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The Potential Gonad of Diadema Setosum as a Healthy Food to Improve the Nutritional Status of Coastal's Children

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Abstract

The problem of malnutrition in the household, especially for children who settled the coastal region are frequent. It required to use the potential of indigenous foods such as gonad of *Diadema setosum*, which has been known to contain macro and micro nutrient substances are highly qualified and the results of microbiological tests by culture, was not contaminated by Salmonella sp and E. coli so it was safe for consumption. The purpose of our study, assessing the effect of gonad of *Diadema setosum* extracts to weight gain in animal models of strain BALB/c mice were induced by lipopolysaccharide (LPS). The method of weight assessment was using a special tool scales OHAUS Triple Beam Balance. Induction of LPS 0.2 ml x 10^3 ml / CFU intraperitoneally. The results showed that the intervention group body weight dose of 200 mg / kg group increased higher than the dose of 100 mg / kg opposite occurred the control group weight loss was significantly (*p value* = 0.001).

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It can be concluded, *Diadema setosum* gonads may play a role in the growth and development of children as it proves it can significantly improve weight BALB / c mice induced by LPS. It show that gonad of *Diadema setosum* have potential as a healthy food for the treatment of latest of ready to use therapeutic foods (RUTFs) sourced from marine biological food.

***Keywords*:** gonad of *Diadema setosum*; nutritional status; coastal children.

1. Introduction

Nutritional status is one indicator to determine the person is in good nutritional status or less. In children who experience malnutrition with weight below normal standards would be susceptible to various infectious diseases so nutritional intervention was important to do. According to Kevin, et al [1] to overcome the dysfunction of the immune system caused by infection and malnutrition interventions need the right nutrients and quality in care and treatment.

The prevalence of thin and very thin in Indonesia were still high 12.1%, and especially in Southeast Sulawesi prevalence of thin and very thin reach 11.4% [2]. The statement of the World Health Organization that is considered as a public health problem if the indicator prevalence of emaciation (weight / height) between 10.0 to 14.0% as a serious problem, and it is considered critical if ≥15.0% [3]. This condition was usually experienced in children who come from families that are economically disadvantaged and the shortage of quality food availability in the household [4].

One effort to deal with the situation, which utilize food sources of local wisdom that comes from the sea, such as gonad of *Diadema setosum*. This type of marine species was very abundant in the waters of Indonesia, has the potential as a healthy food and have high economic value but not yet in use commercially. During this time, gonad of *Diadema setosum* consumed only a small portion of local fishermen with a simple dish and ignorance of the local community that this food has a highly qualified nutritional value.

The gonad of *Sea urchin* types (*Diadema setosum*) was rich in essential amino acids such as arginine and histidine which is indispensable for the growth of children [5], docosahexaenoic DHA, βeta-carotene [6]. In another study, it was found that the accumulation of cellular oxidative damage low due to the high antioxidant in the body *Sea urchin* [7,8]. In addition *Sea urchin* gonads food was very famous and valuable in some developed countries and become a staple food in Cilli and Japan [9], but until now there has been no report scientifically to determine and assess its effect on improvement of nutritional status so that became our goal to conduct this study.

2. Materials and Method

2.1. Microbiology Technique and Testing

The pickup location of gonad *Diadema setosum* in waters of Wakatobi, Southeast of Sulawesi, Indonesia conducted by convenience sampling technique, for more details in Figure 1, adults of *Diadema setosum* gonads

was choosen have diameter test (RT) on average 6 cm with a weight of 60-100 grams of directly harvested (the taking of gonad). The average weight of the gonads of 7.25 gr /*Diadema setosum* and then put into a plastic cup and stored into striped box contains Dry ice cooling so that the quality of the gonads can be maintained. Furthermore, to ensure the feasibility of the consumption gonad of *Diadema setosum* the culture microbiological testing conducted at the Center for Health Laboratory Makassar, (parameter testing has been accredited by the Ministry of Health of the Republic of Indonesia The Directorate General of Health Primary no. Lab.15103957 / LHU / BBLK-MKS / IV / 2015), it is known that the gonad of *Diadema setosum* was not contaminated by Salmonella sp and E. coli so it was safe for consumption

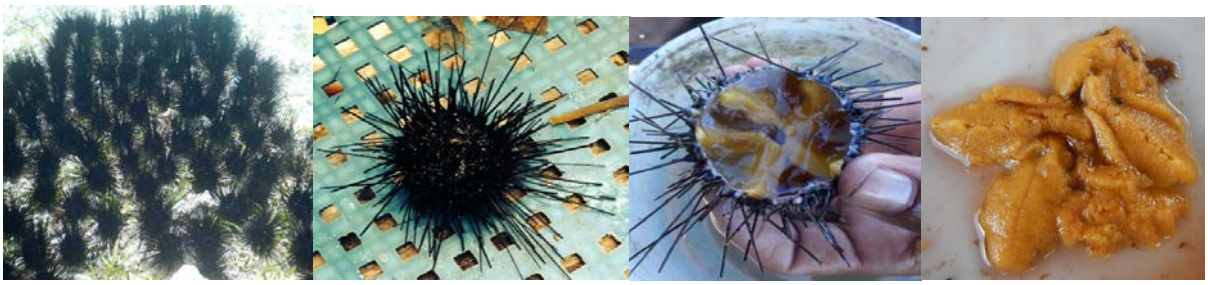

Figure 1: Sea urchin types Diadema setosum and the gonads was taken from sea water at a depth of 2-3 meters in Wakatobi regency, Southeast Sulawesi province

2.2. Preparations Gonad of Diadema setosum Extracts

The process gonad of *Diadema setosum* extract was using acetone solvent according to the methods previously [10] and we have extensively modified. Furthermore, the manufacture perfomed in two doses of 200 mg / kg and a dose of 100mg / kg. These activities are carried out in laboratory biopharmacy and fitopharmacy, Faculty of Pharmacy, University of Hasanuddin, Makassar, Indonesia.

2.3. Samples Animal and the Process of Treatment

BALB / c mice was obtained and maintained at biomolecular and immunology laboratory microbiology section, Faculty of Medicine, University of Hasanuddin, Makassar, was totaling 15 tails, male gender, weight 30-40 g, aged 10-12 weeks, free of pathogens. The experiments were performed in accordance with the guidelines of use and care of laboratory animals and has been reviewed by the ethics committee of the Faculty of Medicine, Hasanuddin University in Makassar. Recommendations Research Ethics, no of registration: 457 / H.8.4.5.31 / PP36-Kometik / 2016, dated 8 April 2016. Trial of preclinical during 17 days conducted in laboratory bio-molecular and immunology, Faculty of Medicine, Hasanuddin University, Makassar. For details, day-0 was conducted the weighing scales using a special tool Triple Beam Balance, OHAUS. Day-1, the control group received only standard feed while the intervention group were given additional extracts of gonad *Diadema setosum* each dose of 100 mg / kg and 200 mg / kg. Day 10 was done weighing again, then a third group of test animals induced by LPS 0.2 ml x 10^3 ml / CFU intraperitoneally with the purpose of infecting BALB / c mice, then rest for 2 hours and then continued feeding additional standards and extracts of gonad *Diadema setosum* in the intervention group and the control group was given only the standard feed for 7 days. Furthermore, at the

end of the 17th day of the study carried out weighing.

2.4. Data Analysis

Data weight ratings (nutrition) in though and analyzed using Excel program SPSS version 23, with Repeated Measure ANOVA test. The research result was considered significant if $p < 0.05$.

3. Results

Our results in figure 2 was showing the differences dynamics of body weight of each group of BALB / c mice. Gonad of *Diadema setosum* extract for 10 days under conditions prior to LPS induced, in the intervention group a dose of 100 mg / kg body weight have increased higher than the 1.32 g dose group of 200 mg / kg only 0.78 ounces, unlike the control group which was not given gonad of *Diadema setosum* extract, the weight was relatively constant. Next we analyze the weight of BALB / c mice in a state after LPS induced to see the impact and influence during 7 days, showed a significant difference (p value = 0.001) in the control group experienced a drastic weight loss (2.24 gr) but the opposite group with the intervention dose 100 mg / kg can maintain their weight and slightly increased by 0.4 grams, while the intervention group a dose of 200 mg / kg higher increase of 1.7 gr.

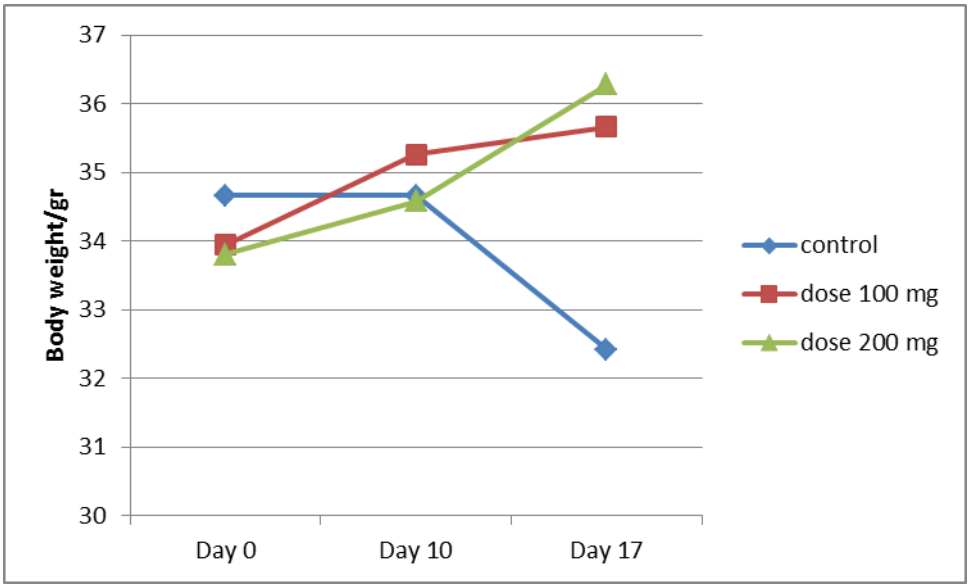

Figure 2: Dynamics of changes in body weight of BALB/c mice

4. Discussion

The supplementary feeding that contain quality nutrients, inexpensive and easily available, was supporting the growth and development of children and prevent malnutrition, especially for children who come from families who can not afford economically and less availability of quality food in the household. It is important in setting nutrient intake for this group because children are the assets of the parents and the State, It should be prepared as early as possible so that they are physically strong and smart, they will be able to compete globally so that the

life quality would be even better.

The gonad of *Diadema setosum* had been known contain highly qualified macro and micro nutrient substances. The main component of gonad *Diadema setosum* such as protein and higher of fat neutral poly unsaturated fatty acid (PUFA) [10] and several antioxidant compounds [6,10], It has been proven in our study may increase the weight of BALB / c mice were intervened extract of *Diadema setosum* gonad for 17 days. Although BALB / c mice with LPS induced a dose of 0.2 ml x 10^3 ml / CFU intraperitoneally with the aim infected with salmonella typhi but groups of BALB / c mice were given extracts of *Diadema setosum* gonad dose of 200 mg / kg body weight increased by 1.7 gr more higher than the intervention group dose of 100mg / kg increased by only 0.4 gr otherwise in the control group experienced a significant reduction in body weight of 2.24 grams.

The existence of infection and if not supported by the intake of foods that have a quality nutrient source, the body's ability to dampen the pathogen infection is so weak and the weight loss occurs. Metabolic strees due to infections and deficiency of nutrient intake can lead to a decrease in the body's immune system [11]. Infectious diseases are inhibiting the growth of children, there was a relationship between nutritional status and susceptibility to infectious diseases [12]. Some poor countries about 3.5 million children aged under five die every year due to malnutrition [13]. There is a direct relationship between malnutrition and mortality caused by immunodefesiency as reported Franca, et al, [14] that babies will be at risk of malnutrition are very high mortality. Nutritional deficiency was also associated with risk factors for the incidence of stunting in children aged 2-3 years in Bangladesh, due to the low economic status [15].

The relationship between local availability of food in the region and format appropriate food stuffs, has been successfully performed for the treatment of the ready to use therapeutic foods (RUTFs) on home-based treatment (*Therapy Home-based*) for severely malnourished children [16]. LNS (Lipid-based nutrient supplement) was one of the proven RUTFs overcome malnourished children aged 6-18 months because it can increase linear growth in the incidence of short stature and enhance the growth of body weight [17,18]. The immune system requires macro-nutrients and micronutrients highly qualified to produce and maintain the balance of immune cells in order to protect the body against disease-causing microorganisms [19], as well as necessary for the growth and development of children [20].

The Gonad of *Diadema setosum* have natural carotenoids that act as antioxidants [9]. Carotenoids derived from marine animal was showing high antioxidant activity against free radicals and may reduce the incidence of oxidative stress and inflammation due to infection [21,22]. Natural carotenoids contained in gonad of *Diadema setosum* may act as anti-microbial as in our study despite BALB / c mice induced strain sallmonela typhi LPS however shows a significant weight gain in the intervention group opposite the control group show lost weight very drastic. This is important if the gonad of *Diadema setosum* considered as a food ingredient the latest RUTFs sourced from food marine because have complete and higher quality of nutrient, easy to obtain and tastes delicious, potentially as a healthy food to improve and enhance the nutritional status of children.

5. Conclusion

The Gonad of *Diadema setosum* may play a role in the growth and development of children as it proves it can significantly improve weight gain of mice which induced by LPS. This gives new insight into the potential as a food ingredient of the latest RUTFs sourced from living marine food so giving an opportunity to study it further using human subjects.

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Conflicts of interest: The authors declare no conflict of interest.

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