances such as carnitine, creatine and choline Phosphatidyl. Thus the addition of L-carnitine with choline the help of frequency of use more methyl groups to build polyamides, repair tissues and followed will have by SCC low and increased udder immune system [6].

TABLE-1: COMPARISON OF AVERAGE SCC IN MILK OF DIFFERENT TREATMENTS IN THE FIVE SAMPLING TIMES

Treatment/Sample	Calving	<i>weeks after parturition</i>				Total average
		1	2	3	4	
Control	2209 ^a	642/7 ^a	788/4 ^a	449/7 ^b	144/6 ^a	846/88
Choline	320 ^a	134/6 ^a	523/6 ^a	408/2 ^{ab}	348/1 ^a	346/9
L-carnitine	239 ^a	833/9 ^a	356/9 ^a	751/9 ^a	241/9 ^a	484/72
Choline +L-carnitine	436 ^a	602/6 ^a	909/6 ^a	348/9 ^{ab}	132/2 ^a	485/86
Standard error	980/56	275/5	419/26	200/24	84/21	

* In each column mean which contained at least one common letter are not significantly different at the 5% level.

Reproductive indices:

According to Table (2), choline + L-carnitine group was a significant effects ($p \leq 0.05$) on services per pregnancy that it was lower than the choline treatment group and control group, But there was no significant difference with L-carnitine group. Also, there was decreased significantly days open in choline + L-carnitine treatment group compare than other groups. In relation to calving interval to first service and calving interval to first visible estrus, choline + L-carnitine group was significantly ($p \leq 0.05$) lower than the other groups.

This study was indicated that choline and L-carnitine have beneficial effect on reducing calving interval to first oestrus, the calving interval to the first service, open days and number of services per pregnancy. However, it was concluded that the combined choline + L-carnitine has a best effect than the other groups on indices of reproductive.

The researchers showed that choline supported to reproductive system by positive energy balance and choline deficiency causes lack of energy balance and reduced follicular development and it was reduced fertility. In

addition, choline deficiency causes decreased production of hormones [7].

Using the L-carnitine in a 40-day period were reduced open days, calving interval to first service that due to reduction of milk parameters such as ketone bodies and blood parameters such as cholesterol and triglyceride and then it was caused decrease ketosis and fatty liver disease. With the decreasing ketosis, it is induction of first estrus after calving and decreased the open days will result to reduce the calving to first service [8]. These reasons are agreement to the results found in this study.

In overall, little information regarding the interaction between choline and L-carnitine on reproductive indices available that is needed further researches.

In conclusion choline + L-carnitine combination (60 gm/daily/cow + 50 gm/daily/cow) has beneficial effect on improved reproduction indices, reduction of milk SCC and support of udder immune system in Holstein Dairy cattle.

TABLE-2-COMPARISON OF MEAN REPRODUCTIVE INDICES IN DIFFERENT TREATMENTS AT FIVE TIMES OF SAMPLING

Treatment/Sample	Calving to first visible estrus(day)	Calving to first service(day)	Days open	Service per conception
Control	63/6 ^a	63/7 ^{ab}	90/07 ^a	2/5 ^a
Choline	62/2 ^a	66/5 ^a	82/2 ^{ab}	1/7 ^b
L-carnitine	63/2 ^a	64/7 ^{ab}	74/7 ^b	1/5 ^{bc}
Choline +L-carnitine	53/3 ^b	59/07 ^c	63/3 ^c	1/2 ^c
Standard error	2/95	1/67	3/72	0/15

*: In each column mean which contained at least one common letter are not significantly different at the 5% level.

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