SELECTED NUTRIENT CONTENTS AND RETENTIONS IN REARED EUROPEAN SEA BASS (*Dicentrarchus labrax* L.)

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Background and objectives

European sea bass (*Dicentrarchus labrax* L.) is one of the most intensively farmed species in Mediterranean countries (Basurco and Abellán, 1999). This success notwithstanding, an almost total lack of data is evident as to nutrient contents in cooked sea bass flesh, and consequently no figures are available about their retention values upon cooking.

Retention values for any nutrient in fish flesh are quite readily and easily attainable following the suggestion of Murphy *et al.* (1975), as long as large size fish are examined and the "twin fillet" approach adopted (i.e. the use of one fillet as a raw control, while its counterpart is cooked). When only portion-size fish are available, as usually is the case with reared sea bass, two or more subsamples have to be drawn from a well-mixed batch, one of them serving as the raw control, the other/s being allocated to one or more cooking methods (Murphy *et al.*, 1975).

This up-to-now rarely used procedure was implemented and tested in the present study, whose main goal was to determine both contents and retentions of proximate and selected minerals in the flesh of reared European sea bass cooked with several methods.

Methods

Ten freshly caught batches (20 fish each) of 15-to-16-month-old European sea bass were received on ice in late summer through mid autumn from an intensive commercial fish farm based in Southern Italy, where they had been grown in the same conditions (i.e. kept in the same pond and fed the same commercial sea fish feed up until the time of sampling).

Within batch, the whole, refrigerated, and noneviscerated fish (overall average weight ± s.e. = 312 ± 5 g) were gutted, finned, scaled, and randomly and evenly allotted to one of the following treatment categories: raw, oven broiled (OB, dry heat), baked in Al foil (B, moist heat), or microwaved in a partially covered pan (MW, "combined" heat). All cooking methods were applied up to a final internal temperature of 75°C. Midway through cooking, fish were rotated 180° to assure uniform heating. After cooking, fish were allowed to drain and cool, and total weight losses were recorded.

All fillets from each subsample of fish (i.e. treatment within batch) were ground together and thoroughly mixed to provide a homogeneous composite paste, which was analysed for moisture, protein, ash, and several macro- and micro-elements (Na, K, Mg, Ca, P, Fe, Zn) using AOAC (1995) methods. Total lipids were determined according to Folch *et al.* (1957). True retention (TR) values of nutrients were calculated according to Murphy *et al.* (1975). Data were submitted to within-subjects (repeated measures) ANOVA and, whenever appropriate, to Scheffé *post hoc* test ($P \leq 0.05$).

Results and discussion

On the arbitrary scale proposed by Stansby (1976), the raw European sea bass presently analysed rated as a medium oil – high protein fish (Table 1). The fat content found in raw flesh was remarkably higher compared to those reported by Carnovale and Marletta (1997) for most finfish species caught in the Mediterranean sea, while being similar to the values reported by the same authors for reared sea bass and sea bream.

The selected cooking methods led to different weight losses: OB 14.9%, B 9.4%, and MW 11.6%. On the whole, though, they were rather low; in fact, only for moisture and protein did a generalised and significant change emerge in cooked flesh compared to the raw state. At any rate, the lower cooking losses of B led to significantly higher TR values for protein and lipids with this method compared to the other, a difference which failed to emerge for ash.

The TR coefficients found for protein (Table 1) deserve special attention. Failing all literature references, their values (around 100%, as usually found in muscle foods) represent a sort of benchmark testifying the validity of the procedure presently implemented in place of the twin fillet approach.

Macro- and micro-mineral contents of raw flesh (Table 2) were well within the range covered by most marine finfish (Holland *et al.*, 1993). No statistically significant differences emerged between raw and baked fillets, while oven broiling led to higher Mg and P contents, microwaving to higher Zn levels. On the whole, higher TR values were found for Na, followed by Zn, whereas lower TR values were found for Ca and Fe (Table 2).

The selected cooking methods did not differ as to the retention of each mineral, with the single exception of Zn, which was less retained in OB. By and large, baking in Al foil qualified as the cooking method more able to preserve macro-nutrients in sea bass flesh, when compared with oven broiling and microwaving. As to minerals, baking and microwaving seemed to be slightly more "conservative" than oven broiling.

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Table 1 – Proximate composition (g/100 g flesh) and true retention values (%, in brackets) of raw and cooked European sea bass

Nutrient[1]	Raw fillets	Oven broiled fillets	Baked fillets	Microwaved fillets	MSE[2]
Moisture	71.56 a (n.a.)[3]	69.76 b (83.3) b	69.40 b (88.1) a	70.06 b (86.6) ab	0.60 (8.4)
Protein	19.40 b (n.a.)	22.61 a (99.6) b	22.43 a (105) a	22.05 a (100) b	0.19 (2.1)
Lipids	7.74 a (n.a.)	6.43 b (70.8) b	7.19 ab (84.6) a	6.75 b (77.8) ab	0.37 (53.1)
Ash	1.18 b (n.a.)	1.23 a (89.2) a	1.18 b (91.3) a	1.18 b (88.8) a	0.001 (9.1)

[1] Means on the same row followed by different letters differ significantly ($P \leq 0.05$).
[2] MSE = mean square error.
[3] n.a. = not applicable.

Table 2 – Selected mineral content (mg/100 g flesh) and true retention values (%, in brackets) of raw and cooked European sea bass

Nutrient[1]	Raw fillets	Oven broiled fillets	Baked fillets	Microwaved fillets	MSE[2]
Sodium (Na)	51.86 a (n.a.)[3]	60.23 a (96.9) a	58.38 a (101) a	58.88 a (98.4) a	55.64 (136)
Potassium (K)	360.4 ab (n.a.)	373.9 a (88.0) a	349.4 b (86.4) a	362.3 ab (88.1) a	260 (17.2)
Magnesium (Mg)	30.00 b (n.a.)	32.00 a (90.9) a	30.52 ab (92.3) a	31.28 ab (91.9) a	1.46 (15.0)
Calcium (Ca)	18.64 a (n.a.)	17.63 a (77.7) a	17.68 a (70.6) a	16.72 a (73.8) a	26.17 (225)
Phosphorus (P)	225.0 b (n.a.)	232.6 a (88.3) a	224.3 b (90.6) a	229.3 ab (89.9) a	26.03 (6.3)
Iron (Fe)	0.62 a (n.a.)	0.57 a (76.8) a	0.57 a (82.0) a	0.56 a (83.4) a	0.01 (122)
Zinc (Zn)	0.72 b (n.a.)	0.75 ab (87.6) b	0.77 ab (96.3) a	0.78 a (95.5) a	0.002 (13.6)

[1] Means on the same row followed by different letters differ significantly ($P \leq 0.05$).
[2] MSE = mean square error.
[3] n.a. = not applicable.