THE EFFECT OF ESSENTIAL OIL OF TEMUKUNCI (Boesenbergia pandurata (Roxb.) Schlecht) ON CALCIUM KIDNEY STONE SOLUBILITY IN VITRO

Ediati Samsud
Faculty of Pharmacy, Gadjah Mada University, Yogyakarta

ABSTRAK

Salah satu dari berbagai penyakit yang sudah dikenal sejak lama adalah penyakit batu ginjal atau batu saluran kemih. Di Indonesia banyak narapidana atau bupati tanjakan yang dinyatakan dapat mengobati penyakit batu ginjal. Salah satu diantaranya adalah rempang Boesenbergia pandurata (Roxb.) Schlecht asu temukan. Tujukan dari penelitian ini adalah untuk mengetahui kadar minyak atsiri rempang temukan dalam etanol 60% yang dapat melaraskan secara maksimum batu ginjal kalsium. Untuk mendapatkan batu ginjal kalsium, dapat diperoleh dari Banah Sakit yang telah melakukan operasi. Batu ginjal dialamisasi kualitatif secara spektrofotomer infra merah dan hasil dilandingskan dengan spektra infra merah batu dari "Analyse des Cacluls par Spectrophotomerie Infra rouge, Avantages et Limites de la Methode".

Minyak atsiri rempang temukan diperoleh dengan hidrodestilasi, yang dilaraskan dengan ekstraksi menggunakan petroleum ether. Penelitian dilakukan dengan cara merendam serbuk batu ginjal kalsium (e.150 mg) dalam 10,0 ml larutan minyak atsiri dalam etanol 60% dengan 3 macam kadar yang berbeda, pada temperatur 37°C selama satu jam. Untuk mengetahui kadar kalsium yang terlaras dalam masing-masing laruan minyak atsiri digunakan Spektrofotometer Serapan Atom pada punjang gelombang 422,7 nm. Hasil penelitian kadar kalsium yang terlaras dalam laruan minyak atsiri dengan konsentrasi 0.1%; 0.4%; 0.8%; 1.2%; dan 2.0% masing-masing adalah 0.62 ± 0.004; 7.13 ± 0.644; 12.52 ± 0.037; 13.43 ± 0.049; dan 7.12 ± 0.165 ppm. Selahal dilakukan analisis variasi data jual dan uji scissors terpenta kemuan konsentrasi minyak atsiri tidak selalu diikuti oleh kemuan kalsium batu ginjal yang terlaras. Hal ini terlihat pada kadar minyak atsiri 1.2% mampu melaraskan kalsium batu ginjal paling besar.

ABSTRACT

One of various diseases known for a long time ago was kidney stone. There are a lot of plants or parts of them stated to be able to cure the kidney stone disease in Indonesia. One of them is the rhizome of Boesenbergia pandurata (Roxb.) Schlecht (temukan). This research aims to study content of essential oil from the rhizome of temukan that has a maximum ability to solubilize calcium kidney stones. The kidney stones obtained from surgery in Hospital, were analyzed by Infrared Spectroscopy to specify it and comparing the result with standard spectra of "Analyse des Calculs par Spectrophotometrie Infra rouge Avantages et Limites de la Methode" so. The essential oil used was obtained by hydrodistillation and then extracted the oil.
using petroleum ether. The study was done by soaking powder of calcium kidney stone (± 150 mg) in 10.0 ml of essential oil solution in 30% ethanol into five different containers, at 37°C for one hour. The soluble calcium in essential oil solution was analyzed using Atomic Absorption Spectrophotometer at wavelength of 422.7 nm. These results of the soluble in essential oil solution contained 0.3% ; 0.4% ; 0.8% ; 1.2% ; and 2.0% were 3.02 ± 0.054 ; 7.13 ± 0.044 ; 12.52 ± 0.057 ; 13.43 ± 0.049 ; 7.12 ± 0.035 ppm respectively. The results of analysis computed using one-way analysis the variance and scheffe test, it is actually the increase of essential oil concentration is not always followed by increasing the calcium solubilized. It is apparent at the content of essential oil 1,2% has a maximum ability to solubilize calcium kidney stone

Key words : Calcium kidney stone, essential oil of Boesenbergia pandurata, (Rath.) Schlect, solubility.

INTRODUCTION

Statistical surveys have confirmed that approximately 1% of the human population can be considered as kidney stone carriers. In F.R. Germany about 60,000 and in United States roughly 160,000 patients are hospitalized yearly for kidneystone treatment. In F.R. Germany health insurance agencies spend about 10 billion DM yearly on outpatient care; of this one-seventh is devoted to urological treatments; of that figure, about 300 billion DM are consumed by renal stone out-patient care. It should be pointed out these figures do not take into account the high costs of hospitalization, sick benefits, and about 15% of privately insured patient. Similar conditions occur in other European countries and in the United States. From this point of view it is obvious that nephrolithiasis is not only a frequent disease but also an issue of great social and economic consequence. The treatment of nephrolithiasis is generally surgical. However, owing to the high percentage of recurrent kidneystones (statistics for several European and U.S. clinics vary between 3 and 50%) and the limitations concerning the operations which can be performed on the same kidney, many endeavors have been undertaken to find nonsurgical methods for the therapy of kidney stone disease (Kallistratos, 1973).

Table 1. The chemical composition and solubility of kidney stones (Kallistratos, 1973).

<table>
<thead>
<tr>
<th>Type</th>
<th>Composition</th>
<th>Solubility</th>
<th>Number of stones (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Calcium oxalate</td>
<td>Almost insoluble</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>2 Magnesium-ammonium phosphate, calcium phosphate, calcium hydrogen phosphate, calcium carbonate.</td>
<td>Soluble in acid urine</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>3 Tartrate</td>
<td>Soluble in slight acid urine</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>4 L-cystine</td>
<td>Soluble by means of thiol-disulfide exchange reaction.</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
According to their chemical composition and solubility, kidney stones can be divided into four types in Table 1. The solubility of calcium oxalate in human urine is very low (Table 1). Theoretically, an efficient oxalate-dissolving drug should have the following properties: (a) water-soluble; (b) nontoxic; (c) react with calcium oxalate to form soluble derivatives, according to the following equation (Kalilasm, 1973):

\[
\text{Ca oxalate} + \text{H}_2\text{R} \rightarrow \text{oxalic acid} + \text{Ca-R} \\
\text{less soluble} + \text{soluble} \rightarrow \text{soluble} + \text{soluble}
\]

(in water)

Indonesia includes in the area of "stone belt", where there are a large number of kidney stone disease comparing with other countries. As usual, for stone treatment, except synthetic drug, also the traditional drug are used a lot in Indonesia. There are a lot of plants or parts of them that are able to cure kidney stone disease. One of them is the rhizome of temulakuci (Borassogigia pandurata (Roehb.) Schlechtd), used in boiling water. The rhizome containes essential oil, curcumin, zedoarinc, and starch (Gunther, 1949). The essential oil is a component which may act for calcium kidney stone treatment, can be obtained by hydrodistillation and then extracted using petroleum ether. The oil is yellowish liquid and possesses the characteristic odor and taste of temulakuci. It contains cineole, camphor, diborneol, methylchloranthal and zingiberone (Gildemeister and Hoffmann, 1950). For their structures see figure 1. Methylchloranthal and zingiberone are the compounds of temulakuci essential oil, they can react with calcium oxalate to form soluble derivatives (fig.2). Essential oil can be capulated and so more practical for consuming comparing with the use in boiling water. It is therefore necessary to study the ability of temulakuci essential oil to solubilize calcium kidney stone.

METHODOLOGY

Materias: Rhizome of temulakuci → was cleaned → cut into slices (± 2 mm) → let them in the air, indirect from sunshine → isolated the essential oil by hydrodistillation and then extracted using petroleum ether. Kidney stones were obtained by surgery and determine using infrared spectroscopy and calcium kidney stone was created → powdered by 40/80 mesh

Methods: Make five different concentrations of essential oil solution in 60% ethanol with the content of 0.2%, 0.4%, 0.8%, 1.2%, and 2.0%. Soaking 150 mg powder of calcium kidney stone in 100 ml of essential oil solution into five different content, with temperature of 37°C for one hour while shaking regularly. The mixture filtered and determined the calcium in the filtrate using atomic ab- sorption spectrophotometry at wavelength of 422.7 nm. Blanks were made by means of 60% ethanol.

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The chemical structures of cineole, camphor, d-borneol, methylcinnamate, and zingiberone.

Figure 1: Suggesting reaction to form soluble derivative between Ca\(^{2+}\) + kidney stone with zingiberone and methylcinnamate.

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RESULTS:

Ternakunci essential oil obtained by hydrodistillation and extracted the oil using petroleum ether is yellowish liquid and possesses the characteristic odor and taste of ternakunci. Kidney stone obtained by surgery and determined using infrared spectrophotometry according to Poulton (1978). The chemical composition of kidney stones is shown in table 2. Kidney stone with code II was chosen for experiment. An example of spectrum of code II is shown in figure 3.

Figure 3: Spectrogram of kidney stone with code II (Whewellite, Weddelite, Apatite)
Figure 4: Standard curve of calcium using atomic absorption spectrophotometry.

Figure 5: Representative curve of the relation between the content of essential oil and calcium which is soluble in solutions 60% ethanol.
An example of standard curve of calcium by means of atomic absorption spectrophotometry is shown in figure 4. The relation between oil concentration and calcium which is soluble in solution is shown in figure 5.

From the result, after being one-way analyzed the variance and Schefe test, it is actually the increase of essential oil concentration is not always followed by increasing the calcium solubilized. It is apparent at the content of essential oil 1.2% has a maximum ability to solubilize calcium kidney stone, but not at the content of 2.0%. The consist of essential oil tanninuct i.e. methylaminanate has a group of Olf-aromatic and zingiberene has a group of aromatic ring. According to March (1962) many metal ions form complexes with olefins, dienes (usually, but not always) and aromatic rings (reaction in figure 2). Roth and Blaschke (1981) said

Table 2. The chemical composition of kidney stone (determined using infrared spectrophotometry).

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Stonovite, Carbaspatite</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Weddelite</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Suyvita</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>Urs acid arbutate</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>Wheewelliae, Weddelite, Apatite</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>Weddelite, Wheewelliae</td>
</tr>
</tbody>
</table>

Olf-aromatic forms complex with Fe+++ both in water and a mixture of water with alcohol. Therefore it can be suggested that Ca+++ kidney stone forms complex ions with methylaminanate and zingiberene from semukan essential oil. Also it can be suggested that there is/are component/s of semukan essential oil similar with zingiberene and methylaminanate cause competitive inhibition (i.e. cataphere) in forming complex 1os with calcium. This effect is more significant for higher content of oil.

CONCLUSION:

The result of determination of calcium which is soluble in essential oil solution with the content of 0.2% ; 0.4% ; 0.8% ; 1.2% ; and 1.0% were 3.62 ± 0.054 ; 7.13 ± 0.044 ; 12.52 ± 0.037 ; 13.45 ± 0.049 ; 7.12 ± 0.035 ppm respectively. From this result, after being one-way analyzed the variance and Schefe test, it is actually the increase of essential oil concentration is not always followed by increasing the calcium solubilized. It is apparent at the content of essential oil 1.2% has a maximum ability to solubilize calcium kidney stone.

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