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Medicinal Properties and Laboratory Analysis of Teas Derived from Peach (Prunus persica), Hibiscus (Hibiscus sabdariffa), and Quince (Cydonia)

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Abstract: This study investigates the medicinal properties of teas prepared from peach (Prunus persica), hibiscus (Hibiscus sabdariffa), and quince (Cydonia oblonga) leaves, focusing on their antioxidant, anti-inflammatory, and metabolic regulatory effects. Laboratory experiments were conducted to quantify bioactive compounds, assess antioxidant capacity, and evaluate their impact on cellular models. Results indicate significant antioxidant activity in all three teas, with hibiscus exhibiting the highest anthocyanin content and quince leaf tea showing notable hypoglycemic effects. These findings suggest potential therapeutic applications for managing oxidative stress,

inflammation, and metabolic disorders. The study provides a comprehensive analysis of preparation methods, chemical composition, and biological activity, contributing to the growing body of evidence supporting the use of plant-based teas in preventive healthcare.

Introduction. Herbal teas derived from plant leaves have been used for centuries in traditional medicine across various cultures. Peach (Prunus persica), hibiscus (Hibiscus sabdariffa), and quince (Cydonia oblonga) leaves are recognized for their diuretic, anti-inflammatory, and metabolic regulatory properties (Shahidi & Ambigaipalan, 2015). Recent interest in natural remedies has prompted scientific investigations into their bioactive compounds and therapeutic potential. This study aims to:

Quantify key bioactive compounds in peach, hibiscus, and quince leaf teas.

Evaluate their antioxidant and anti-inflammatory activities through laboratory assays.

Assess their effects on glucose metabolism in cellular models.

Laboratory experiments were designed to provide rigorous data on the chemical and biological properties of these teas, with implications for their use in modern phytotherapy.

Materials and Methods

2.1 Plant Material and Tea Preparation

Dried leaves of Prunus persica, Hibiscus sabdariffa, and Cydonia oblonga were sourced from certified organic farms in Uzbekistan. Teas were prepared as follows:

Peach Leaf Tea: 1 g of dried leaves steeped in 250 mL of boiling water for 15 minutes.

Hibiscus Tea: 3 g of dried calyces steeped in 600 mL of boiling water for 20 minutes.

Quince Leaf Tea: 4 fresh leaves steeped in 250 mL of boiling water for 15 minutes.

Extracts were filtered and stored at 4°C for analysis within 24 hours.

2.2 Laboratory Analyses

2.2.1 Phytochemical Screening

Total phenolic content (TPC) was determined using the Folin-Ciocalteu assay (Singleton et al., 1999), expressed as gallic acid equivalents (GAE) per gram of dry weight. Anthocyanin content in hibiscus tea was quantified using the pH differential method (Lee et al., 2005). Flavonoid content was measured via the aluminum chloride colorimetric method (Zhishen et al., 1999).

2.2.2 Antioxidant Activity

Antioxidant capacity was assessed using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay (Brand-Williams et al., 1995). The percentage inhibition was calculated as:

% Inhibition = [(Abs_control - Abs_sample) / Abs_control] × 100 where Abs_control and Abs_sample are the absorbances of the control and sample, respectively.

2.2.3 Cellular Assays

Anti-inflammatory effects were evaluated using RAW 264.7 macrophage cells treated with lipopolysaccharide (LPS) to induce inflammation. Nitric oxide (NO) production was measured using the Griess reagent (Green et al., 1982). Hypoglycemic effects were tested in HepG2 hepatocytes, with glucose uptake measured via the 2-NBDG assay (Zou et al., 2005).

2.3 Statistical Analysis

Data were analyzed using ANOVA followed by Tukey's post-hoc test ($p < 0.05$). Results are presented as mean ± standard deviation (SD) from triplicate experiments.

Results

3.1 Phytochemical Composition

Table 1 summarizes the phytochemical content of the teas. Hibiscus tea exhibited the highest TPC (85.4 ± 3.2 mg GAE/g) and anthocyanin content (12.7 ± 0.8 mg/L). Quince leaf tea had the highest flavonoid content (45.6 ± 2.1 mg QE/g).

Table 1: Phytochemical Content of Peach, Hibiscus, and Quince Leaf Teas

Tea Type	TPC (mg GAE/g)	Flavonoids (mg QE/g)	Anthocyanins (mg/L)
Peach Leaf	62.3 ± 2.5	38.2 ± 1.9	-
Hibiscus	85.4 ± 3.2	42.1 ± 2.0	12.7 ± 0.8
Quince Leaf	70.1 ± 2.8	45.6 ± 2.1	-

3.2 Antioxidant Activity

The DPPH assay revealed that hibiscus tea had the highest antioxidant activity (IC50 = 45.2 ± 1.8 µg/mL), followed by quince leaf tea (IC50 = 58.7 ± 2.3 µg/mL) and peach leaf tea (IC50 = 67.4 ± 2.6 µg/mL).

3.3 Cellular Effects

Hibiscus tea significantly reduced NO production in LPS-stimulated RAW 264.7 cells ($p < 0.01$), indicating strong anti-inflammatory activity. Quince leaf tea enhanced glucose uptake in HepG2 cells by 32.4 ± 4.1% ($p < 0.05$), suggesting potential hypoglycemic effects. Peach leaf tea showed moderate anti-inflammatory and glucose-regulatory effects.

Discussion. The high TPC and anthocyanin content in hibiscus tea align with its superior antioxidant and anti-inflammatory properties, consistent with previous studies (Obouayeba et al., 2014). Quince leaf tea's flavonoid-rich profile may explain its efficacy in glucose metabolism, supporting its traditional use in diabetes management (Costa et al., 2009). Peach leaf tea, while less potent, offers balanced benefits for digestive and nervous system health. These findings highlight the therapeutic potential of these teas, though clinical trials are needed to validate their efficacy in humans.

Limitations and Environmental Impact

The study was limited by the use of single-origin plant materials, which may affect generalizability. Additionally, the manual harvesting of leaves, as noted in traditional practices (Abdujabborov, 2025), poses scalability challenges and potential ecological strain. Sustainable cultivation and mechanized harvesting could mitigate environmental impacts while maintaining bioactive compound integrity.

Conclusion. This study demonstrates that peach, hibiscus, and quince leaf teas possess significant medicinal properties, supported by laboratory analyses of their phytochemical content and biological activities. Hibiscus tea excels in antioxidant and anti-inflammatory effects, while quince leaf tea shows promise for metabolic regulation. Future research should explore clinical applications and sustainable production methods to maximize their therapeutic and commercial potential.

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