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Early adipogenesis contributes to excess fat accumulation in cave populations of *Astyanax mexicanus*

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Abstract:

Cavefish populations of *Astyanax mexicanus* have increased body fat compared to surface fish populations of the same species when fed *ad libitum* in the laboratory. We have previously shown that some cavefish populations display hyperphagia (elevated appetite) to increase food consumption, fat deposition and starvation resistance. However, not all cavefish populations display hyperphagia, yet all previously tested cavefish display elevated body fat levels. Here we have extended this analysis by focusing on visceral fat acquisition in three independently derived cavefish populations. We show that cavefish from two independently derived cavefish populations (Pachón and Tinaja) display increased amounts of visceral adipose tissue (VAT) due to hypertrophy of visceral adipocytes while Molino cavefish display hypertrophy but only slightly elevated VAT levels compared to surface fish. Furthermore, we show that Pachón and Tinaja cavefish develop increased VAT even when food intake is matched to surface fish, suggesting appetite independent mechanisms. We show that in the Pachón population, the differences in the visceral fat in adults correlates with changes in the timing of visceral development, making a developmental contribution likely. Visceral fat development in surface fish starts between 10 and 11 dpf, while in Pachón cavefish, visceral fat cells become visible as early as 8 dpf and develop significantly higher amounts of lipid droplets before surface fish start visceral fat accumulation. We further show that this developmental difference is unique to the Pachón cavefish population, while the Tinaja cavefish population - which displays hyperphagia - starts to develop visceral fat similar to surface fish. We suggest the differences in early adipogenesis in the Pachón population as an additional strategy of increased fat gain in cavefish to adapt to food scarcity.

Keywords

Cavefish, *Astyanax mexicanus*, Visceral Fat, Adipogenesis, Hypertrophy, Obesity, Adaptation

Abbreviations

VAT – Visceral Adipose Tissue, dpf – days post fertilization, QTL – Quantitative Trait Loci

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