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Article

Evaluation and Comparison of Antioxidant Capacities of Different Taros

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Abstract: Taro is widely cultivated, and has rich nutritional properties. The antioxidant capacities, total phenolic contents (TPC) and total flavonoid contents (TFC) of different taros were evaluated and compared, including small red taro, big red taro, and betel taro. The antioxidant capacities of 50% ethanol and 80% methanol extracts of three taros were measured using ferric-reducing antioxidant power (FRAP) and Trolox equivalent antioxidant capacity (TEAC) assays, respectively. The TPC and TFC of the extracts from three taros were determined by the Folin-Ciocalteu method and $AlCl_3$ colorimetry, respectively. The results showed that different extraction solvents markedly influenced the antioxidant capacities of extracts, and the ethanol extract of small red taro possessed the strongest FRAP, TEAC, TPC and TFC values among the extracts of three taros. The results were helpful for the public to choose taro.

Keywords: *Colocasia esculenta*; taro; antioxidant activity; phenolics; flavonoid

1. Introduction

Taro (*Colocasia esculenta*) contains a variety of health substances, such as starch, polysaccharides, vitamins, minerals, dietary fiber, etc., and is a good resource of functional food (Otekunrin et al., 2021). Taro possesses antioxidant, anti-inflammatory, hepatoprotective, anticancer,

hypolipidemic, and immunomodulatory effects (Aditika et al., 2022; Correa et al., 2019; Ribeiro Pereira et al., 2021). As a potential crop for the food processing industry, taro can be processed into a variety of products, such as taro flour, taro paste, taro cookies, and noodles (Dilek and Bilgicli, 2021).

In addition, taro starch can be used in the food industry as an emulsifier, stabilizer and filler agent (Singla et al., 2020). In this study, the antioxidant capacities of three taros were evaluated, and their total phenolic contents (TPC) and total flavonoid contents (TFC) were also measured. This study was helpful for the people to choose taro, and for exploitation and utilization of taro as functional food.

2. Materials and Methods

2.1. Chemicals and Materials

The chemicals 2,4,6-tri(2-pyridyl)-s-triazine (TPTZ), 6-hydroxy-2,5,7,8-tetramethylchromane-2-carboxylic acid (Trolox), 2,2′-azinobis (3-ethylbenothiazoline-6-sulphonic acid) diammonium salt (ABTS), and Folin-Ciocalteu's phenol reagent were purchased from Sigma-Aldrich (St. Louis, MO, USA). Potassium persulfate, methanol, ethanol, iron(II) sulfate heptahydrate, iron(III) chloride hexahydrate, aluminum chloride, and sodium carbonate were bought from Damao Chemical Factory (Tianjin, China). The distilled water was used for all experiments.

The betel taro, big red taro and small red taro were bough from local markets in Guangzhou, China.

2.2. Sample Extraction

Taro samples were washed with double distilled water and dried at room temperature. The peel of taro was removed, and its pulp was cut into blocks and then ground into particles using a grinder. The 1.000 g of sample was weighed and extracted with 20 mL of 80% methanol (or 50% ethanol) for 24 h at room temperature in a shaking water bath. The sample was centrifuged at 4,200 g for 10 min, and the supernatant was collected.

All the experiments were performed three times, and the results were expressed as mean ± standard deviation.

2.3. Determination of Ferric-Reducing Antioxidant Powers

The ferric-reducing antioxidant powers (FRAP) was performed according to the literature (Xu et al., 2019). The FRAP reagent was a mixture of sodium acetate-acetic acid buffer (300 mmol/L), ferric chloride solution (20 mmol/L) and TPTZ (10 mmol/L) at a volume ratio of 10:1:1. The prepared FRAP reagent should be put in a 37 °C water bath for future experiments. The 100 μL of diluted sample was

added to 3 mL FRAP reagent. After incubation for 4 min at room temperature, the absorbance of the mixture was measured at 593 nm, and the result was shown as μmol Fe^{2+}/g FW.

2.4. Determination of ABTS Free Radical Scavenging Activity

The Trolox equivalent antioxidant capacities (TEAC) assay was used to determine ABTS free radical scavenging activity according to the literature (Shang et al., 2020). The $ABTS^{\bullet+}$ stock solution was prepared by mixing 7 mmol/L $ABTS^{\bullet+}$ solution and 2.45 mmol/L potassium persulfate at an equal volume, and placed in dark for 16 h and used within 2 d. The $ABTS^{\bullet+}$ stock solution was diluted with distilled water to an absorbance of 0.710 ± 0.050 at 734 nm and configured as $ABTS^{\bullet+}$ reaction solution. Finally, the 100 μL of diluted sample was mixed with 3.8 mL $ABTS^{\bullet+}$ reaction solution at room temperature for 6 min, and the absorbance of the mixture at 734 nm was measured, and the result was expressed as μmol Trolox/g FW.

2.5. Determination of Total Phenolic Contents

The TPC was measured according to the literature (Zhao et al., 2019). The 500 μL diluted sample was added to 2.5 mL of 0.2 mol/L Folin-Ciocalteu reagent for 4 min, and the 2 mL of 75 g/L saturated sodium carbonate solution was added to the mixture. Finally, the mixture was incubated at room temperature for 2 h in the dark, and the absorbance of the mixture was determined at 760 nm, and the result was expressed as mg of gallic acid equivalent (GAE)/g FW.

2.6. Determination of Total Flavonoid Contents

The TFC was determined by the aluminum chloride method based on previous literature (Mammen and Daniel, 2012). The 500 μL diluted sample was added to 1.5 mL of 95% ethanol, 0.1 mL of 10% aluminum chloride, 0.1 mL of 1 mol/L potassium acetate, and 2.8 mL distilled water. Then, the mixture was reacted at room temperature for 30min, and the absorbance of the mixture was determined at 415 nm, and the result was expressed as mg of quercetin equivalent (QE)/g FW.

2.7. Statistical Analysis

All experimental data were exhibited as mean ± standard deviation. The SPSS 25.0 statistical software and Excel 2016 were used.

3. Results and Discussion

3.1. Ferric-Reducing Antioxidant Power of Taro

The ferric-reducing antioxidant power (FRAP) assay is a simple and inexpensive method, which is widely used to determine the antioxidant level of samples (Griffin and Bhagooli, 2004). The FRAP values of 50% ethanol extract were significantly higher compared with 80% methanol extract (Figure 1). In addition, the FRAP values of 50% ethanol extract from small red taro showed the highest FARP value among six extract, which was about 52 folds that of 80% methanol extract. Furthermore, the FRAP value was markedly correlated with TPC value ($R^2 = 0.986$, $p < 0.001$, Table 1), and the FRAP value was also significantly related to TFC value ($R^2 = 0.885$, $p < 0.05$), which showed that phenolics in taro could contribute to FRAP values.

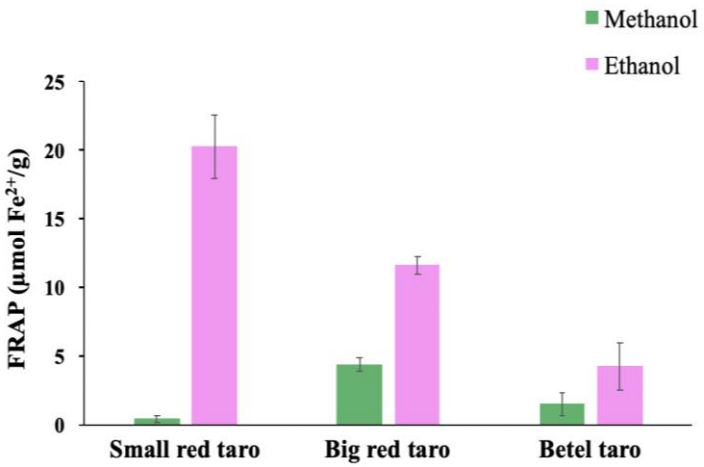

Figure 1. The FRAP values of 80% methanol and 50% ethanol of three taros.

Table 1. The relation of different parameters

Parameters	Equation	R^2	*p* value
TPC vs. TFC	y = 0.561x + 1.089	0.916	< 0.01
TPC vs. FRAP	y = 0.159x + 0.839	0.986	< 0.001
TPC vs. TEAC	y = 0.143x - 2.242	0.308	> 0.05
TFC vs. FRAP	y = 0.233x - 0.090	0.885	< 0.05
TFC vs. TEAC	y = 0.479x - 12.568	0.633	> 0.05
TEAC vs. FRAP	y = 0.074x + 28.960	0.212	> 0.05

3.2. ABTS Free Radical Scavenging Activity of Taros

The antioxidant capacities of taros were also determined by Trolox equivalent antioxidant capacity (TEAC) assay in this paper. The extraction efficiencies of methanol were similar to those of

ethanol (Figure 2). In addition, the small red taro with 50% ethanol extraction showed the highest TEAC value among six samples, which was in accordance with the FRAP results.

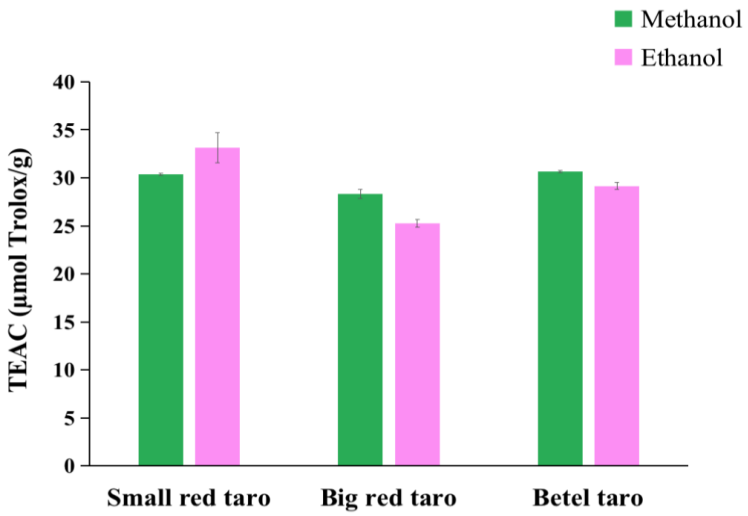

Figure 2. The TEAC values of 80% methanol and 50% ethanol of three taros.

3.3. Total Phenolic Contents of Taros

The TPC values of taro samples were measured according to Folin-Ciocalteu method. The TPC values of 50% ethanol extract were significantly higher than those of 80% methanol extract, which were 4.32, 1.66 and 1.89 folds, respectively (Figure 3). Moreover, the TPC values of 50% ethanol extract from small red taro showed the highest TPC value among six samples, which were in accordance with the results of FRAP and TEAC. Furthermore, the TPC value was significantly correlated with TFC value ($R^2 = 0.916$, $p < 0.01$, Table 1), which showed that flavonoids were a main contributor of phenolics.

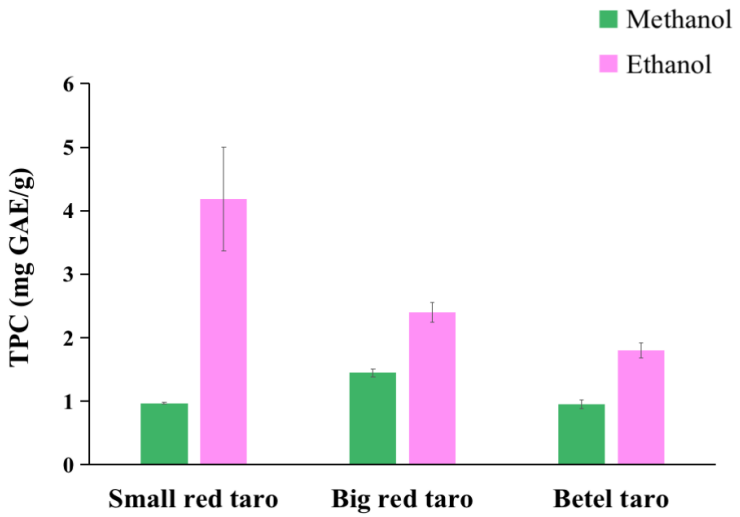

Figure 3. The TPC values of 80% methanol and 50% ethanol of three taros.

3.4. Total Flavonoid Contents of Taros

The aluminum chloride assay is a commonly used analytical method for assessing the TFC, which relies on the colored complexes formed between Al^{3+} and the carbonyl and hydroxyl groups of flavonoids in alkaline media (Magalhaes et al., 2012). The TFC value of 50% ethanol extract for small red taro was 14.3 folds that of 80% methanol extract, which was also the highest TFC value among six samples (Figure 4). Furthermore, there were no difference between the TFC values of the different solvent extracts for the big red taro and betel taro.

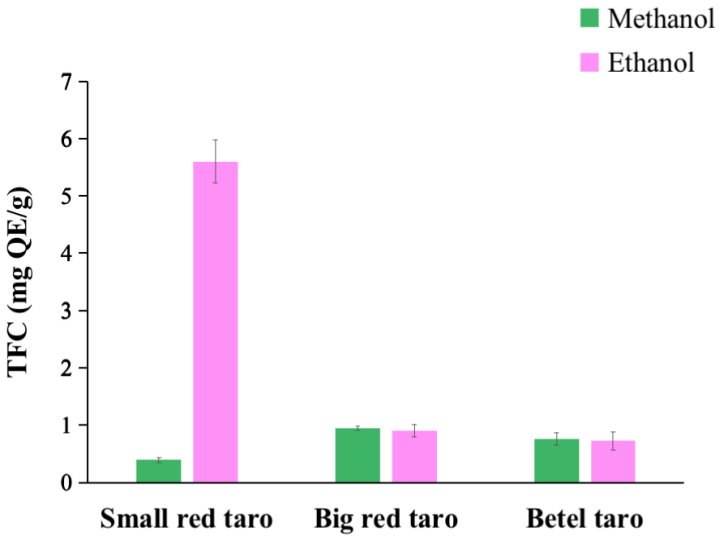

Figure 4. The TFC values of 80% methanol and 50% ethanol of three taros.

4. Conclusions

In this study, the antioxidant capacities, total phenolic contents and total flavonoid contents of three taros were determined. The results showed that in the 50% ethanol extract from small red taro had the highest antioxidant activities, total phenolic contents and total flavonoid contents among six extracts. Therefore, small red taro has the potential to become a functional food, and could be used to prevent oxidative stress related diseases.

Potential Conflicts of Interest

The authors declare no conflict of interest.

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