

Rapid growth in adolescence leads to fewer offspring, biologists find

July 20 2010



Guppies are small freshwater fish that have been the subject of long-term studies. Credit: Pierson Hill

University of California, Riverside biologists working on guppies - small freshwater fish that have been the subject of long-term studies - report that rapid growth responses to increased food availability after a period of growth restriction early in life have repercussions in adulthood.

Based on their experiments, the biologists found that female guppies that grew rapidly as juveniles produced fewer offspring than usual.

Study results appear in the August issue of [Ecology Letters](#).

"When food levels increase after a period of low availability, many organisms - including humans - undergo what is called 'catch-up' or

compensatory growth," explained Sonya Auer, the first author of the research paper and a Ph.D. graduate student in the Department of Biology. "This accelerated growth response allows them to catch up, fully or in part, to the body size they would have achieved under more favorable food conditions.

"We found that female guppies that underwent compensatory growth as juveniles produced less offspring than would be expected for their body size relative to females that underwent normal growth as juveniles," she said. "In the ecological literature, however, theory and empirical research have assumed that juvenile compensatory growth has only a positive effect on reproduction - being bigger is better."

"This study is of interest even for human biology," said David Reznick, a professor of biology and Auer's advisor, "because we want to know if there are any such long-term consequences for rapid growth and weight gain early in life."

Auer explained that low early food availability alone does not have negative effects on future [reproductive success](#) in guppies.

"The long-term costs to reproduction we observed in our experiments appear to result from the compensatory growth response," she said.

She offered possible explanations for these results: The compensatory growth phase could be interfering with the development of reproductive structures. It could also negatively affect reproduction if it increases metabolic needs and thereby decreases the amount of energy available for reproduction.

"Our research helps us to better understand how organisms - including humans - respond to changes in their environment, such as [food availability](#), and what the consequences of those responses are," she said.

Results from the study may have important implications for human reproductive success.

"Scientists have known that low birth weight and subsequent compensatory growth in humans lead to juvenile and adult obesity," Auer said. "Adult obesity is linked to problems such as type 2 diabetes. Type 2 diabetes has been linked to problems in pregnancy. However, to my knowledge, no direct link between juvenile compensatory growth and reproduction has been demonstrated until now."

The research was supported by a University of California Dissertation Research Grant, a National Science Foundation Graduate Research Fellowship to Auer and grants from the National Science Foundation to Reznick.

Auer and Reznick were joined in the research by Jeffrey D. Arendt, a research associate, and Radhika Chandramouli, an undergraduate, who work in Reznick's lab.

Study details:

To study the long-term effects of juvenile compensatory growth on later reproduction, the researchers compared different components of reproduction between female guppies that underwent compensatory growth as juveniles (called experimental females) with females that underwent normal, routine growth (called control females). To initiate the compensatory growth response, they placed young guppies on low food for two weeks followed by a return to normal food levels. They measured the guppies' compensatory growth response and then examined effects on reproduction. They looked at effects on the rate of reproduction (how frequently they produced a litter), the size of the offspring as well as the number of offspring they produced in each litter. They looked at effects of reproduction on the first four litters, the first

litter being produced at around 60 days of age and subsequent litters being produced every three weeks thereafter.

Provided by University of California - Riverside

Citation: Rapid growth in adolescence leads to fewer offspring, biologists find (2010, July 20)
retrieved 27 April 2024 from

<https://phys.org/news/2010-07-rapid-growth-adolescence-offspring-biologists.html>

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