The Potential of Sidoarjo Marine Product: *Corbula* Sp. as Therapeutic Nutrition to Improve Immune System

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Abstract. The regulation of immune responses are controlled by hormone and gene regulation. Micro-mineral such as Selenium is the precursor for immune response based on glutathione hormone activity. The glutathione hormone mainly works against diseases such as HIV/AIDS, avian influenza, and cancer. The aim of this study was to explore the selenium levels and antioxidant activity marine product *Corbula* sp in Sidoarjo East Java. The *Corbula* sp. was obtained Candi district, Sidoarjo. Measurement of selenium concentration was performed by atomic absorption spectroscopy. Measurement of antioxidant activity was performed by FRAP (ferric reducing antioxidant power). The selenium measurement result showed that *Corbula* sp was contained 0.28 ppm. The antioxidant activity was identified by increasing levels at 517 nm. The study was indicated that *Corbula* sp in Sidoarjo East Java, contains selenium levels to increase antioxidant activity as improvement of immune response with a potential function as alternative nutrition.

1. Introduction

The consumption pattern is influenced by the accessibility of purchasing product, ease of access, knowledge of foodstuffs and culture [1]. Indonesians tend to choose diet with high cholesterol such as fast food, risking to a healthy condition. Immediate changes in food consumption patterns often lead to increased incidences of chronic diseases in the community [2].

One of the emerging factors of chronic disease is an increase in the number of antigens that potentially disrupt the condition of cell homeostasis. Changes in homeostasis will lead to impair immune responses in the body in the form of cell degradation. The most common antigen is free radicals. Free radicals can be formed through normal physiological activities in the body or due to the influence of exogenous species. Exogenous species may take the form of a natural compound present in the environment (ozone, NO₂, ethanol), industrial chemical compounds (carbon tetrachloride) or xenobiotics arising from metabolic activity [3]. Radicals that often arise from the results of metabolism is superoxide (O₂⁻-1) which then subsequently dismutase into hydrogen peroxide (H₂O₂). Superoxide dismutase is a catalyst enzyme in the formation of hydrogen peroxide [4]. These compounds become indicators of the process that produces superoxide in the body. Taking into account the effect of free radical-mediated reactions, there is a strong evidence that free radicals play an important role in promoting the development of chronic events affecting health [3].
The free radicals are compounds in nature where the atom or its constituent molecule has unpaired electrons in its own independent outbound orbital and is reactive to other surrounding compounds [5]. Naturally, the presence of free radicals in cellular environment can be controlled by the equilibrium between radical and antioxidant compounds.

The 21st century is beginning of the development period research on alternative nutritional products from local resources that have not been explored optimally. The study is an attempt to find alternative solutions to overcome health problems such as free radicals. The results of Hartmann and Meisel's research (2006) show up that to 2006 there were 10 food products with the role as an ACE inhibitor, immunomodulator, cytomodulator, an opioid agonist, an opioid antagonist, anti-thrombotic, antimicrobial, mineral binder, anti-hyper-cholesterol and antioxidant [6]. With the large potential of local food products as a source of healthy nutrition, of course, Indonesia has an important role by abundant natural resources.

As an archipelagic country with 60% of its territory compound by waters, Indonesia offers a large number of marine commodities. One of them is the abundance of Corbula sp.; one of the many fishery products in Indonesia [7]. Corbula sp. consumption rate reached 10 thousand tons per year, is a source of animal protein consumed by many people. These fishery products are easy to get at a relatively cheap price, making it affordable for the whole community. Corbula sp. is classified as triploblastic stomata. The size of the Corbula sp. varies considerably between 1 -2 cm long, with a circular body and enveloped by a cupped shell [8]. The potential of Corbula sp. as a food product is not limited to macronutrients. Micronutrient Corbula sp. content is a potential to be explored and has a role in support quality of consumer health. Based on the previous research Saurabh and Sahoo [8], describe the micronutrients of fishery products that have a great role as an antioxidant precursor compound is selenium [9].

Selenium is an important mineral in protein synthesis and enzyme activity of glutathione peroxidase (GSH-Px). Selenium in the synthesis of glutathione peroxidase has a role as a catalyst in the breakdown of peroxides formed in the body into non-toxic bonds [10]. Peroxides may turn into free radicals that can oxidize unsaturated fatty acids present in cell membranes, thus damaging cell membranes. Based on these roles, it is known that selenium works with vitamin E and acts as an antioxidant. The role of vitamin E by maintaining cell membranes from free radicals by releasing hydrogen ions, selenium plays a role in breaking the peroxide into non-reactive bonds so as not to damage the unsaturated fatty acids present in the membrane, helping to maintain the integrity of the membrane and protect DNA from damage [11–13]. The integrity of cell membranes is indispensable in the immune system because the production of cytokines is largely determined by the receptors contained in the cell membrane, therefore selenium is necessary to enhance cellular immunity [12,14].

Various role of selenium that supported by the big potency of Corbula sp. product in Sidoarjo, this research aims to explore and analyze the content of selenium and antioxidant activity level from Corbula sp. as a healthy nutrition alternative for the community. The study was conducted with Corbula sp. exploration in the eastern coastal area of Sidoarjo, followed by a test of selenium and antioxidant activity in Corbula sp.

2. Methods
The study was conducted from January to June 2013 consisting of exploration and measurement of selenium concentration and anti-oxidant activity. The exploration of Corbula sp (Corbula faba Hind) was conducted in Sidoarjo east coast, at Balongbendo village where Corbula sp is intensively produced. Exploration was done through collection, identification, and determination over the sample.

Selenium concentration in the sample was analyzed using Shimadzu model AA 6300G atomic absorption spectrometer (Kyoto, Japan) with graphite furnace (GFA-EX 7i), a selenium hollow cathode lamp as radiation source (Hamamatsu Photon-ics, Japan) at the 196.0 nm wave length with a slit width of 0.7 nm, 23 mA current and deuterium background corrector, was used for measurement. A L'vov total pyrolitic graphite platform tube (Shimadzu) was used. The pyrolitic graphite platform
was modified according to the procedure described in previous study [15]. The samples injection volume was 20 μL. Integrated absorbance (peak area) was used for quantitation analysis.

The pH values were measured with a Metrohm pH-meter (model: 691, Herisau, Switzerland) supplied with a glass-combined electrode. The Centurion Scientific centrifuge (model 1020D, UK) was used for centrifuging.

Antioxidant activity of Corbula sp. was analyzed using 1,1-Diphenyl-2-picryl-hydrazyl (DPPH) reagent, was purchased from Sigma–Aldrich (USA). Ascorbic acid and butylated hydroxytoluene (BHT) were purchased from E. Merck (India). Propyl gallate was purchased from Life Science Central Laboratories, Malang, Indonesia. Stock solutions of DPPH were prepared in methanol, and methanol buffered with acetic acid buffer (0.1 M, pH 5.5), respectively. Buffered methanol was prepared by mixing 40 ml of 0.1 M acetate buffer (pH 5.5) with 60 ml methanol. The solvents and other chemicals were of analytical grade. The reaction tubes, in triplicates, were wrapped in aluminum foil and kept at 30°C for 30 min in dark. All measurements were done under dim light. Spectrophotometric measurements were done at 517 nm using Spectronic Genesys 5 spectrophotometer [16]. The data are mean ± SD.

3. Results and Discussion

The following table and graph represent the observation data about selenium concentration and antioxidant activity.

**Table 1.** The results of testing selenium and protein in Corbula sp.

| Samples | Selenium (μg/g) | Protein (mg/g) |
|---------|----------------|---------------|
| Corbula | 0.279 ± 0.09   | 15.05 ± 0.5   |

The table 1 show that Corbula sp. containing selenium 0.279 μg/g and protein 15.05 mg/g (p <0.05)

**Figure 1.** antioxidant activity of Corbula sp. A. Optimal wavelength spectrum using reagent 1,1-diphenyl-2-picrylhydrazyl. B. antioxidant activity control (-) without Corbula sp. C. Antioxidant activity of Corbula sp. was identified by increasing levels at 517 nm
The relationship between disease and nutrition has been shown to be related one another [17]. Consumption of nutrients have an influence on the metabolic system. This fact supports that in the state of nutritional deficiency the immune system will be depressed and increase the risk of metabolic changes [1].

In conditions of immune system suppression, the glutathione level tends to decrease. Decreased glutathione levels are enhanced by nutritional supplements. Some cases of deficiency of selenium or glutamic acid, glycine, cysteine, and methionine lead to increased indications of decreased glutathione enzymes [17]. In addition, low selenium significantly decreased the activity and sensitivity of immune cells during the incubation period of infection.

Problem-solving with the efforts of the fulfillment of nutrition sources that support metabolism activity is one effort that can be carried out by society in overcoming health problem [18]. By utilizing the potential Corbula sp that has the content of selenium, glutamic acid, glycine, cysteine and methionine that can be used as a therapy in HIV infection. will be used by the body to produce glutathione and glutathione peroxidase [19].

The process of glutathione formation in the body by the presence of glutamic acid, glycine, cysteine, and methionine content in the Corbula sp through the digestive tract of proteins in general, begins in the stomach with the help of stomach acid and pepsin enzymes, then continues in the small intestine by the aid of protease enzymes and pancreatic enzymes to into free amino acids, some of which are glutamic acid, glycine, cysteine, and methionine. This free amino acid subsequently enters the blood circulation through the portal vein and is brought into the blood circulation of the organ which is then used as the synthesis of glutathione [20].

Of the four amino acids, glycine and glutamate are the ready-to-use amino acids for glutathione synthesis; but for cysteine and methionine, those will change first into cysteine [3]. The change of cysteine to cysteine is mediated by the aid of GSH-cysteine transhydrogenase enzyme, while for the conversion of methionine into cysteine is mediated by several enzymes, namely: methionine adenosyl transferase, methyltransferase, SAH hydrolase, cystathionine beta-synthase and vitamin B6 aids [21]. The cysteine formed later together with glutamate will be converted to L-γ-glutamyl cysteine by the aid of the glutamate-cysteine ligase enzyme. Furthermore, L-γ-glutamyl cysteine joins the glycine to form glutathione through the intermediate enzyme glutathione synthase [13].

The glutathione that has been formed will be converted to glutathione peroxidase by the aid of selenium. Glutathione and glutathione peroxidase act as antiretroviral to antigens. An antiviral that plays glutathione occurs through 2 reactions. First, through the blockade of oxidative stress that occurs due to metabolic abnormalities. Oxidative stress plays a role in activating the transcription of cellular factor NF-B (nuclear factor-kappa B) [22]. NF-B plays a role in improving and maintaining the cellular inflammatory cell. Glutathione may interfere with the complex phosphorylation process of NF-B and active NF-B release, or active NF-B delivery process to the nucleus so that the inflammatory condition can be suppressed [23].

Glutathione plays a role in inhibiting antigen activity by activating macrophage cells. Macrophages play a role in the infection process and counteract the cytopathic effects of the antigen [1]. The role of glutathione delivered to macrophage cells by neutrophil cells can play a role in enhancing and regulating the activity of macrophages before the antigen can be overcome. The results of in vitro study note that antigen activity can decrease significantly due to the macrophages that have high glutathione expression [13]. Meanwhile, according to a recent study conducted by Hurwitz and colleagues at the University of Miami in Florida, USA for 9 months of 174 HIV-infected patients (91 patients grouped with 200 μg selenium and 84 others in the placebo group) found that selenium could maintain HIV viral load and even in some patients, selenium can lower HIV viral load averaging as much as 10,000. Selenium also increases CD4 counts in HIV-infected patients [12].

4. Conclusion

Selenium is consisted in Corbula sp. important for co-activator glutathione peroxidase enzyme. Consumption of selenium source has a potential role to improve immune response based on
glutathione peroxidase enzyme metabolisms pathway. The abundant number of *Corbula* sp. in Sidoarjo was a potential source for health nutrition.

5. Reference

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