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Evaluation of fucoidan bioactivity as anti gastric ulcers in mice

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Abstract

Fucoidan is a polysaccharide compounds containing sulfate group. Fucoidan is found in brown seaweed. In this study, we assess fucoidan activity extracted from brown seaweed Sargassum crassifolium origin from Binuangeun, Banten. Fucoidan extract was tested in mice in vivo. Observations were carried out during 16 days the control (without fucoidan) and fucoidan treatment. Fucoidan were given in various concentration of 100, 200, 300, 400 ppm. On the 14th day, aspirin was given to mice with pre-treated fucoidan 400 ppm as gastric ulcer induction. The fucoidan extracts compositions showed: water content 3.11%, uronic acid 556 ppm, 0.12 ppm sulfate and 1648 ppm total carbohydrate. Results from histopathology assay in mice tissue stomach showed that 100 ppm of fucoidan can inhibit gastric ulcers caused by 400 ppm aspirin irritation. Fucoidan was associated with an increase in the mucus layer in the gastric mucosa.

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Keywords: fucoidan, induced-gastric ulcer, irritation, aspirin, bioactivity

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1. Introduction

Fucoidan is a sulfated polysaccharide found mainly in various species of brown seaweeds. Sulfated polysaccharides extracted from seaweeds have been proven to have valuable pharmaceutical and biomedical potential activities [1], such as antioxidant, anticoagulant, antithrombic, and antiviral properties [2,3]. It was also reported that polysaccharides from the brown alga *P. pavonia* (*pavonica*) exhibit anticoagulant activity.

Research on indications of fucoidan can prevent hyperplasia in rats. Aspirin known as acetylsalicylic acid, and drugs called salicylates. Aspirin is often used to reduce pain. Aspirin is known as a class of non-steroidal drugs. Aspirin was the first-discovered member of the class of drugs known as non-steroidal anti-inflammatory drugs (NSAIDs), not all of which are salicylates, although they all have similar effects and most have some mechanism of action which involves non-selective inhibition of the enzyme cyclooxygenase [4].

Studies have indicated that fucoidan can induce apoptosis in human lymphoma cell lines and inhibit hyperplasia in rabbits. Few studies have reported the effect of fucoidan on proand anti-inflammatory cytokines. In animal models, ingestion of fucoidan has inhibitory effects on tumors, which appears to be associated with a rise in interferon-gamma (IFN- ϒ) and interleukin-12 (IL-12) and stimulation of innate immunity[5].The fucoidan is a safe substance with potential for gastric protection[6]. Therefore, the objective of this study is to investigate the effectiveness of fucoidan on the used aspirin as a cause of gastric ulcers in mice.

2. Materials and methods

2.1. Chemicals

Brown seaweed *Sargassum duplicatum* was obtained from Banten. EtOH, acetone, NaOH, and inorganic acids and salts ($CaCl_2$, NaCl) were commercial products. CMC (carboxyl methyl celulosa) was commercial products.

2.2. Experiments

First we extracted fucoidan from brown seaweed followed (Sinurat method). Before the extraction of fucoidan has been tested of species brown seaweed. Brown seaweed was rinsed with water and dried in open air then milled and freeze -dried. The solid powder of brown seaweed was dissolved and incubated in mixture solvent of MeOH-$CHCl_3$- H_2O with a ratio of 4: 2: 1 for 12 hours then washed with acetone and dried (F1). Moreover, this sample then was soaked with HCl 0,1N (1:10) (w / v) then mixing for 6 hours at room temperature. Planktonic filtered using 500 mesh, the filtrate collected. The filtrate was neutralized using NaOH 0.5 M and 4M $CaCl_2$ solution (1:10) while stirring mechanically for 60 minutes and heating at temperature 85 ^oC then filtered, the filtrate collected (F2). The filtrate was centrifuged and diluted in water containing 0.5 M $CaCl_2$ and 5% CPC precipitation as precipitated filtrate (F3). In addition of 3 M $CaCl_2$ and ethanol with ratio (1: 2) also water then centrifuged to the filtrate will obtain the better result of fucoidan quality. The final filtrate was rinsed with0.5 M NaCl and aquabides was obtained as extract fucoidan (F4). The quality of fucoidan determination were conducted as following methods : total carbohydrate[7] method), turbidimeter assay to quantify the sulfate content using $BaCl_2$-gelatin method and quantification, uronic acid (Scot method).

The second step fucoidan was be tested in mice *in vivo* as an anti-gastric ulcer followed Jong et al. method (2010). The methods were performed as follows: mice were used as animal model were divided into 7 groups. Group 1: control / only given CMC 0.5%. Group 2: control only CMC 0.5% was given every day during the previous 14 days, then mice were conditioned fasting for 48 hours after the mice were given aspirin (400 mg / kg body weight). Group 3: mice were given fucoidan at dose of 100 mg / kg of body weight every day, for 14 days and then fasted for 48 hours after the mice were given aspirin (400 mg) / kg body weight. Group 4: rats were given fucoidan at dose of 200 mg / kg of body weight per day during the early 14 days, then fasted for 48 hours after the mice were given aspirin (400 mg) / kg body weight. Group 5: mice were given fucoidan at dose of 300 mg / kg of body weight per day during the previous 14 days, then fasted for 48 hours after the mice were given aspirin (400 mg) / kg body weight. Group 6: rats were given fucoidan at a dose of 400 mg / kg of body weight per day during the previous 14 days, then fasted for 48 hours after the mice were given aspirin (400 mg) / kg body weight. Group 7: rats were given commercial fucoidan at a dose of 300 mg / kg of body weight per day during the previous 14 days, then fasted for 48 hours after the mice were given aspirin (400 mg) / kg body weight. Used as a coating solution of