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The antioxidant activity of seaweed salt from *Sargassum polycystum* in *Sprague-Dawley* male White rats

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ABSTRACT

Seaweed has many health benefits and has been the potential raw material for making low sodium and high potassium healthy salt. *Sargassum polycystum* is widely used as a low-sodium functional salt, which has a strong antioxidant capacity. However, it's *in vivo* potential is unknown. This research was a purpose to determine the antioxidant activity of SOD and catalase enzymes in seaweed salt through *in vivo* test in *Sprague-Dawley* rats. To achieve this, salt was produced from *S. polycystum* flour and distilled water at a ratio of 1:10 and heated at 40°C for 10 minutes, using a water bath. The mixture was stirred using 500 mesh nylon cloth and filter paper, then dried with an oven at 60°C for 30 hours. *In vivo* research method was then adopted using 20 male *Sprague-Dawley* rats, which were divided into 5 treatment groups. The analysis used was the treatment of commercial and seaweed salt, *Sargassum polycystum*, and plain water (aquades) in the test animals with 4 replications, which include each treatment group consisting of 4 Sprague-Dawley rats. Data were analyzed using Analysis of variance (ANOVA) from Statistical Package for Social Sciences (SPSS) software. *S. polycystum* salt had a Sodium (Na) and Potassium (K) ratio of 0.38 and NaCl content of 49.05%. The antioxidant activity of SOD and catalase enzymes ranged between 54.09–73.40 U/mL and 0.67 – 0.79 U/mL, respectively. These values indicate that the application of *S. polycystum* salt is able to balance the antioxidant activity of SOD and catalase. In addition, seaweed salt has the potential to reduce cell damage due to free radicals.

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INTRODUCTION

Brown seaweed contains bioactive compounds in the form of secondary metabolites, namely alkaloids, terpenoids, steroids, tannins, saponins, and glycosides (Deyab *et al.*, 2016). Furthermore, the active compounds from brown macroalgae are confirmed to have anti-tumor, antioxidant, antiviral, antimicrobial, anticoagulant, and anti-inflammatory activity. Brown seaweed has been widely researched and developed as a raw material for cosmetic products (Nurjanah *et al.*, 2016) such as peel-off masks (Nurjanah *et al.*, 2019c), sun-

screens (Nurjanah *et al.*, 2017, 2019a,b), lightening (Dolorosa *et al.*, 2017; Sari *et al.*, 2019; Dolorosa *et al.*, 2019), lipbalm (Abdullah *et al.*, 2018), acne mask (Nurjanah *et al.*, 2018b), body lotion (Nurjanah *et al.*, 2021, 2020b), food products such as seaweed salt (Nurjanah *et al.*, 2020a; Nufus *et al.*, 2019; Nurjanah *et al.*, 2018a), tyrosinase inhibitors (Arifianti *et al.*, 2018), antioxidants and phenolic compounds (Diachanty and Asadatun, 2017; Gazali *et al.*, 2019), and immunomodulators (Subaryono *et al.*, 2017). In the food sector, the use of brown seaweed in Indonesia is only sold in the form of raw materials and hydrocolloids. The body of a living being has a complex defence system that relies on enzymatic and non-enzymatic antioxidants, which play an important role in fighting free radicals in body tissues. Antioxidant enzymes such as SOD, catalase, and glutathione peroxidase have been reviewed severally for their function in the prevention of oxidative damage. One of the important antioxidant enzymes in cells that is included in the defence system against reactive oxygen species (ROS) is superoxide dismutase. Also, catalase, which plays an important role in the reduction of H_2O_2 (Ighodaro and Akinloye, 2018), are present in all tissues of living organisms. The function of these enzymes in the body is supported by exogenous antioxidants from seaweed salt. In addition, *sa rgassum polycystum* seaweed is believed to contain phenolic and flavonoid compounds that have potential as antioxidants. In Japan, seaweed is used as a source of iodine (a supplement in food) (Zava and Zava, 2011) and a raw material for making salt. Salt production in Japan uses *Ascophyllum nodosum* brown seaweed, which naturally has a salty taste and mineral content, for example, K and Mg (Dunuwila and Berglund, 2005). Research on seaweed salt in Indonesia was conducted by (Nurjanah *et al.*, 2018a) using green seaweed of *Ulva Lactuca*. Seaweed salt research was then developed using red seaweed *Actinotrichia fragilis* (Priyanto and Bogor Agricultural University, Indonesia. Collections, 2019), a combination of *Halimeda macroloba* green seaweed with Padina australis brown seaweed (Wulandari, 2019), the use of activated charcoal and liquid smoke to neutralize odors in green seaweed salt (*Ulva Lactuca* and *Caulerpa lentillifera*) (Kurniawan *et al.*, 2019) and brown seaweed *Sargassum polycystum* and *Padina minor* (Manteu, 2019). Brown seaweed types *S. polycystum*, *P. minor*, and *T. conoides* were found to have functional salt yields of 20-31%. The Na: K ratio of *S. polycystum* and *T. conoides* (0.69-1.49 mg/g) is included in this category. Furthermore, the NaCl content of the brown seaweed functional salt ranges from 27.74-49.94%. *S. polycystum*, *P. minor*, and *T. conoides* have antioxidant activity with IC50 values ranging from 39-344 mg/L (Diachanty and Asadatun, 2017), CUPRAC method 40.05-113.95 μM trolox/g, and FRAP of 18.19-55.31 μM trolox/g (Nurjanah *et al.*, 2020a). The utilization of green seaweed from *Ulva ohnoi* and *Ulva tepida* species has yields of 29.3% and 36.5%, respectively, with Na and K ratios ranging from 1.1-2.3 (Magnusson *et al.*, 2016). Furthermore, *Caulerpa lentilifera*, *Halimeda opuntia*, *Ulva Lactuca*, have salt yields range of 20-27%, Na and K ratios is 2.95-19.95 g/kg, and NaCl levels ranges from 12.16-61.85% (Nufus *et al.*, 2019). Seaweed salt has met the standard of dietary salt with a maximum NaCl content of 60% (SNI, 2010; Regulation of the Ministry of Industry, 2014). The antioxidant activity found in functional salts is an indicator of the presence of bioactive compounds. This placed it at an advantage over consumption salts on the market. Additionally, the antioxidant activity of in vitro as functional salt was tested and is classified as strong. These test results need to be supported by in vivo research to determine the effectiveness of antioxidant activity in living cells. Based on this background, it is necessary to investigate the antioxidant activity of *S. polycystum* seaweed salt in Sprague-Dawley rats. Therefore, this study aims to determine the antioxidant activity of SOD and catalase enzymes on *S. polycystum* salt through in vivo tests on Sprague Dawley rats.

MATERIALS AND METHODS

Seaweed Salt Production

Sargassum polycystum , which were collected from Serang waters, Banten were cleaned from sand and foreign matter, and the rest of the samples were, cut and crushed using a blender until smooth. Afterwards, it was sieved with a size of 30 mesh using seawater, then placed in a container and dried for 14 days. The result of the blender is seaweed flour which is ready to be used as an ingredient for making salt. The process begins by smoothing the seaweed with a blender, followed by sifting. 50 g of seaweed flour was then added to purified water (1:10) and heated at 40°C for 10 minutes, using a waterbath. The mixture was stirred using 500 mesh nylon cloth and filter paper, then dried with an oven at 60°C for 30 hours (modified (Magnusson *et al.*, 2016)). Afterwards, the result was analyzed for proximates, phytochemicals, yield, heavy metal, minerals, NaCl, phenol and flavonoids content, antioxidant ABTS, and CUPRAC.

In vivo Antioxidant Activity Assay

In vivo antioxidant activity assay with SOD and cata-

lase in rat liver.

Liver samples were collected by killing the rats and removing their blood by minimizing pain (exanguination) after 14 days of treatment for 14 days.

Liver Homogenate

The liver homogenate was used to determine SOD and catalase assay. The rat liver tissue was weighed to 100 mg and then mashed. The tissue that has begun to disintegrate is then added to 1 mL of 0.05 M saline phosphate buffer and stored in a liver container tube soaked in 4°C ice water to maintain its quality. Subsequently, the mashed hepatic homogenate was centrifuged at a speed of 5000 rpm for 10 minutes to separate the precipitate and the supernatant, which was then transferred to another tube for further use in SOD and catalase analysis (Zainuri and Wanandi, 2012).

Measurement of SOD Activity

The activity of Superoxide dismutase (SOD) was determined biochemically using the RanSOD® kit. The total SOD activity was determined by the degree of formazan colour formation and measured by a spectrophotometer with a wavelength of 505 nm. The reagent contained in the kit consists of a mixed substrate containing xanthine, phosphate buffer, xanthine oxidase, and standard solution for creating standard curves. Furthermore, 25 μL livers/standard sample was inserted into the cuvette, and a 0.85 mL mixed substrate was added. Also, 0.125 mL xanthine oxidase is mixed with the previous solution.

The analysis of SOD activity was measured at a wavelength of 505 nm in the first 30 seconds after the addition of the enzyme xanthine oxidase (A1) and read again after 3 minutes (A2) (Zainuri and Wanandi, 2012). The formula for calculating the antioxidant activity of SOD is as follows,

$$Antioxidant\ activity\ of\ SOD = \triangle A/minute$$

$$= \frac{A1-A2}{3}$$

$$\%\ inhibition = \frac{100-(\triangle A\frac{S}{minute}\times 100)}{(\triangle A\frac{S1}{minute})}$$

Note,

A1 = Absorbance in the first 30 seconds

Ab = Absorbance in 3 minutes later

S1 = Sample diluent; S = Sample/standart

Measurement of Catalase Activity

The antioxidant activity of catalase was determined by a spectrophotometer. The liver homogenate sample was diluted 20 times, 50 μL was taken and placed in the cuvette, then 950 μL of 27.2 μM H_2O_2 substrate reagent was added. The reparation of the blank solution was the same as the sample. However, it was replaced with a phosphate buffer 0.05 M pH 7 at a wavelength of 210 nm in the first 30 seconds, and the absorption was read again after 2 minutes (Zainuri and Wanandi, 2012). The formula for calculating the antioxidant activity of catalase is as follows,

$$Antioxidant\ activity\ of\ catalase = \frac{(\triangle Au-\triangle Ab)/minute}{Molaritas\ H_2O_2\ x\ volume\ sample} \times dilution$$

Note,

Au = Absorbance test

Ab = Absorbance blanko

Statistical Analysis

A Completely Randomized Design (CRD) was used to obtain conclusions from the conducted experiments. The analysis used was the treatment of commercial and seaweed salt, *Sargassum polycystum*, and plain water (aquades) in the test animals with 4 replications, which include each treatment group consisting of 4 Sprague-Dawley rats. Data were analyzed using Analysis of variance (ANOVA) from Statistical Package for Social Sciences (SPSS) software.

RESULTS AND DISCUSSION

Proximate of *Sargassum polycystum* seaweed F lour

A proximate analysis, which aims to determine the chemical composition of raw materials, was carried out on samples of dry *Sargassum polycystum* in the form of flour. The composition of the *Sargassum polycystum* seaweed flour is presented in Table 1.

Furthermore, the water content in a material is an important component, including in seaweed. Its value in this study is 11.53% and has met the SNI for dry seaweed that the maximum water content is 15% (BSN, 2015). (Vijay *et al.*, 2017) examined the ash content in brown seaweed of 45.05%, which is higher than the ash content of red (28.79%) and green 14.10% seaweed. Also, the fat content of *S. polycystum* seaweed and *P. minor w*as 0.50% and 0.52%, respectively (Manteu, 2019). In addition, the protein content of *S. polycystum* flour was 7.03%. The test results for the protein content of seaweed *S. polycystum* were 3.65%, and *P. minor* was 4.78% (Manteu, 2019). Kumar *et al.* (2011) reported that the fat content of seaweed is generally less than 4%. (Mišurcová *et al.*, 2010) tested that of brown seaweed by 1.5%. The value of the protein and amino acid content of a material is related.

Table 1: Chemical Characteristics (%) of *Sargassum polycystum*

Component (%)	*Sargassum polycystum*	*Sargassum polycystum**
Water	11.53 ± 0.056	17.69 ± 0.03
Ash	27.49 ± 0.23	24.51 ± 0.13
Fat	0.58 ± 0.07	0.50 ± 0.11
Protein	7.03 ± 0.37	3.65 ± 0.00
Crude fiber	3.05 ± 4.19	6.52 ± 0.65
Carbohydrate	50.3 ± 4.93	53.66 ± 0.21
acid insoluble ash	0.67 ± 0.02	-

Source: (Manteu, 2019)

Table 2: The active compound content of S. polycystum seaweed flour extract

Bioactive compound	*Sargassum polycystum*	*Sargassum polycystum**	*Sargassum polycystum***	Positive results
Alkaloid				
Meyer	-	-	+	White precipitate
Wagner	-	-	+	Orange/brown
Dragendrof	+	-	+	Red/orange
Flavonoids	+	+	+	Yellowish green
Phenol	+	-	-	Green/blue
Saponin	+	-	+	Foam
Tanins	-	-	-	Black/navy
Steroid	+	+	+	Green
Triterpenoid	-	+	-	Red

Note: (+) Detected ; (-) Not Detected; (Diachanty and Asadatun, 2017; Manteu, 2019)

Table 3: Seaweed salt content of Na and K minerals

Minerals	*Sargassum polycystum*	*Sargassum polycystum**	*S. polycystum* with activated carbon treatment 1.5%**
Na (mg/g)	96.96 ± 2.21	47.13 ± 0.49	80.28
K (mg/g)	247.58 ± 3.89	68.65 ±1.05	91.79
Na : K	0.38 ± 0.007	0.69	0.87

Source: Diachanty and Asadatun (2017); Manteu (2019)

Table 4: Heavy metal residue of seaweed salt

Parameter	*Sargassum polycystum* seaweed salt (mg/kg)	Standart (mg/kg)	Limit detection (mg/kg)
Mercury (Hg)	Not Detected	Max. 0.1*	0.004
Lead (Pb)	Not Detected	Max. 10*	0.24
Cadmium (Cd)	0.17 ± 0.007	Max. 0.5*	0.004
Arsenic (As)	Not Detected	Max. 0.1*	0.002

Source : (BSN, 2015)

Table 5: Seaweed salt levels of NaCl

Salt	NaCl (%)
S. polycystum salt	49.05 ± 0,07
S. polycystum salt*	33.87 ± 1.62
Consumption salt**	94.0

Source : (Diachanty and Asadatun, 2017; BSN, 2016)

Table 6: In vitro antioxidant activity of seaweed salts

Sampe	ABTS IC50 (ppm)	CUPRAC (μmol ascorbic acid/g garam)
S. polycystum salt	144.41	27.65 ± 4.3
S. polycystum salt*	-	107.76
Ascorbic acid	5.53	-

Note : (Diachanty and Asadatun, 2017); (-): ABTS testing was not carried out

Table 7: SOD and catalase enzyme activity in the liver of Sprague-Dawley rats

Enzyme activity	Akuades	GS 1	GS2	GS3	GK
SOD (U/mL)	77.34 ± 2.30^{a}	73.40 ± 3.27^{a}	60.13 ± 3.57^{bc}	54.09 ± 0.00^{c}	66.05 ± 0.98^{b}
Katalase (U/mL)	0.98 ± 0.04^{a}	0.79 ± 0.04^{b}	0.75 ± 0.02^{bc}	0.67 ± 0.02^{c}	0.68 ± 0.05^{c}

Note: GS1 = *S.polycystum* salt treatment 1, GS2 = *S. polycystum* salt treatment 2, GS3 = *S. polycystum* salt treatment 3, GK = conventional salt merk Revina; The numbers on the same row followed by the sameletter indicate a value that is not significantly different at the 5% testlevel (Duncan's test).

Furthermore, protein, together with fat and carbohydrates, act as the main energy source in the body (Ratana-Arporn and Chirapart, 2006). The carbohydrate content (by difference) of *S. polycystum* flour is 50.3%. (Manteu, 2019) tested the carbohydrate content of *S. polycystum* seaweed, namely 53.66% and *P.* minor, which was 41.88%. The high carbohydrate content in the Phaeophyta group is due to phycocolloid content in the cell walls of seaweed.

Bioactive Compound of *Sargassum polycystum* Seaweed Flour

The active *Sargassum polycystum* compound was tested qualitatively based on changes in colour and sediment that occurred in response to the reagent. Furthermore, the phytochemical test on crude seaweed extract includes components of alkaloids, flavonoids, phenols, saponins, tannins, steroids, and triterpenoids. The test results for the active compound *S. polycystum* are presented in Table 2.

Alkaloid compounds were only detected in the extract during the test with the Dragendrof reagent. Furthermore, flavonoids, phenols, saponins, and steroids are also found in the extract of *S. polycystum*. Diachanty and Asadatun (2017) reported that the studied *S. polycystum* contained flavonoids and steroids. However, there were no alkaloid, phenol, and saponin compounds. (Manteu, 2019) reported that the *S. polycystum* extract contained alkaloids, flavonoids, saponins, and steroids.

However, there were no phenolic compounds. Furthermore, alkaloids have pharmacological activity, antihypertensive, antitumor, and vasodilating (Babbar, 2015). Polyphenol components in seaweed have the potential to reduce blood pressure, antioxidants, photoprotective activity, and anti-photo aging in preventing oxidative stress and cell damage due to UV radiation (Chojnacka, 2012; Mutmainah and Estiasih, 2016).

Saponins are glycosidic compounds that have strong potential as anti-microbial, antifungal, cholesterol-lowering agents, antioxidant, anti-viral, and anti-carcinogenic, as well as dietary supplements (Jeeva *et al.*, 2012; Mien *et al.*, 2015). In addition, steroid compounds are included in the triterpenoid group whose class compounds have anti-microbial, anti-fungal activity (Suptijah *et al.*, 2013), antioxidant and wound healing processes (Bakovic, 2015).

Characteristics of *Sargassum polycystum* s eaweed Salt

The yield value of functional salt is 12-15%. However, that of dietary, which include *S. polucys-*

tum and *T. conoides* with a heating temperature of 40°C for 10 minutes is 28% and 24%, respectively (Diachanty and Asadatun, 2017). Furthermore, a longer heating time and warmer temperatures result in a higher salt yield (Magnusson *et al.*, 2016).

The mineral content in seaweed is of various types, including sodium and potassium, which are elements needed by plants. Therefore, It is important to know the ratio of Na and K in determining the preparation of dietary salt. The test results of Na and K minerals on seaweed salt are presented in Table 3.

The test results of the mineral content of Na and K salt of *S. polycystum* in this study gave a Na and K ratio of 0.38. This figure is in accordance with the ideal Na and K intake ratio for the body between 0.3-1 based on dietary guidelines regarding the daily intake of each mineral element. A maximum Na and K ratio of 1:1 helps to maintain blood pressure, and a low Na and K ratio is associated with the application of a salt diet for hypertensive sufferers (Peng *et al.*, 2013).

Furthermore, the potassium (K) and sodium (Na) minerals are included in essential macro elements and are the main cations in the body that are beneficial for body health, acting as electrolytes and maintaining several organs, such as the heart, brain, kidneys, and muscle tissue (Yusuf, 2014). Odium specifically functions to maintain the balance of acid-base, the transmission of nerve impulses and normal cell function (Nurjanah *et al.*, 2013).

The analysis of heavy metal residue aims to determine its concentration in seaweed salt. The commonly tested heavy metals include mercury (Hg), lead (Pb), cadmium (Cd), arsenic (As). The results are shown in Table 4.

The test results of the residual heavy metal salt of *S. polycystum* are shown in Table 4. Seaweed salt was not detected for mercury (Hg), lead (Pb), and arsenic (As). However, cadmium (Cd) was detected at 0.17 mg/kg, and this value meets the requirements of Indonesian national standards (SNI) for iodized salt.

The mineral content of NaCl is an important parameter as a requirement for a salt material, including seaweed salt. The purpose of testing the NaCl level in salt samples is to determine the sodium concentration. The test results of NaCl levels are presented in Table 5.

The test result of the NaCl salt content of *Sargassum polycystum , seaweed salt of S. polycystum and U. Lactuca are* 49.05%, 33.87% (Diachanty and Asadatun, 2017), and 13.93% (Nurjanah *et al.*, 2018a), respectively.

Furthermore, the results of testing the functional salt (NaCl) levels are included in the dietary salt category. The maximum limit of NaCl for dietary salt is 60% (Regulation of the Ministry of Industry, 2014).

In Vitro Antioxidant Activity of *Sargassum polycystum* seaweed salt

Total phenol salts of *S. polycystum* were tested using the folin-ciocalteu method. This is a quantitative test of bioactive phenolic compounds. The results of this test on seaweed salt were 251.88 $\pm$ 2.26 mg GAE/g. Furthermore, the total flavonoids salt of *S. polycystum* were tested using quercetin standard reagent, and the result is 307 $\pm$ 3.25 mg QE/g. In addition, antioxidant activity is strongly influenced by the content of active compounds in ingredients, such as phenols and flavonoids (Dewi *et al.*, 2018). The measurement of total phenol content becomes a basis for testing antioxidant activity because phenolic compounds are known to play a role in preventing oxidation. Therefore, it is suspected that the higher the total phenol content in a material, the higher the antioxidant activity (Djapiala *et al.*, 2013). Flavonoids, which are also polyphenolic compounds with antioxidant properties, donate hydrogen or electrons to free radicals in order to stabilize radical compounds.

Therefore, the higher the flavonoid content in the extract, the higher the antioxidant activity (Dewi *et al.*, 2018). The antioxidant activity of *S. polycystum* seaweed salt was tested using the CUPRAC and ABTS methods. This is an indicator that there is an active component in functional salt, in addition to the presence of activity, which is one of its advantages compared to dietary salt. The results of the in vitro antioxidant activity test of *S. polycystum* salt is shown in Table 6.

The test result of the antioxidant activity of *S. polycystum* salts using the CUPRAC method is 27.65$\pm$4.3 μmol of ascorbic acid/g. (Diachanty and Asadatun, 2017) reported that the antioxidant capacity of *S. polycystum* salt is 107.76 μmol of ascorbic acid/g. These differences are due to varying habitat, season, harvest age, and the phase of *S. polycystum*.

The antioxidant activity of *S. polycystum* salt using the ABTS method in this study gave an IC50 value of 144.41 ppm, which is classified as moderate in strength. Furthermore, that of *Actinotrichia fragilis* salt using the ABTS method is 120.27 ppm (Priyanto and Bogor Agricultural University, Indonesia. Collections, 2019), while the combined salts of *H. macroloba* and *P. minor* have moderate antioxidant activity, ranging from 112.35-144.05 ppm (Wulandari, 2019).

In Vivo Antioxidant Activity of *Sargassum polycystum* seaweed salt

The measurement of the antioxidant activity of functional salts is done in vivo. The analysis was carried out by measuring the antioxidant activity of the superoxide dismutase (SOD) and the catalase enzyme, which scavenges free radicals. The results of the SOD and catalase activity tests in the liver of Sprague-Dawley rats are presented in Table 7.

The response of the SOD enzyme, which tends to decrease due to seaweed salt, is predicted because of the reducing number of free radicals in the body. Therefore, the reactivity of the enzyme is low. In addition, seaweed salt samples of *S. polycystum*, which act as exogenous antioxidants, are reactive to the endogenous in the body. This reactivity corrects the antioxidant activity of the SOD enzyme. Furthermore, the intermediate decrease in the SOD enzyme activity of *S. polycystum* salt shows the potential of seaweed salt, which is predicted to balance endogenous antioxidant activity. Meanwhile, seaweed salt treatment gave a response that tended to decrease the activity of the catalase enzyme, which appears to be quite sensitive to both seaweed and conventional salt.

This is due to the significant difference of its activity value from aquadest treatment. Suda *et al.* (2003) stated that the role of exogenous antioxidants helps the endogenous, such that they reduce the number of free radicals and the activity of the SOD and catalase enzymes. It is believed that the bioactive compounds from seaweed salts act as exogenous antioxidants in the tissue of tested animals that support the activity of the enzymes (SOD and catalase). Ganapathi *et al.* (2013) stated that the total phenol contained in brown seaweed ranges from 20-30% of its dry weight. In addition, the total phenol content of *S. polycystum* seaweed salt ranged from 244.19-253.59 mg GAE/g extract, which was associated with the antioxidant activity in the CUPRAC test, as evidenced by the correlation value R = 0.734. The salt of *S. polycystum* was able to influence the activity of the SOD and catalase enzymes and was reactive. The application of seaweed salt to test animals has the potential to reduce cell damage due to free radicals.

CONCLUSIONS

Sargassum polycystum seaweed salt has an influence on the antioxidant activity of catalase and enzymes superoxide dismutase (SOD), which resulted in decreased values. Furthermore, the salt treatment of *S. polycystum* had a SOD activity value of 54.09 - 73. 40 U/mL, and the catalase enzyme was 0.67 - 0.79 U/mL. Conclusively, *sargassum polycystum* salt is able to balance the activities of endogenous antioxidants. Therefore, it is predicted that the potential for free radical damage to liver cells is reduced.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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