

Sea Cucumber as an Alternative Supplement in Increasing Bone Health

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Abstract— Nutrition is an important factor in maintaining bone health, such as calcium, magnesium, phosphorus, protein, and iron. Sea cucumber is one of sea creatures that has plenty of nutrition which is for the body.

Objective : To compare the nutrition of *Susu* sea cucumber, *Gosok* sea cucumber, *Gamat* sea cucumber, and packaged milk so they can be used as alternative source in bone health.

Methods : The in vitro test using three samples of sea cucumber and three different kinds of packaged milk for kids. The test was performed to five nutritions e.g. calcium, magnesium, phosphor, protein, and iron. The analysis results used independent sample test methode and anova test.

Results : Sea cucumbers can meet the number of daily nutritional needs. Calcium in sea cucumbers is higher than that of milk (95% CI: -1969.85354 - 4094.26021). Its phosphorus is higher than that in milk (95% CI: -224.68925). Its magnesium is higher than that in milk (95% CI: 1499.67724 - 3243.20276). Its protein is higher than that in milk (95% CI: 18.71876 - 67.70790). Its iron is higher than that in milk (95% CI: 25.08204 - 54.45796).

Conclusion : The nutrition in sea cucumber is greater than that in packaged milk. *Susu* sea cucumber is better than that in the other two types. Sea cucumber could be used as alternative source for bone health.

Keywords— *Susu* sea cucumber; *Gosok* sea cucumber; *Gamat* sea cucumber; packaged milk; bone health; recommended dietary allowance.

I. INTRODUCTION

Bone is the hardest tissue in the human body. According to (Dorland, 2010) bone is a form of connective tissue, which is hard and stiff, arranging the vertebral skeleton, mainly composed of calcium salts. The function of the bones is also very diverse, for example as a passive movement, a place for the formation of red blood cells, protective organs.

For bone health, we need a lot of nutrients, but what is highlighted is calcium, magnesium, phosphorus, protein, and iron. Good nutrition such as sufficient vitamin D, calcium, vitamin K, forfor, magnesium, which can help the growth and formation of strong and perfect bones

(Situmorang & Tarigan, 2012). Calcium is useful for forming the structure of bones and teeth as well as for preventing osteoporosis which is at risk of fractures, especially the pelvis, vertebrae, and deformity (changes in bone shape). (Rachmiaty, 2009).

Phosphorus is useful for structuring bones and teeth to stay healthy and strong. The good and strong bones and teeth begin with the deposition of phosphorus on the bone matrix. Phosphorus plays a role in reducing the problem of losing bone density or loss of minerals, which is known as osteoporosis (Mardiyah & Sartika, 2014).

Magnesium is useful for maintaining bone health and density, it is a mineral that plays an important role as a constituent of bones. Thus, magnesium levels in the body can affect bone health and density. In addition, magnesium also plays a role in maintaining muscle strength. In addition, the presence of sufficient magnesium content in the body serves to prevent and to reduce the risk of osteoporosis (Mardiyah & Sartika, 2014).

Iron is useful for the formation of red blood cells. Red blood cells function to deliver oxygen throughout the body. As for bone health, iron is useful for collagen synthesis. Osteoporosis can be prevented by consuming collagen (Djuwantono, 2012).

Low protein intake is at risk for low bone density because protein is a constituent of cartilage structures and as a transporter of nutrients, including calcium. If the amount of protein in the body is insufficient, then calcium cannot be transported properly and the bone structure is not formed to the maximum so the bone density is low (Pradipta, 2014).

These nutrients can be easily obtained from packaged milk which are sold in the market, but besides milk, there are also many food ingredients that can be used as alternative sources of nutrition.

One of the foods containing nutrients above is sea cucumber. Sea cucumbers are marine invertebrates that have been utilized to treat certain diseases (Soltani, Baharara, 2014). Sea cucumbers is an animal not a kind of food. Sea cucumber is a member of thorn skin (Echinodermata). The spines in sea cucumbers are actually skeletons or skeletons composed of lime and are contained in the skin. The lime framework cannot be seen with the naked eye because it is so small that it needs to use a microscope. However, not all types of sea cucumbers have thorns, some types of sea

cucumbers do not have thorns (Elfidasari, Noriko, Wulandari & Perdana, 2012). Sea cucumbers are useful as deposit feeder and suspensi feeder (Purwati, 2005). Types of sea cucumbers are also diverse, ranging from *susu* sea cucumber, *gosok* sea cucumber, sea cucumber *gamat*, and others. The results show that the nutritional content of sea cucumbers in dry conditions consists of protein, fat, water, ash, and carbohydrates (Martoyo, Aji, & Winanto, 2000). Natural products derived from plants and marine organisms have health benefits that have been used to treat some diseases (Sagar SM, Yance D, Wong R 2006). Sea cucumbers also contain minerals that are quite complete in the form of calcium, sodium, phosphorus, chromium, manganese, iron, cobalt, zinc, and vanadium (Kordi, 2010).

Based on the nutrients mentioned above, theoretically, sea cucumbers can be used to improve bone health such as: preventing osteoporosis, helping healing fractures, and also fulfilling the integrity of nutrition for pregnant women. However, people consume more milk for bone health than sea cucumbers because sea cucumbers are not well known to the public. Therefore quantitative data is needed to compare the nutritional content of sea cucumbers with the nutritional content of packaged milk so that it can be seen which ingredients are the best in improving bone health.

II. METHODS

This research is an in-vitro study conducted in the laboratory with a quantitative approach method. Meanwhile, the research design used was observational design by comparing the nutritional content of calcium, magnesium, phosphorus, protein, and iron in *Susu* sea cucumbers, *Gosok* sea cucumbers, and sea cucumber *Gamat* with packaged milk and also by knowing the types of sea cucumbers that have the best content for bone health.

The object in this study is the type of sea cucumber like *gamat duri*, *gosok* sea cucumber, and *susu* sea cucumber obtained from several distributors of dried sea cucumbers purchased online and directly go to distributors. Meanwhile, the packaged milk samples are types of packaged milk sold freely in minimarkets that meet the inclusion and exclusion criteria.

The results of Integrated research and testing laboratory, University Gadjah Mada (LPPT UGM) examinations which include examination of calcium, magnesium, phosphorus, protein, and iron contents in *gamat* sea cucumbers, *gosok* sea cucumbers, and *susu* sea cucumbers will be averaged and then compared with the average nutrient content in packaged milk. Previously, the average difference will be sought whether or not it is significant using the mean test of 2 independent populations (independent sample test) using the SPSS 15.00 program. After that, it will be followed by a manual comparison of the sample average.

To find the highest content of sea cucumber like *gamat duri*, *gosok* sea cucumber, and *susu* sea cucumber will be used one-way analysis of variance (one way anova) that uses the SPSS 15.00 program to find out the similarities on average and to proceed with comparisons manually by finding the highest content or maximum value from laboratory results. The average yield of nutrients in calcium, magnesium, phosphorus, protein, and iron among *gamat* sea

cucumber, *gosok* sea cucumber, and *susu* sea cucumber will be compared.

III. RESULTS & DISCUSSION

The sea cucumber samples used in this study were obtained from the distributor of sea cucumbers directly through special orders so that the samples were not mixed with ingredients or cooking spices.

Table 1. Weight of each sea cucumber.

| Sea Cucumber | Weight (gram) |
|---------------------------|---------------|
| <i>Susu</i> Sea Cucumber | 370 gram |
| <i>Gosok</i> Sea Cucumber | 365 gram |
| <i>Gamat</i> Sea Cucumber | 400 gram |

The milk sample used in this study was obtained from the minimarket in Yogyakarta with the type of milk used was packaged powder milk.

Table 2. Net Weight of Each Packaged Milk.

| Milk | Net weight (gram) |
|----------|-------------------|
| Sample 1 | 750 gram |
| Sample 2 | 700 gram |
| Sample 3 | 500 gram |

Table 3. Test Results of Sea Cucumber.

| Sea Cucumber | Nutrition | Results |
|---------------------------|-----------|---------------|
| <i>Susu</i> Sea Cucumber | Calcium | 3630,5 mg/kg |
| | Phosphor | 168,13 mg/kg |
| | Magnesium | 1955,07 mg/kg |
| | Protein | 62,46 % b/b |
| | Iron | 53,13 mg/kg |
| <i>Gosok</i> Sea Cucumber | Calcium | 894,48 mg/kg |
| | Phosphor | 220,08 mg/kg |
| | Magnesium | 2244,15 mg/kg |
| | Protein | 55,98 % b/b |
| | Iron | 46,75 mg/kg |
| <i>Gamat</i> Sea Cucumber | Calcium | 1,63 mg/kg |
| | Phosphor | 636,33 mg/kg |
| | Magnesium | 3007,6 mg/kg |
| | Protein | 34,2 % b/b |
| | Iron | 41,03 mg/kg |

Table 4. Composition of Milk Based on List in Packaging.

| Milk | Nutrition | Results |
|----------|-----------|-------------|
| Sample 1 | Calcium | 500 mg/kg |
| | Phosphor | 148 mg/kg |
| | Magnesium | 39 mg/kg |
| | Protein | 6 % b/b |
| | Iron | 15 mg/kg |
| Sample 2 | Calcium | 400 mg/kg |
| | Phosphor | 112,4 mg/kg |
| | Magnesium | 28,5 mg/kg |
| | Protein | 5 % b/b |
| | Iron | 4,6 mg/kg |
| Sample 3 | Calcium | 440 mg/kg |
| | Phosphor | 190 mg/kg |
| | Magnesium | 25 mg/kg |
| | Protein | 12 % b/b |
| | Iron | 2 mg/kg |

Table 5. Average of Calcium Samples.

| | Category | N | Mean |
|---------|--------------|---|-----------|
| Calcium | Sea Cucumber | 3 | 1508.8700 |
| | Milk | 3 | 446.6667 |

It was found that the calcium content of sea cucumbers was better when compared to packaged milk.

Table 6. Average of Phosphorus Samples.

| | Category | N | Mean |
|----------|--------------|---|----------|
| Phosphor | Sea Cucumber | 3 | 341.5133 |
| | Milk | 3 | 150.1333 |

It was found that the content of sea cucumber phosphorus was better when compared to packaged milk.

Table 7. Average of Magnesium Samples.

| | Category | N | Mean |
|-----------|--------------|---|-----------|
| Magnesium | Sea Cucumber | 3 | 2402.2733 |
| | Milk | 3 | 30.8333 |

It was found that the magnesium content of sea cucumbers was better when compared with packaged milk.

Table 8. Average of Protein Samples.

| | Category | N | Mean |
|---------|--------------|---|---------|
| Protein | Sea Cucumber | 3 | 50.8800 |
| | Milk | 3 | 7.6667 |

It was found that the sea cucumber protein content was better when compared with packaged milk.

Table 9. Average of Iron Samples.

| | Category | N | Mean |
|------|--------------|---|---------|
| Iron | Sea Cucumber | 3 | 46.9700 |
| | Milk | 3 | 7.2000 |

It was found that the iron content of sea cucumbers was better when compared to packaged milk.

Table 10. Average of Sea Cucumber.

| Category | Gamat Sea Cucumber | Gosok Sea Cucumber | Susu Sea Cucumber | Maximum Value |
|-----------|--------------------|--------------------|-------------------|---------------|
| Calcium | 1.63 | 894.48 | 3630.5 | 3630.5 |
| Phosphor | 636.33 | 220.08 | 168.13 | 636.33 |
| Magnesium | 3007.6 | 2244.15 | 1955.07 | 3007.6 |
| Protein | 34.2 | 55.98 | 62.46 | 62.46 |
| Iron | 41.03 | 46.75 | 53.13 | 53.13 |
| Average | 744.158 | 692.288 | 1173.858 | 1173.858 |

From the table above, it can be seen that *susu* sea cucumber is superior in three nutrients, namely calcium, protein, and iron with the average of *susu* sea cucumber is also superior compared to *gamat* sea cucumber and *gosok* sea cucumber.

The results of this study indicate that the average number of sea cucumber nutrients is far superior compared to packaged milk.

It can be seen that there are significant differences in the nutrients contained in sea cucumbers and packaged milk. Nutrients used in the study, namely calcium, magnesium, phosphorus, protein, and iron are very influential to maintain bone health. For example calcium is useful for forming the structure of bones and teeth and also for preventing osteoporosis. (Rachmiaty, 2009).

IV. CONCLUSIONS & RECOMMENDATION

Based on the results of research and discussion, it can be concluded that:

Calcium in sea cucumbers is higher when compared to calcium in milk. Phosphorus in sea cucumbers is higher when compared to phosphorus in milk. Magnesium in sea cucumbers is higher when compared with magnesium in milk. Protein in sea cucumbers is higher when compared to protein in milk. Iron in sea cucumbers is higher when compared to iron in milk. *Susu* sea cucumber has a higher content when compared to *gosok* sea cucumber and *gamat sea* cucumber.

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