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Analysis of Active Content in “Salacca Vinegar” in Sibetan Village with Potential as Antidiabetic and Anticancer

I Wayan Karta¹, Cokorda Dewi Widhya Hana Sundari¹, Luh Ayu Nanamy Khrisnashanti Eva Susila², Nyoman Mastra³

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ABSTRACT

Price of salacca at harvest time in Sibetan village, Karangasem is very low, consequently researcher and farmers process it into vinegar. On the other hand natural compound is necessary to be used as anti-diabetic and anticancer. This study is aimed at analyzing active content of salacca vinegar, to know its potential in healthcare such as for anti-diabetic and anti-cancer. This is a descriptive research by analyzing the active content in laboratory.

The result of this research shows that salacca vinegar of Sibetan village contain high levels of acid as vinegar with total of 6.68%; total of phenols is 27.47 mg / 100ml GAE, total of tannins is 71.69 mg / 100ml TAE, flavonoid content is 26.51 mg / 100ml QE, antioxidant capacity is 70.21 mg / L GAEAC, IC 50 is 103.09 mg / ml, vitamin C is 4.6547 mg / 100g. The content of chemicals such as acetic acid, tannins, antioxidants, and flavonoids are potential as anti-diabetic and anticancer, because it serves in lowering blood sugar levels, free radical scavenger, helps in curing damaged pancreatic beta cells, keep the cells from oxidation and protect cells from cancer through five mechanisms. For further research, research in vitro and in vivo of salacca vinegar as an anti-diabetic and anticancer is needed.

Keywords: Vinegar, Salacca, anti-diabetic, anticancer, tannins, flavonoids, antioxidants

INTRODUCTION

(Salacca zalacca) is one of the palm species belonging to family Arecaceae spread in areas of Indonesia and Malaysia. In Indonesia, there are 18 types of Salacca that was developed in several areas, particularly in Karangasem Bali. Based on data from Department of Agriculture in Karangasem recorded 8,098,568 trees were scattered in several districts. Besides Karangasem, Tabanan is also the production center of Salacca in Bali, but the quality is not as good as Salacca in Karangasem, making it less preferred by consumers because its sour taste.

Although vinegar traditionally has been used as a food flavoring and preservative, recent investigations demonstrate the potent bioactive effects of vinegars which may benefit human health. Functional therapeutic properties of vinegar described include antibacterial activity, blood pressure reduction, antioxidant activity, reduction in the effects of diabetes, and prevention of cardiovascular disease. Other positive health effects of daily consuming vinegar reported include improving blood glucose response which would be of benefit to diabetic patients¹.

Vinegar is able to inhibit the action of enzymes that cause the absorption of glucose disakaridase result will be slower digestion and control the increase in the glycemic index². In type 2 diabetes, vinegar reduces postprandial hyperglycaemia, hyperinsulinaemia, and hypertriglyceridaemia without affecting lipolysis. As a result, vinegar’s effect on carbohydrate metabolism may be accounted for, at least in part, by an increase in insulin-stimulated glucose uptake, demonstrating an improvement in insulin action in the skeletal muscles³.
Depending on variety of vinegar and inherent acetic acid and total phenolic content, daily intake of vinegar may affect human health and metabolism. A major cause of diabetes is impaired insulin secretion, insulin resistance and excess of glucose produced by our body. Treatment of diabetes is often done through insulin therapy and medications oral antidiabetic (OAD), but such treatment can have negative effects, such as severe hypoglycemia, nausea, discomfort in the abdomen, anorexia and the long-term complications that can harm the brain and costs expensive so many people are trying to control their blood glucose levels with traditional treatments using natural ingredients such as fruit vinegar.

Based on the above exposure, so in this study will be assessed on the contents contained in salacca vinegar that has been processed by researcher together with farmer groups of Abian Salak, Sibetan village, Karangasem. Literature study is carried out to find potential vinegar as an antidiabetic and anticancer bark. The purposes of this study are (1) To describe the chemical content in fermented extract of salacca vinegar in Sibetan village, Karangasem; (2) To describe the potential of salacca vinegar to be used as antidiabetic and anticancer drugs based on chemical content.

MATERIALS AND METHOD

The type of the study is descriptive to determine the chemical content (total phenols, levels of tannins, flavonoids, antioxidant capacity, vitamin C, and acetic acid) and its potential as an antidiabetic and anticancer. Place and time of the research was conducted in farmer groups of Abian Salak, Sibetan village for the production of salacca vinegar; Applied Chemistry Laboratory, Department of Medical Laboratory Technology, Health Polytechnic Denpasar for acetic acid testing, test the total phenol, levels of tannins, flavonoids, antioxidant capacity, and vitamin C.

This study is conducted in three phases, namely the preparatory phase, implementation phase, and the data analysis stage.

(1) The preparation phase.

This phase is done by preparing tools and materials activities. Fruits as the samples obtained from farmer groups Abian Salak, Sibetan village. Sample of ripe fruits were picked at random. Other materials prepared are distilled water, sodium hydroxide (NaOH 0.1 N), oxalic acid (H$_2$C$_2$O$_4$ 0.1 N), pp indicator. Materials for testing in Laboratory been provided by a laboratory.

(2) The Process of Making Salacca Vinegar

The process of making vinegar bark is done by squeezing the fruits as much as 5 kg, in order to obtain the juice of 1 liter, and then allowed to stand for 3 months.

(3) Content Analysis of Vinegar Acid

A total of 25 mL of salacca vinegar that has been filtered, then diluted 10 times by adding distilled water up to 250 mL in a volumetric flask. Then the bark as much as 25 mL of vinegar diluted with 0.5 mL added with fenofaltein indicator (pp) and titrated with 0.1 N NaOH solution standardized with 0.1 N oxalic acid titration is stopped if there has been a change in color from clear colorless to pink. Titration done 3 times restating. Acetic acid as the total acid is calculated using the following equation.

\[
% \text{Total } \text{acid} = \left( \frac{B_{\text{titrated}} \cdot V_{\text{acid}} \cdot N_{\text{acid}}}{V_{\text{acetic}} \cdot 1000} \right) \times \text{dilution factor} \times 100\%
\]

(4) Total Analysis of phenols, tannins, flavonoids, antioxidants, and vitamin C

Total Analysis of phenols, tannins, flavonoids, antioxidants conducted using a spectrophotometer, and vitamin C by iodometry. This examination is carried out by a laboratory in Applied Chemistry Laboratory, Department of Medical Laboratory Technology, Polytechnic Denpasar of Health.

(5) Data Analysis Phase

Data have been obtained from the results of laboratory tests manually processed and analyzed descriptively in tables and narrative with relevant literature review.

RESULTS

Results of measurements of the levels of vinegar (acetic acid) in a sample performed in chemical laboratories required 0.1 N NaOH with an average volume of 27.83 mL, thus obtained acidic and 6.68%. Results calculation vinegar acid levels and other chemical constituents are presented in Table 1.
Table 1. Chemical Content of Salacca Vinegar of Sibetan Village

<table>
<thead>
<tr>
<th>No.</th>
<th>Analysis</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Total of Fenol</td>
<td>27.47 mg/100 mL GAE</td>
</tr>
<tr>
<td>2.</td>
<td>Level of Tanin</td>
<td>71.69 mg/100 mL TAE</td>
</tr>
<tr>
<td>3.</td>
<td>Level of Flavonoid</td>
<td>26.51 mg/100 mL QE</td>
</tr>
<tr>
<td>4.</td>
<td>Antioxidants Compounds</td>
<td>70.21 mg/L GAEAC</td>
</tr>
<tr>
<td>5.</td>
<td>IC 50</td>
<td>103.09 mg/mL</td>
</tr>
<tr>
<td>6.</td>
<td>Vitamin C</td>
<td>4.6547 mg/100gr</td>
</tr>
<tr>
<td>7.</td>
<td>Total Levels of Acid</td>
<td>6.68 %</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Results of calculation to determine the amount of salacca vinegar is 6.68%. The total acid content is higher than the content of the acetic acid bark varieties Suwaru Malang 3.49%. These levels high enough to provide benefits to consuming salacca vinegar Abian Salak, Sibetan Karangasem. Vinegar contains acetic acid that has been implicated in the regulation of blood glucose levels\(^6\). Salacca Vinegar Sibetan also greater than the apple cider vinegar at 4.53%\(^7\). The acetic acid in salacca vinegar allegedly give effect to control blood glucose by affecting the rate of gastric emptying. The results showed that a decline in the rate of gastric emptying after giving vinegar resulting darah11 control glucose levels.

Mechanism of vinegar in lowering blood glucose levels is a major component in vinegar in the form of acetic acid allegedly capable of inhibiting the action of enzymes disakaridase resulting in digestion of complex carbohydrates so that the absorption of glucose products of digestion will be slower and the increase in the glycemic index can be controlled\(^2\). This is reinforced by studies showing that administration of vinegar can improve insulin sensitivity, lower glucose levels pospandrial, and lowering the level of insulin resistance due to substances such as acetic acid\(^8,9\). The study also shows that the test results salacca vinegar contains total phenols of 27.47 mg / 100 mL or 274.7 ppm; tannins 71.69 mg / 100 mL or 716.9 ppm; flavonoid 26.51 mg / 100 mL or 265.1 ppm; and the antioxidant capacity of 70.21 mg / L (ppm). The chemical content has potential as an antidiabetic. This is based on testing in vivo in Wistar rats, treatment with the diabetes drug metformin is more effective in lowering blood glucose levels compared vinegar bark, but not better repair damaged pancreatic tissue\(^10\).

Antioxidant compound effect on a decrease in blood glucose levels for allegedly able to function as a free radical scavenger. The antioxidant activity of bark vinegar serves as a free radical scavenger which is able to reduce the reactivity of free radicals, which can lower blood glucose levels as a result of oxidative stress and prevent excessive oxidation. This inhibition can protect pancreatic beta cells from damage\(^10,11\). A decrease in blood glucose levels of mice allegedly caused by a combination of acetic acid, antioxidants, and a variety of other functional components such as tannins and flavonoids contained in vinegar helps repair damaged pancreatic beta cells, thereby increasing insulin secretion\(^6\).

Flavonoids also donate a hydrogen atom to form a peroxide radical flavonoids radicals easily react with free radicals so radical chain reaction stops. The ability of polyphenol compounds in counteracting free radicals caused by its structure. In the flavonoid compound, the hydroxyl group on the aromatic ring, it will donate H atoms on the free radicals. Phenoxyl radical flavonoids formed then undergoes resonance stabilization by conjugated double bond system so that the radicals are less reactive\(^12\). Antioxidant compounds such as flavonoids and tannins well in anticancer function.

Polyphenols in foods can provide an anticancer effect through several mechanisms are possible, such as the elimination of carcinogenic agents, modulation signals cancer cells and enzymatic antioxidant activity and induction of apoptosis and cell cycle arrest\(^13,14\). Some of these effects may be related, at least in part of antioxidant activity. In recent years, a new concept of the effect of polyphenolic antioxidants in foods have emerged, namely, direct activity against reactive species and antioxidant activity indirectly; last activity is thought to arise primarily through the activation of nuclear factor-erythroid 2-related factor 2, which stimulates the activity of antioxidant enzymes such as glutathione peroxidase (GPx), glutathione S-transferase, catalase, NAD (P) H: quinone-oxidoreductase 1 (NQO1), and / or phase II enzymes.

Antioxidants are found in the bark vinegar Sibetan
village is that polyphenolic compounds flavonoids and tannins. Flavonoids are polyphenolic compounds that are known to have anticancer activity. At least five mechanisms of anticancer activity of polyphenols. First, the ability of polyphenolic antioxidants may protect cells from DNA damage by cleaning the cell from free radicals (Reactive Oxygen Species / ROS). Secondly, polyphenols modulate protein that plays a role in signal transduction pathways such as activator protein 1 (AP-1), mitogen-activated protein kinase (MAPK), phosphatidylinositol 3-kinase (PI 3'K), p70S6-K and Akt. Third, polyphenols reduce the activity of the tyrosine kinase receptor (PDGF-Rβ, EGF-R), which plays a role in malignant proliferation of tumor cells. Fourth, polyphenols induce apoptosis in tumor cells. Fifth, polyphenols overcome multidrug resistance by blocking the P-glycoprotein efflux (P-gp) against anticancer drugs. Of the five such mechanisms play a role in the cytotoxic mechanism is by inducing programmed cell death (apoptosis) (Demeule et al. 2002). Antioxidant mechanisms in the cell can be illustrated in Figure 1.

Cancer cells can propagate and spread to other cells. Antioxidants block the damaging free radicals when the cell nucleus by providing a hydrogen atom from the free radicals that antioxidants free radicals to be stable. In the cyst disease, free radicals attack the cell nucleus from an organ that is being attacked, so do the division with uncontrolled and mutated. Antioxidants work by providing hydrogen atoms to free radicals so as not to damage the cell nucleus and free radicals to be stable. Antioxidants can prevent early blood vessel damage if consumed regularly. Antioxidants capture the free radicals that are in the blood vessels to the heart so that the heart blood vessel damage does not occur16. Antioxidants can prevent and repair damage to the respiratory tract and lung area. Free radicals that come from cigarettes and pollutants will be captured by antioxidants that improve lung health channel. In the eye, the antioxidant will capture free radicals that enter the eye before the radical molecules oxidize lipids and proteins in the lens by binding free radicals. So that eye damage can be prevented. Antioxidants will help capture free radicals will oxidize bone cells, thus preventing damage to the bone. For hepatitis, antioxidants will help to capture free radicals, preventing the gene mutation, and repair damaged liver cells16. Based on this, the bark vinegar Abian Salak Sibetan village has great potential as a product resulting from the processing of fruits of economic value because of its chemical content of health benefits that anti-diabetes and anticancer.

CONCLUSION

Vinegar bark or Salacca vinegar processing results of researchers with farmers’ groups Abian Salak Sibetan village Karangasem contain chemicals that total levels of acid as vinegar acid by 6.68%; total phenols of 27.47 mg / 100ml GAE, tannins of 71.69 mg / 100ml TAE, flavonoid content of 26.51 mg / 100ml QE, the antioxidant capacity of 70.21 mg / L GAEAC, IC 50 of 103.09 mg / ml, vitamin C of 4.6547 mg / 100g. The content of these chemicals such as acetic acid, tannins, antioxidants, and flavonoids potential as antidiabetic and anticancer, because of the presence of the compound can function in lowering blood sugar levels, free radical scavenger, helps improve pancreatic beta cells are damaged, keep the cells from oxidation and protect cells from cancer with five mechanism.

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