

Development of a test method for transgenerational effects of genetically modified crops in food using the zebrafish model

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Ever since genetically modified (GM) crops were introduced, their safety regarding human consumption has been questioned. One of the main concerns is that the current methods for GMO evaluation do not specifically assess effects on embryonic development or reproduction. Therefore, the goal of this study is to develop a new test method, using the zebrafish model, to assess transgenerational effects of GM crops in food.

Since GM maize was selected to develop the test method, the first phase of this study was to determine the maximum percentage of maize tolerable for zebrafish. Fish were fed with 3 controls and 6 experimental feeds ranging from 0% to 25% of non-GM maize. After 4 weeks, growth was slightly decreased when fish were fed with 0% or 25% of maize. The hepatosomatic index (percentage liver weight relative to total body weight) of males was significantly increased when fed with 20% or 25% of maize. Feed digestibility analysis showed a decrease in carbohydrate uptake when fed with an increasing percentage of maize. Based on these outcomes, we selected 15% maize as the maximum tolerable percentage.

Furthermore, it is important that any potential effect of a GM crop is interpreted relative to the natural variation that can be found in response to feeding with non-GM varieties of the same crop species. We therefore fed zebrafish for 12 weeks with 10 different non-GM maize varieties (15%). We observed significant differences for the carbohydrate level in the liver of adult males, for the swimming behaviour of adults and embryos, and for the relative condition factor and length of embryos. These results highlight the importance of defining the natural response variation as even feeding with non-GM varieties can cause significant differences.

Next, a transgenerational experiment was initiated to investigate whether the test system allows us to assess potential transgenerational effects. Fish were fed for 16 weeks with an experimental and a commercial GM maize and their corresponding non-GM controls (15%). No significant differences were observed. We continued by producing the first generation. The next step is to analyse this first generation and produce and analyse a second/third generation.

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