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Pharmacological Activities of Bunga lawang (*Illicium verum*)

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A B S T R A C T

Star anise (*Illicium verum*) has long been used in traditional medicine and the food industry to prevent cold and relieve pain. The traditional use of star anise (Illicium verum) is evidenced from South Asia and West Asia, where the star anise has been consumed for the treatment of a number of disease disorders. In this article, the discussion on star anise (*Illicium verum*) is focused on its chemical composition and medical value, especially on its pharmacological activities such as antimicrobial, antioxidant, anti-insect, anticancer, anti-inflammatory, antidiarrheal, antifungal and the use of star anise as orthodox medicine and traditional applications.

INTRODUCTION

Plants are an important part of ancient medical systems for treating various communicable and non-communicable diseases in the world. Plants are rich in bioactive compounds such as phenols, terpenoids, alkaloids, and so on which make plants important medicines. In general, the use of herbal medicines to treat various disease conditions is more common in rural areas where accessibility to food and health services is also limited (Bukar, Dayom, and Uguru, 2016). People usually consume plants in various forms, namely infusions, spices, and medicines and some are used as a spice in the kitchen to add flavor to food to provide health benefits (Bagchi and Srivastava, 2003). The star anise comes from the Magnoliaceae family, is an aromatic plant, has a star shape, and its fruit is very important as a spice for oriental cuisine. The star anise (*Illicium verum*) has a number of medicinal properties which are very popular in China and Vietnam in Figure 1.

Figure 1. The left Image is an Anise Flower Plant
(The Picture on the Right is an Anise Flower)

LITERATURE REVIEW

In addition to its use in China, star anise fruit is often used in traditional Indian medicine to treat dyspepsia, flatulence, spasmodic colonalgia, dysentery, cough, asthma, rheumatism, facial paralysis, and so on. In addition, the essential oil of star anise consists of prenylated C6-C3 compounds, lignans, sesquiterpenes, and flavonoids. Among all, it is the anethole compound that is responsible for the characteristic taste. In addition, α-pinene, β-pinene, myrcene, αphellandrene limonese, ɣ-terpineol, linalool, α-terpineol, estragole, trans anethole, α-cubebene, carryophyllene oxide, and α-humulene in anise essential oil also reported to contain a number of pharmacological activities (Aly, Sabry, Shaheen, and Hathout, 2016). The star anise (*Illicium verum*) used and applied in traditional medicine has properties such as antimicrobial, antioxidant, anti-insect, anticancer, anti-inflammatory, antidiarrheal and antifungal. Therefore, the discussion focuses on the chemical composition and pharmacological activity, and functional applications of star anise.

METHODOLOGY

This research method is a literature review, namely a systematic, explicit and reproducible method for identifying, evaluating and synthesizing research works and ideas that have been produced by researchers and practitioners. Purpose of research literature revew to obtain a theoretical basis that can support solving the problem being studied. The theory obtained is the first step for researchers to better understand the problems being studied correctly according to the scientific framework of thinking.

RESEARCH RESULT AND DISCUSSION

Chemical Composition of the Star Anise

Star anise (*Illicium verum*) is a source of carbohydrates, protein, vitamin A, and arcoic acid. Star anise (*Illicium verum*) contains protein (2 g to 4 g), carbohydrates (65 g to 75 g), fat (4 g to 6 g), dietary fiber and sugar. Anise flower (*Illicium verum*) is a rich source of minerals such as sodium, calcium, zinc, magnesium, potassium, iron and copper. Energy of 359 kcal is obtained from 100 g of star anise. The aromatic smell that arises from the star anise is due to the essential oil content of the star anise of 2.5% to 3.5% in fresh fruit and 8% to 9% in dried fruit. GCMS is commonly used to determine the chemical profile of essential oils. The scented essential oil mainly consists of trans anethol and shikimic acid (3,4,5-trihydroxy-1cyclohexane-1-1carboxylic acid) in Figure 2

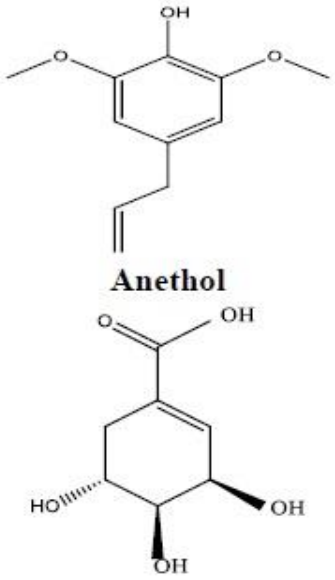

Figure 2. The structure of the Shikimic Acid Compound
Found in Star Anise Flower Essential Oil (*Illicium verum*) (Boota, 2018)

Outemsaa et al (2021) reported that the results of gas chromatographic mass spectrometry (GC and GC/MS) analysis of star anise essential oil where star anise contains twenty-eight constituents with the main compounds being trans anethole (83.46%), D-Limonese (4.56%), estragole (3.47%), and linalool (1.07%). The results of other studies showed similar results and were able to identify the percentage of trans anethole star anise from 88.5% to 92.4% (De et al, 2002). These main compounds are known for their pharmacological activity. Other compounds found in star anise are d-Limonene (4.56%), estragole, an

isomer of anethole (3.47%), and terpineol (1.7%) which are all known as bioactive photochemicals which are found in many anise flower essential oil. The percentage variation in star anise essential oil varies based on variations in climatic conditions, harvest time, extraction methods, and methods of storage of star anise essential oil.

Pharmacological Activities of the Star Anise

In general, star anise (*Illicium verum*) contains an excellent source of chemical compounds and the presence of these compounds can be a potential pharmacological activity in star anise (*Illicium verum*) with the following explanation:

1. **Antimicrobial activity**
   Star anise (*Illicium verum*) has excellent antimicrobial activity. Trans anethol is the main component of star anise which exhibits antiparasitic, antiviral, antibacterial and antifungal properties (Huang et al, 2010). The IC50 value of star anise oil on the micellar growth of eleven plant pathogenic fungi observed was in the range of 0.07 mg to 0.25 mg per mL. Meanwhile, for all other tested parasitic fungi this IC50 value was observed from 0.06 mg to 0.25 mg per mL. The agar diffusion method is adopted as the standard method for identifying the in vitro antiseptic activity of isolated anetholes. The results of research conducted in 2010 showed that CO2 and ethanol supercritical extracts of anise flowers provided substantial antibacterial activity against 67 isolates that were resistant to clinical drugs, including Pseudomonas aeruginosa and Acinetobacter baumannii (Yang et al, 2010). Antimicrobial compounds from mace flowers including shikimic acid and the flavonoid quercetin were also identified in this study. Antibacterial activity of methanol extract and anise flower decoction against anaerobic and aerobic bacteria was also carried out in vitro using standard disc diffusion method. The researchers examined the antimicrobial activity of the decoction and methanol extract of the anise flower against various anaerobic bacteria including Porphyromonas gingivalis, Eikenella corrodens, Actinomyces odontolyticus, Veilonella parvula, Peptostreptococcus micros, and Capnocytophaga gingivalis. Only Eikenella corrodens showed susceptibility to methanol extract (MIC 256 mg/L) and anise flower decoction (512 mg/L). In addition, moderate anti-HIV activity was demonstrated by compounds (phenylpropanoid, 26-methyl ester and 26-dioic acid) isolated from anise roots (Boota et al, 2018).

2. **Antioxidant activity**
   Star anise (*Illicium verum*) contains relatively low phenolics (2.02 g gallic acid equivalent per 100 g dry weight) and has slightly low antioxidant activity (TEAC value 20.3 mmol per 100 g dry weight) (Surveswaran et al, 2007; Guo et al, 2008; Thring et al, 2009). The antioxidant activity of the ethyl acetate extract of anise flowers was tested in refined peanut oil at 60 ± 0.5 C (Pan et al, 2014). The concentration of anise flower ethyl acetate extract added was 0.20%. The degree of oxidation is assessed by measuring the peroxide number and calculating characteristics such as the induction period. The

results showed that the extract slightly reduced peroxide formation in refined peanut oil compared to pure oil. The antioxidant activity of star anise extract was further studied in vitro using the iron thiocyanate method in a linoleic acid system by reducing the power and scavenging effect (%) on 1,1-diphenyl-2-picryl hydrazyl (DPPH) radicals. The rinsing effect of star anise extract on radical DPPH increased linearly with increasing concentration from 5 mg to 20 mg per mL. At 20 mg per mL, the inhibition percentage of mace extract was 97.6% and this is comparable to well-known antioxidants such as butylated hydroxytoluene (BHT, 96.3%), butylated hydroxyanisole (BHA, 97.0%), and popyl gallate (P.G.,93.4%). However, the inhibition percentages of BHA<BHT and PG were much more effective at lower concentrations and were 72.1%, 69.4% and 71.6% at 5 mg per mL, respectively. Various solvent fractions of star anise (Illicium verum) together with spice powder were evaluated for antioxygenic activity by sunflower oil, linoleic acid peroxidatone, β-carotene-linoleate and DPPH method (Padmashree et al, 2007). The inhibition percentages of star anise powder, petroleum ether, ethanol, and water extract were 53.0%, 40.6%, 76.3%, and 56.7%, respectively. Synthetic tertiary antioxidant butylhydroquinone (TBHQ) was used to control the ratio of 83.9%.

3. Anti-insect activity

The anti-insect activity of star anise against the fruit fly (Drosophia melanogaster) was observed in vitro by direct contact application and the fumigation method and separation oriented towards the activity of the methanol extract to produce (E)-anethole as an important substance in the anti-insect activity of star anise. (E)- anethole used in D. melanogaster was 0.2 mg per mL. Anti-insect activity (E)-anethole was also shown against adult Blatella germanica (Chang and Ahn, 2002). In the filter paper diffusion test, (E)-anethole caused an insect mortality percentage of 80.3% at 0.159 mg/cm2 at 1 and 3 days after treatment. Meanwhile, hydramethylnon showed an insect mortality percentage of 93.3%. Good anti-insect activity against Lasioderma serricorne adult was achieved by methanol extract of anise flower applied at 3.5 mg/cm2 in the filter paper diffusion method (Kimel et al, 2003). At 3.5 mg/cm2, the methanol extract of anise flower acts fast causing the percentage of insect mortality to be 100% 1 day after treatment. Anti-insect properties were also observed in star anise essential oil against larvae and adults of *Callosobruchus chinensis*, *T. castaneum*, *Botrytis cinerea*, and *Colletotrichum gloeosporioides* (Chaubey, 2008; Shukla et al, 2008; Lee et al, 2007). The LC50 for anise oil against adults and larvae of C. chinensis were 12.5 L and 11.1 L, respectively. The LC50 for adults and larvae of T. castaneum were 19.87 L and 18.43 L, respectively. Maini and Morallo (1992) reported that the toxicity of star anise oil for golden snails showed that the percentage of insect mortality was 100% at 10 to 20 ppm for young snails.

4. Anticancer activity

The human body has natural arrangements to counteract free radicals. However, consumption of foods rich in cancer-preventing substances can

increase innate protection. Free radical and nicotine diseases can be cured by using star anise because it has carcinogenic substances. Anticancer activity is triggered by flavonoids, resveratrol, and curcumin in mace flowers. In addition, the use of star anise shows potential for repair including anti-inflammatory cell defense and DNA protection and has a positive effect on cancer cell migration and DNA damage (Huang et al, 2009).

5. **Antiviral Activity**
   Star anise (*Illicium verum*) has strong antiviral activity. The chemical, namely shikimic acid in the anise flower is responsible for the antiviral activity. Shikimic acid exhibits nativirus activity well when mixed with another compound called quercetin (a cancer-preventing agent). The mixture of these two ingredients also prevents and cures flu. A mixture of these two ingredients is also being tested by Chinese and Taiwanese researchers for the treatment of bird flu (Boota et al, 2018).

6. **Anti-Inflammatory Activity**
   Acute inflammatory protection is a normal protective process that helps the body fight infection. Star anise (*Illicium verum*) is used in inflammatory disorders. Anti-inflammatory activity of star anise flower was identified in rats with sylene-induced rat earlobe edema. To identify anti-inflammatory activity, the digestive system of the rat digestive system was separated and then injected with xylene. The pressure and contractions of the intestinal muscles are reduced. Swelling of the ears of rats by injection of xylene can reduce the torsion pain threshold of rats. 10 mg star anise extract and 20 mg crude drug per mL decreased the contractility of the smooth muscle of the rat intestine within 15 minutes after the rats were under the influence of acetylcholine and barium chloride. Therefore, anise flower water extract has an anti-inflammatory effect on rat intestinal smooth muscle (Deng et al, 2014).

7. **Antidiarrheal Activity**
   In various countries in the world, diarrhea is a serious health problem. This disease can be cured with herbal medicine. One of the herbal remedies that can be used is the use of star anise (*Illicium verum*) for the treatment of diarrhea. A study of the gastrointestinal action of a mixture of chamomile and star anise (*Illicium verum*) was performed on rats and the rate of activated carbon through the intestinal tract of the animals was measured. Different mixtures were prepared in 50:50 proportions of the herbs and administered at 10 mg/kg, 20 mg/kg, 40 mg/kg, and 80 mg/kg orally. The results obtained are a mixture of 40 mg/kg and 80 mg/kg reduces the level of activated carbon and inhibits intestinal looseness and reduces the amount. This study recommends that a mixture of chamomile and star anise (*Illicium verum*) can be used as an alternative anti-diarrhea treatment (Diaz et al, 2014).

8. Antifungal Activity

Antifungal activity of star anise (*Illicium verum*) was tested against *Fusarium solani*, *Fusarium graminearum*, and *Fusarium oxysporum*. Thorough inhibition was examined using a concentration of star anise of 100 ppm because the antifungal action was very high. The growth of *Fusarium verticilioides* was also completely inhibited at a concentration of star anise of 200 ppm (Aly et al, 2016)

CONCLUSION AND RECOMMENDATIONS

Star anise (*Illicium verum*) is an important plant species that has high pharmacological activity. Star anise has been used as an ingredient in various traditional medicines to be processed and applied to treat various disease conditions. Anise flower is considered very promising because of its chemical composition and pharmacological activity which is very useful in the world of health. Overall, consumption and utilization of star anise (*Illicium verum*) should be further supported. More in-depth research is needed on the potential of other pharmacological effects.

ADVANCED RESEARCH

It is necessary to carry out qualitative and quantitative test studies on the content of secondary metabolites from star anise or bunga lawang (*Illicium verum*).

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