THE EFFECT OF TEMPERATURE ON OOGENESIS AND BRAIN GENE EXPRESSION OF HORMONES INVOLVED IN REPRODUCTION AND GROWTH IN THE FEMALE BLUE GOURAMI (*TRICHOGASTER TRICHOPTERUS*)

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Introduction:

The blue gourami (*Trichogaster trichopterus*) female has an asynchronic ovary development and the FOM will occur only in the presence of the male. Thus, each stage of its gonadal development can be controlled and examined separately in the laboratory [4]. Previous studies in our laboratory have shown variations in hypothalamic and pituitary hormonal gene expression during reproduction stages. Gonadotropin releasing hormone 3 (GnRH3), and pituitary adenylate cyclase activating polypeptide (PACAP - long and short form [PRP]) gene expression increased in reproductively active females [5,6], and beta-follicle stimulating hormone (beta FSH) and beta-luteinizing hormone (beta LH) gene expression were increased in females in the vitellogenic stage [4]. Accumulated data indicate an involvement of growth factors in the regulation of reproduction, e.g., growth hormone (GH) and prolactin (PRL) [2, 3]. The present study examined the effect of temperature on reproduction and growth-related factors in blue gourami (*Trichogaster trichopterus*) females under non-reproductive (NRC) and reproductive conditions.

Methods:

The females, maintained in three different containers at the temperatures as described in prevue study [1], gonads were sampled and mRNA levels of GnRH3, PACAP, PRP, IGF1, GH, beta-LH, beta-FSH and PRL were mustered[1].

Results:

A higher percentage of oocytes in the advanced vitellogenic stage was found in FNRC kept at 27 °C than in those kept at 23 °C or 31 °C ($P<0.05$,Fig. 1a). In contrast, in FRM and FNRM, a higher percentage of oocytes at the FOM stage were observed at 23 °C, than at 27 °C (Fig. 1b). In FNRC kept at 23 ºC and 27 ºC, as compared to the group at 31 ºC, significantly higher mRNA levels of brain GnRH3 were detected, whereas no significant differences in the mRNA levels of brain IGF-1, PACAP and PRP were observed in these females at 23 ºC, 27 ºC or 31 ºC. In FRM, mRNA levels of brain GnRH3, IGF1, PACAP and PRP were higher when kept at 27 °C than at 23 °C (Figs. 2A-D). PRP mRNA levels were also higher at 27 °C than at 31 °C in these fish. On the other hand, mRNA levels of PACAP were greater in FNRM kept at 27 °C than in those fish maintained at 23 °C and 31°C (Fig. 2B); and mRNA levels of IGF-1 were higher in the brains of FNRM kept at 23 °C than in those kept at 31 °C (Fig. 2C).

Fig 1. (A) Percentage of oocytes at the advanced vitellogenic stage in adult FNRC ovaries. (B). Females at the vitellogenic stage were separated after an acclimation period of four days and held at 23 °C, 27 °C or 31 °C in the presence of a mature male for one day (mean±SEM; n=15). Different letters above each bar of the histogram denote a significant difference among the temperatures ($P<0.01$, Student's t-test).

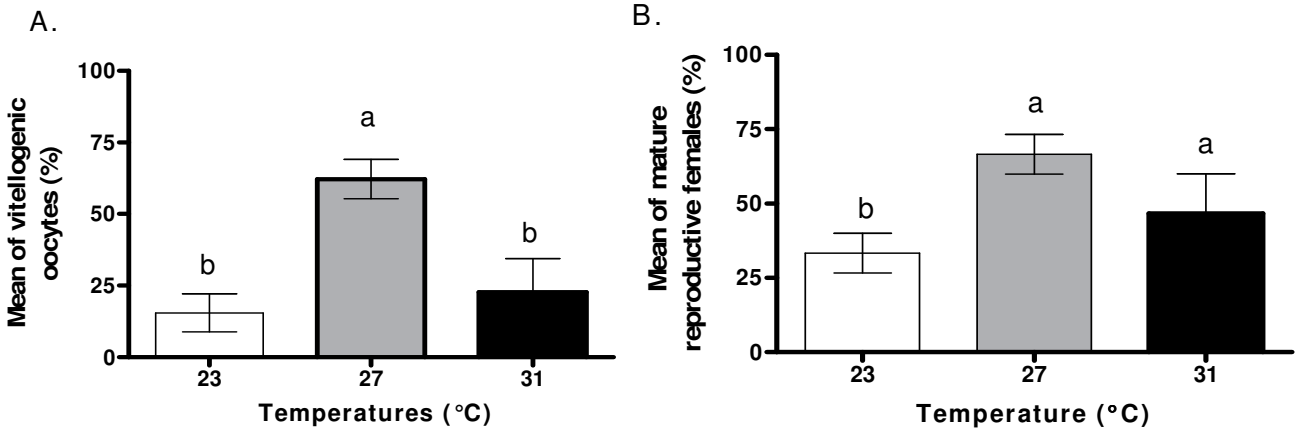
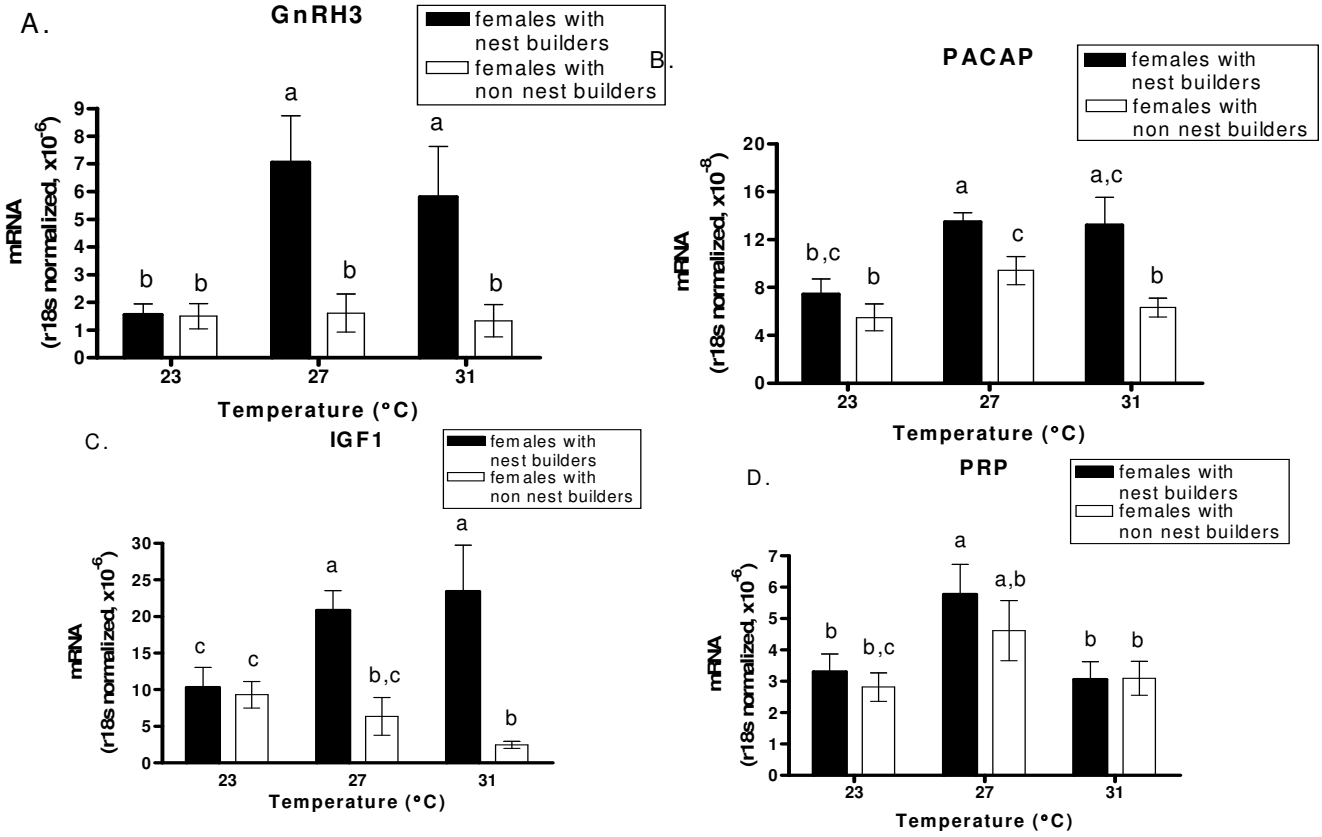


Fig 2. Relative mRNA levels of (A) GnRH3, (B) PACAP, (C) IGF-1 and (D) PRP in brains from FRM or FNRM. Each histogram represents the average of at least five independent measurements (mean±SEM; n=5–9). Different letters above each histogram denote a significant difference among the mRNA levels ($P<0.05$, one way ANOVA, followed by Student Newman–Keuls post-hoc test).



Conclusion:

We propose that in the blue gourami female, vitellogenesis and FOM may be affected by changes in the environmental temperature, through modifications in GnRH3, IGF1, PACAP and PRP gene expression.

References:

[1]DAVID, D., DEGANI, G., 2011. Temperature affects brain and pituitary gene expression related to reproduction and growth in the male blue gouramis, Trichogaster trichopterus. J. Exp. Zool. A Ecol. Genet. Physiol., 313A: 1-11.

[2]DEGANI, G., YOM-DIN S., GOLDBERG, D., JACKSON, K. 2011. cDNA cloning of blue gourami (Trichogaster trichopterus) prolactin and its expression during the gonadal cycles of males and females. J. Endocrinol. Invest., 33: 7-12.

[3]GOLDBERG, D., JACKSON, K., YOM-DIN, S., DEGANI, G. 2004. Growth hormone of Trichogaster trichopterus: cDNA cloning, sequencing and analysis of mRNA expression during oogenesis. J. Aquacult. Tropics, 19(3): 215-229.

[4]JACKSON, K., GOLDBERG, D., OFIR, M., ABRAHAM M., DEGANI G. 1999. Blue gourami (Trichogaster trichopterus) gonadotropic beta subunits (I and II) cDNA sequences and expression during oogenesis. J. Mol. Endocrinol., 23(2): 177-187.

[5]LEVY, G., DEGANI G. 2011. Evidence for a reproduction-related function of pituitary adenylate cyclase-activating polypeptide-related peptide (PRP) in an Anabantidae fish. J. Mol. End., 46: 1-11.

[6]LEVY, G., JACKSON, K., DEGANI, G. 2010. Association between pituitary adenylate cyclase-activating polypeptide and reproduction in the blue gourami. Gen. Comp. Endocrinol., 166: 83-93.