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THE POTENTIAL OF SWEET STARFRUIT AS A GASTROPROTECTOR OF GASTER DAMAGE DUE TO FREE RADICALS

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ABSTRACT
Gastric ulcer is a condition when deep gastric mucosa is damaged. This condition can be caused by oxidative stress which produces free radicals. Ulcer can be potentially prevented or treated with active substances contained by plants such as sweet starfruit. Sweet starfruit (Averrhoa carambola Linn) is a plant that has a high antioxidant effect with flavonoid content which plays a role in the process of gastric mucosal damage Objective to describe the potential gastroprotector effect of sweet starfruit (Averrhoa carambola Linn) in gastric damage caused by free radicals. This paper used literature study involving 18 libraries both national and international books and journal. Sweet starfruit (Averrhoa carambola Linn) contains flavonoid, this compound can work as an antioxidant by giving electrons to free radicals which causes the structure of free radicals to be more stable so that it can prevent the process of lipid peroxidase. Conclusions: Sweet starfruit has anti-ulcer potential effect with its antioxidant content which is flavonoids.

Keywords: gastric ulcer, free radical, sweet starfruit, antioxidant

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INTRODUCTION

Gaster is an organ that has a variety of functions in the digestive process, this organ plays role as a food storage before digestion to organs that involve in the process of mixing foods that contain gastric secretions containing gastric acid and digestive enzymes. Gaster is located in the upper left quadrant of the peritoneal cavity. The normal length of an adult gaster ranges from 15 cm to 25 cm, while the diameter and volume of the gaster is very dependent on the volume of food that enters the gaster. Unfilled gastric has a volume of about 50 mL and the volume can increase up to 4 L (Martini, *et al*., 2012; Guyton & Hall, 2008).

Gaster is very susceptible to exposure of various irritants that are either consciously or unconsciously consumed by humans. Gaster can be damage by exposure to irritants continuously in form of gastritis or gastric ulcer (Anjasmara, Romdhoni & Ratnaningsih, 2017). Gastric ulcer is histologically defined as a damage to the gastric mucous membrane

both superficially and the deeper part of the mucosa until it reaches the muscular tunica. Besides due to exposure to irritants, this condition can be caused by gastric acid secretion or excessive pepsin activity (Mejia & Kraft, 2009; Ahmad, et al., 2013). Some of the factors that can be the etiology of this condition are alcohol consumption, smoking, nutritional deficiencies, infections from Helicobacter pylori, psychological conditions such as stress, and irrational use of nonsteroidal anti-inflammatory drugs (NSAIDS) (Ahmad, et al., 2013). Some of these causes can cause oxidative stress which can induce damage to the gastric cell membrane. Oxidative stress will produce free radical, which is defined as compounds that have unpaired electrons so that it causes a very reactive and unstable nature. Damage to gastric cells due to free radicals occurs through the mechanism of lipid peroxidation. The components contained in the gastric cell will be released due to damage of the integrity of the gastric cell, one of these components is the release of the enzyme lysosomes which can cause further tissue damage (Suzuki, et al., 2011).

Conventional therapies used in patients with gastric ulcers include antacids, H_2 blockers such as ranitidine or cimetide, proton pump inhibitors (PPI) groups such as omeprazole, prostaglandin analogues, antibiotics in H. pylori infection, to surgical therapy. However, this therapy is limited by the side effects that can be caused or limited by the presence of other morbidity conditions. Scientists have developed a method that can be used to treat tissue damage caused by oxidative stress, which is antioxidant. Antioxidants are used widely over the last few years in Indonesia. This is because antioxidants can be found in a variety of plants. Antioxidants can be used for wound healing, hepatoprotecting, and gastroprotecting by binding free radicals that inhibit oxidation reactions (Sunil, 2014; Hatware, *et al*., 2018; Vimala & Gricilda, 2014; Song, *et al*., 2016).

Sweet starfruit (Averrhoa carambola Linn).can be easily found in Indonesia. Sweet starfruit (Averrhoa carambola Linn) is one of the medicinal plants that has been utilized in various countries both tropical and subtropical countries in the world, especially in Indonesia. Sweet starfruit contains lots of vitamin C and oxalic acid, while starfruit extract contains glycosides, amino acids, and antioxidants such as flavonoids and phenols (Alhassan & Ahmed, 2016). Based on its potential, research for sweet starfruit is important to be conducted to determine the anti-ulcer effect in preventing or treating gastric ulcer. The purpose of this article is to describe the potential gastroprotector effect of sweet starfruit (Averrhoa carambola Linn) in gastric damage caused by free radicals.

METHOD

The method used in this article is literature study. Literature sources obtained through the PubMed and Google Scholar databases. The selection of source articles is done by reviewing the title, abstract and results that discuss the potential of sweet star fruit (Averrhoa carambola Linn) as a gastroprotector from gastric damage caused by free radicals.

RESULTS

Goncalves et al in 2006 analyzed the potential anti-ulcer effect of starfruit ethanol extract in rats given alcohol and found a significant difference (one way ANOVA $p<0.05$) in the

administration of extracts with doses of 800 and 1200 mg/kgBW. The anti-ulcer effect is seen with the ulcer index obtained by adding up an arbitrary scale score of 1 for bleeding in the form of ptechiae, 2 is for small ulcers, and 3 is for two ulcers or one large ulcer. Based on the result, the ulcer index in the starfruit extract group with a dose of 800 mg/kgBB had a mean ulcer index of 20.73±3.42, and the group given extracts with a dose of 1200mg/kgBB had an average ulcer index of 8.90±1.58. Based on these results, there is a decrese in the ulcer index in graded doses of star fruit extract, this indicates the potential for anti-ulcers in rats induced by alcohol to cause a condition of oxidative stress (Goncalves, et al., 2006).

In addition, the anti-ulcer potential of sweet starfruit plants was investigated by Pal et al. in 2019. In this study also seen the anti-ulcer effect in mices induced by alcohol administration. In the results obtained, the ulcer index in the starfruit ethanol extract group with a dose of 100mg/kgBB and 200mg/kgBB had a mean ulcer index of 2.333 ± 0.441 and 1.75±0.461 respectively compared to the control group which had a mean ulcer index of 3.833 ± 0.358 (Pal, et al., 2019).

DISCUSSION

Gaster is a digestive organ that is very easily exposed to exogenous substances such as irritants or pathogenic exposure obtained from daily diet. Damage of gastric mucosa can be caused by excessive gastric acid secretion or pepsin activity. Under normal circumstances the secretion of gastric acid and pepsin activity will not cause damage to the gastric mucosa. However, if the defense from gastric mucosa are damaged, there will be a reverse diffusion of H^+ from the gastric lumen into the mucosa. Reverse diffusion of H^+ will cause reactions that can damage the gastric mucosa and cause pepsin to be released in large quantities (Mejia & Kraft, 2009; Ahmad, et al., 2013).

Although infections from Helicobacter pylori have the highest role as inducers of oxidative stress, conditions such as alcohol consumption, smoking habits, nutritional deficiencies, psychological conditions such as stress, and irrational use of nonsteroidal anti-inflammatory drugs (NSAIDs), and other comorbid conditions such as infections from cytomegalovirus, Tuberculosis infection, Crohn's disease, hepatic cirrhosis, chronic kidney failure can cause oxidative stress which can induce damage to the gastric cell membrane. Free radicals that are formed due to oxidative stress are atoms or molecules that have unpaired electrons and are unstable and very reactive.

The formation of free radicals such as reactive oxygen species (ROS) in normal circumstances is a natural part of aerobic life. The formation of ROS is responsible for the manifestation of cellular functions including signal transduction pathways, defense against invading microorganisms and gene expression to encourage growth or death (Finkel & Holbrook, 2000). Oxidative stress occurs due to imbalance of production and elimination of free radicals and a decrease in the production of natural antioxidants in the body, glutathione (GSH). Excessive level of ROS under conditions of oxidative stress will induce damage to the gastric membrane through the process of lipid peroxidation causing damage to DNA strands and oxidizing all biological molecules that cause tissue damage (Ahmad, et

al., 2013; Suzuki, et al., 2011). Oxidative stress can also cause cell death through the mechanism of apoptosis, which leads to larger cellular and tissue injury (Apel & Hirt, 2004; McCord, 2000).

Sweet starfruit (Averrhoa carambola L) (Oxalidaceae) can be found in various countries such as America, Brazil, Australia, Southeast Asia including Malaysia, South China, Taiwan, and Indonesia. Star fruit trees can grow as high as 3 to 5 m and can reach a maximum height of 10 meters. Star fruit trees have wooden stems that grow perpendicularly, with trunks in the shape of gilig and dark brown in color. Sweet star fruit, including berries (buni), namely fruit that can be eaten. Star fruit is oval in shape with five flesh, with a length of about 8.0–16.5 cm, thickness and length of the grain, respectively 1.5–2.7 cm, and 2.2–5.2 cm (Ashok, et al., 2013).

Based on research that has been done, the flavonoid content in sweet star fruit is thought to be an active compound that contributes to the anti-ulcer effect in research subjects induced by alcohol administration to cause an oxidative stress condition. Flavonoids are compounds that are generally found in green plants that have antioxidant effects. This compound can work as an antioxidant due to the presence of free hydroxy functional groups and carbon-carbon double bonds. Flavonoids captures free radicals by releasing hydrogen atoms in their hydroxyl groups, so the structure that is considered to play the most role is the configuration of beta-hydroxyl rings because this structure works by donating hydrogen molecules and electrons to hydroxyl radicals, peroxyls, and peroxynitrites so that these free radicals will be relative stable so as to prevent lipid peroxidation and the formation of signals that can induce apoptosis (Kumar & Pandey, 2013)

CONCLUSION

Sweet starfruit has the potential as a gastroprotector from gastric damage caused by free radicals with its antioxidant content which is flavonoids. Flavonoids work by giving electrons to free radicals which causes the structure of free radicals to be more stable so that it can prevent the process of lipid peroxidase. Due to its benefit, further research is needed to determine the substances contained in Sweet starfruit which has a role to protect gaster from free radicals damage.

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