Examining Tapioca for Evidence of Cassava

Junice Caminero, Elani Colon, Megan Navarro, Catherine Rivas and Vince Joralemon (Mentor)

Frank McCourt High School

Cold Spring Harbor Laboratory DNA Learning Center

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Abstract

Tapioca balls are sold in many NYC establishments as accompaniments to teas, and are supposedly made of cassava root (*Mannitol esculenta*). Rumors have swelled that tapioca is in fact made of things like rubber and plastic, and contains no cassava[1]. We wanted to know - what are tapioca balls made of? Do they actually contain cassava? We hypothesized that there would be some cassava DNA found in our samples, but expected that other DNA was likely to be found as well. Our objective was to determine what was actually in tapioca pearls, and to confirm whether or not cassava could be found. Our results were mostly inconclusive, however, we did receive two DNA samples that seemed to have no connection to each other or to cassava. While it is possible that the matching species that we found in our two samples was in the tapioca balls, it is more likely that the DNA was denatured and brought up an incorrect match after sequencing.

Introduction

Tapioca are small pearls that are used to put into drinks. Tapioca is supposed to be made out of an edible starchy tuberous root named cassava. In a recent review of Tapioca factory workers, when asked what was included in the tapioca balls, most of them said either starch or potato or that they didn't know but as odd as it sounds an employee claimed that they were chemically made at a factory. This is a very important issue because we are putting many lives at risk if it is true that tapioca is made of potentially dangerous materials, so we have to be able to identify if this claim is actually true.

Tapioca is supposed to be made of cassava. Cassava is a gluten-free plant.

Although DNA barcoding is not useful to identify if there is any type of rubber or plastic, it can help us identify other plant or animal species. If we did find plant or animal species other than cassava it might indicate that cassava and tapioca is being replaced with less expensive ingredients like gluten, wheat, or corn. Before beginning our research, we hypothesized we would be successful at being able to find cassava DNA in several samples of tapioca pearls.

Materials & Methods

We went to locations and asked if we were allowed to have just a cup full of tapioca balls and if not we then asked if we could have some type of bubble tea that doesn't have any additives that we may not want when testing them. It was important to make sure the bubble tea doesn't have any unnecessary additives due to the fact that we might have come across some of the other DNA present in this experiment.

Storage: Upon receiving the bubble tea we took the bubbles out of the cup and and placed them into a sterile ziplock bag with a label of the store name and geographic location (including longitude and latitude).

DNA Barcoding: Once the tapioca had been procured and stored, we transported them to the Harlem DNA Open Lab in sterile tubes. We then followed the rbcl isolation technique, and compare sequences on DNA Subway according to the DNA Barcoding protocol. We conducted a rbcl gene sequencing to find potential plants (cassava and otherwise).

Results

During this experiment we only found results in 2 samples out of 20. One sample was *Sorbus Psuedofennica* and the other sample was *Quercus.* These two finding were distantly related to cassava.

Tables & Figures

All Sample Results

Store Identifier	Sample DB Code	Plant DNA Present?	Store Identifier	Sample DB Code	Plant DNA Present?
Store 1	KKG-001	Yes	Store 11	KKG-011	No
Store 2	KKG-002	No	Store 12	KKG-012	No
Store 3	KKG-003	No	Store 13	KKG-013	No
Store 4	KKG-004	No	Store 14	KKG-014	No
Store 5	KKG-005	No	Store 15	KKG-015	No
Store 6	KKG-006	Yes	Store 16	KKG-016	No
Store 7	KKG-007	No	Store 17	KKG-017	No
Store 8	KKG-008	No	Store 18	KKG-018	No
Store 9	KKG-009	No	Store 19	KKG-019	No
Store 10	KKG-010	No	Store 20	KKG-020	No

Positive Sample Results

ID	Top BLAST Result	Common Name	Aln. Length	Bit Score	e	Mismatches
KKG-001	Sorbus pseudofennica	Arran-Service Tree	419	682	0	23
KKG-006	Quercus sp.	Oak	408	682	0	11

Discussion

Our results indicate that cassava is likely difficult to extract from tapioca using the DNA Barcoding process tried in this procedure. We think it is unlikely that KKG-001 is *Sorbus psuedofennica*, as that species is endangered. We also think it is unlikely that KKG-006 is *Quercus*, because the DNA was of such low quality that it is more likely to have been analyzed as *Quercus* due to denatured DNA.We believe tapioca was difficult to extract DNA from for several reasons. One reason is that the balls are highly processed, meaning they are heated continually in their production, which would denature the DNA. Another issue is that cassava is a root, meaning it does not have a lot of chloroplasts, and the gene we were looking at, rbcl, is found primarily in chloroplasts. The final issue is that tapioca balls contain other additives that might present other DNA that could have given us our results. These results are important because we did not find a single positive cassava DNA sample. The expectation in place when we started was that we would find cassava DNA. However, after 20 samples, we were left with no cassava DNA, and left with

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