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(RESEARCH ARTICLE)



## Analysis of the components of commercially traditional herbal tea (*Platostoma palustre*) in Taiwan

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### Abstract

*Platostoma palustre* jelly is a traditional food. It has been used as folk medicine and is effective against heat-shock, hypertension and diabetes. Therefore, the aim of this study was to analyze the components of commercially traditional herbal tea (*P. palustre*) in Taiwan. The commercial herbal tea (*P. palustre*) was kindly provided by Yueta Agricultural Biotechnology Inc. The detection methods of the components of commercially traditional herbal tea (*P. palustre*) were followed the analysis protocols in Taiwan Herbal Pharmacopeia (IV). The levels of chlorogenic acid, rosmarinic acid, caffeic acid, and rutin were detected via using high-performance liquid chromatography / photodiode array detector (HPLC-PDA). The level of astragaloside was detected by using high-performance liquid chromatography / evaporative light scattering detectors (HPLC-ELSD). In this analysis, the levels of chlorogenic acid, astragaloside, and rutin were not detected. The levels of rosmarinic acid and caffeic acid were 46.96 µg/mL and 29.29 µg/mL, respectively. Taken all results together, the components of commercially traditional herbal tea (*P. palustre*) were detected via HPLC-PDA and HPLC-ELSD. The major components of commercially traditional herbal tea (*P. palustre*) were rosmarinic acid and caffeic acid. Based on the results of this assay, it is speculated that the herbal tea has the functional properties that are considerable potential for physiological function regulations.

**Keywords:** Analysis; Commercially traditional herbal tea; Components; Taiwan

### 1 Introduction

The related food with *Platostoma palustre* as tea, herbal jelly, and sweet soup with herbal jelly are popular during the summer. Additionally, the heated herbal jelly with *P. palustre* is admired by many Taiwanese in winter. *P. palustre* has been used as folk medicine. *P. palustre* has been verified that possessed many functional compounds [1-5]. Therefore, these functional compounds of *P. palustre* have indicated that many biological effects is effective against and attenuating the metabolic syndrome, heat-shock, hypertension, diabetes, liver disease, muscle and/or joint pains, hyperglycemia, inflammation, oxidant activity, free radical scavenging effects, acute and chronic hepatitis, and cancer

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growth [1-10]. In this study, the research objective was to analyze the components of commercially traditional herbal tea (*P. palustre*).

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## 2 Material and methods

### 2.1 Chemicals

In this study, HPLC grade solutions as methanol and acetonitrile etc were purchased from Mallinckrodt Baker (Phillipsburg, NJ, USA). The standard samples were purchased from Sigma-Aldrich (St. Louis, MO, USA) and stocked at -20 °C.

### 2.2 Apparatus

The HPLC system consisted of a **quaternary solvent delivery system** (Waters, Milford, MA, USA), an autosampler (Waters), PDA or ELSA (Waters), and Cosmosil 5C18-MS columns (5 µm, 4.6 × 150 mm i.d.; Nacalai, Kyoto, Japan). Analysis of HPLC data was performed with Millennium 32 software (Version 4.0, Waters).

### 2.3 Assay method

The components of commercially traditional herbal tea (*P. palustre*) were detected via HPLC-PDA and HPLC-ELSD accord to the analysis protocols of *Lonicerae japonicae* flos, *Perillae caulis*, *Mori folium*, *Astragali radix*, and *Taraxaci herba* in Taiwan Herbal Pharmacopeia (version 4.0).

### 2.4 Source of Herbal Tea

The herbal tea (*P. palustre*) were kindly provided by Yueta Agricultural Biotechnology Inc. (Guanxi, Hsinchu, Taiwan) (Fig. 1). Yueta® herbal tea has been passed the SGS pesticide test, and is cooked through high-temperature cooking. The operation process of machinery and equipment is consistent, and it is sterilized by high-temperature sterilizing kettle, without adding preservatives.



**Figure 1** Commercially traditional herbal tea (*P. palustre*) was kindly provided by Yueta Agricultural Biotechnology Inc. (Guanxi, Hsinchu, Taiwan)

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## 3 Results

### 3.1 Analysis of the Components of Commercially Traditional Herbal Tea (*P. palustre*)

In this study, the results were shown that the components of commercially traditional herbal tea (*P. palustre*) were analyzed. The components of commercially traditional herbal tea (*P. palustre*) were detected via HPLC-PDA and HPLC-ELSD. The levels of chlorogenic acid, astragaloside, and rutin were not detected. The levels of rosmarinic acid and caffeic

acid were 46.96  $\mu\text{g/mL}$  and 29.29  $\mu\text{g/mL}$ , respectively. The major components of commercially traditional herbal tea (*P. palustre*) were rosmarinic acid and caffeic acid (Table 1).

**Table 1** The components of commercially traditional herbal tea (*P. palustre*)

Items	Detection		Limit of quantitation (LOQ)	
	Results	Unit	LOQ	Unit
Chlorogenic acid	ND	$\mu\text{g/mL}$	5	$\mu\text{g/mL}$
Rosmarinic acid	46.96	$\mu\text{g/mL}$	10	$\mu\text{g/mL}$
Astragaloside	ND	$\mu\text{g/mL}$	50	$\mu\text{g/mL}$
Rutin	ND	$\mu\text{g/mL}$	5	$\mu\text{g/mL}$
Caffeic acid	29.29	$\mu\text{g/mL}$	10	$\mu\text{g/mL}$

ND: non-detection

#### 4 Discussion

*P. palustre* has been used as folk medicine and is effective against heat-shock, hypertension and diabetes. Previously, the effect of different ethanolic concentrations on antioxidant properties and cytoprotective activities of *P. palustre* has been verified. The antioxidant activities of *Mesona procumbens* ethanolic extracts which displayed variable antioxidant levels. The 60% *Mesona procumbens* ethanolic extracts exhibited higher antioxidant activities that possessed a protective capability for the biological membrane system to prevent and treat oxidative stress-related disorders [6-9]. According to our previous data (data not shown), the bio-functional components and concentrations of *P. palustre* ethanolic extracts via 90% ethanol extraction were chlorogenic acid (0.30 mg/mg *P. palustre* ethanolic extracts), caffeic acid (0.70 mg/mg *P. palustre* ethanolic extracts), rutin (0.80 mg/mg *P. palustre* ethanolic extracts), astragaloside IV (7.50 mg/mg *P. palustre* ethanolic extracts), and rosmarinic acid (15.90 mg/mg *P. palustre* ethanolic extracts). Among of these bio-functional components of *P. palustre* ethanolic extracts via 90% ethanol extraction, the contents of astragaloside IV and rosmarinic acid were higher than others. In this study, we analyzed the components of commercially traditional herbal tea (*P. palustre*). Data were presented that the levels of chlorogenic acid, astragaloside, and rutin were not detected. The levels of rosmarinic acid and caffeic acid were 46.96  $\mu\text{g/mL}$  and 29.29  $\mu\text{g/mL}$ , respectively. The major components of commercially traditional herbal tea (*P. palustre*) were rosmarinic acid and caffeic acid. Comparison of *P. palustre* 90% ethanolic extracts and commercially traditional herbal tea (*P. palustre*), the ethanolic extraction is more effected for extracting the functional components.

Caffeic acid has many physiological properties as antibacterial activity, antiviral activity, antioxidant activity, anti-inflammatory activity, anti-atherosclerotic activity, immunostimulatory activity, antidiabetic activity, cardioprotective activity, antiproliferative activity, hepatoprotective activity, anticancer activity, and anti-hepatocellular carcinoma activity.

Rosmarinic acid is a phenolic compound and ester of caffeic acid. Rosmarinic acid exhibits antioxidant and anti-inflammatory effects and it has been shown to protect neurons *in vitro* against oxygen-glucose deprivation. In addition, Rosmarinic acid can reduce brain infarction and BBB breakdown via inhibition of NF- $\kappa$ B activation and decreased expression of the proinflammatory cytokine high-mobility group protein B1 via *in vivo* experiment. Rosmarinic acid also can possessed neuroprotection via Nrf2 activation.

In 2022, we have verified that extracts of *P. palustre* possesses anti-tumor activities *in vitro* [11]. Also, we have verified that 40% ethanolic extracts of *P. palustre* was safe without genotoxicity via *in vivo* micronucleus assay [12]. In 2023, we also verified *P. palustre* possess the properties of blood glucose (13) and blood lipid regulation (data not shown). In this study, we focused on the analysis of the components of commercially traditional herbal tea (*P. palustre*). Based on the results of this analysis, it is speculated that drinking the herbal tea (*P. palustre*) has considerable potential for the physiological function regulations, which can be used as the basis for the development of related products of the herbal tea (*P. palustre*) in the future.

## 5 Conclusion

The commercial herbal tea (*P. palustre*) was kindly provided by Yueta Agricultural Biotechnology Inc. Taken all results together, the levels of chlorogenic acid, astragaloside, and rutin were not detected. The levels of rosmarinic acid and caffeic acid were 46.96 µg/mL and 29.29 µg/mL, respectively. The major components of commercially traditional herbal tea (*P. palustre*) were rosmarinic acid and caffeic acid. Therefore, based on the results of this analysis, it is speculated that drinking the herbal tea (*P. palustre*) has considerable potential for the physiological function regulations, which can be used as the basis for the development of related products of the herbal tea (*P. palustre*) in the future.

## Compliance with ethical standards

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### Disclosure of conflict of interest

The authors declare no conflict of interest.

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