

EFFECT OF DIETARY L-CARNITINE SUPPLEMENTATION ON THE LONG-TERM PERFORMANCE OF SOWS

DJELOVANJE DODAVANJA L-KARNITINA U OBROKE NA DUGOROČNE REZULTATE KRMAČA

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SUMMARY

This study confirms the findings of previous studies which demonstrated that supplementation of sows diets with L-Carnitine during gestation and lactation improved their reproductive performance. As was also shown in these studies, L-Carnitine supplementation increased the body weight gain of the sows from day 1 to day 85 of pregnancy, the body weights of piglets at birth and litter weights at birth and weaning. Moreover, this study demonstrates that the beneficial effect of L-Carnitine is sustained over several reproductive cycles during continuous supplementation. Positive effects of L-Carnitine supplementation on litter weights at birth and at weaning were apparent throughout all age categories of sows, ranging from one to ten previous pregnancies.

The experimental data suggest that permanent L-Carnitine supplementation produces a sustained increase in the reproductive performance of sows. The recommended level is 50 mg L-Carnitine per kg of feed. Supplementation of gilts should start when they are introduced into the sow herd.

INTRODUCTION

Recent studies have demonstrated that supplementing the diet of sows with L-Carnitine increases their reproductive performance. The results concur in showing that L-Carnitine supplementation during gestation and lactation increases the body weight gain of sows during pregnancy, reduces the number of non-viable piglets, increases the birth weight of piglets and increases the weight gain of piglets during suckling. In a previous study (Eder et al. 2001), birth weights of piglets from sows fed L-Carnitine-supplemented diets were 7% higher than in control sows. The improvement in the weight gain of piglets from L-Carnitine treated sows

during suckling compared with control sows was 6% and that in the body weight of piglets at weaning as much as 11%.

Recent experiments have been limited to one reproductive cycle in sows. L-Carnitine supplementation is, however, of practical benefit only if positive effects on the reproductive performance of L-Carnitine are sustained over several reproductive cycles. Moreover, the previous study (Eder et al. 2001) suggested that the effect of L-Carnitine supplementation could depend on the age of sows.

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Therefore the effect of L-Carnitine supplementation on reproductive performance was investigated over three consecutive pregnancies in sows with various numbers of previous parities.

MATERIALS AND METHODS

In this study two trials were carried out in an agricultural cooperative that kept a herd of 300 sows (Leicoma breed). From this herd, 127 sows were selected for the first trial and 100 for the second. The animals were divided into two groups (control group vs. treated group) by weight and number of previous parities. Both trials were identical in design and conduct but were performed with different animals. All animals were kept and fed individually throughout gestation and lactation. Two nutritionally balanced, commercial feed mixtures provided the ration (Table 1). The diet for the sows in early gestation was basic fed from days 1 to 84 of pregnancy, with each animal receiving exactly 2.5 kg daily. Between day 85 of gestation and day 28 of lactation the sows were fed the lactation diet. The daily feed allowance per sow from day 85 to day 114 of pregnancy was 2.5 kg. On the day of farrowing the sows received 1.5 kg, rising to 3 kg daily on days 1 and 2 of lactation and 4.5 kg daily on days 3 and 4 of lactation. Between days 5 and 28 of lactation the sows received 6 kg of feed daily. The animals were fed once daily (8.00 hours) until day 108 of gestation and three times daily thereafter (8.00, 13.00 and 17.00 hours) until the end of lactation, one-third of the daily allowance being dispensed at each meal. The native L-Carnitine concentration of both diets was below 5 mg per kg. The sows of the treated group received a

supplement of 125 mg L-Carnitine (Carniking®) per head and day during pregnancy and 250 mg L-Carnitine per head and day during lactation. The supplement was added to the ration in the form of a premix (wheat bran based). Water was available ad libitum to all animals. On day 7 after farrowing, the young piglets received a commercial piglet supplement for unrestricted feeding. On day 28 after farrowing, the piglets were weaned. Data were generated over three reproductive cycles.

RESULTS

Sow body weight

The body weight gain of the sows from day 1 to day 85 of pregnancy was significantly increased by dietary L-Carnitine supplementation. In the late stage (day 85 to day 107) of pregnancy the body weight gain was not influenced by L-Carnitine supplementation (Table 2). There was, however, a tendency towards a higher body weight loss between day 107 and weaning under L-Carnitine supplementation.

Litter size

In the first trial a total of 212 litters were produced and evaluated for number and live weights of the piglets. In the second trial a total of 173 litters were produced and evaluated. The average total number of piglets born was similar in both trials (11.8 and 11.6 respectively).

Table 1. Nutrients in the experimental basal diets

Tablica 1. Hranjive tvari u pokusnim osnovnim obrocima

Nutrient - Hranjiva tvar	Gestation diet - Obrok u trudnoći	Lactation diet - Obrok u laktaciji
Energy - Energija (MJ ME/kg)	12.0	12.9
Crude protein - Sirova bjelančevina (g/kg)	136	178
Crude fat - Sirova masnoća (g/kg)	39	38
Crude fibre - Sirova vlaknina (g/kg)	64	59
Crude ash - Sirovi pepeo (g/kg)	55	62
Lysine - Lizin (g/kg)	7.0	10.0

Table 2. Body weight changes in the sows during the reproductive cycle**Tablica 2. Promjene tjelesne težine krmača za vrijeme reprodukcijskog ciklusa**

Treatment group - Pokusna skupina	Controls Kontrolne skupine	+ L-Carnitine + L-karnitin	Significance of L-Carnitine Važnost L-karnitina	Difference Razlika
Number of pregnancies (2 trials, 3 cycles each) - Broj trudnoća (2 pokusa svaki od 3 ciklusa)	190	195	(P)	(%)
Body weight change (kg) Promjena tjelesne težine (kg)				
Day 1 to day 85 - Dan 1. do 85.	21.0	27.6	0.01	+31
Day 85 to day 107 / Dan 85. do 107.	13.4	13.7	0.72	+2
Day 107 to weaning - Dan 107. do odbića	-21.3	-25.7	0.07	+20

Table 3. Litter size at birth and weaning (day 28 after birth)**Tablica 3. Veličina legla pri rođenju i odbiću (28. dan nakon rođenja)**

Treatment group - Pokusna skupina	Controls Kontrolne skupine	+ L-Carnitine + L-karnitin	Significance of L-Carnitine Važnost L-karnitina	Difference Razlika
Number of litters (2 trials, 3 cycles each) Broj prašćića (2 pokusa, svaki od 3 ciklusa)	190	195	(P)	(%)
Number of piglets born Broj rođenih prašćića	11.5	11.9	0.38	+3
Number of piglets born alive Broj živo rođenih prašćića	10.6	11.1	0.16	+5
Number of stillborn piglets Broj mrtvorodenih prašćića	0.9	0.8	0.50	-11
Number of non-viable piglets Broj neodrživih prašćića	0.4	0.3	0.08	-25
Number of piglets fit for rearing Broj prašćića sposobnih za uzgoj	10.2	10.8	0.20	+6
Number of weaned piglets Broj odbijenih prašćića	8.4	9.1	0.06	+8

L-Carnitine supplementation did not significantly influence the total number of piglets born or the number of piglets born alive and stillborn piglets (Table 3). However, there was a tendency towards a lower number of non-viable piglets (-25%) and a higher number of weaned piglets (+ 8%) under L-Carnitine supplementation. The number of piglets lost during suckling was not influenced by the L-Carnitine supplementation.

Piglet and litter weight

L-Carnitine supplementation to the sows significantly increased weights of piglets and litters at birth (Table 4). Weight gains of individual piglets during suckling and weights of piglets at weaning were not influenced by L-Carnitine supplementation to sows. However, weight gains of litters during suckling and weights of litters at weaning were

significantly increased by the L-Carnitine supplementation. The effects of L-Carnitine supplementation on litter weight are the result of a slight

increase in weight gains of piglets (+ 4%) during suckling and a higher number of weaned piglets per litter (+ 8%).

Table 4. Average litter and piglet weight at birth and weaning (day 28 after birth)

Tablica 4. Prosječno leglo i težina praščića pri rođenju i odbiću

Treatment group - Pokusna skupina	Controls Kontrolne skupine	+ L-Carnitine + L-karnitin	Significance of L-Carnitine Važnost L-karnitina	Difference Razlika
Number of litters (2 trials, 3 cycles each) Broj praščića (2 pokusa, svaki od 3 ciklusa)	190	195	(P)	(%)
Birth - Rođenje				
Weight of piglets, birth (kg) Težina praščića, rođenje (kg)	1.38	1.48	0.02	+7
Weight of litters, birth (kg) Težina legla, rođenje (kg)	14.5	16.3	<0.01	+12
Weaning - Odbiće				
Weight of piglets, weaning (kg) Težina praščića, odbiće (kg)	7.64	7.97	0.23	+4
Weight of litters, weaning (kg) Težina legla, odbiće (kg)	65.5	73.9	<0.01	+13
Weight gain during suckling Prirast težine za vrijeme sisanja				
Weight gain of piglets (kg) Prirast težine praščića (kg)	6.27	6.52	0.32	+4
Weight gain of litters (kg) Prirast težine legla (kg)	51.2	57.9	0.02	+13

Table 5. Average litter weight at weaning (day 28 after birth) as a function of the number of parities

Tablica 5. Prosječna težina legla pri odbiću (28. dan nakon rođenja) kao funkcija broja pariteta

Parity number Broj pariteta	Number of litters - Broj legala		Litter weight at weaning (kg) Težina legla pri odbiću (kg)		Difference Razlika (%)
	Controls Kontrolne	+L-Carnitine L-karnitine	Controls Kontrolne	+L-Carnitine L-karnitine	
1	13	13	62.4	74.3	+19
2	26	22	70.2	78.4	+12
3	42	40	68.9	75.4	+9
4	33	32	70.7	79.5	+15
5	26	34	71.0	75.8	+7
6	21	23	65.1	70.6	+8
7	14	17	62.2	66.8	+7
8	10	7	61.6	77.8	+26
9	4	4	65.7	72.7	+11
10	1	3	57.0	67.3	+18

Table 6. Average litter weight at weaning (day 28 after birth) as a function of the number of cycles within the experiment

Tablica 6. Prosječna težina legla pri odbiću (28. dan nakon rođenja) kao funkcija broja ciklusa u pokusu

Parity number Broj pariteta	Number of litters - Broj legala		Litter weight at weaning (kg) Težina legla pri odbiću (kg)		Difference Razlika (%)
	Controls Kontrola	+L-Carnitine L-karnitine	Controls Kontrola	+L-Carnitine L-karnitine	
1	89	86	65.9	73.1	+11
2	61	67	71.4	76.3	+7
3	40	42	59.2	72.3	+22

L-Carnitine vs. parities

The effect of L-Carnitine supplementation on piglet weights and litter weights was independent of the trial, number of previous pregnancies and number of reproductive cycles within the experiment. Litter weights at weaning as a function of the number of parities and the number of reproductive cycles within the experiment are shown in Table 5 and 6.

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SAŽETAK

Ovaj rad potvrđuje nalaze ranijih radova koji su pokazali da je dodavanje L-karnitina u obroke krmača za vrijeme trudnoće i laktacije poboljšalo reproduktivne rezultate. Kao što je pokazano u tim radovima dodavanje L-karnitina povećalo je prirast tjelesne težine krmača od 1. do 85. dana trudnoće, tjelesne težine praščića pri rođenju i težine legla pri rođenju i odbiću. Osim toga, ovaj rad pokazuje da se povoljno djelovanje L-karnitina zadržava kroz nekoliko reproduktivnih ciklusa uz neprekidno dodavanje. Pozitivno djelovanje L-karnitina na težine legla pri rođenju i odbiću bilo je očito u svim dobnim kategorijama krmača, od jedne do deset ranijih trudnoća.

Podaci iz pokusa navode na zaključak da neprekidno dodavanje L-karnitina daje stalan porast reproduktivnih rezultata krmača. Preporučena razina je 50 mg L-karnitina na 1 kg krmiva. Dodavanje nazimicama treba početi kad su uvedene u stado krmača.



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