Testing Foods for GMOs and Its Effects

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Introduction

GMOs, or Genetically Modified Organisms have increased in their existence for the last few decades, specifically since 1994, according to the *New York Times*. Genetically modified foods were believed by many to be healthier, more efficient to grow, and lasted longer on shelves, which ultimately resulted in less money spent by the consumer. Through altering the DNA of various food sources, such as cows, consumers were understood to have the best of both worlds. However, in more recent years environmental agencies and health activists have disputed the alleged benefits of GMO foods, saying they're actually unethical, risky, and controlled by corporate interests instead of what's best for consumers and the environment. Because of this controversy, many foods previously containing GMOs have been marked with labels or removed from shelves altogether. In this experiment, six samples from different foods were tested for presence of GMOs. The tested products included: oat grain (labelled non-GMO), frozen meatballs (not labelled), frozen corn (labelled organic), corn puffs (not labelled), Jiffy cornmeal (labelled partially GE), and, again, frozen corn (not labelled). It is predicted that GMO foods will definitely be labelled and those that aren't may or may not have GMOs, since there is no legislation for it. The original hypothesis was that, if the foods have GMOs, then they will be labelled and vice versa. To test this hypothesis, DNA was extracted from each food sample in order to prepare it for the PCR reactions and electrophoresis.

Methods

To begin the experiment, materials were labelled with a specific group number. Test foods were dealt with and tested for GMOs individually and GMO positive and negative control

groups were used to measure the results. The test foods were: oat grain (labelled non-GMO), frozen meatball (not labelled), frozen corn (labelled organic), frozen corn (not labelled), corn puffs (not labelled), and Jiffy cornmeal mix (labelled partially GMO). The experiment consisted of three processes: extraction, PCR reactions, and electrophoresis. PCR has many research and practical applications. PCR is routinely used in DNA cloning, medical diagnostics, and forensic analysis of DNA while Gel electrophoresis is a technique used to separate DNA fragments according to their size (Khan Academy, 2016).

First, one-half to two grams of a certified non-GMO control food was weighed out and put into the mortar. Second, 5 mL of water was placed in the same mortar and the substance was mixed together for exactly two minutes. These three steps were then repeated with each groups specific test food. Then, 50 microliters of both the non-GMO food substance and the test food were placed in their own separate screw caps. These small tubes were placed in a centrifuge balanced conformation for five minutes at 1500 RPM. Lastly, the tubes were stored in a refrigerator at 40 degrees Celsius.

The PCR tubes were labelled with numbers one through six. Using a fresh tip for each addition, a pipette was employed to add 20 microliters of the indicated master mix to each tube, before quickly capping the tubes again and putting them in ice to chill. Three of the tubes received 20 microliters of plant master mix (green) while the other three received the same amount of GMO master mix (red). Tubes one and two then received 20 microliters of non-GMO food control DNA; tubes three and four received 20 microliters of test food DNA; and tubes five and six received 20 microliters of GMO positive control DNA. After, the PCR tubes were placed in the thermal cycler.

For the electrophoresis lab, three percent agarose gel was prepared by mixing three grams of agarose in 100 mL of 1XTAE. Second, 1.5 microliters of EtBr was mixed into the agarose gel in order to help with visualizing DNA at the end of the experiment. The gel was poured into a cast so it could solidify and after it solidified, there were a number of places DNA could be seen. Next, 10 microliters of Orange G loading gel was added to each sample and mixed well. After this, 10 microliters of molecular weight ruler was loaded as well as 10 microliters of each sample into the agarose gel. The gel was then run for 30 minutes at 200 V.

Results & Discussion

The main objective of this experiment was to test which of the six sample foods contain GMOs and which didn't. The original hypothesis was that, if the foods did contain any trace of GMOs, the results would indicate exactly which ones did. There is a chance that the hypothesis was proven wrong, because only one group was shown in the results to contain GMOs, even though three of the food samples were not labelled at all whether they contained GMOs. After DNA extraction, PCR reactions, and Electrophoresis, the results were calculated. A molecular weight ruler was used to compare which food samples lined up to both the GMO negative and GMO positive samples. Results gathered from the agarose gel electrophoresis showed that only one of the six food samples were considered GMO positive, while the rest matched with the negative GMO control group. Figure 1 is a depiction of the results collected in Electrophoresis. The agarose gel solidified and gathered in lines, which show that only one sample lined up with the GMO positive control group.

Only one of the six food samples was determined to be genetically modified, even though one sample (Jiffy cornmeal) was labelled partially GE and three other samples were not labelled at all whether they contained GMO or not. The only sample out of the six to match up with the GMO positive control was sample four, the Jiffy cornmeal mix. One reason that the results did not show these other three samples is that the pictures were inconclusive, meaning that their outcomes were not completely correct or that the PCR reaction did not work for sample four. However, according to Matt Bernstein, Technical Support for MidSci, the fault is less likely to result from failed PCR reactions and more likely has something to do with an internal problem - such as forgetting an ingredient in the reaction mix, an incorrect amount of reactant was used, or primer design. Another reason could be that the only food out of the six to truly have any trace of GMOs was the Jiffy cornmeal, meaning the other five where natural.

Figures

Results 1:

Ruler N N 1 1 2 2 3 3 Ruler Ruler 4 4 5 5 6 6 P P Ruler

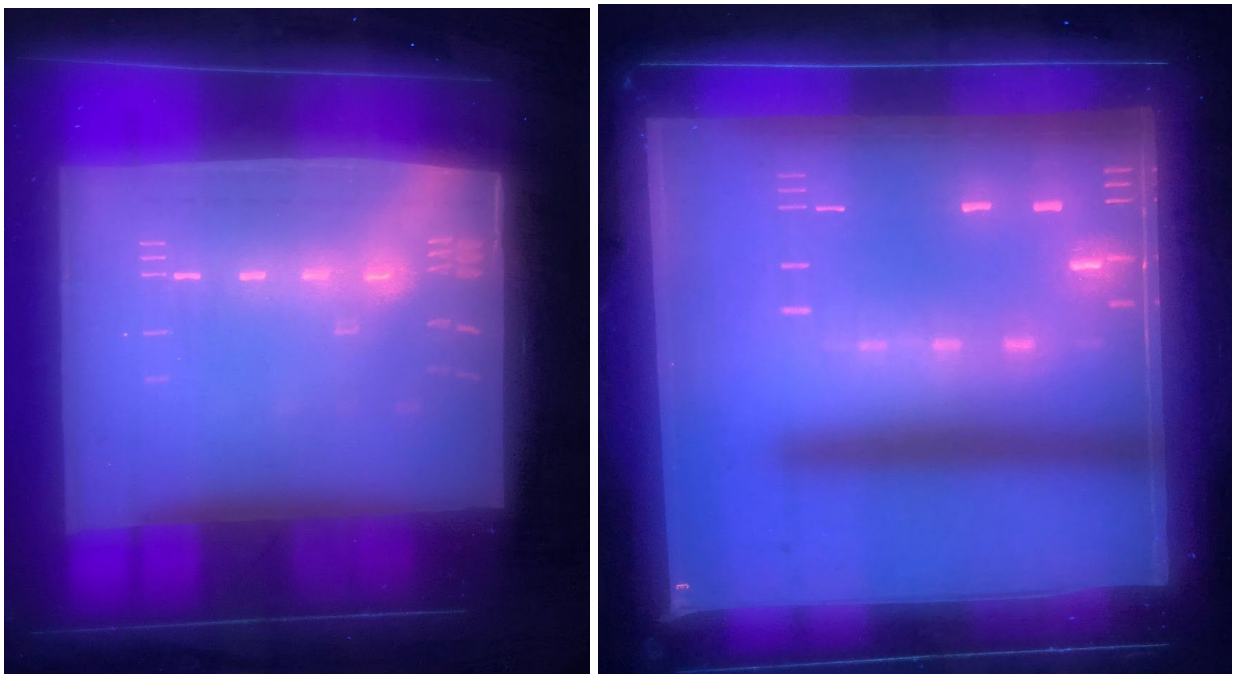

Figure 1: The pictures above show the results from Electrophoresis. The only sample to line up perfectly with the GMO positive control group was sample food 4, which can be seen above in the second picture.

"N" = GMO negative control group

"P" = GMO positive control group

Citations

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