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Total flavonoid and Antioxidant Activity of Some Selected Medicinal Plants in South Kalimantan of Indonesian

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Abstract

The present study was undertaken to find the antioxidant value of certain medicinal plants in South Kalimantan in Indonesian. Antioxidants have been reported to prevent oxidative damage caused by free radical and can be used in cardiovascular and anti-inflammatory diseases. The amount of total flavonoids and radical scavenging activity has been studied. Major amount of flavonoid were determined in kasturi fruit followed by leaf of kelakai, stem of gerunggang, and root pasak bumi. However, kelakai, kasturi, pasak bumi, and gerunggang extracts potent of antioxidant by chelating effect on ferrous ions, hydroxyl radical scavenging, and hydrogen peroxide scavenging.

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1. Introduction

Since ancient times, the medicinal properties of plants have been investigated in the recent scientific developments throughout the world, due to their potent antioxidant activities. Antioxidant refers to a

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compound that can delay or inhibit the oxidation of lipids or other molecules by inhibiting the initiation or propagation of oxidative chain reactions and which can thus prevent or repair damage done to the body’s cells by oxygen. They act by one or more of the following mechanisms: reducing activity, free radical-scavenging, potential complexing of pro-oxidant metals and quenching of singlet oxygen. Epidemiological studies have shown that many medicinal plant might protect the human body against damage by ROS. The consumption of natural antioxidant was reported to have potential health benefits. [1-4]

Besides, phenolic compounds and flavonoids are also widely distributed in plants which have been reported to exert multiple biological effects, including antioxidant, free radical scavenging abilities, anti-inflammatory, anticarcinogenic etc. [5]. As crude extracts of herbs and spices and other plant materials, rich in phenolics are increasing interest in the food industry because they retard oxidative degradation of lipids and thereby improve the quality and nutritional value of food. While, flavonoids are a group of polyphenolic compounds with known properties, which include free radical scavenging, inhibition of hydrolytic and oxidative can enzymes and anti-inflammatory action [6].

South Kalimantan of Indonesian, as a tropical district, shows on amazing diversity of plants species. Some of them have been long used as traditional medicines. Many of them were reported to have various desirable activities [7,8]. In the present study, we investigate total flavonoid and antioxidant activity of kelakai, kasturi, pasak bumi, and gerunggang that were commonly found in the South Kalimantan of Indonesia.

2. Material and methods

2.1. Chemical

1mM FeCl3, 2 mM FeCl2, 1mM 1,10- phenanthroline, 0.2 M phosphate buffer (pH 7.8), 0.17 M H2O2, ascorbic acid, NaNO2, AlCl3, and quercetin were from Sigma. All other reagents were of the highest quality grade available.

2.2. Plant material

Kelakai, kasturi, pasak bumi, and gerunggang ferns were collected in June 2009 from Gambut subdistrict, South Kalimantan. Species identification was performed by the Department of Biology, Pharmacy Study Program, Faculty of Mathematics and Natural Sciences (FMIPA), Lambung Mangkurat University. The active principles in the kelakai and kasturi plants were extracted by maceration.

2.3. Total flavonoid content

Flavonoids were determined using Aluminum chloride colorimetric method [9]. The calibration curve was made by preparing quercetin solutions at different concentrations. Each experiment was carried out in triplicate and results averaged expressed as mean ± SD.

2.4. Chelating effect on ferrous ions

The chelating effect of ferrous ions was estimated by the method of Hung-Ju Chou et al. [10]. The absorbance of the mixture was measured at 562 nm. Chelating effect was calculated using the equation: (1 - absorbance of sample/ absorbance of control) × 100. Each experiment was carried out in triplicate and results averaged expressed as mean ± SD.
2.5. Hydroxyl radical scavenging activity

The scavenging activity for hydroxyl radicals was measured with Fenton reaction [11]. The absorbance of the mixture at 560 nm was measured with a spectrophotometer. Hydroxyl radical scavenging activity was calculated using the equation: (1 - absorbance of sample/ absorbance of control) × 100. Each experiment was carried out in triplicate and results averaged expressed as mean ± SD.

2.6. Hydrogen peroxide scavenging activity.

The hydrogen peroxide scavenging was determined according to the method of Ruch et al. [12]. The absorbance value of the reaction mixture was recorded at 230 nm. Hydrogen peroxide scavenging activity was calculated using the equation: (1 - absorbance of sample/ absorbance of control) × 100. Each experiment was carried out in triplicate and results averaged expressed as mean ± SD.

3. Results and discussion

3.1. Total flavonoid

The total flavonoid concentrations equivalents were used for the measurements of water extract concentrations. Based on this study, we proposed that the potent free radical-scavenging and antioxidative activity of medicinal plant might result from its high contents of flavonoid type compounds. Flavonoids are regarded as one of the most widespread groups of natural constituents found in plants. The results are shown in Table 1. All the tested fractions had high flavonoid content; kasturi had the highest (30 g/mL of quercetin equivalent, QE) and gerunggang had the lowest content (3.8 g/mL of QE). Flavonoids are known to show antioxidant activity having considerable effects on human nutrition and health. The mechanism of flavonoid action is based on scavenging or chelating process.

Table 1. Total flavonoid of kelakai, kasturi, pasak bumi, and gerunggang extracts

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Local name</th>
<th>Part used</th>
<th>Total flavonoid (Quercetin equivalents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stenochlaena palustris</td>
<td>kelakai</td>
<td>leaves</td>
<td>14.5 ± 0.7</td>
</tr>
<tr>
<td>Mangifera casturi</td>
<td>kasturi</td>
<td>fruit</td>
<td>30.0 ± 1.2</td>
</tr>
<tr>
<td>Eurycoma longifolia Jack</td>
<td>pasak bumi</td>
<td>root</td>
<td>6.1 ± 0.8</td>
</tr>
<tr>
<td>Cratoxylon arborescens Blume</td>
<td>gerunggang</td>
<td>stem</td>
<td>3.8 ± 0.4</td>
</tr>
</tbody>
</table>

3.2. Chelating effect on ferrous ions

The ferrous ion chelating activities of kelakai, kasturi, pasak bumi, and gerunggang extracts are shown in table 2. The metal scavenging effect of these samples decreased in the order of kasturi > gerunggang > kelakai > ascorbic acid > pasak bumi. Metal chelating capacity was significant, since it reduced the concentration of the catalysing transition metal in lipid peroxidation. It was reported that chelating agents are effective as secondary antioxidants because they reduce the redox potential thereby stabilizing the oxidized
form of the metal ion.

3.3. Hydroxyl radical scavenging activity

The hydroxyl radical can damage virtually all types of macromolecules: carbohydrates, nucleic acids (mutations), lipids (lipid peroxidation) and amino acids (e.g. conversion of Phe to m-Tyrosine and o-Tyrosine). The hydroxyl radical has a very short in vivo half-life of approximately $10^{-9}$ seconds and a high reactivity. This makes it a very dangerous compound to the organism. Unlike superoxide, which can be detoxified by superoxide dismutase, the hydroxyl radical cannot be eliminated by an enzymatic reaction. Mechanisms for scavenging peroxyl radicals for the protection of cellular structures includes dietary antioxidants such as flavonoid and vitamin C. The hydroxyl radical scavenging activity of the various extracts was investigated (Table 2). The hydroxyl radical scavenging of these samples decreased in the order of kasturi ≈ gerunggang > kelakai > ascorbic acid > pasak bumi.

<table>
<thead>
<tr>
<th>Plants</th>
<th>% Chelating effect on ferrous ions</th>
<th>% hydroxyl radical scavenging</th>
<th>% hydrogen peroxide scavenging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelakai</td>
<td>27.64 ± 3.12</td>
<td>16.60 ± 7.72</td>
<td>60.10 ± 9.19</td>
</tr>
<tr>
<td>Kasturi</td>
<td>53.82 ± 2.51</td>
<td>19.04 ± 0.12</td>
<td>10.75 ± 1.86</td>
</tr>
<tr>
<td>Pasak bumi</td>
<td>16.59 ± 2.11</td>
<td>5.42 ± 1.23</td>
<td>3.29 ± 0.24</td>
</tr>
<tr>
<td>Gerunggang</td>
<td>36.44 ± 1.92</td>
<td>19.09 ± 1.02</td>
<td>16.13 ± 1.36</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>26.68 ± 8.60</td>
<td>16.43 ± 5.68</td>
<td>60.10 ± 7.11</td>
</tr>
</tbody>
</table>

3.4. Hydrogen peroxide scavenging

Hydrogen peroxide scavenging activity are shown in table 2. Hydrogen peroxide can be formed in vivo by many oxidase enzymes such as superoxide dismutase. It can cross membranes and may slowly oxidize a number of compounds. The hydrogen peroxide scavenging effect of 75 μg/mL concentration of kelakai, kasturi, pasak bumi, and gerunggang extracts decreased in the order of ascorbic acid ≈ kelakai > gerunggang > kasturi > pasak bumi. Hydrogen peroxide itself is not very reactive, but it can sometimes be toxic to cells because it may give rise to hydroxyl radicals in the cells. Addition of hydrogen peroxide to cells in culture can lead to transition metal ion-dependent OH radical mediated oxidative DNA damage. Levels of hydrogen peroxide at or below about 20–50 mg seem to have limited cytotoxicity to many cell types. Thus, removing hydrogen peroxide as well as superoxide anion is very important for protection of food systems.

4. Conclusions

In the present study, the antioxidant activity of four traditionally used medicinal plants grown around the Sout Kalimantan of Indonesian was evaluated. The results of the present study suggest that tested plant materials have moderate to potent antioxidant activity and/or free radical scavenging activity. Total flavonoid were decreased in the order of kasturi > kelakai > gerunggang > pasak bumi.
Acknowledgement

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References


