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To cite this article: Luca Fasolato, Carla Elia, Anna Liguori, Adolfo Corato & Severino Segato (2005) Effect of dietary fat level on carcass traits and flesh quality of European Sea Bass (*Dicentrarchus labrax*) from mariculture, Italian Journal of Animal Science, 4:sup3, 98-100, DOI: 10.4081/ijas.2005.3s.98

To link to this article:  https://doi.org/10.4081/ijas.2005.3s.98

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Published online: 02 Mar 2016.

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Effect of dietary fat level on carcass traits and flesh quality of European Sea Bass (*Dicentrarchus labrax*) from mariculture

Luca Fasolato, Carla Elia, Anna Liguori, Adolfo Corato, Severino Segato

Dipartimento di Scienze Animali. Università di Padova, Italy

Corresponding author: Dr. Luca Fasolato. Dipartimento di Scienze Animali - Università degli Studi di Padova. Viale dell’Università 16, 35020 Legnaro (PD), Italy – Tel. +39 049 8272628 – Fax: +39 049 822669 – Email: luca.fasolato@unipd.it

ABSTRACT

The study aimed at evaluating the effect of the reduction of dietary fat on juvenile European sea bass nutritional value and quality traits. Fish were reared in floating cages (Trieste Gulf, Italy) from July (11) to October (10). Two isoproteic diets were compared: LF (low fat, EE = 19.4%) vs. HF (high fat, EE = 24.6%). No significantly different growth performance was observed. LF diet-fed fish were characterized by the reduction of celomatic fat (not edible fraction) and by the increase in dressing percentage. The tested dietary fat level also affected both fillet and epaxial white muscle proximate composition, resulting in a significantly lower fillet lipid concentration in LF diet-fed fish. Dietary treatment influenced cooked fillet colour and texture probably as a consequence of the different intramuscular fat deposition. Fillet from HF-fed fish, in fact, presented higher lightness (L*) value and lower instrumental strengthness.

Key words: Lipids, Carbohydrates, Fish quality, European sea bass

Introduction

In order to reduce feeding cost, recent achievement on marine fish nutrition suggests the partial substitution of crude protein with lipids or carbohydrates (protein-sparing effect). However, an increase of dietary fat could result in higher fillet lipid concentration that influence organoleptic flesh quality (Lopparelli et al., 2004). Indeed, the partial substitution of fish meal with starch was suggested to reduce catabolism of protein for energy with no significant effect on fish weight and whole body lipid deposition (Robaina et al., 1997; Peres and Oliva-Teles 2002). When using 19% crude fat diets in European sea bass, Lanari et al. (1999) did not find any differences in growth and feed efficiency between 21.5% and 28.5% of dietary NFE concentration; instead, a further increase of NFE concentration led to a significantly higher whole body crude fat concentration.

Considering that consumers prefer lean products, the convenience of the substitution of dietary crude protein and/or lipids with carbohydrates must consider also nutritional value and quality traits of final product. Taking this in account, it is necessary to enhance knowledge about carbohydrates utilisation by marine finfish. Thus, this trial investigated the effects of the dietary crude fat level on quality traits and proximate composition of sea bass (*Dicentrarchus labrax*) reared on floating cages.

Material and methods

Fish were reared in two floating cages (1000 m³) near Trieste (Monfalcone, GO) under the same environmental conditions. The feeding period elapsed from July 11 to October 10, 2001. Two isoproteic (43.2% wet weight) diets were formulated varying the ether extract level: LF (Low Fat, EE = 19.4%) vs. HF (High
determined by Hunter-L*a*b* system. After cooking during 25 min at 70°C, trunk cooking losses were recorded (Lopparelli et al., 2004). In cooked fillet, colour and instrumental tenderness (Maximum Shear Force) were also assessed. According to a monofactorial design, data were submitted to ANOVA within PROC GLM of SAS (1999).

Results and conclusions

Performance data were not submitted to ANOVA because of the trial considered just two cages (one for dietary thesis). Similar feed intake and growth per-

| Table 1. Effect of dietary fat level (LF, Low Fat vs. HF, High Fat) on juvenile European sea bass carcass traits, proximate composition and fillet pH, colour and texture. |
|---------------------------------|-----------------|-----------------|        |
| Carcass traits                  | July 11         | October 10      | P     |
| Weight                          | 304±30          | 412             | 407    |
| Dressing percentage             | 88.4±1.9        | 89.5            | 88.7   |
| Trunk weight                    | 176±20          | 245             | 235    |
| Viscera                         | 5.7±0.7         | 6.1             | 6.0    |
| Liver                           | 5.2±1.0         | 11.1            | 10.9   |
| Celomatic fat                   | 24.4±6.0        | 19.6            | 22.9   |
| Proximate composition           |                 |                 |        |
| Fillet                          |                 |                 |        |
| Moisture                        | 70.6±1.1        | 70.0            | 68.8   |
| Crude protein                   | 20.1±0.4        | 20.7            | 20.6   |
| Ether extract                   | 7.7±1.4         | 7.7             | 8.9    |
| White muscle                    |                 |                 |        |
| Moisture                        | -               | 73.8            | 72.8   |
| Crude protein                   | -               | 21.5            | 21.6   |
| Ether extract                   | -               | 3.0             | 4.0    |
| Raw fillet                      |                 |                 |        |
| pH                              | -               | 6.12            | 6.10   |
| Lightness                       | 42.9±1.7        | 45.7            | 46.2   |
| Redness                         | 1.6±0.7         | 1.2             | 0.7    |
| Yellowness                      | -2.9±0.6        | -3.7            | -3.4   |
| Cooked fillet                   |                 |                 |        |
| Lightness                       | 84.1±1.2        | 77.6            | 81.4   |
| Redness                         | -1.6±0.3        | 2.5             | 0.5    |
| Yellowness                      | 7.1±0.4         | 7.6             | 7.3    |
| Cooking weight losses           | 9.0±1.5         | 5.0             | 6.4    |
| Maximum shear force             | 5.1±0.8         | 7.8             | 6.0    |

†: P<0.10; *: P<0.05; **: P<0.01. Data represents means of 30 fish for carcass traits, 18 for proximate composition and 12 for reological traits.

Fat, EE = 24.6%), and consequently increasing Nitrogen-free extract (NFE) percentage. Gross energy ranged from 21.4 to 22.5 MJ/kg. Fish were handled until visual satiety and the administrated feed was daily recorded. At the beginning and at the end of the trial samples of fish (n=30 for each dietary thesis) were caught according to mean body weight. After dissection, the weight of body fraction was recorded. Whole body fish and skinned flesh (fillet and white dorsal muscle) were submitted to proximate composition analysis (AOAC, 2000). Raw fillet pH was determined 24 h post mortem. After exposition of trunks to air (1 hour at 2±1°C), raw fillet instrumental colour was determined by Hunter-L*a*b* system. After cooking during 25 min at 70°C, trunk cooking losses were recorded (Lopparelli et al., 2004). In cooked fillet, colour and instrumental tenderness (Maximum Shear Force) were also assessed. According to a monofactorial design, data were submitted to ANOVA within PROC GLM of SAS (1999).
formances (108 vs. 103 g of weight increase) were observed throughout the feeding experimental period. Final body weight was not affected by dietary crude fat level as reported in table 1.

Dressing percentage was significantly higher for LF fish than HF ones. The result was probably due to a significant different coelomatic fat amount (19.6 vs. 22.9 g; P<0.05), which represents a not edible fraction. Higher dietary lipid level induced fat deposition, especially around viscera (coeloma cavity). The reduction of dietary fat was associated to a lower crude fat concentration of whole body (16.1 vs. 17.6%; P<0.05 – data not tabulated). On contrast, whole body humidity decreased on HF diet-fed fish, meanwhile crude protein (CP) content was similar between dietary theses. Fillet and epiaxial white muscle weights were not influenced by diets. Moreover, proximate composition of fillet showed also a higher amount of lipids on HF diet-fish (table 1), indicating that a partial substitution of dietary lipids with carbohydrates reduced intramuscular adipogenesis too. Flesh lipid data were influenced by diets. 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Higher dietary lipid level induced fat deposition, especially for eicosapentaenoic (20:5n-3) and docosahexaenoic (22:6n-3). Raw fillet colour showed no differences between dietary theses, except for a* (redness). After cooking, HF-fed fish showed a fillet characterized by a higher L* (lightness) and a lower a* (redness). Decrease on texture of cooked fillet but not its cooking losses.

Financial support by MIPAF – Direzione Generale della Pesca e dell’Acquacoltura (Project 5C 137).

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