

# Unlocking the Secret to Weight Loss: Discovering the Most Effective Green Tea Product

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## Abstract

To find the most effective green tea product that can replace weight loss drugs, we compared the amount of catechin in six different green tea products. The result was green tea latte powder contained a significantly small amount of catechin compared to other products, and the dried pearl green tea leaves had the highest amount of catechin. Also, the unexpected result was that green tea supplements had less amount of catechin compared to dried leaves or even tea bags that are commonly sold in markets.

## Introduction

As the pandemic wanes, there's a surge in interest in weight loss diets and medications to regain pre-COVID lifestyles. Common drugs like Wegovy and Ozempic, often prescribed for diabetes, are popular choices. Wegovy is validated for weight loss. These medications typically contain semaglutide, targeting the GLP-1 receptor. While effective, they may cause side effects, and stopping them without lifestyle changes can lead to weight regain.

Catechins, primarily found in green tea leaves, include EGC, EGCG, ECG, EC, shown in Figure 1, with EGCG being the most abundant. They are crucial in preventing chronic diseases by activating antioxidant enzymes and reducing free radicals. Evidence indicates catechins may enhance metabolism, aiding weight loss. However, prescription drugs, while faster, pose health risks and are expensive for long-term use.

Here, we conducted a study analyzing various popular green tea products to investigate their catechin content, aiming to provide insights into alternative weight loss products for consumers.

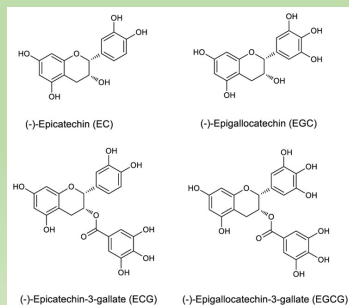


Figure 1. The molecular shape of catechin EC, EGC, ECG, and EGCG. They have a common structure, but have some differences from each structure.

## Method

- Six green tea products:** pearl tea leaves, latte powder, dried leaf, tea bag, green tea supplement, and green tea powder.
- Extract green tea solution:** Mix each 10.0 grams of products with 200 ml of water (pH between 7.0 to 7.2). Then, each solution was placed in the 79.5 °C water bath for 30 minutes, and immediately move for an ice bath for 10 minutes.
- Acidify solution:** Adjust the pH of the solution between 3.9 and 4.0 after ice bathing by adding 15M vinegar. Next, filter the solution to separate insoluble particles from the liquid. (Photos were shown in Figure 2).
- Isolate catechin using ethyl acetate and citric acid:** Use 25 ml ethyl acetate and mix with 25 ml of each solution to isolate catechin by collecting the organic layer. Then, the ethyl acetate from the collected organic layer is evaporated to obtain crude catechin.
- Make diluted solutions for UV analysis:** Add 50 ml of DI water to the collected crude catechin and mix 5 ml of this solution with 75 ml of DI water to dilute a solution.
- Calculate catechin absorption spectra:** Using a spectrophotometer, obtain absorption spectra for each solution and compare peaks for absorption graphs.

## Result

### Theoretical Study to identify Catechin absorption wavelength

- Structure was optimized to use the density functional theory (DFT) with the B3LYP exchange and correlation function and 6-311++G(d,p) bases set of GAUSSIAN 16.
- Then, the optimized structure was used to calculate an absorption UV-Visible spectrum by using Time Dependent-DFT calculation of GAUSSIAN 16 to create the UV/Visible.

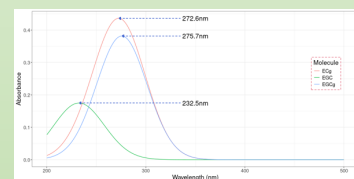


Figure 3. Theoretical UV absorption spectra of ECG, EGC, and EGCG, molecules of catechin in aqueous environment.

- ECG and EGCG have similar shapes and peaks in similar wavelengths (around 270 nm), but EGC has a much lower peak and a lower wavelength (around 230 nm).

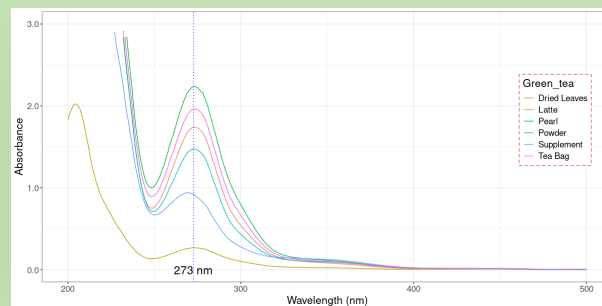


Figure 5. Obtained UV absorption spectra of six different green tea solutions.

- By comparing these spectra with the theoretical peaks of ECG and EGCG, we can confirm that the peak of each green tea product indicates the presence of catechins, especially EGCG and ECG, in the product.
- The absorption was lowest for green tea latte powder, while green tea powder, dried leaves, tea bags, and pearl green tea leaves exhibited the highest absorption rates.

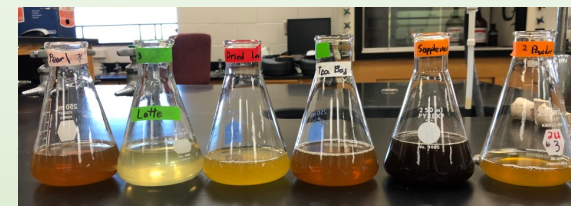


Figure 2. Color of each solutions after extraction. From the left, pearl green tea leaves, green tea latte powder, dried green tea leaf, green tea bag, green tea supplement, and green tea powder. They all have different color of solution compared to another.

## Conclusion

- Peaks of UV absorption spectra were caused by ECG and EGCG.
- Green tea latte is not effective for weight loss as it has almost no catechin.
- Pearl green tea has the most amount of catechin.
- The supplement that we used had less catechin compared to not only different kinds of dried leaves but also a tea bag.
- Based on our study, drinking tea, including just tea bags that are commonly sold in the market, has a better effect on weight loss than the supplement.

## Future Work

- Drinking green tea is a safe choice, but it doesn't have an outstanding effect as drugs
- Need some more research for other natural ingredients that are helpful for weight loss
- Research if two ingredients are combined and whether they have a better effect than consuming separately.

## Reference

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