OSMOREGULATORY, METABOLIC AND ENDOCRINE RESPONSES OF AIR-BREATHING FISH (*ANABAS TESTUDINEUS* BLOCH) TO EXOGENOUS ESTRADIOL-17β

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Introduction:

Estrogens have been shown to affect many physiologic processes in many vertebrates including fishes [1,2]. However, the exact role of estradiol-17β in hydromineral and metabolic regulations in fish is less studied in teleosts particularly in air-breathing fishes. The phylogenetic importance of air-breathing fishes demand a detailed examination of functional role of estradiol-17β as this estrogen has shown more functional diversity in homeothermous vertebrates which are unique with their ability to utilize atmospheric oxygen. Air-breathing as an advanced physiologic adaptation makes these fish more vulnerable and it is probable that these fishes rely on many hormones including estradiol-17β to perform both fundamental and specific functions during their survival in both water and land.

Methods:

The purpose of this study was, therefore, to test the role of estradiol-17β in the regulation of water and mineral balance and metabolic and endocrine status in air-breathing fish, though this sex hormone has specific reproductive functions. To achieve this goal, experiments were designed and the osmotic competence of major osmoregulatory and target organs were studied in the air-breathing fish *Anabas testudineus* Bloch. We quantified Na^+, K^+-ATPase activity in these organs and measured the major electrolytes such as [Na], [K], [Cl], metabolites like glucose and lactate and hormones like E_2, T_3, T_4 and cortisol in the plasma. Appropriate statistical methods (ANOVA with SNK tests) were employed and tested the significance between test and control fish groups.

Results and discussion:

Varied doses of estradiol-17β (E_2) showed dose (2 and 5 µg g^{-1} body wt) and time (24 and 96 h)-dependent actions on the activity of Na^+, K^+- ATPase and the levels of minerals and metabolites. A strong correlation between plasma E_2 and Na^+ K^+- ATPase activity was found in the gills, a major osmoregulatory organ. Lliver and ovary as target organs also responded to E_2 treatment. This suggests that E_2 has a specific osmoregulatory role in this air-breathing fish. The pattern of metabolite and electrolytes in the plasma also responded to E_2 treatment and this point to a coupled action of E_2 with the indices of metabolic and hydromineral regulations. The dynamics of thyroid hormones and cortisol in E_2-treated fish indicates correlations of E_2 with these hormones in the test species.

Conclusion:

Overall, our data provide evidence that estradiol-17β has a fundamental role in and hydromineral and metabolite homeostasis in air-breathing fish. The results also support the hypothesis that the reproductive status of fish contributes to the physiologic performance of fish.

References:

[1]LERNER D.T., BJORNSSON B.T., MCCORMICK S.D. 2007. Environ. Toxicol. Chem., 26, 1433-1440.

[2]MANCERA J.M., SMOLENAARS M., LAIZ-CARRION R., RIO M.P.M.., WENDELAAR BONGA S.E., FLIK G. 2004. Comp. Biochem. Physiol.,139 B:183-191.