EFFECTS OF BENZO[A]PYRENE ON THE EXPRESSION OF CYTOCHROME P4501A1, ESTROGEN RECEPTOR β, MEMBRANE PROGESTIN RECEPTOR α, AND SEX STEROID LEVELS IN CHAMELEON GOBY, *TRIDENTIGER TRIGONOCEPHALUS*

In Joon Hwang (1), Young Don Lee (2), Hyung Bae Kim (3), Hea Ja Baek (1)

(1) Department of Marine Biology, Pukyong National University, Busan 608-737, Korea, Fax: +82-51-6295931
email: fire-joon@hanmail.net
(2) Marine and Environmental Research Institute, Jeju, 695-814, Korea
(3) Department of Marine Bio-resources, Gangwon Provincial University, Gangnung 210-804, Korea

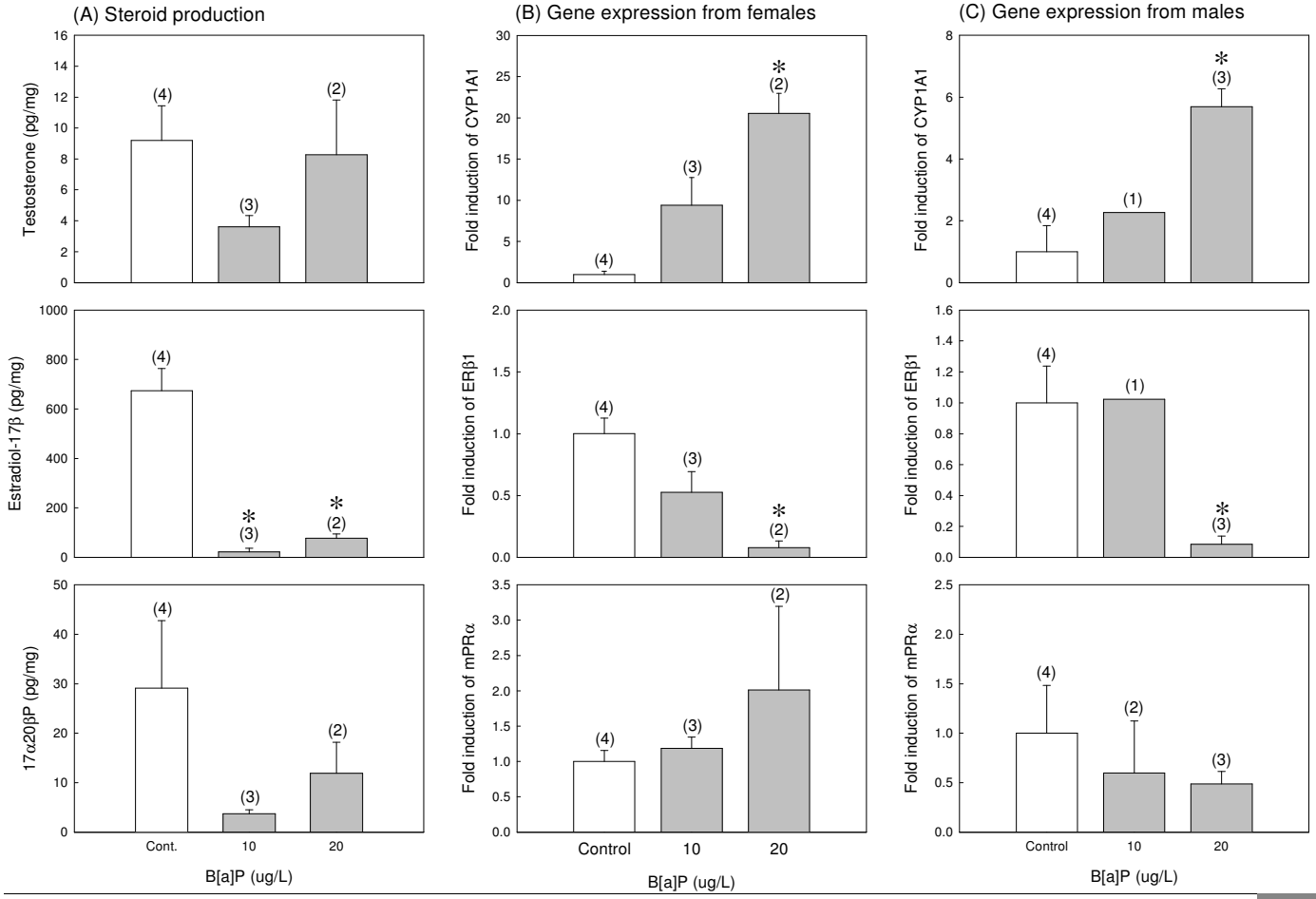
Introduction:

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental contaminants derived from incomplete combustion and crude oil. Benzo[a]pyrene (B[a]P), the representative PAHs, is typically associated with toxicity, B[a]P also has been suggested as endocrine disrupter by negatively impacting reproduction; decrease in egg output, estradiol-17β (E_2) and vitellogenin production. In this study, we investigated the effects of B[a]P on ovarian maturation of chameleon goby, *Tridentiger trigonocephalus*.

Methods:

Matured *T. trigonocephalus* were exposed to waterborne B[a]P (0, 10 and 20 μg/L) for 30 days with renewal rearing condition. After exposure, liver and gonad were fixed, embedded and stained with hematoxylin and eosin for histological observation. Levels of steroids; testosterone (T), E_2 and 17,20β-dihydroxy-4-pregnen-3-one (17α20βP) from ovary were quantified by radioimmunoassay (RIA). As target genes for B[a]P exposure, cytochrome P450 1A1 (CYP1A1) and estrogen receptor β1 (ERβ1) from liver and

Fig. 1. Effects of B[a]P on steroid production from ovary (A), relative expression levels of CYP1A1, ERβ1 from liver and mPRα from ovary (B) and testis (C). Values are mean±SE. Numbers indicated sample size. Data were analyzed using Kruskal-Wallis test and the Bonferroni's adjusment. Asterisks show significant differences from controls ($P < 0.05$).



membrane progestin receptor α (mPRα) from ovary were cloned partially and their expression was quantified by real-time PCR.

Results and discussion:

In histological observations of ovary and testis, there were not any significant differences followed by B[a]P exposure. However, B[a]P caused swelling of lipid droplet from liver in both of females and males. In the production of steroid hormones from ovary, B[a]P significantly decreased E_2 compared to controls. Moreover, B[a]P also decreased the ratio of E_2/T and E_2/17α20βP. Similarly, B[a]P inhibited the aromatase activity in killifish [1] and E_2 production in cuvier [2]. In the transcription of target genes, B[a]P increased transcription of CYP1A1 and decreased transcription of ERβ1 mRNA dose-dependently in liver from females. There were not any significant differences in transcription of mPRα from ovary, although the values were slightly increased with high fluctuation. In males, B[a]P increased the transcription of CYP1A1 and decreased transcription of ERβ1. These results suggested that B[a]P may act as an antiestrogen with inhibition of E2 production and transcription of ERβ1 in chameleon goby. Future study with aromatase activity or vitellogenin production will provide more detailed mechanism of endocrine disruption by exposure to B[a]P.

Conclusion:

The results from this study suggested that ovarian maturation in chameleon goby is affected with increase in transcription of CYP1A1, decrease in E_2 production and transcription of ERβ1 by exposure to B[a]P. Moreover, B[a]P may act as an antiestrogen in the process of maturation of chameleon goby.

Acknowledgement:

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (No. 2010-0017176).

References:

[1]PATEL, M.R., SCHEFFLER, B.E., WANG, L., WILLETT, K.L. 2006. Effects of benzo(*a*)pyrene exposure on killifish (*Fundulus heteroclitus*) aromatase activities and mRNA. Aquat. Toxicol., 77: 267–278.

[2]ZHENG, R., WANG, C., ZHAO, Y., ZUO, Z., CHEN, Y. 2005. Effect of tributyltin, benzo(*a*)pyrene and their mixture exposure on the sex hormone levels in gonads of cuvier (*Sebastiscus marmoratus*). Environ. Toxicol. Pharmacol., 20: 361–367.