Importance of relative levels of dietary ARA and EPA for culture performance of gilthead seabream (*Sparus aurata*) larvae

Grupo de Investigación en Acuicultura

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Introduction

Most marine fish larvae require high amounts of n-3 HUFA (highly unsaturated fatty acids) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Watanabe, 1982; Izquierdo, 1996), while studies focusing the value of arachidonic acid (ARA, 20:4n-6) as an essential fatty acid for marine fish are more scarce (Bessonart *et al.*, 1999; koven *et al.*, 2001; Ganga *et al.*, 2006). The objective of the present study was to determine the effect of different ARA dietary contents at several dietary EPA levels, to better define the importance of this fatty acid as a function of EPA.

Materials and methods

Gilthead sea bream (*Sparus aurata*) larvae (18 days old) were fed eight microdiets with different ratios of DHA, EPA and ARA oils as indicated in Table 1. Survival was calculated by individually counting all the alive larvae at the end of the experiment. Growth (standard length, dry body weight) was determined at the beginning, middle and at the end. Diets were analyzed for proximate and fatty acid composition (Table 2). All data were submitted to one-way ANOVA using SPSS software and means were compared using Duncan's test (P<0.05).

Table 1. Different oil sources (% total ingredients) of the experimental diets.

Diet (EPA/ARA)	EPA45[1]	ARA44[1]	DHA45[1]	Oleic acid[2]
0.3/0.1	0	0	0	14.9
2/0.6	0	0.9	9.2	4.8
2/1.2	0	2	9.2	3.7
3/0.3	2.2	0	8.7	4.0
3/1.2	1.9	2	8.6	2.4
4/0.3	4.5	0	8	2.4
4/0.6	4.5	0.7	8	1.7
4/1.2	4.3	2	7.9	0.7

1 Polaris, Pleuven, France; 2 Merck, Darmstadt, Germany.

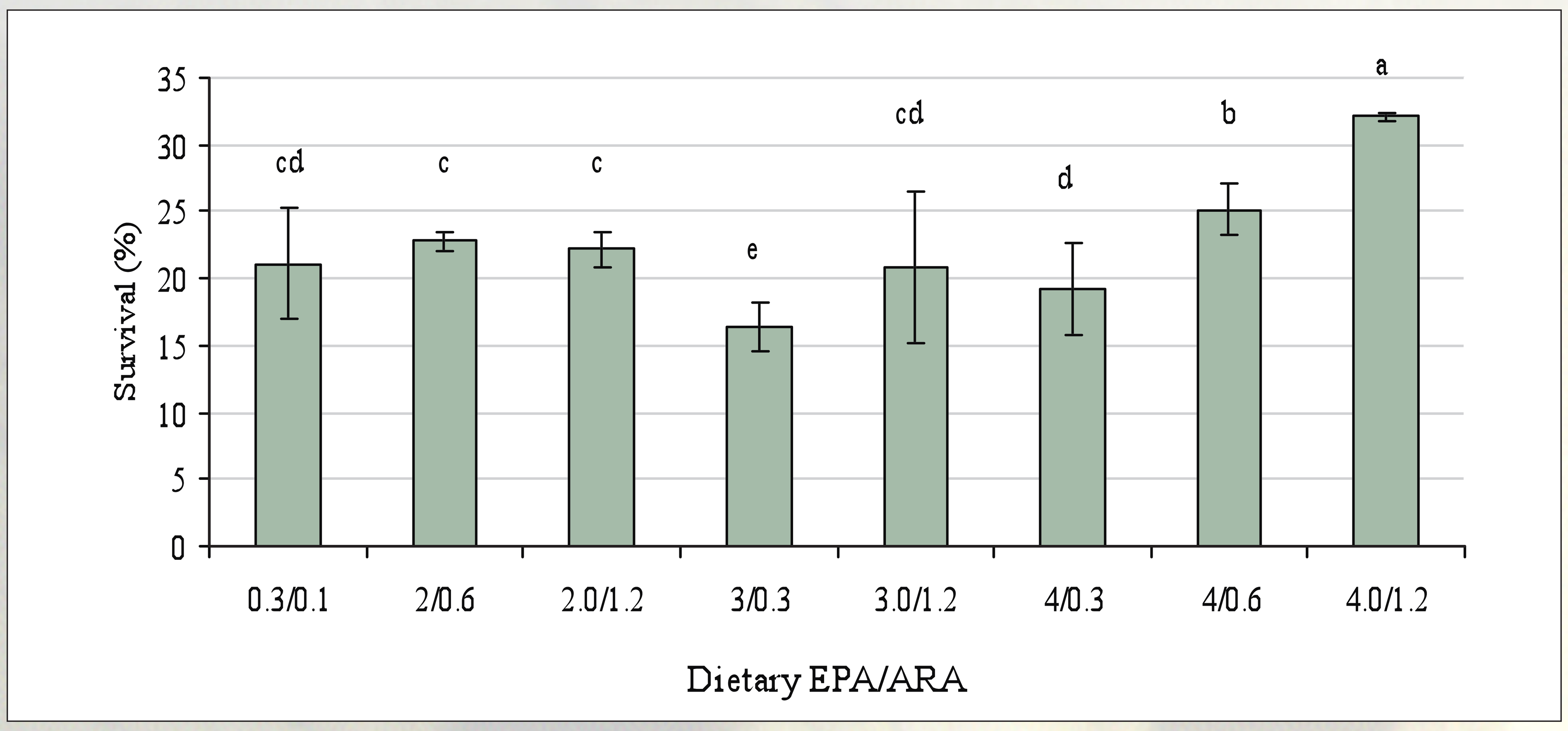
Table 2. Fatty acid composition of experimental diets for larval gilthead seabream (g/100 g diet dry weight).

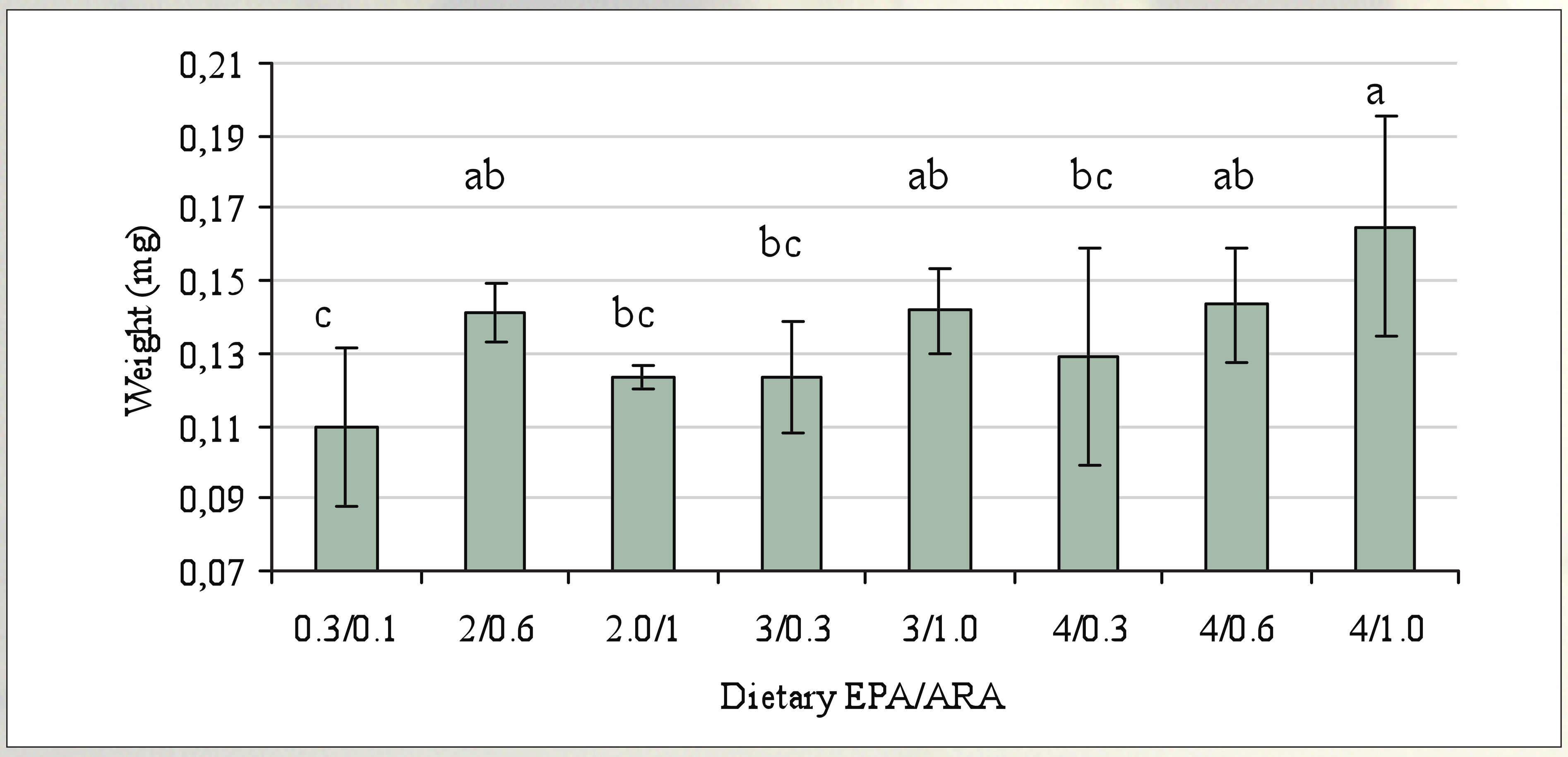
Dietary (EPA/ARA)	0.3/0.1	2/0.6	2.0/1.2	3/0.3	3/1.2	4/0.3	4/0.6	4/1.2
Saturated	2.165	2.316	2.981	2.558	2.776	2.627	2.755	3.117
Monoenoics	14.626	6.997	6.313	6.93	5.301	5.549	4.893	3.989
20:4n-6	0.052	0.609	1.137	0.240	1.159	0.3	0.616	1.251
20:5n-3	0.258	1.839	1.842	2.794	2.679	4.057	3.970	3.867
22:6n-3	0.491	5.154	5.158	5.030	5.143	5.161	5.045	4.925
n-3HUFA	0.749	7.431	7.436	8.333	8.33	9.707	9.63	9.391
ARA/EPA	0.202	0.331	0.617	0.086	0.433	0.074	0.155	0.324
EPA/DHA	0.525	0.357	0.357	0.555	0.521	0.786	0.787	0.785

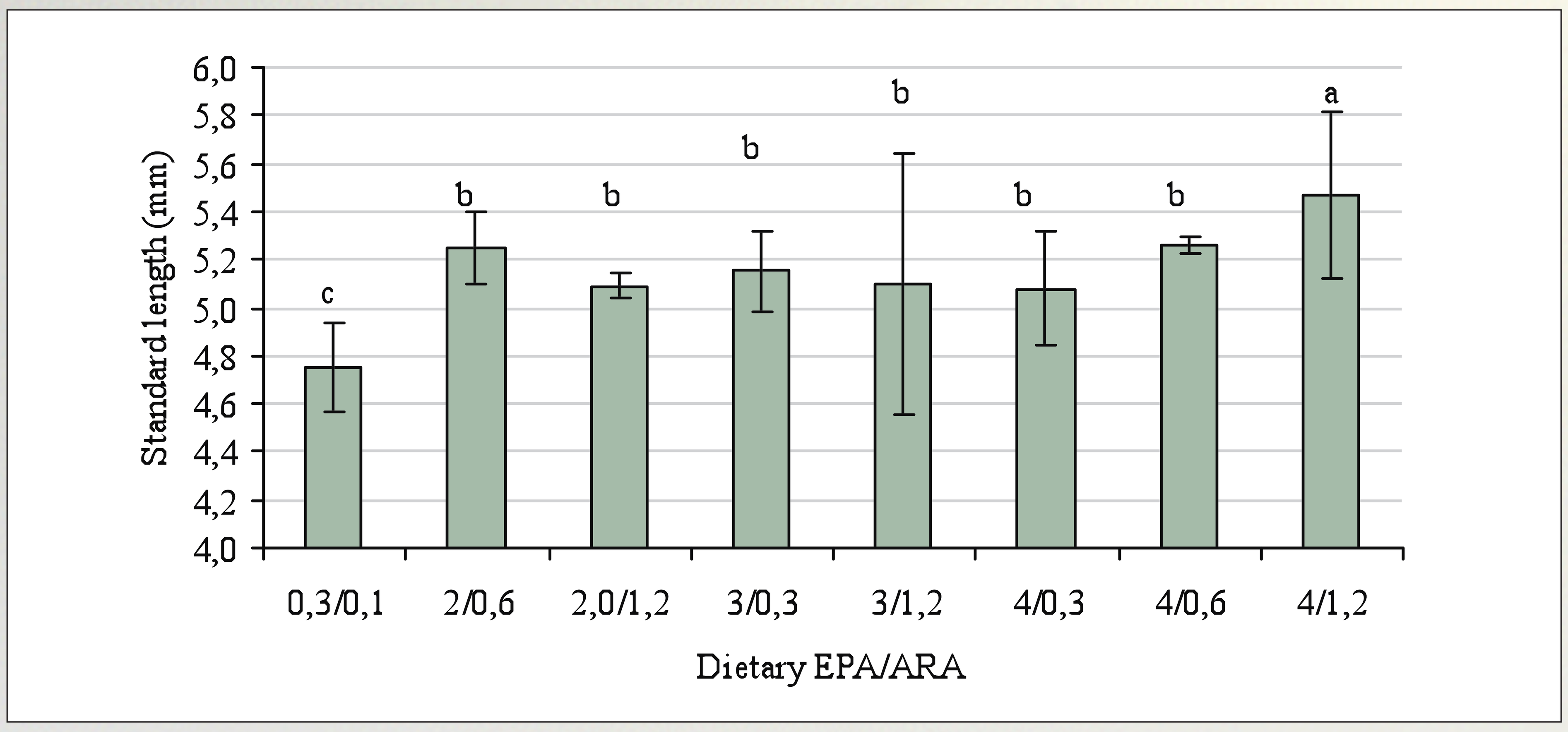
Table 3. Fatty acid composition of larval gilthead seabream (g/100g total fatty acids).

Dietary (EPA/ARA)	0.3/0.1	2/0.6	2.0/1.2	3/0.3	3/1.2	4/0.3	4/0.6	4/1.2
Saturated	28.499	28.398	27.024	26.963	28.575	30.466	29.951	33.933
Monoenoics	37.117	30.297	29.591	30.461	27.968	30.631	27.344	26.964
20:4n-6	3.074	3.609	4.527	3.067	4.582	2.578	3.403	4.776
20:5n-3	3.617	4.105	4.274	5.172	4.625	5.740	5.993	4.547
22:6n-3	13.493	22.072	22.721	22.511	22.540	19.543	22.236	18.463
n-3HUFA	18.392	27.781	28.654	29.595	29	26.86	29.905	24.54
ARA/EPA	0.850	0.879	1.059	0.593	0.9908	0.449	0.568	1.05
EPA/DHA	0.268	0.186	0.188	0.230	0.205	0.294	0.27	0.246

Results and discussion







In the present study, dietary increase of either ARA or EPA alone did not improved survival, whereas the increase in both fatty acids (diets 4/0.6 & 4/1.2) significantly enhanced survival. Larvae fed the diet with the lowest EPA/ARA contents (Diet 0.3/0.1) showed the lowest whole body weight, increase in both EPA and ARA improved growth, when dietary EPA/ARA ratios were higher than 2. Larval standard length followed also a similar tendency, in agreement with other studies which demonstrated the importance of ARA for growth and survival (Watanabe *et al.*, 1989; Bessonart *et al.*, 1999). Generally, fatty acid composition of total lipids from whole larval body lipids (Table 3) reflected the dietary fatty acid profiles. Increased ARA in larval lipids was also followed by a reduction in EPA contents when dietary EPA was kept at higher levels (3 and 4 %).

Conclusions

The results of this study have shown that when DHA is not a limiting factor in larval diets, only the increase in both EPA and ARA enhanced growth and survival, suggesting an optimum dietary ratio close to 4:1.2 for gilthead sea bream. Dietary ARA, being more efficiently incorporated into larval tissues may reduce EPA deposition, denoting the competition among both fatty acids.

References

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