



To What Extent Are the Ingredient Labels of Herbal Supplements Accurate?

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Abstract

In America, obesity is an epidemic: more than half of the adult population are either overweight or obese (68.6%) (“Overweight and Obesity Statistic”). This has lead to the increase in advertising for a variety of weight loss products, such as herbal supplements. In the last decade, there have also been claims of companies not being completely truthful with regards to the ingredients in their products. We hypothesize that several popular products that claimed to be miracle weight loss products did not contain any DNA extract from the plant they were supposed to be derived from. In order to ascertain whether the hypothesis was accurate, various methods and techniques introduced by *DNA Barcode 101* were used on herbal supplements said to contain *Garcinia cambogia*, acai, or green coffee bean extract. However, we were unable to come to a certain conclusion since several of our samples lacked sufficient DNA. A possible reason as to why a conclusion cannot be reached is due to the fact that DNA in supplements might be too processed to extract DNA from.

Introduction

- In New York City, more than half of adult New Yorkers are overweight (34%) or obese, which makes up 22% of the population, (“Obesity”).
- With the society’s pressures of a perfect body and the health effects, the weight loss industry has taken over- introducing new methods of losing excess weight with the use of a pill.
- There were reports regarding these pills that demonstrated some companies are adding ingredients that are not meant to be consumed or not including the active ingredient of the supplement at all, leading to potential health problems of the consumer. These instances have included big name companies such as Walgreens and GNC (*CBS News*).
- We hypothesize that *Garcinia cambogia*, *Euterpe olceracea* (acai), and *coffea arabica* (green coffee beans) extract (the three ingredients that are being tested) will not be present in some of the herbal supplements.
- This experiment is important to conduct since the health of the majority of New York are at stake, based on whether or not these three active ingredients (that are effective in weight loss due to having an antiobesity effect) are present and what is present (other than these plants).

Materials & Methods

To determine whether or not the supplements contained the main ingredient, DNA was extracted and amplified from the herbal supplements. In the laboratory, we used the *DNA Barcode 101* procedure.

Throughout the experiment, we conducted 3 trials in which we extracted DNA from each herbal supplement in order to maintain accuracy. In order to retrieve the medicine, each product was ordered from local pharmacies. Each herbal supplement was given a name (YE- #), and was documented in the journal, along with the name of the supplement and the company.

When the analyzed DNA strand was sequenced through the DNA Subway, the sequence was cross referenced to other plants in order to see the similarities between the two. If the medicine is proven to have a similar DNA structure to the alleged plant the companies claimed to have, then the ingredient labels of the supplements would be accurate.

Results

Out of 8 samples, there were only two samples that proved to be successful in the DNA extraction process: YE-05 and YE-08.

According to DNA Subway, YE-05 is closely related to *Oryza sativa*, *Leersia japonica*, *Grespania circinata*, and *Panicum repens*. While YE-08 contained DNA that is similar to *Syringa vulgaris*, *Schrebera alata*, and *Notelaea ovata*.

Both of these samples, YE-05 and YE-08, have claimed to contain *Garcinia cambogia*. However, looking at the highest matches (listed above), there is no sign of such plant present in the herbal supplements. Instead, the pills contain other types of plants that has no connection to weight loss.

Chart 1:

Accession #	Details	Aln. Length	Bit Score	e	Mis- match
gi 90826683 gb KF827660	<i>Oryza sativa</i>	570	1002	0.0	5
gi 341872943 gb HQ600421	<i>Leersia japonica</i>	73	78.8	3e-11	6
gi 144583403 gb EF125080	<i>Greslania circinata</i>	73	78.8	3e-11	6
gi 270155967 gb GU135141	<i>Panicum repens</i>	73	78.8	3e-11	6
gi 387912196 emb FN870396	<i>Leersia oryzoides</i>	73	78.8	3e-11	6
gi 407724273 emb HE577876	<i>Oryza coarctata</i>	73	78.8	3e-11	6
gi 57283776 emb AJ746179	<i>Arundinaria tecta</i>	73	78.8	3e-11	6
gi 57283811 emb AJ746266	<i>Fargesia dracocephala</i>	73	78.8	3e-11	6
gi 57283819 emb AJ746270	<i>Oligostachyum oedogonatum</i>	73	78.8	3e-11	6
gi 57283833 emb AJ746277	<i>Yushania maling</i>	73	78.8	3e-11	6
gi 144583405 gb EF125081	<i>Himalayacalamus cupreus</i>	73	78.8	3e-11	6
gi 144583409 gb EF125083	<i>Neurolepis elata</i>	73	78.8	3e-11	6
gi 341872939 gb HQ600419	<i>Phyllostachys nigra</i>	73	78.8	3e-11	6
gi 8314441884 gb KM538817	<i>Phyllostachys reticulata</i>	73	78.8	3e-11	6
gi 831441886 gb KM538818	<i>Pseudosasa japonica</i>	73	78.8	3e-11	6
gi 384594296 gb JQ593376	<i>Oryza latifolia</i>	73	78.8	3e-11	6
gi 313664250 gb HQ590154	<i>Leersia virginica</i>	73	78.8	3e-11	6
gi 387865460 gb JN114801	<i>Dendrocalamus sp.</i>	73	78.8	3e-11	6
gi 341872933 gb HQ600416	<i>Sasa kuriensis</i>	73	78.8	3e-11	6
gi 341872935 gb HQ600417	<i>Sasa borealis</i>	73	78.8	3e-11	6
gi 341872937 gb HQ600418	<i>Sasa quelpaertensis</i>	73	78.8	3e-11	6
gi 526849276 gb KF381154	<i>Bambusa bambos</i>	73	78.8	3e-11	6
gi 325515974 gb HQ847285	<i>Aulonemia laxa</i>	73	78.8	3e-11	6
gi 406034795 emb HE575811	<i>Greslania multiflora</i>	73	78.8	3e-11	6
gi 144583419 gb EF125088	<i>Thyrsostachys siamensis</i>	73	78.8	3e-11	6
gi 325515962 gb HQ847279	<i>Arthrostyidium excelsum</i> -	73	78.8	3e-11	6
gi 325515972 gb HQ847284	<i>Rhipidoeladum bartlettii</i> -	73	78.8	3e-11	6

Chart 1. The chart demonstrates a variety of plants that possess a similar DNA composition to Sample YE05, which was created with the help of DNA Subway. As noticed, there is no sign of *Garcinia Cambogia*. The elimination of certain plants involved looking at the mismatches and the bit score, where the eliminated plants had more than 6 mismatches and repetition (in which case, the bit score was used).

Chart 2:

Accession #	Details	Aln. Length	Bit Score	e	Mis- match
gi 108773703 gb DQ673303	<i>Syringa vulgaris</i>	524	933	0.0	3
gi 108773697 gb DQ673300	<i>Schrebera alata</i>	524	930	0.0	4
gi 108773709 gb DQ673306	<i>Notelaea ovata</i>	524	930	0.0	4
gi 108773723 gb DQ673313	<i>Comoranthus minor</i>	524	930	0.0	4
gi 227809964 gb FJ862062	<i>Phillyrea angustifolia</i>	524	930	0.0	4
gi 227809966 gb FJ862063	<i>Phillyrea latifolia</i>	524	930	0.0	4
gi 227809968 gb FJ862064	<i>Phillyrea media</i>	524	930	0.0	4
gi 108773707 gb DQ673305	<i>Nestegis sandwicensis</i>	524	924	0.0	5
gi 108773713 gb DQ673308	<i>Haenianthus salicifolius</i>	524	924	0.0	5
gi 108773717 gb DQ673310	<i>Forestiera angustifolia</i>	524	924	0.0	5
gi 263043455 gb GU120325	<i>Picconia excelsa</i>	524	924	0.0	5
gi 108773705 gb DQ673304	<i>Olea europaea</i>	524	921	0.0	6
gi 108773711 gb DQ673307	<i>Noronhia emarginata</i>	524	921	0.0	6
gi 108773715 gb DQ673309	<i>Chionanthus virginicus</i>	524	921	0.0	6
gi 108773721 gb DQ673312	<i>Phillyrea angustifolia</i>	524	921	0.0	6
gi 108773725 gb DQ673314	<i>Picconia excelsa</i>	524	921	0.0	6
gi 227809962 gb FJ862060	<i>Olea europaea</i>	524	921	0.0	6
gi 241993463 gb FJ395605	<i>Ligustrum vulgare</i>	516	915	0.0	4
gi 817992384 gb KM361002	<i>Syringa vulgaris</i>	504	902	0.0	2
gi 530444045 gb KF496329	<i>Olea paniculata</i>	505	899	0.0	3
gi 756776419 gb KP094654	<i>Ligustrum lucidum</i>	506	897	0.0	4
gi 290586091 gb GQ436541	<i>Forsythia suspensa</i>	504	893	0.0	4
gi 332183479 gb JF830410	<i>Ligustrum sempervirens</i>	503	892	0.0	4
gi 332183517 gb JF830429	<i>Ligustrum confusum</i>	503	892	0.0	4
gi 332183549 gb JF830445	<i>Ligustrum delavayanum</i>	503	892	0.0	4

Chart 2. The data was produced the same way as Chart 1. However, the elimination of certain plants involved any mis-matches that were higher than 6 and any repetition in the data.

Discussion

Through the results that have been collected, several conclusions could be reached:

1. A possible explanation for the lack of the active ingredient is because there was never any to begin with. The active ingredient that was in the supplement was not *Garcinia Cambogia*, but rather, substitute plants that has little effect on the dietary loss.
2. The second explanation would retain to the methods of extracting DNA. Perhaps there was *Garcinia Cambogia*, but our method of detecting such DNA sequence is not sufficient enough.

Although these results are not affinitive, they are definitely important to note. The fact that we did not find the active ingredient heightens the doubt of these “miracle” pills that is present in the minds of many researchers and consumers. From the results of this experiment, consumers should be more aware of the substances they are consuming, and take extra precautions. This experiment sheds light on meaningful weight loss and whether or not herbal supplements should be the sole reliance of obese and overweight New Yorkers.

For future experiments in regards to successfully extracting DNA from supplements, the procedure should include more trials and use a greater quantity of the powder from the supplements. With these changes, the chances of extracting any DNA from the pill should increase.

References

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Acknowledgements

We must thank Dr. Tzall and Dr. Parlo for lending a helping hand with the experiment conducted as well as Brooklyn Technical High School for the space needed. We also give our thanks for Cold Spring Harbor Laboratory’s DNA Learning Center and DNA Subway for the help on sequencing the DNA strands.