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Araştırma Makalesi

The Effects of L-carnitine on Plasma Carnitine Concentrations of Nile Tilapia (*Oreochromis niloticus*) in Cage Condition

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Abstract

The present study was conducted to determine whether dietary supplemental L-carnitine affects plasma L-carnitine concentration of Nile tilapia in cage condition. One-year-old Nile tilapias were used in the experiment. One group was fed the control diet, which contained 62.4 mg biogenic L-carnitine/kg diet while the other group received feed supplemented with 500 mg L-carnitine/kg diet. At the end of the 90 days feeding trial, dietary treatments were fed unsupplemented dietary for 30 days to determine the influence of L-carnitine supplementation on the physiological response to this unsupplemented feeding. Plasma L-carnitine concentration was significantly increased in treatment group compared to control group on 90th day and 120th day.

The result of the present study demonstrated a positive effect of L-carnitine on the plasma L-carnitine concentration of Nile tilapia. The results also provide evidence that L-carnitine could be stored after period of feeding supplemental L-carnitine.

Key words: Blood plasma**,** L-carnitine, Nile Tilapia

Kafes Koşullarında L-karnitinin Nile Tilapyalarının (*Oreochromis niloticus*) Plazma Karnitin Konsantrasyonları Üzerine Etkisi

Özet

Bu çalışma kafes koşullarında yetiştirilen Nil tilapyalarının rasyonlarına ilave edilen L-karnitinin plazma L-karnitin konsantrasyonu üzerine etkili olup olmadığını belirlemek amacıyla yapılmıştır. Bu amaçla denemede 1 yıllık Nil tilapyaları kullanılmıştır. Kontrol grubuna verilen bazal rasyonun doğal L-karnitin içeriği 62.4 mg/ kg iken deneme grubunun dietine bazal rasyona ilave olarak 500 mg/kg L-karnitin ilave edilmiştir. Doksan günlük besleme periyodunun sonunda, deneme grubu da kontrol grubuyla birlikte otuz gün süreyle bazal rasyonla beslenerek L-karnitinin fizyolojik etkisi belirlenmiştir. Doksan ve yüzyirminci günlerdeki deneme grubunun plazma L-karnitin konsantrasyonun kontrol grubuyla karşılaştırıldığında önemli düzeyde artmış olduğu belirlenmiştir.

Sonuç olarak, Nil tilapyalarının rasyonlarına L-karnitin ilavesinin plazma L-karnitin konsantrasyonu üzerine pozitif etki gösterdiği belirlenmiştir. Ayrıca sonuçlar, L-karnitinin besleme periyodunun sonunda depolanabildiğini göstermiştir.

Anahtar kelimeler: Plazma, L-karnitin, Nil Tilapyası

Introduction

L-carnitine functions as a carrier for the transport of activated long-chain fatty acids across the inner mitochondrial membrane besides being a binder of acetyl groups, leading to increase the pool free coenzyme-A, which stimulates the generation of metabolic energy (Bremer 1983; Borum 1991). It is, therefore, speculated that dietary carnitine supplementation could be beneficial for energy metabolism, thereby facilitating fatty acid oxidation and balancing energy deficit by using the long chain fatty acids (Rebouche 1992).

The beneficial effects of L-carnitine on fish growth and feed conversion have been demonstrated for freshwater species (Burtle and Liu 1994; Torreele et al. 1993; Schlechtriem, 2004), whereas results of some studies did not exhibit any significant effects (Rodehutscord 1995). Further work from Becker et al. (1999), on the *Oreochromis niloticus* x *Oreochromis aureus* hybrids showed that on commercial fattening diets low in L-carnitine, supplementation of 150 mg/kg feed is effective but not supplementation of 300 mg/kg. In the same direction, Jayaprakas et al. (1996), suggested that L-carnitine promoted growth rate of *Oreochromis mossambicus*. Santulli and D'Amelio (1986a,b)

indicated that dietary carnitine increased the growth of sea bass *Dicentrarchus labrax* L. fry. Chatzifotis et al. (1995) observed that L-carnitine (2088 mg/kg) has positive effects on growth of red sea bream fingerlings. Becker and Focken (1995) also reported that better feed conversion, growth rate and protein efficiency in *Cyprinus carpio* L. fed the diet containing 400 or 600 mg L-carnitine/kg.

However, in the present literature no research has been found on the evaluation of plasma L-carnitine concentrations of Nile tilapia in cage condition. The purpose of this experiment therefore, were 1) to determine the effects of supplemental L-carnitine on the plasma L-carnitine concentrations of Nile tilapia in cage condition; and 2) to determine whether store in plasma carnitine levels are reflected in storage in the body.

Material and methods

Nile tilapias (*Oreochromis niloticus*) were obtained from the Aquaculture Research Facility of the Fisheries Faculty, University of Çukurova, Adana/Turkey. The average fish weight (middle of July) was 9 g. They were stocked in cages for 120 days.

The experiment was conducted at Seyhan River Lake in Adana. The rearing was carried out in two groups and two replicates (four cages of $1m^3$ capacity). The cages are moored in approximately 10 m of water.

Carnitine was supplemented to each diet by dissolving the respective quantity in water and mixing prior to pelleting. This ensured that hygroscopic compounds were evenly distributed in the diet. Diet was manufactured immediately prior to initiating the feeding trial. Fish were divided into two experimental groups (0 and 500 mg L-carnitine/kg feed) of similar mean body weight, comprising 66 fish each. One group was fed the experimental diets for 90 days and plus 30 days fed unsupplemented diet to the other group unsupplemented feed was given for the whole trial period. Water temperatures ranged from 28 °C to 31 °C.

The %45 crude protein basal diet contained 14.79 MJ of feed. Concentration of natural L-carnitine in the basal diet was 62.4 mg per kg feed determined according to Břichnáčová, (1999).

At 90^{th} and 120^{th} days from each experimental group, blood samples were taken. After centrifugation of blood samples, plasma samples were obtained and analyzed for free L-carnitine. Free L-carnitine was analyzed according to Enzymatic UV test (Roche 1999).
The data with respect to fish plasma L-carnitine concentration were subjected to t-test using SPSS (1999).

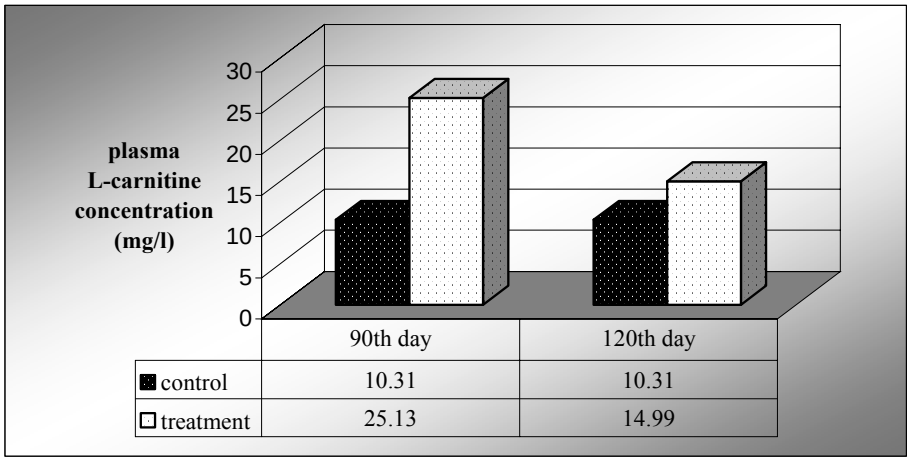
Results

The results with regard to plasma L-carnitine concentrations are summarized in Figure 1.

The plasma L-carnitine concentrations of fish was affected ($P<0.01$) by L-carnitine at 90^{th} and 120^{th} day of experimental period.

As indicated in Figure 1, at 90^{th} day, the plasma concentrations of L-carnitine were significantly 10.308±0.35 and 25.128±0.57 mg/l in control and treatment groups, respectively. At 120^{th} day, it was seen that there were significant differences in plasma L-carnitine levels between control (10.306±0.94 mg/l) and treatment (14.986±0.58) groups.

Figure 1. Effect of L-carnitine on plasma L-carnitine concentration of Nile Tilapia



Discussion

Reports on the response of tilapia to supplementary dietary L-carnitine are limited. Studies with tilapia have shown some favorable responses to supplemented dietary L-carnitine (Becker et al. 1999; Jayaprakas 1996; Schlechtriem, 2004).

The results obtained in the present experiment suggest that L-carnitine could have a potential to improve L-carnitine requirement of fish by increasing plasma L-carnitine concentration. Ji et al. (1996) observed significant increment in plasma carnitine concentration of atlantic salmon in response to dietary 3700 mg/kg L-carnitine supplementation. Furthermore, De Almeida Ozorio (2001) reported that plasma carnitine level was increased (7.7 vs. 16.5 μmol/ml) by high carnitine supplements in diet. In many reports, low plasma or serum carnitine concentrations were taken as evidence of carnitine deficiency (Rebouche 1992). The addition of L-carnitine in this experiment led to increased plasma L-carnitine concentration compared to the control group. This is probably indicated that L-carnitine requirements of fish are sufficient to meet by L-carnitine supplementation. Contents of plasma L-carnitine at 120^{th} day were high in supplemented animals. This result may suggest that feeding with L-carnitine during the 90 days could be accumulated L-carnitine in their bodies.

It could be concluded that supplemental L-carnitine (500 mg/kg) could have a potential to improve the plasma L-carnitine concentrations of Nile tilapia in cage condition. The results also provide evidence that L-carnitine could be stored after period of feeding supplemental L-carnitine.

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