FEED INTAKE AND BRAIN LEVELS OF APPETITE CONTROLLING NEUROPEPTIDES IN COBIA IS AFFECTED BY ELEVATED WATER TEMPERATURES


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Introduction
Increased sea temperature due to climate change will affect the physiology, behavior, and geographical distribution of marine species, including fish (Botkin et al., 2007). However, little information is available on the impact of elevated temperature and interactions with appetite, amino acid metabolism and growth in cobia (Rachycentron canadum), a candidate species in aquaculture. This work is part of a larger study aimed to determine whether there is a link and possibly a positive effect between the dietary methionine levels, elevated temperature and feed intake. Here we describe the effects on appetite and mRNA expression of the orexigenic (appetite stimulant) neuropeptide Y (NPY), agouti-related protein (AgRP), and the anorexigenic (appetite inhibiting) cocaine- and amphetamine-regulated transcript (CART) and cholecystokinin (CCK) in cobia brain.

Materials and Methods
The present experiment was carried out at a wet lab of Nha Trang University (Vietnam) for 6 weeks. Juveniles with 3.7±0.4 g BW and 9.7±0.9 cm TL were randomly distributed to 18 experimental tanks (200 l rectangular fiberglass tanks; 60 fish tank-1) and reared at two temperatures (30 and 34 ºC) in recirculation systems (Nguyen et al., 2013). Each of the experimental diets, produced by SPAROS Lda. (Portugal) was randomly assigned to three tanks. Formulations of the experimental diets were modified from Nguyen et al. (2013), and contained 47% protein and 10% lipid. Crystalline methionine was added into the diets, in order to make diets with low methionine level (9.1g kg-1; M9), fulfilled requirement (12.8g kg-1; M12) and surplus methionine (16.8g kg-1; M16) (Zhou et al., 2006). After one week, 44 cobia from each tank were removed for peri-prandial gene expression study (data not shown). Uneaten feed was recorded to determine feed intake (FI). At the end of the experiment, three unfed cobia (pre-feeding) and three fed cobia (postfeeding) per tank were dissected for collecting the brain for molecular analysis at the University of Bergen (Norway). Sampling protocol, cloning and qPCR were described in Nguyen et al. (2013), using EF1 as the reference gene.

Results and Discussion
Dietary methionine and temperature significantly affected FI in cobia. Feed intake in cobia fed M12 and M16 at 30ºC was 1.31 and 1.35 g fish-1 day-1 that were higher than those fish at 34 ºC (1.12 and 1.20 g fish-1 day-1). The lowest FI was recorded in cobia fed low methionine diet (M9) at both temperatures (0.88 and 0.91 g fish-1 day-1), resulting in reduced fish growth (data not shown). Findings from the present study are not in accordance with the results from Wang et al. (2016) that suggested dietary methionine (between 6.2 to14.2 g kg-1 diet) did not affect FI in cobia. Expression levels of brain npy in pre-feeding cobia were higher than postfeeding cobia for all diets at both temperatures (Fig.2A; P<0.01). Nevertheless, higher expression levels of brain AgRP occurred in pre-feeding compared to postfeeding cobia at 34 ºC fed M12 (Fig.2B). There was a significant interaction between dietary methionine and temperature on levels of brain npy (P=0.05). Temperature significantly affected expression levels of CART and CCK (P<0.01). Higher expression levels of CART and CCK, and lower feed consumption in cobia at elevated temperature indicate the involvement of these two neuropeptides in appetite regulation in cobia.

Conclusions
Results from the present study indicate that elevated temperature and dietary methionine deficiency reduced FI in cobia. Elevated temperature and/or dietary methionine affects the expression levels of orexigenic neuropeptides NPY and AgRP. Elevated temperature affects expression levels of CART and CCK, though the role of these two neuropeptides in feed intake regulation in cobia remains to be identified.

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References


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