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Matrotrophic transfer of fluorescent microspheres with differing amounts of nutrient resouce in poeciliid fishes: the potential role of β-catenin

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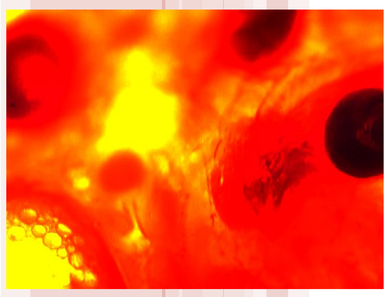

Matrotrophic transfer of fluorescent microspheres with differing amounts of nutrient resouce in poeciliid fishes: the potential role of β-catenin

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INTRODUCTION

❖ Within viviparity there is a continuum from lecithotrophy and obligate matrotrophy. Lecithotrophy relies on yolk reserves for the entire development of the embryo, while obligate matrotrophy requires the transfer of nutrients to the developing young. In between is facultative matrotrophy where nutrient transfer is variable and may entail environmental factors affecting the degree of contribution of maternal nourishment. (DeMarais & Oldis, 2005)

❖ Mosquito fish (*Gambusia affinis*) and guppies (*Poecilia reticulata*) were previously presumed to be lecithotrophs, however, there is evidence suggesting facultative matrotrophy. Variable nutrient transfer seemed to be occurring to select few embryos. (Marsh-Matthews et al., 2001; DeMarais & Oldis, 2005)

❖ The possible mechanism for facultative matrotrophy is unknown since it lacks the elaborate placental-like structure in obligate matrotrophy. However, yolk proteins cross the chorion during egg development via cell processes and these could be the same ones used in nutrient transfer to the embryo. (Constantz, 1989)

❖ β-catenin serves two major functions at the cellular level. It is involved in cell adhesion (insoluble) and regulates specific gene expression by relaying signals to the nucleus of the cell (soluble). It is also present in the ovary and there seems to be a potentially important relationship between β-catenin and matrotrophy. (Ben-Ze'ev et al., 2000)

METHODS

❖ Mosquito fish and guppies were separated into tanks according to a high food and low food feeding schedule. High food tanks consisted of the fish being fed every day, while low food tanks consisted of the fish being fed once every three days.

❖ After two or more weeks of controlled feeding, the pregnant female fish were either, or both:

- Injected with 20 nm fluorescent beads and then left overnight to insure that the beads had enough time to circulate. The fish were then dissected for the purposes of extracting the embryos. These embryos were visualized under a confocal microscope or a fluorescent microscope in the CY3 range.
- Dissected to remove the embryos, which were then ground up and separated by centrifuge. The soluble and insoluble proteins were then run through gel electrophoresis and western blot to analyze the concentration of β-catenin.

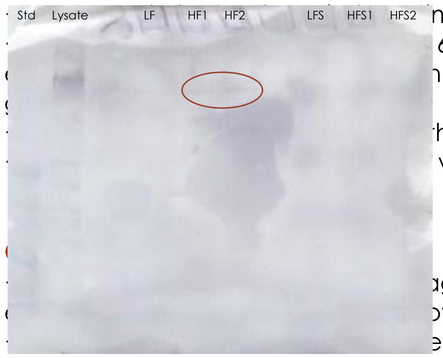
❖ For the benefits of analysis, high and low food fish embryos were compared in similar stages when possible.

Viviparity Continuum

lecithotrophy < facultative matrotrophy > obligate matrotrophy

RESULTS

Mosquito fish



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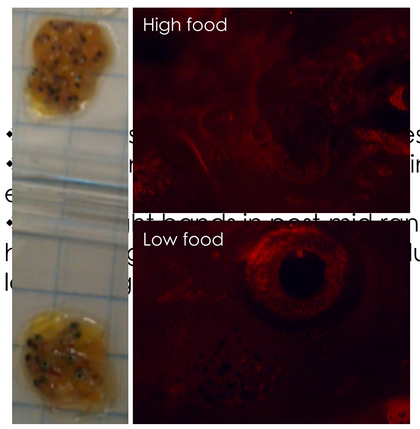

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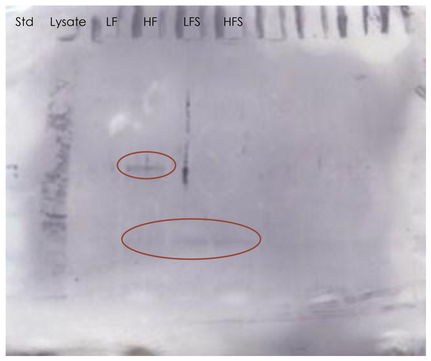

CONCLUSION

❖ The transfer of the fluorescent beads supports previous evidence suggesting that guppies are not lecithotrophs, but are facultative matrotrophs.

❖ There was support for the basis of a connective structure that facilitates nutrient transfer from mother to embryo.

- In mosquito fish, the amount of insoluble β-catenin is greater in high food embryos than in low food embryos.
- In guppies, two proteins of different size are recognized by the β-catenin antibody. These results imply that, the amount of soluble β-catenin is similar in both treatment embryos, but that insoluble β-catenin is greater in high food embryos than in low food embryos. Further protein identification is necessary.

❖ The fact that there were many fertilized eggs in the high food mosquito fish versus fewer fertilized eggs in the low food mosquito fish could have arisen from fewer sperm in the low food male fish, or selective fertilization or embryo reabsorption by the female.

FUTURE RESEARCH

❖ Repeat study to get increased sample sizes and more revealing protein gels.

❖Use confocal microscopy or fluorescent microscopy with a lower power objective to see multiple embryos in one field.

❖ Study the system of nutrient transfer to the egg, pre-fertilization. Looking at soluble and insoluble β-catenin levels would be useful in comparison to embryo nutrient transfer. Also if selective and variable nutrient transfer is seen in both egg development and embryo development, the process/structure of transfer is much more likely to be similar.

❖ Fertilize low food female mosquito fish with high food males.

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