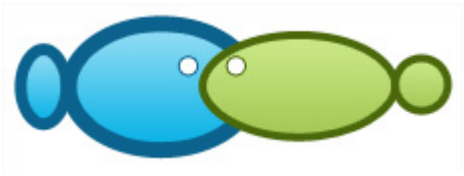

# Amino acid profile of *Strombus luhuanus* and *Lambis lambis* from Waisarisa and Suli waters, Maluku Province, Indonesia

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**Abstract**. This research was conducted to determine type and content of amino acid in fresh flesh gastropods, strawberry conch (*Strombus luhuanus*) and spider conch (*Lambis lambis*) collected from Waisarisa and Suli waters, Maluku Province, Indonesia. Chemical composition was tested by using proximate analysis while amino acid content was done using high performance liquid chromatography (HPLC). The results showed that flesh chemical composition of *S. luhuanus* from Waisarisa and Suli consisted of water content 72.52% and 73.42%, protein 17.45% and 17.94%, fat 1.25% and 1.41%, ash 4.57% and 2.65% and carbohydrate 4.21% and 4.58%, respectively, while for *L. lambis* from both locations were: water content 77.20% and 77.90%, protein 15.52% and 16.97%, fat 1.23% and 1.29%, ash 2.84% and 1.68% and carbohydrate 3.21% and 2.16%, respectively. Amino acid composition from flesh *S. luhuanus* and *L. lambis* consisted of 15 types in which nine were essential amino acids and the other six were non-essential amino acids. In general, non-essential amino acid i.e. Glutamic acid had high percentage and the highest was found in flesh of *L. lambis* from Waisarisa (2.82%), while the lowest percentage belonged to essential amino acid i.e. histidine of *S. luhuanus* from Suli (0.12%).
**Key Words**: chemical composition, gastropods, strawberry conch, spider conch, Maluku waters.

**Introduction**. Seafood is an important contributor to the diets of many communities because of their unique nutritional composition. In developing countries such as Indonesia many of which rely on fish largely for the animal protein. However, when the sea is rough and marine fish become scanty, people especially who live in coastal area will utilize whatever marine animals including molluscs to fulfill their protein requirement. Molluscs provide high quality protein with all the dietary essential amino acids for the maintenance and growth of human body. King et al (1990) stated that molluscs should be considered a low-fat, high protein food-one that can be included in a low-fat diet. In addition to their dietary importance, protein affect food texture and food flavor. The quality of protein is usually assessed by its amino acid composition. The amino acid composition in turn is helpful in assessing the nutritive value of an organism.

Utilization of molluscs as source of food especially for coastal community in Indonesia has increased rapidly. Many species of molluscs in Indonesia especially bivalves have been studied for their nutritional values. Some of those species that have been studied are blood cockle *Anadara granosa* (Nurjanah et al 2005), blood clam *A. inflata* (Arnanda et al 2005), antique ark *A. antiquata* (Abdullah et al 2013), Asian green mussel *Mytilus viridis* (Nurjanah et al 1999), tiger snails *Babylonia spirata*, shellfish snow *Pholas dactylus* and Asiatic hard clam *Meretrix meretrix* (Nurjanah et al 2015) razor clams *Solen* spp (Nurjanah et al 2008), swan mussel *Pilsbryoconcha exilis* (Nurjanah et al 2010), Chinese pond mussel *Anodonta woodiana* (Salamah et al 2008) and violet batissa clam *Batissa violacea* (Putri 2005). Among the molluscs, the gastropods are not popular like bivalves and cephalopods, thus studies on their biochemical composition are very limited (Samuel 1988).

Coastal community of Suli in Ambon Island and Waisarisa in Seram Island, Maluku Province have exploited and consumed marine molluscs for long time. Two of those are strawberry conch (*Strombus luhuanus*) or locally called *bia jala* and spider conch (*Lambis*

*lambis*) or *bia jari-jari.* Even though has been consumed for long time, there is no information about nutritional value of both gastropods in Indonesia. Hence, the present study was carried out to analyze and to determine proximate composition and amino acid profile from gastropods in *S. luhuanus* and *L. lambis*.

**Material and Method**. Samples of *S. luhuanus* and *L. lambis* were collected from the waters of Suli, Ambon Island and from Waisarisa, Seram Island (Figure 1) on December 2016. Collected samples were preserved with ice in a cool box, brought to the laboratory, cleaned and were removed from the shells.


Figure 1. The map showing sampling site (red square).

Proximate analysis which consisted of water content, protein, fat, carbohydrate and ash was based on the method proposed by Association of Official Analytical Chemist (AOAC 2005) while amino acids profile was determined by using High Performance Liquid Chromatography (HPLC).

## Results and Discussion

***Chemical composition***. Proximate composition means percentage composition of five basic constituents namely water or moisture content, protein, fat, ash and carbohydrate. The result of proximate analysis of *S. luhuanus* and *L. lambis from* Suli and Waisarisa, Maluku Province is shown in Table 1.

Table 1

Proximate of fresh flesh (%) some molluscs in Indonesian waters

| *Species*[1] | *Water* | *Protein* | *Fat* | *Ash* | *Carbohydrate* | *References* |
|---|---|---|---|---|---|---|
| *S. luhuanus*[2] | 73.42 | 17.94 | 1.41 | 2.65 | 4.58 | Present study |
| *S. luhuanus*[3] | 72.52 | 17.45 | 1.25 | 4.57 | 4.21 | Present study |
| *L. lambis*[2] | 77.90 | 16.97 | 1.29 | 1.68 | 2.16 | Present study |
| *L. lambis*[3] | 77.20 | 15.52 | 1.23 | 2.84 | 3.21 | Present study |
| *A. granosa* | 74.37 | 19.48 | 2.50 | 2.24 | 1,41 | Nurjanah et al 2005 |
| *A. inflata* | 82.51 | 8.20 | 4.30 | 2.08 | 2.91 | Arnanda et al 2005 |
| *B. spirata* | 78.44 | 17.38 | 0.33 | 1.20 | 2.65 | Nurjanah et al 2015 |
| *P. dactylus* | 83.78 | 11.37 | 0.11 | 1.19 | 3.55 | Nurjanah et al 2015 |
| *M. meretrix* | 79.98 | 9.39 | 0.24 | 1.37 | 9.02 | Nurjanah et al 2015 |

Notes: [1]=see text for species name; [2]=location Suli; [3]=location Waisarisa.

In general, both molluscs from Suli tend to have higher content of water, protein and fat but had lower content of ash and carbohydrate compared to molluscs sampled from Waisarisa. Except for *A. granosa* (Nurjanah et al 2005), *S. luhuanus* had the highest protein content than other molluscs as reported Arnanda et al (2005) and Nurjanah et al (2015). Furthermore, *S. Luhuanus* from Maluku Waters also had higher percentage of ash compared to ash content belonged to other molluscs in Indonesia waters (Nurjanah et al 2005; Nurjanah et al 2015; Arnanda et al 2005). In addition, this species also had the highest content of carbohydrate compared to other molluscs except for carbohydrate found in *M. meretrix* (Nurjanah et al 2015) (Table 1).

It can be seen in Table 1 that proximate composition of molluscs varied, not only within species but also between species. This variation is probably due to differences in species, size/age, food availability and environment/season condition (Celik et al 2014; Nurjanah et al 2015). Celik et al (2014) reported negative correlation between protein as well as fat with temperature. The authors also reported increasing of protein, fat and carbohydrate during gametogenesis and eggs development in spring and summer when more food is available and decreasing of those components after spawning of some edible marine molluscs in Turkey. The increasing of protein, fat and carbohydrate is necessary because marine organisms need more energy in reproduction process and those components are primary sources of energy.

***Amino acid composition***. The results of amino acid profile analysis for *S. luhuanus* and *L. lambis* from Waisarisa and Suli waters revealed the presence of 15 amino acids, in which nine were essential amino acids and the other six were non-essential amino acids (Table 2).

Table 2

Amino acid composition (%) of molluscs

| *Amino acid type* | *Strombus luhuanus* | | *Lambis lambis* | | *Anadara antiquata** | *Haliotis sp*** |
|---|---|---|---|---|---|---|
| | *Waisarisa* | *Suli* | *Waisarisa* | *Suli* | | |
| Essential amino acid | | | | | | |
| Histidine | 0.19 | 0.12 | 0.20 | 0.17 | 0.15 | 0.23 |
| Threonine | 0.65 | 0.44 | 0.67 | 0.62 | 0.42 | 0.82 |
| Arginine | 1.62 | 1.21 | 1.74 | 1.59 | 0.83 | 2.99 |
| Methionine | 0.51 | 0.38 | 0.62 | 0.44 | 0.27 | 0.13 |
| Valine | 0.77 | 0.53 | 0.83 | 0.73 | 0.36 | 0.37 |
| Phenylalanine | 0.67 | 0.42 | 0.71 | 0.57 | 0.36 | 0.26 |
| Isoleucine | 0.57 | 0.42 | 0.63 | 0.60 | 0.33 | 0.18 |
| Leucine | 1.26 | 0.86 | 1.39 | 1.21 | 0.76 | 0.24 |
| Lisyne | 1.05 | 0.74 | 1.24 | 1.00 | 0.46 | 0.76 |
| Sub-total | 7.29 | 5.12 | 8.03 | 7.93 | 3.94 | 5.98 |
| Non-essential amino acid | | | | | | |
| Aspartic acid | 1.67 | 1.11 | 1.61 | 1.50 | 1.13 | 0.09 |
| Glutamic acid | 2.67 | 1.90 | 2.82 | 2.73 | 1.74 | 1.09 |
| Serine | 0.71 | 0.47 | 0.73 | 0.65 | 0.52 | 0.95 |
| Glysine | 0.86 | 0.54 | 0.78 | 0.70 | 0.59 | 1.74 |
| Alanine | 1.21 | 0.73 | 1.12 | 1.00 | 0.84 | 0.98 |
| Tyrosine | 0.95 | 0.57 | 0.84 | 0.71 | 0.38 | 0.57 |
| Sub-total | 8.07 | 5.32 | 7.9 | 7.29 | 5.20 | 5.42 |
| Total amino acid | 15.36 | 10.44 | 15.93 | 15.22 | 9.14 | 11.40 |

Sources: *Hidayat (2011); ** Okuzumi & Fujii (2000).

The presence of 15 amino acids found in this study is higher than amino acids profile of *L. lambis* i.e. 13 amino acids reported by (Giji et al 2011) and *B. spirata* i.e. 10 amino acids reported by (Periyasamy et al 2011), both from Southeast Coast of India. However, amino acids found in this study is lower compared to 20 amino acids of *Tonna*

*dolium* and *Phalium glaucum* reported by Babu et al (2010) as well as 19 amino acids of *Bursa spinosa* (Babu et al 2011) in Southeast Coast of India.

It can be seen in Table 2 that the amino acids of both gastropods from Waisarisa was higher than those from Suli waters. The total amino acids content of *S. luhuanus* and *L. lambis* from Waisarisa were 15.36% and 15.93%, respectively while from Suli were 10.44% and 15.22%, respectively. It seems that non-essential amino acid, Glutamic acid of both species from Waisarisa as well as from Suli waters had higher percentage compared to other amino acids while essential amino acid, Histidine had lower percentage. In general, composition of amino acids for gastropods found in this study is higher than those found in bivalves such as in *Anadara antiquata* (Hidayat 2011) and *Haliotis* sp (Okuzumi & Fujii 2000).

Variation of amount of amino acid in marine organism is not only occurred in different species but also in within species. According to Wesselinova (2000), the amino acid contents of marine organisms vary depending on a variety of factors such as the species, size, seasonal conditions and geographical location. Furthermore, Okuzumi & Fujii (2000) and Litaay (2005) stated that variation in amino acids content could be due to age, season and life stage of marine organisms.

All amino acids have different role that helps body normal function and growth. Essential amino acids are indispensable and are required for nutrition, promotion of normal growth and maintenance of nitrogen balance while non-essential amino acids are physiologically important and take part in the general metabolic reactions (Jayaprabha 2016). Essential amino acids are not synthesized in the body and are required to be supplied in adequate amounts through diet. The absence of any of these amino acids will compromise the ability of tissue to grow, be repaired or be maintained (Hoffman & Falvo 2004).

It can be seen in Table 2 that Arginine dominated essential amino acid followed by Leucine and Lysine. Essential amino acid needed by human being vary and it depend on age in which its requirement decreased when the age increased. For example, Lysine requirement for preschool child, school child and adult are 58 mg $kg^{-1}$, 44 mg $kg^{-1}$ and 16 mg $kg^{-1}$, respectively (FAO/WHO/UNU 1985). Comparison between the amino acid composition of the present study and the reference values of FAO/WHO/UNU (1985) showed that for each g protein $kg^{-1}$, all of the amino acids would meet the recommended range of amino acid requirements for children and adults except for Histidine in *S. luhuanus* and *L. lambis* from Suli samples. Minimum requirement of Histidine stated by FAO/WHO/UNU (1985) for children and adults are 19 mg $kg^{-1}$ and 16 mg $kg^{-1}$ respectively, so both gastropods from Suli waters failed to fulfill this minimum amino acid requirement for children. Histidine is particularly essential to accelerate growth especially for children and to repair as well as to maintain tissue for both adults and children (FAO/WHO/UNU 1985).

**Conclusions**. *S. luhuanus* and *L. lambis* consist of 15 types of amino acid in which nine of them were essential amino acid while the other six were non-essential amino acid. The lowest type of amino acid was Histidine belonged to *S. luhuanus* from Suli, while in the highest percentage was the Glutamic acid found in *L. lambis* from Waisarisa. For every g protein $kg^{-1}$, all essential amino acids of gastropods meet minimum requirement of amino acids for human being except for Histidine of gastropods sampled from Suli waters.

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