Amount of corn-based processed foods that are genetically engineered

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Introduction

GMOs are organisms that have had DNA injected into them and are created by transferring DNA into their cells (Center for Food Safety, 2022). The goal of creating GMOs is to study and conduct research, and the benefits of doing so include increased crop yields, lower prices, insect protection, and higher food quality (Center for Food Safety, 2022). Corn, papaya, cotton, potato, canola oil, and soybean are the most popular GMOs, and these GMOs may be found in practically every grocery (Center for Food Safety, 2022). The DNA sequencing of plant cells is used to test for the presence of GMOs in food (Wheeler & Kennedy, 2017). The polymerase chain reaction is one of the testing procedures employed, and it is regarded as the most accurate way for testing DNA (Wheeler & Kennedy, 2017).

Genetically modified organisms have been shown in studies to pose significant dangers to human health, plants, animals, and the environment (Center for Food Safety, 2022). The public has been buying and eating genetically modified foods without any labeling, and FDA experts have discovered that these foods can pose serious health hazards (Center for Food Safety, 2022). The Center for Food Safety is working to prevent the distribution of genetically modified crops until they have been thoroughly vetted for human and environmental safety (Center for Food Safety, 2022). According to Pew Research Center, 39 percent of individuals believe genetically modified foods are bad for their health, whereas 16 percent believe genetically modified foods do pose health hazards (Pew Research Center, 2020).

According to the Center for Food Safety, up to 92 percent of corn-based processed foods include genetically modified organisms (Center for Food Safety, 2022). It is estimated that the use of genetically modified foods will increase by roughly 75 percent. (Center for Food Safety, 2022). We examined the foods that were given by extracting DNA, starting a polymerase chain

reaction, and performing an Agarose Gel Electrophoresis to see which of the corn-containing processed goods were genetically engineered. According to the product labeling, 50 percent of corn-based processed food contains genetically modified organisms.

Purpose

Which foods are genetically modified, and which are not, what factor is the best predictor of whether a corn-based processed food contains genetically engineered corn, and which transgene has been introduced into GMO crops are the research questions we investigated.

Hypothesis

According to the product labeling, 50 percent of corn-based processed food contains genetically modified organisms. We were able to tell that three of the foods contained corn by analyzing the product labeling.

Methods

Group 1 acquired four food samples of which were *Quick 5-Minute Grits; Jimmy Dandy;* $0.90; HEB (Food 1), *Red Mill Corn Grits; Bob's*; $3.99; Whole Foods Market (Food 2), *Quick Grits; Minute 3 Brandy*; $1.80; HEB (Food 3), and *Quick Grits; Jimmy Dandy*; $0.94; HEB (Food 4) (Kang, Y., Esmaeiliyan, M., Minard, M., 2022). I experimented with food sample 1 , the Quick 5-Minute Grits Jimmy Dandy, for DNA extraction.

Transferred up to 0.30–0.35 grams of the food sample using a weighing boat (Kang, Y., Esmaeiliyan, M., Minard, M., 2022). Then, used a plastic pestle (Fisher scientific – Part number 14-222-357), once done, poured half of the sand using a weighing boat (VWR – Part number MK706206) into the food sample and grinded again. Following that, a total of 1.0 mL molecular-

grade water (VWR – Part number 95043-414) was added to the food sample at once. For gravity separation, the collecting tube was put on a Styrofoam rack for 5 minutes, allowing the components within the tube to create a slurry layer at the top and a solid layer at the bottom. Following that, 300 microliters of the upper portion was transferred to a 1.5 mL microcentrifuge tube containing InstaGene Matrix (BioRad – Part number 7326030) (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

For conducting PCR, in one tube, 15 microliters of tubulin PCR primer mix (contains required components such as Magnesium, dNTPs, Taq Polymerase, TAGCs) was added, while another tube received the same volume but of 35S PCR primer mix. For each PCR tube, a negative control was set up in which 10 microliters of molecular grade water and 10 microliters of DNA were added to each tube. The PCR tubes were then placed in a thermocycler and heated to 94°C for 2 – 3 hours. The thermocycler has three stages, denaturation at 94 degrees Celsius, annealing at 56 degrees Celsius, and extension at 72 degrees Celsius. The three stages run for a total of 41 cycles. (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

Conducted the agarose gel when the PCR process was completed. Used tape to secure all edges of a casting tray and a comb within the tray for this technique. Measured 1.4 grams of agarose and combine it with 70 mL of 1x TAE buffer to produce a 2 percent gel. At this point, heated the solution for 1 minute until it boiled, then added 5 microliters of SYBR – a harmless dye for the viewing of DNA in an agarose gel, and stir for a few seconds. Following that, poured the boiled agarose into the casting tray, and remove any air bubbles using a micropipette (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

Lastly, for the Agarose Gel Electrophoresis, placed the gel tray in a chamber, filled the chamber with 1x TAE buffer, received 6 microliters of DNA loading dye (Biolabs – Part number

32005). The DNA loading dye was also applied to the 1 Kb plus DNA ladder. After that, 20 microliters of DNA with blue dye was added into each well along with the ladder. The electrophoresis was set up at this point, and the power supply was set to 100 volts for 30 minutes. After that, the gel was carried to a dark room and placed under an ultraviolet illumination visualization device, which causes the DNA to show as a yellow or an orange band (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

In scientific research, bioinformatics is used to do a basic nucleotide search and identify the transgene of modified plants. Following that, demonstrated the complexity of science by accurately interpreting scientific data and doing a literature search on related issues. Following that, we made a distinction between credible and non-credible sources (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

When conducting the BLAST search, opened the website the *National Center for Biotechnology Information*. Once on the website, clicked on Nucleotide BLAST, copied the 35S primer sequence into the search window, chose the search set as "Nucleotide collection(nr/nt) database, optimized for "somewhat similar sequences" by selecting "blastn", clicked on "BLAST. Subsequently, a graphic overview illustrated how significant matches align with the query sequence (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

Afterward, conducted another BLAST search with the 162-basepair product amplified by the primers. Subsequently, pasted the sequence into a word document, disregarded extra nucleotides from the ends, and deleted non-nucleotide characters. Then, copied the amplicon, pasted it into the search window, narrowed the options to Viridi plantae. Last but not the least, searched for the species that may be present in the tested GMO food sample (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

Results

Figures 1 and 2 show the results. F-1, F-2, F-4 Tubulin, Tubulin negative control were the foods that revealed a DNA band, and F-4 35S and 35S negative control did not reveal a DNA band. The presence of DNA bands in the negative controls indicates contamination. Tubulin DNA bands were found in three out of four food samples, while 35S DNA bands were found in one out of four that we tested.

The number of DNA bands present for both PCR primers is determined by the relationship between cycle number, temperature, length, and purpose. Tubulin DNA bands significantly enhanced the number of food samples in which it was found. The effect of DNA bands on 35S was also anticipated to be linear, although it did not start until the cycle number exceeded 41 times.

After performing nucleotides and identifying the transgene of modified plants, illustrating the nucleotide complexity, and accurately interpreting the results, it was determined which transgene had been inserted into the GMO plants. The nucleotide sequences of the modified plant and the transgene are shown in figure 2, and the interpretation of the class results from all eight food samples is demonstrated in table 1.

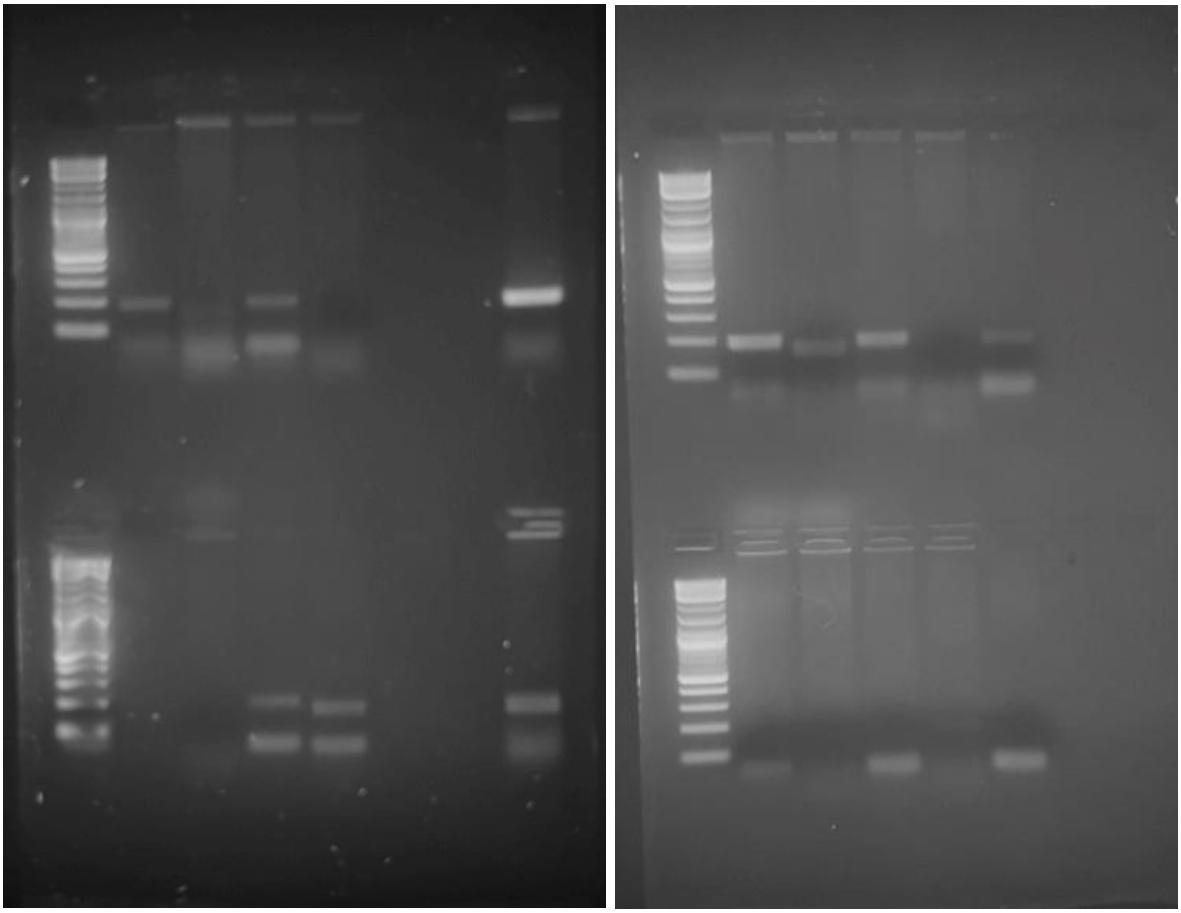

Figure 1. The image to the left is from the first trial conducted and it shows the appearance of DNA bands for the four food samples of Tubulin primer conveying the food samples contained GMOs. The image to the right is from the second trial conducted and it shows the 35S primer indicated contamination for the negative control or showing no band.

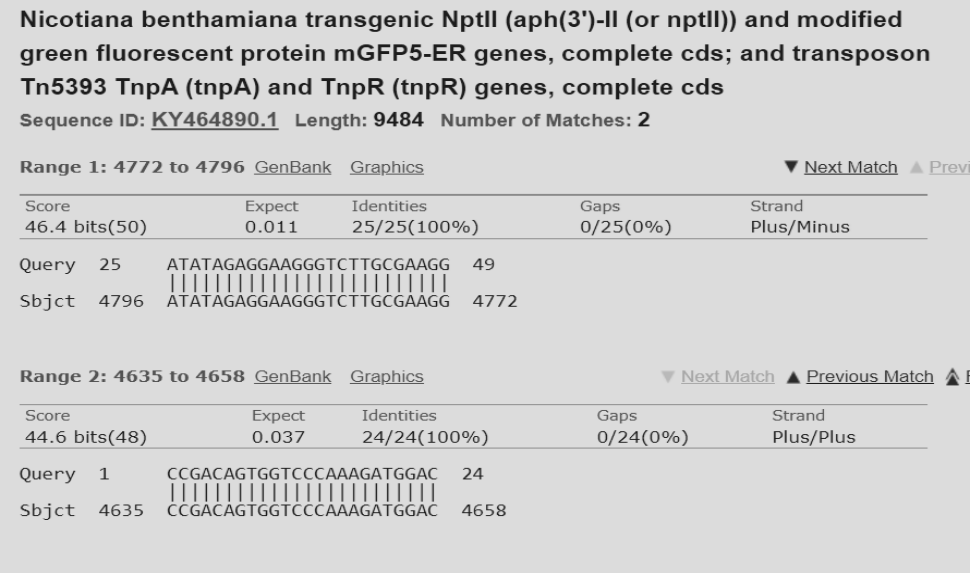

Figure 2. The result of the conducted search was performed in silico during class. The result indicates the nucleotide sequence of the plant, along with the sequence, query, and subject. The formation of the nucleotide sequence enabled the transgenic sequence to be carried out.

Class Results for DNA Extraction, PCR, Gel Electrophoresis

	Tubulin PCR	**35S PCR**	**Interpret Data**
Food 1	Yes	Yes	Positive Control: Both PCRs amplified
Food 2	Yes	No	Positive Control: Both PCRs amplified
Food 3	Yes	Yes	Positive Control: Both PCRs amplified
Food 4	Yes	Yes	Positive Control: Both PCRs amplified
Food 5	Yes	Yes	Positive Control: Both PCRs amplified
Food 6	N/A	N/A	N/A
Food 7	N/A	N/A	N/A
Food 8	No	No	Positive Control: No PCRs amplified, no DNA

Table 1. The table demonstrated above concludes the results of the eight food samples received in class to be performed and the results shown were adapted from conducting the experiment.

Discussion

Genetically modified organism was found in the effects of corn-based processed foods. Tubulin was found in three out of four food samples, indicating that the food contained a genetically engineered organism. Tubulin had a stronger influence on the GMO than 35S, which suggests that the action of genetically modified organisms was working.

My results show that enough DNA was retrieved to identify whether foods included genetically modified organisms, according to my judgment. They became infected regardless of

whether the controls functioned or not. Contamination can happen when more than one food sample is utilized and/or the pipette tips aren't changed, therefore the controls weren't effective.

Following the nucleotide sequence for the plant, the query and subject of the sequence were used to analyze the transgene of the plant. The transgene that had been inserted into the GMO crop was identified by Blast results. It was determined that the food was genetically engineered, therefore the food contained genetically modified organisms, and was of positive transformants when the transgene was revealed.

As per sciencedirect.com, the modified plant nucleotides were sequenced and spliced, resulting in the processing of the transgene *Nicotiana benthamiana,* and providing a simple and reliable method for producing the transgene. (Nicotiana Benthamiana, 2022).

Conclusion

The hypothesis was found to be supported. There were no discrepancies explained by the hypothesis. I would continue the experiment in my profession from here. I'm seeking a career as a Research Lab Assistant, and I'm aware that I'll be dealing with these types of experiments, and now that I have performed them, I am confident in my ability to carry them out.

Due to its genetic material being modified from a gene of a different organism, I do not endorse genetically engineered food. I would rather not eat such foods and endure any health hazards that come with consuming genetically modified organisms. The knowledge gained in this lab will apply to my daily life, allowing me to check the labels on all food products before purchasing them at any supermarket. Although I recognize that I lack the essential tools to conduct an experiment on the food I purchase, however, the labeling of the food product will notify me as to whether the food contains genetically modified organisms.

References

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Revisions

The subsequent sections such as methods and results are where I revised my final report. In the methods section, I explained how many grams of agarose is necessary to produce a 2 percent gel and the names of the four unknown foods we received. In the results section, my professor wanted us to state whether a band was present, and for which of the foods a band was present. By applying the recommendations to my final report, I was able to be more precise in writing and delivering a more detailed report.