



Impossible Burger: Is It Really A Meat-Free

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Abstract

The purpose of the project is to see if the Impossible Burger is really what it claims to be, which is a meat-free burger. For this experiment, we decided to test three different burgers offered at Bareburger, in order to have some controls which included a positive control, the beef patty, a negative control, the veggie burger, and finally the Impossible Burger. Once the DNA was extracted we were able to figure out what was in each DNA sample. Our hypothesis was that the beef burgers would come back positive for animal DNA and the other two burgers would strictly come back with only plant DNA. Our objective was to extract the DNA from these burgers and sequence them to find out what is really in the meat that they are serving. We used a DNA extraction method and an amplification of the DNA to get proper results. After all the extraction, we were able to find DNA for both plant and animal. The plant came back positive in mostly all the different burgers but an unexpected finding came back where there was animal DNA in the Impossible Burger, which is supposed to be only plants. This could mean that either the restaurant may be serving meat in there impossible burger, or the DNA sequence was simply not strong enough.

Introduction

Is the Impossible Burger a meat-free burger? To answer this question we took to comparing three different burgers all sold at Bareburger. The burgers we tested on were: the Impossible Burger, a veggie burger and a regular beef burger. With this, we compared the DNA samples of each patty, once extracted, and really look into the specific species present in each patty. Four meat samples of each burger were collected, only using the patty part of the burger, which resulted in twelve total samples. This was done so that there was a little to no chance of getting no data back from any of the patties. The objective of this experiment is to clearly answer the driving question which is, Is the Impossible Burger really a completely meat-free burger? And by extracting DNA and having some controlled variable to compare the species in all three specimens we have been able to answer that question. Our hypothesis was that the beef patty would contain animal DNA and the veggie burger and Impossible burger would contain plant DNA.



The "Beyond Burger": Our Vegan Control



The "Impossible Burger": Our Suspect



The "Standard Burger": Our Beef Control

Materials & Methods

- 3 burgers from Bareburger:
 - Impossible Burger
 - Veggie Burger
 - Beef Burger
- Tubes
- Tweezers
- PCR Machine
- Distilled Water
- Wash Buffer
- Lysis Solution
- Silica Resin
- Vortex
- Centrifuge
- Pipette
- Incubator
- Gel Electrophoresis Materials

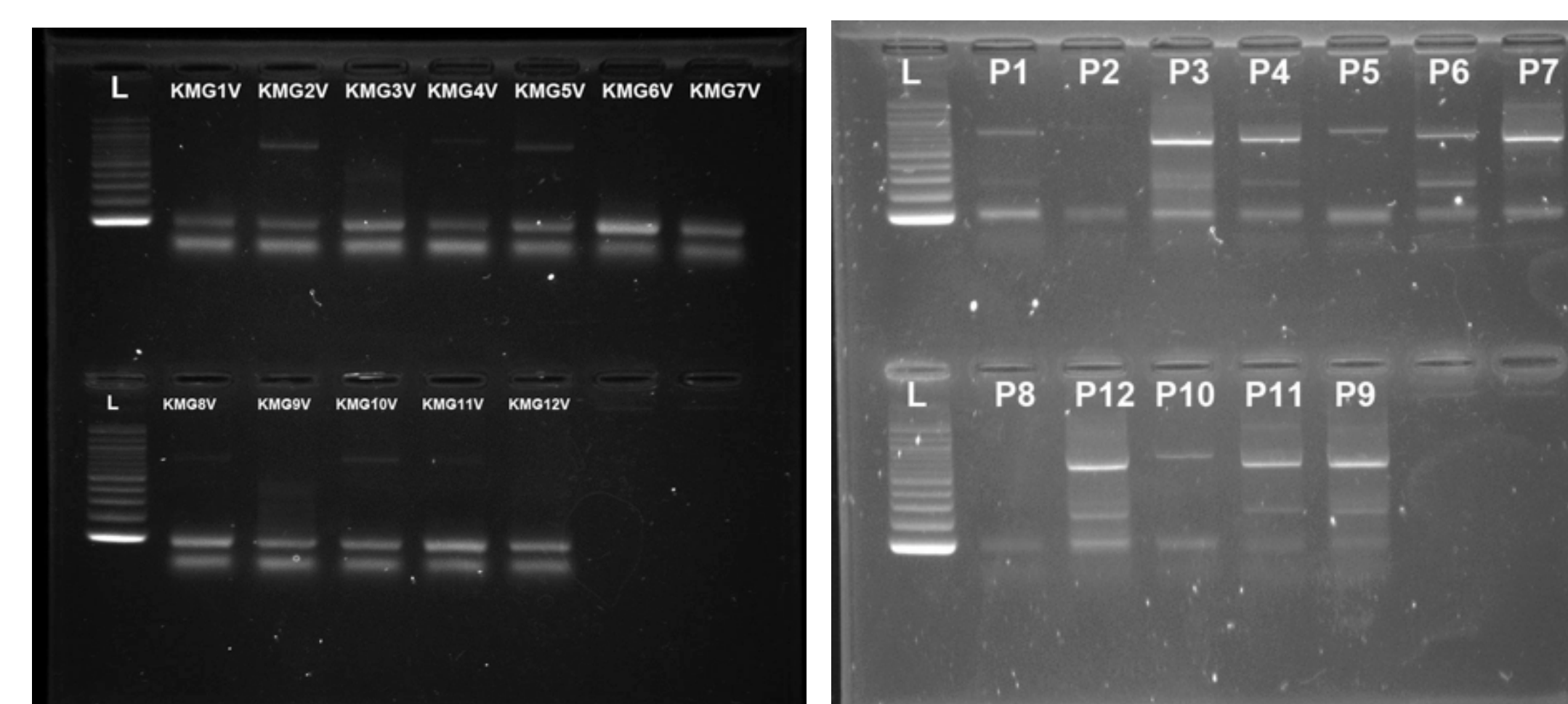
Collecting Samples: In order to find out if the Impossible Burger contains meat, we had to go to Bareburger and ask for a regular meat hamburger (our positive control) and an Impossible Burger (our experimental group). However, the best results would come from an uncooked patty but the restaurant isn't allowed to sell it due to health code regulations. We had to ask for the most rare burger they could make. After the receiving the burgers, we had to separate the cheese, lettuce, and bread from the actual meat using tweezers and scalpels. We then had to get very small samples from the regular hamburger and the Impossible burger. We placed those samples in twelve clean test tubes and labeled them KMG-001 through KMG-012.



DNA Extraction/Isolation: For the DNA extraction, we followed the entire DNA isolation protocol as prescribed by the DNA Learning Center.

Amplify DNA: After we got the DNA, the samples need to be run through PCR. Polymerase chain reaction is a technique that can make multiple copies of DNA. After this is done, we used gel electrophoresis to analyze the DNA samples. This is a crucial step because it validates if we did the DNA extraction correctly and whether the DNA is even usable. After this process is finished, we send the results to a lab where the DNA sequence will be determined and analyzed. We can then view the sequences on DNA subway and see if the Impossible Burger really contains meat.

Sample Number	Species Expected / Location	Species Found / Common Name	e Value
KMG001-p	impossible	N/A	N/A
KMG002-p	beef	N/A	N/A
KMG003-p	veggie	<i>Pisum sativum</i> / Peas	0.0
KMG004-p	impossible	<i>Lactuca sativa</i> / Lettuce	0.0
KMG005-p	beef	<i>Sinapis arvensis</i> / Wild mustard	0.0
KMG006-p	Veggie	N/A	N/A
KMG007-p	impossible	<i>Brassica nigra</i> / Black mustard	0.0
KMG008-p	beef	N/A	N/A
KMG009-p	veggie	<i>Pisum sativum</i> / Peas	0.0
KMG010-p	Impossible	N/A	N/A
KMG011-p	beef	<i>Moricandia sinaica</i>	0.0
KMG012-p	Veggie	<i>Pisum sativum</i> / Peas	0.0
KMG001-v	impossible	N/A	N/A
KMG002-v	beef	<i>Bos taurus</i> / Beef	0.0
KMG003-v	veggie	N/A	N/A
KMG004-v	impossible	<i>Euryzgomatomy s spinosus</i> / Guiara	7e-11
KMG005-v	beef	<i>Euryzgomatomy s spinosus</i> / Guiara	8e-11
KMG006-v	Veggie	N/A	N/A
KMG007-v	impossible	N/A	N/A
KMG008-v	beef	N/A	N/A
KMG009-v	veggie	N/A	N/A
KMG010-v	Impossible	<i>Euryzgomatomy s spinosus</i> / Guiara	1e-11
KMG011-v	beef	N/A	N/A
KMG012-v	Veggie	N/A	N/A



Discussion

Our results answer our question by allowing us to see what burgers are actually made out of, and if it is what the restaurants claim.

The meaning behind the data that we found is that most of the patties came out positive for plant DNA, which is what we were expecting. We found plenty of lettuce, peas, and various mustards. We also found a beef burger that came back positive for cow DNA. This is also something we expected from a beef burger. However we found DNA that was very surprising and not at all what we expected. We found Guiara DNA in the impossible burger and in the beef burger. This DNA comes from a rat species in South America. This type of DNA should not have even come up for a beef burger, so the fact that it also came up in a burger that is supposed to have no meat at all is very shocking. Some may be completely disgusted by this just as we were when we first discovered this, but there may be an explanation. This finding could have been a mistake seeing that the DNA sequence was not that long. The sequence from the burger may have matched up with a part of the sequence in the Guiara's DNA. Our DNA strands may not have been that strong. Either way, this result was completely unexpected. Before building on our findings, it is important to make sure of them. There may have been a few mistakes with the extraction and sample collecting that could be improved. For example, we could try and get raw burgers from the places of they allow us, this would be the ideal circumstance. We could also improve the consistency of the original solution. For many of the solutions, the consistency was almost that of a thick yogurt. We could fix this by putting less of the sample into the tube to really isolate the DNA. From here, we could also experiment with veggie burgers from other locations and find out what is really in them.

References

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Acknowledgements

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