Grupo de Investigación en Acuicultura

Growth and fatty acid composition of *Octopus vulgaris* fed different diets based on bogue (*Boops boops*) in comparison to wild individuals

J. Estefanell[1], J. Socorro[1], J. Roo[1], D. Montero[1], M. Ait Chattou[2], H. Fernández-Palacios[1], M. S. Izquierdo[1].

[1]Grupo de Investigación en Acuicultura (ICCM& IUSA) P.O. Box 56, 35200 Telde, Las Palmas, Canary Islands, Spain. • Email: juanestefanell@iccm.rcanaria.es

[2]INRH, Dakhla Regional Centre, Boujador rd, Km. 7, BP. 127 Bis (Civ.), Dakhla, 73 000 (Morocco)

Introduction

Octopus vulgaris is a suitable candidate to diversify marine aquaculture (Iglesias *et al*., 2000; Vaz Pires *et al.* 2004). Actually, wild sub-adults are on-growing in floating cages showing promising results (Chapela *et al*., 2006; Rodríguez *et al*., 2006). Even though octopus industrial development is still limited, mainly associated to the dependence of wild catch individuals for on-growing (Iglesias *et al*., 2007) and a lack of an appropriate formulated diet (García García and Cerezo, 2006). In addition, essential macronutrient requirements for this species are still not well known.

Materials and methods

Experimental conditions

- Wild individuals (n=10) mean fresh weight 2.002 ± 0,604 g, with a sex ratio (M:F; 8:2), were fed *ad libitum* 6 days/week for a six weeks period, in duplicate tanks.
- Four tanks 1.5 m^3, in an open flow-through system (1500 l/h) mean culture Tª = 22.6 ± 0.4ºC and O_2 = 5.9 ± 0.4 ppm.
- Diets:
  - A: 50% bogue* (*Boops* boops L. 1758) - 50% crab (*Portunus pelagicus* L. 1758) on alternate days.
  - B: 100% bogue*

*Discarded bogue from local off shore sea bream cages.

Evaluated parameters

- Absolute Protein Feeding Rate (APFR), Absolute Lipid Feeding Rate (ALFR), Standard Feeding Rate (SFR), Absolute Growth Rate (AGR), Feed Conversion Rate (FCR), Digestive Gland Index (DGI).
- Macronutrient analysis and fatty acids profile of feeds, muscle and digestive gland from 6 individual from each diet and 3 wild octopuses (W).

Results

Table 1 Mean crab-bogue ingested (%), macronutrient composition of diets (% wet substance ± S. D.) and gross energy (GE, kj/100 g. food) (P<0.01).

	Diet A	Diet B
Ratio crab-bogue ingested	65/35	0/100
Total Lipid	1.8 ± 0.1 [a]	3.6 ± 0.6 [b]
Total Protein	15.3 ± 0.2 [a]	19.7 ± 0.5 [b]
Moisture	79.7 ± 0.3 [b]	74.3 ± 1.4 [a]
Ash	2,3 ± 0,04 [b]	1.5 ± 0.1 [a]
Gross Energy	448 ± 9 [a]	619 ± 44 [b]

Table 2 Mean values ± S. D. for every index of each experimental group (P<0.01).

	Diet A fed group	Diet B fed group
APFR (g./day)	59.9 ± 3.9	60.6 ± 2.0
ALFR (g./day)	7.2 ± 0.6 [a]	11.1 ± 0.4 [b]
SFR (%)	2.42 ± 0.19 [b]	1.90 ± 0.09 [a]
AGR (g./day)	17,1 ± 14.8	18.2 ± 4.3
FCR	4.75 ± 0.02 [b]	2.30 ± 0.25 [a]
DGI	0.89 ± 0.42 [a]	2.29 ± 0.90 [b]

Fig.1 Evolution of crab and bogue ingested in diet A along the experimental period.

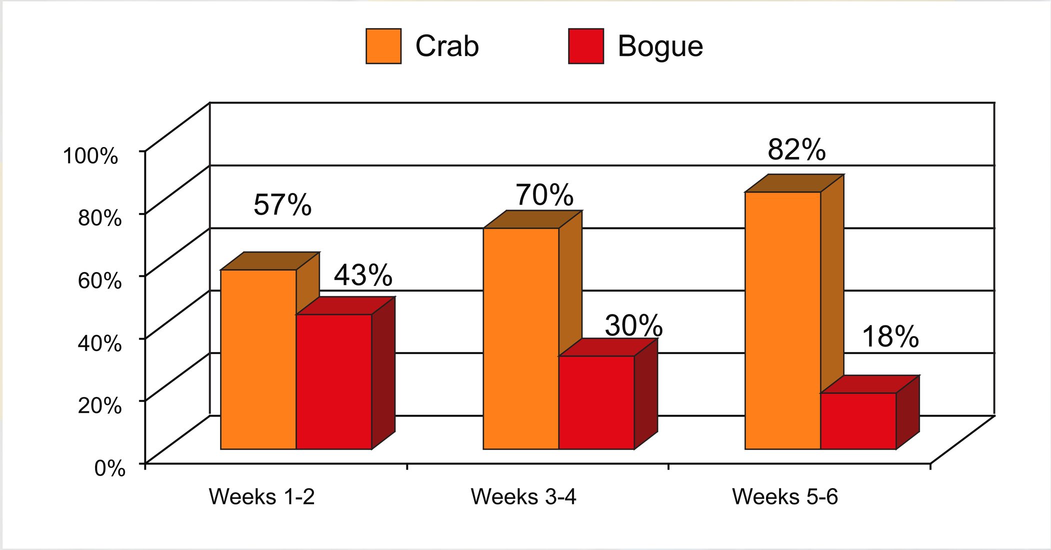

Table 3 Macronutrient composition in muscle and digestive gland (% dry weight ± S. D; P<0.05).

		Wild group	Diet A group	Diet B group
Muscle	Total Lipid	8.54 ± 1.26 [c]	6.29 ± 0.71 [b]	5.69 ± 0.62 [a]
	Total Protein	80.24 ± 1.13 [c]	70.64 ± 4.48 [a]	78.00 ± 2.67 [b]
	Ash	2.15 ± 0.05 [a]	2.46 ± 0.13 [c]	2.33 ± 0.16 [b]
Digestive gland	Total Lipid	25.95 ± 2.12 [b]	18.35 ± 3.38 [a]	37.00 ± 6.38 [c]
	Total Protein	73.90 ± 2.09 [c]	67.71 ± 2.38 [b]	53.51 ± 6.08 [a]
	Ash	1.57 ± 0.12 [a]	2.16 ± 0.27 [b]	1.70 ± 0.18 [a]

Fig. 2 AGR (g./day) along the experimental period.

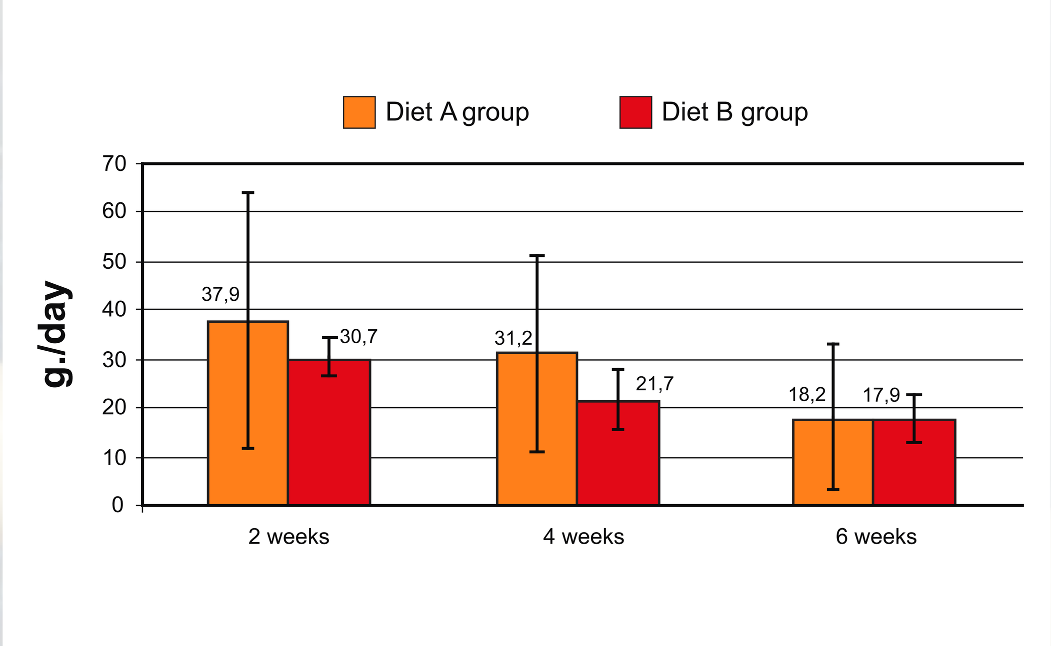

Table 4 Fatty acids profile in feeds, digestive gland and muscle in *O. vulgaris* in wild, diet A fed and diet B fed group (%) (P<0.05)

	Feeds		Digestive gland			Muscle		
Fatty acid	Crab	Bogue	W	A	B	W	A	B
14:00	1,0	4,5	3,9 [b]	2,4 [a]	3,8 [b]	0,7 [a]	1,6 [c]	1,2 [b]
16:00	13,3	18,4	17,4 [a]	15,2 [a]	16,5 [a]	16,9 [a]	22,1 [b]	24,7 [b]
18:00	8,9	5,0	6,9 [ab]	7,5 [b]	5,7 [a]	6,4 [a]	7,9 [a]	7,4 [a]
18:1 n-9	14,3	20,0	13,4 [a]	12,3 [a]	13,9 [a]	8,9 [a]	15,1 [b]	14,9 [b]
18:2 n-6	2,3	13,94	7,1 [a]	3,7 [a]	11,3 [b]	1,0 [a]	1,0 [a]	1,1 [a]
20:4 n-6	9,9	0,7	5,4 [a]	14,0 [b]	3,4 [a]	12,9 [a]	12,5 [a]	9,8 [a]
20:5 n-3	11,8	5,2	5,6 [a]	6,1 [ab]	7,5 [b]	10,3 [b]	5,5 [a]	7,0 [a]
22:6 n-3	13,9	9,7	16,4 [a]	15,3 [a]	13,4 [a]	24,1 [b]	11,5 [a]	12,0 [a]
Saturates	25,8	28,9	30,4 [a]	26,4 [a]	27,2 [a]	26,3 [a]	35,2 [b]	36,6 [b]
Monoenes	23,2	32,3	23,9 [ab]	22,0 [a]	25,7 [b]	15,2 [a]	22,9 [b]	22,5 [b]
n-3	31,1	19,9	27,8 [a]	27,7 [a]	26,8 [a]	39,2 [b]	22,1 [a]	23,6 [a]
n-6	14,2	15,5	15,8 [a]	21,1 [b]	18,7 [ab]	17,1 [a]	17,2 [a]	14,7 [a]
n-9	14,8	22,5	15,4 [a]	15,6 [a]	17,0 [a]	11,7 [a]	19,3 [b]	18,9 [b]
n-3 PUFA	27,6	17,3	24,5 [a]	23,2 [a]	23,5 [a]	36,1 [b]	18,1 [a]	20,2 [a]

Discussion

Final growth were similar to obtained by Socorro *et al.* (2005) feeding octopus with discarded bogue but higher than reported by García-García and Cerezo (2006) and Estefanell *et al.* (2006) when wild bogue was used as food.

ALFR, was higher in diet B according with the higher lipid content of this diet, in addition, a lower SFR and FCR was obtained in octopus fed with diet B. Despite a selective ingestion of crabs instead of bogue was observed in Diet A, no significant differences were observed in AGR (Figures. 1,2).

Macronutrients composition of muscle and digestive gland from both diets, significantly differs from the wild octopus. However, according with Rosa *et al.* (2004) DG showed higher lipid and lower protein content than muscle regardless of dietary treatment.

In general, FA content of DG and muscle did not differ among diets, but clearly differ from wild FA profile in these tissues. However, Araquidonic acid content of both Muscle and DG of octopus fed Diet A were higher than diet B, this fact could be associated to the higher ARA content observed in crabs (Iglesias *et al*., 2007) and more similar to wild octopus ARA content.

Conclusions

Used of discarded bogue as single food for Octopus on-growth results in similar growth than co-fed diets with the crab (*Portunus pelagic)*.

FA content of Muscle and DG showed important ARA content, suggesting the important functions of this FA in this specie.

Acknowledgements

This work was financed by JACUMAR Spanish National Plans for Aquaculture.

JACUMAR

Bibliography

- Chapela, A., González, A.F., Dawe, E.G., Rocha, F., Guerra, A., 2006. Sci. Mar. 70, 121–129.
- Estefanell J., Socorro J., Roo J., Martin, A, Fernández- Palacios H., Izquierdo M. S. 2006. Actas del XI Congreso Nacional de Acuicultura, 675-678
- García García, B., Cerezo Valverde, J., 2006. Aquaculture 253, 502–511.
- Iglesias, J., Sánchez, F.J., Otero, J.J., Moxica, C., 2000. Cahiers Options Méditerranéennes, vol. 47, 313–322.
- Iglesias, J., Sánchez, F.J., Bersano, J.G.F., Carrasco, J.F., Dhont, J., Fuentes, L., Linares, F., Muñoz, J.L., Okumura, S., Roo, F.J., van der Meeren, T., Vidal, E.A.G., Villanueva, R., 2007. Aquaculture 266, 1–15
- Rodríguez, C., Carrasco, J.F., Arronte, J.C., Rodríguez, M., 2006. Aquaculture 254, 293–300.
- Rosa, R., Costa, P.R., Nunes, M.L., 2004. Mar. Biol. 145, 563–574.
- Socorro, J., Roo, J., Fernández-López, A., Guirao, R., Reyes, T. e Izquierdo, M. 2005. Actas X Congreso Nacional de Acuicultura, 428-429.
- Vaz-Pires, P., Seixas, P., Barbosa, A., 2004. Aquaculture 238, 221–238.