

Development of Herbal Tea Formulations from *Citrus microcarpa* (Calamansi), *Mangifera indica* (Mango), and *Zingiber officinale* (Ginger) Peels and the Evaluation of the Antioxidant and Sensory Profiles of their Infusions

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INTRODUCTION & AIM

Imbalances in free radicals and antioxidants lead to oxidative stress, a condition linked to numerous health issues such as cancer, inflammation, diabetes, and aging. While the human body has built-in antioxidant defenses to neutralize these radicals, an excess can overwhelm these mechanisms.



Calamansi
Citrus microcarpa

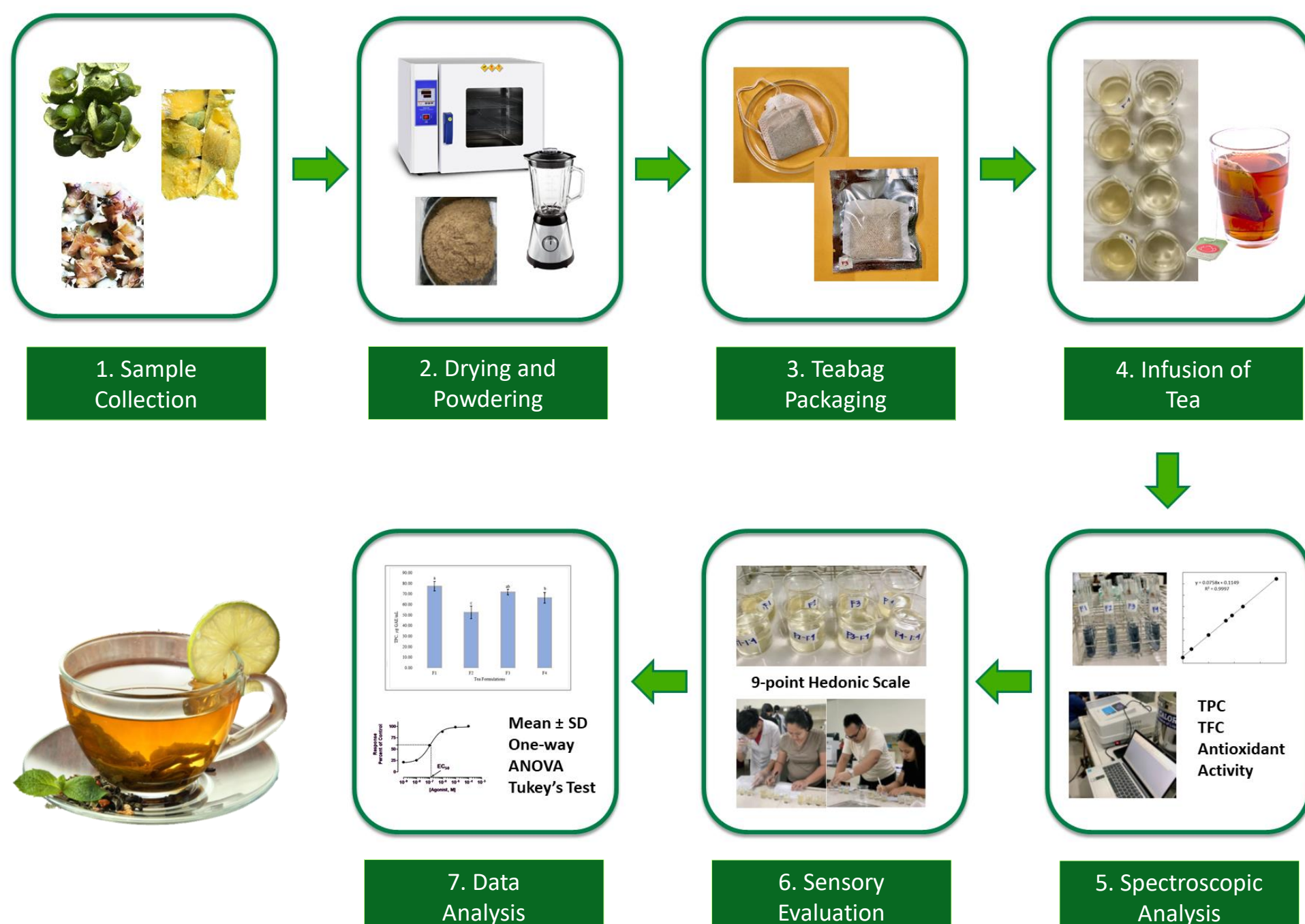
Mango
Mangifera indica

Ginger
Zingiber officinale

Antioxidant, particularly phenolic and flavonoid compounds found in plants, are essential for combating oxidative stress. Notably, the peels of *Citrus microcarpa* (Calamansi), *Mangifera indica* (Mango), and *Zingiber officinale* (Ginger) are rich in these beneficial compounds, making them valuable sources of natural antioxidants. With the increasing popularity of herbal beverages as consumers prioritize health and wellness, formulating herbal teas from these fruit peels presents a promising avenue for investigation.

This study aims to develop four herbal tea formulations utilizing the peels of calamansi, mango, and ginger. The objectives include determining the total phenolic content (TPC) and total flavonoid content (TFC) of the infused teas, evaluating their antioxidant activity through the DPPH radical scavenging assay, and assessing the sensory profile to gauge consumer preferences. This research seeks to highlight the potential health benefits of these herbal teas and their viability in the growing market for wellness-focused beverages.

METHOD



RESULTS & DISCUSSION

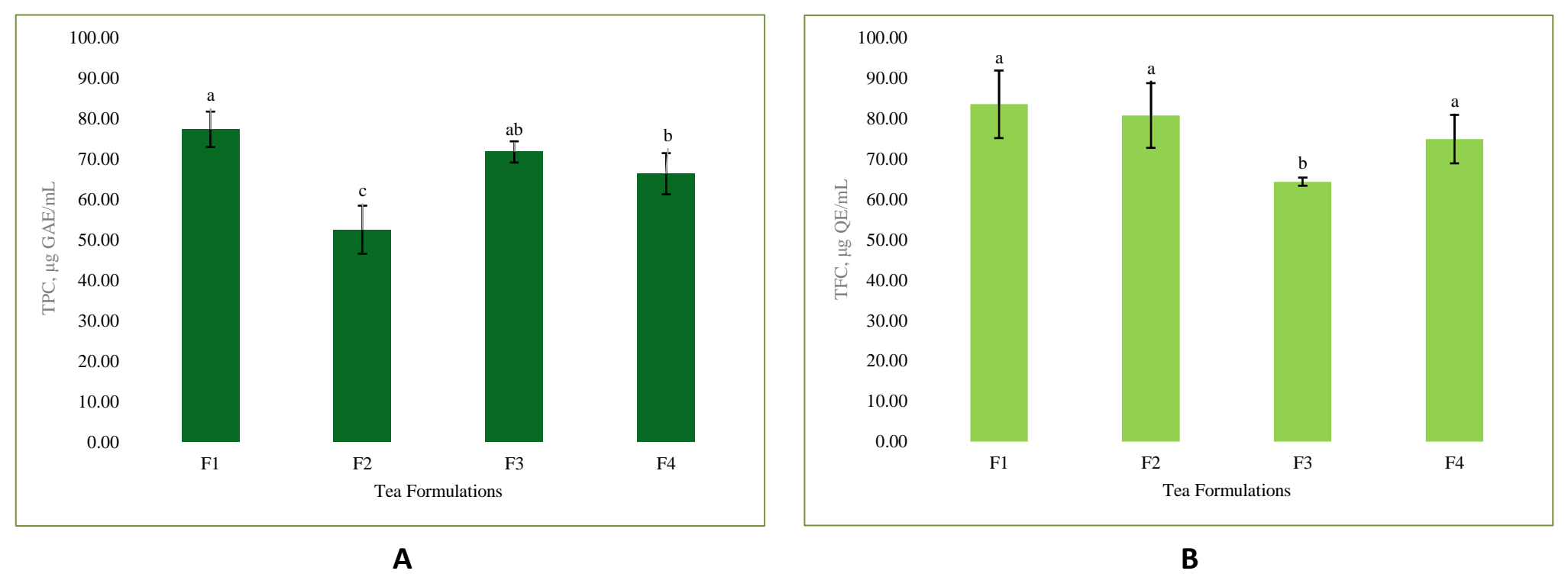


Figure 1. Graphical presentation of the (A) total phenolic contents and (B) total flavonoid contents of the four tea formulations. Different lower case letters show significant differences ($p < 0.05$).

Formulation F1 stands out among the four formulations as it has the highest TPC and highest TFC. Interestingly, there is a trend from these results wherein formulations with mango peels exhibit significantly higher TPC compared to the formulation without mango peels. Also, formulations with calamansi peels exhibit significantly higher TFC compared to the formulation without calamansi peels. These trends suggest that the combination of mango peels and calamansi peels in F1 significantly influences its phenolic and flavonoid content.

Table 1. Antioxidant activity and sensory profile of the four tea formulations.

Formulation	Composition	EC ₅₀ (µg/mL)	Antioxidant Classification	Average Sensory Analysis Score	Rating
F1	1:1 mango and calamansi	98.66±3.42 ^b	Strong	7.0±1.7 ^a	Like Moderately
F2	1:1 calamansi and ginger	507.81±127 ^a	Weak	6.0±2.0 ^b	Like Slightly
F3	1:1 ginger and mango	71.76±6.13 ^{bc}	Strong	5.7±1.9 ^c	Like Slightly
F4	1:1:1 mango, ginger, and calamansi	94.08±19.1 ^b	Strong	6.0±1.9 ^b	Like Slightly

Values are means ± SD obtained from 3 replicates. Different lower case letters show significant differences ($p < 0.05$).

The EC₅₀ value of a sample serves as a measure of its antioxidant activity. An EC₅₀ value <50 µg/mL is classified as a very strong antioxidant, 50-100 µg/mL represents a strong antioxidant, 101-150 µg/mL is a moderate antioxidant, and a value >150 µg/mL suggests a weak antioxidant. Based on this, F1 is categorized as a strong antioxidant. The strong antioxidant activity of F1 could be attributed to its highest TPC and highest TFC, and this implies that F1 has strong health-promoting properties.

F1, with its mango and calamansi blend, is the most preferred tea formulation. This could be due to the excellent organoleptic properties of mango peels and the aromatic flavor from calamansi peels which are preferred by the sensory panelists.

CONCLUSION & FUTURE WORK

- We have developed four tea formulations from fruit peels, with F1 (mango and calamansi blend) showing strong antioxidant activity and the highest levels of phenolics and flavonoids.
- F1 presents as a promising herbal tea option, suggesting potential health benefits.
- This study supports mango and calamansi peels tea as a low-cost, health-promoting functional beverage.
- Further research on the promising F1 formulation is recommended, including microbiological tests, shelf-life studies, and additional bioactivity tests.
- Investigating other combinations and infusion methods may yield formulations with enhanced properties.

