Kafkas Üniv Vet Fak Derg
14 (1): 9-12 2008

The Effect of L-Carnitine Injection at Prepartum Period on The Plasma IgG Level and Gamma-Glutamyltransferase (GGT) Activity in Cows and Calves

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Yayın Kodu (Article Code): 2007/32-A

Summary

This study investigated the effect of L-carnitine on IgG and GGT levels in cows receiving L-carnitine during the last three weeks of pregnancy and on the parturition and their newborn calves. The study involved 20 cows and their calves. Animals were divided into two equal groups; cows in L-carnitine group subcutaneously received 3 injections of 1g/cow/day of L-carnitine weekly intervals during the last three weeks of gestation, at the parturition (0 day) and control group received placebo during the same period. All cows and newborn calves were blood sampled on the 1 and 3 days after birth in order to determine IgG, total protein and albumine and GGT concentrations. The concentrations of IgG, total protein, albumine, and GGT. The values were similar in cows of both groups but calves in L-carnitine group had higher GGT levels on day 1 and 3 and IgG level on day 3 whereas IgG level was higher in control calves on day 1. As a result, L-carnitine injection in pregnant cows did not cause a significant change in IgG, GGT, total protein and albumine levels in cows and their newborn calves.

Keywords: *Cow, Calf, L-Carnitine, IgG, GGT*

Prepartum Dönemde L-Carnitine Enjeksiyonlarının, İnek ve Buzağılarda Plazma IgG Düzeyi ve Gamma-Glutamyltransferase (GGT) Aktivitesine Etkisi

Özet

Bu çalışmada, gebeliğin son üç haftasında ve doğumda L-carnitine uygulanan inekler ve bunların buzağılarında plazma IgG ve GGT seviyesi araştırıldı. Çalışma 20 adet inek ve bunların buzağılarında yapıldı. Hayvanlar iki eşit gruba ayrıldı. L-carnitine uygulanan ineklere, gebeliğin son üç haftasından doğuma kadar birer hafta aralıklarla ve doğumun gerçekleştiği gün (0. gün) 1 g/hayvan/gün dozunda L-carnitine subkutan yolla uygulandı. Kontrol grubundaki ineklere ise subkutan yolla placebo uygulandı. Bütün inekler ve yeni doğan buzağılardan doğumdan sonraki 1 ve 3. günlerde kan alındı. Alınan kanlarda IgG, total protein, albumin ve GGT seviyelerine bakıldı. İki gruptaki ineklerde benzer sonuçlar bulundu. L-carnitine uygulanan ineklerin buzağılarında 1 ve 3. günlerdeki GGT oranının kontrol grubu buzağılarına göre yüksek olduğu tespit edildi. IgG seviyesinin 1. günde kontrol grubu buzağılarda, 3. günde ise L-carnitine uygulanan ineklerin buzağılarında daha yüksek olduğu görüldü. Sonuç olarak gebe ineklerde L-carnitine uygulamalarının ne ineklerde ne de bu ineklerin yeni doğan buzağılarında IgG, GGT, total protein ve albumin parametrelerinde önemli bir değişikliğe yol açmadığı kanısına varıldı.

Anahtar sözcükler: *İnek, Buzağı, L-Carnitine, IgG, GGT*

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INTRODUCTION

Passive immunisation of new-born calves is very important because calves are born agammaglobulinemic due to the lack of placental transfer and the risk of exposure to infectious agents (bacteria, virus, and parasites) is remarkably high during first days of life [1-4]. The only natural way of the passive immunization is colostrum which contains all antibodies existing in the maternal serum. It is well known that antibodies in colostrum are 8 times higher than that of maternal serum [1,4]. Colostrum feeding should commence within 6 hours of parturition for satisfactory immuntransfer because intestinal transfer of antibodies decreases due to gut closure as calf ages. Therefore calf has to receive colostrum as much as 10% of its body weight within 24 hours of life [1,3]. It is well documented that IgG is the dominant immunoglobulin in ruminants and that hypogammaglobulinemic calves have a high risk of morbidity and mortality [5,6].

Gamma-Glutamyltransferase (GGT) enzyme is synthesised in bile duct, liver, kidney, pancreas and small intestine and is known to play role in gammaglobulin transfer in early life by enhancing IgG absorption in the small intestine [7,8]. It has been shown that following colostral ingestion, serum immunoglobulin concentrations increased. Similarly, the enzyme GGT, whose concentration in the colostrums is very high, is also absorbed by intestine and gets to calf serum [9]. Studies have shown that calves received adequate colostrum had high serum GGT concentration and a positive correlation between IgG1 and GGT concentrations [1,10].

Carnitine exists in nature in the form of D and L and only L form is important for both human and animals [11]. L-carnitine has a great role in transforming fatty acid into mitochondrion energy by forming long-chain free fatty acid and esters. β-oxidation transforming fatty acid into energy does not occur when carnitine synthesis is hindered [12-14].

L-carnitine has a role in intestine absorption by means of energy formation and increasing passive diffusion. L-carnitine has important functions in supporting the immune system and protecting against infectious diseases through activation of B and T lymphocyte and phagocytosis [15-18]. But to the best of our knowledge no study exists on the relationship between IgG level and Carnitin in cattle.

This study was therefore designed to evaluate the effect of L-carnitine on passive transfer of immunoglobulin in new-born calves.

MATERIAL AND METHODS

The study involved 20 cows in last three weeks of gestation and their newborn calves. The pregnant cows were divided into two equal groups. L-carnitine (Carnitine®, Santa Farma, Istanbul) was given to the 1st group (n=10) subcutaneously at dose rate of 1g/cow/day weekly intervals during the last three weeks of gestation and on the parturition (0 day). The 2nd group (n=10) received placebo during the same period. Cows in both groups were fed the same ratio consisting of hay and concentrate (dry matter 88%, crude protein 16%, crude cellulose 14%, crude ash 9%, insoluble ash in HCI 1%, calcium between 0.8-1.5%, phosphor 5% sodium 0.2-0.4%, NaCl 1%, metabolic energy 2400 kcal/kg). Cows of both groups were blood sampled after L-carnitine application, on the 1st day and on the 3rd day after birth. Calves born to the selected cows were also blood sampled 24 hours after colostrums intake (%10 gravity body calf) and on the 3rd day of birth. Sera was separated by centrifugation at 3000g for 10 minutes and then stored at -20°C degrees until analyses.

Serums IgG levels (Competitive ELISA, BIOX, Belgium), GGT activity, (DDS Diasis Diagnostic System, Holzheim, Germany), total protein (TP) and albumine analyses (BioMeriuex/France) were determined spectrophotometrically using commercial kits.

Statistical differences between the groups were evaluated by analysis of variance (ANOVA) and Duncan test using SPSS for Windows version 10.0. Data were presented as mean±standard errors, and p values less than $P<0.05$ were considered significant.

RESULTS

Plasma IgG, GGT, total protein and albumine

concentrations of cattle received L-carnitine and control were not significantly different on 1st and 3rd days after of postpartum (p>0.05; *Table 1*).

Table 1. *Biochemical parameters determined on 1st and 3rd days after of parturition in cows (mean±SD)*

Tablo 1. *İneklerde doğum sonrası 1 ve 3. günlerdeki biyokimyasal parametreler*

PARAMETERS	L-Carnitine (n=10)		Control (n=10)	
	Day 1	Day 3	Day 1	Day 3
IgG (g/L)	3.2±1.1	3.3±1.1	3.5±1.7	3.7±1.7
GGT (U/L)	19.4±8.8	19.4±9.1	19.4±9.1	19.4±5.9
TP (g/dL)	5.5±0.2	5.5±0.3	5.5±0.4	5.7±0.3
Albumine (g/dL)	2.9±0.1	2.7±0.1	2.9±0.1	2.7±0.1

Plasma IgG of day 1 was 4.5±2.3 g/L for calves born to cows received L-carnitine and 5.7±2.2 g/Lfor calves born to control cows. This difference was not statistically significant (p>0.05). Plasma IgG concentrations of both groups on day 3 significantly decreased. This decrease was more marked in calves born to control cows (2.9±1.6 g/L) when compared to the value of calves born to L-carnitine received cows (3.4 g/L; p<0.01). GGT activity levels of both groups were not significantly different and the concentration increased in both groups on day 3 when compared to the value of day 1. Total protein concentration of calves born to control cows was insignificantly lower than the level of calves born to L-carnitine group (p>0.05). Albumine concentration of both groups did not significantly different *(Table 2)*.

Table 2. *Biochemical parameters determined on 1st and 3rd days after of birth in calves (mean±SD)*

Tablo 2. *Buzağılarda 1 ve 3. günlerdeki biyokimyasal parametreler*

PARAMETERS	L-Carnitine (n=10)		Control (n=10)	
	Day 1	Day 3	Day 1	Day 3
IgG (g/L)	4.5±2.3	3.4±1.1	5.7±2.2	2.9±1.6
GGT (U/L)	281.1±66.4	330.0±49.5	251.4±70.9	307.9±78..2
TP (g/dL)	5.7±1.6	7.0±0.9	4.9±1.3	7.2±1.0
Albumine (g/dL)	5.0±0.8	5.8±0.9	5.5±0.7	5.6±0.8

DISCUSSION

Colostrum enhances the immune system of new borns and protects them against infections [1-4].

The enhancing effects of L-carnitine on immune system have been investigated by many researchers [15-18]. But L-carnitine supplementation during pregnancy and its effect on plasma IgG concentration is not detailed in cattle.

In our study IgG level of control group was higher than the L-carnitine group on 1st day but an obvious decrease was noted in calves of control group on the 3rd day of parturition when compared to L carnitine. Plasma IgG level in calves is expected to decrease after first day of life as reported here [19-22], but L-carnitine supplementation slightly maintained high level beyond the first day of life as compare to control group.

Although GGT activities of cows in both groups were similar the activity in calves born to cows received L-carnitine was higher than the control group. This finding may support the L-carnitine effect on IgG concentration especially on the value of the 3rd day. Enhancing effect of L-carnitine on immune system was previously reported by researchers [15-18], but no study is available about the relationship between L-carnitine and plasma IgG level in calves. Andrea [23] reported that GGT activity of newborn calves peaked up at first 12 hours of birth and then decreased by 40% within 24 hours of birth. Studies have demonstrated positive association between GGT and IgG [7,24].

A positive correlation between immunglobulin and total protein level within first 24 hours of life was reported [23,25]. Total protein and albumine concentration of day 1 was lower than the value of day 3 in calves in this study. This maybe related to colostrum intake as colostrum intake increases plasma protein and albumine concentration [25,26]. In our study negative association existed between plasma protein and albumine concentration and IgG level on the 3rd day in both groups of calves.

As a result, L-carnitine injection in pregnant cows did not cause a significant change in IgG, GGT, total protein and albumine levels in cows and their newborn calves.

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