The Potency and Food Safety of Lamp Shells (Brachiopoda: Lingula sp.) as Food Resources

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Abstract. Lamp shells is one of primitive brachiopods that can be found in the tropical region. One species of brachiopod has been reported found in Indonesia. This invertebrate is collected by local people for consumption as well as traded in the local market in the area of the southern shore of Madura Island and the northern shore of East Java, Indonesia. This research aimed to analyze the potency of lamp shells as food resources based on the protein and fat content and to evaluate the food safety based on the content of lead (plumbum) and cadmium. The sample of lamp shells was collected from Probolinggo beach. Fresh samples of flesh and pedicle of lamp shell were kept in a cool box for laboratory analysis. The protein content was analyzed using Kjeldahl method, while the content of fat was analyzed using soxhlet method. In addition, the level of plumbum and cadmium in the flesh and pedicle of lamp shell were tested using atomic absorption spectroscopy. The results revealed that both of the flesh and the pedicle of lamp shells contained protein, namely 14.02±0.62% and 12.06±0.44% respectively. The flesh contained 1.12±0.13% of fat, meanwhile, the pedicle contained 0.84±0.07% of fat. These nutrient content were comparable other marine invertebrates. It seems that the nutrient content outweighs the content of heavy metal that can be accumulated in the sessile invertebrate. The content of plumbum in the flesh and pedicle of lamp shells were 0.10±0.01 ppm and 0.08±0.01 ppm respectively. Meanwhile, the content of cadmium in the flesh and pedicle of lamp shells were 0.09±0.01 ppm and 0.06±0.01 ppm respectively. These numbers are considerably lower that the level permitted. Hence, it can be concluded that lamp shells has potency as food resources.

1. Introduction
The coastal waters of Indonesia are rich in invertebrate animals, one of which belongs to Phylum Brachiopoda, which is a primitive invertebrate that is well-known as living fossils. Previous publications recorded the presence of brachiopod from the middle to Upper Jurassic [1] and from Middle Triassic [2]. Nowadays, living brachiopods consisted of 116 genera and 391 species [3]. Current publication reported the distribution of brachiopod from some locations, for instance Queensland, Australia [4], North Western Philippines [5], South China Sea [6], India [7–10].

Brachiopods are also found in Indonesia. The Siboga Expedition (1899-1900) collected 13 species of brachiopods from the coastal waters of Indonesia, belongs to genus Lingula, Discinisca, Tugularbynchia, Basiliola, Terebratulina, Gryphus, Campages, Jolonica, Frenulina [11]. Sahidin et al. [12] reported the occurrence of brachiopod in Banten, Indonesia. Darmarini et al [13] also reported
new findings of *Lingula* sp from Damar Lubuk (Aceh). Previously, described that the lamp shells can be found in Muara Angke, West Java and the local people called them as “kerang kucuk” or “kerang keco”, but they did not consume this brachiopod [14]. However, in fact local coastal communities in East Java have been these animals consuming lamp shells and the lamp shells are traded in the local market. In Probolinggo, coastal communities refer to this animal as the name tebalan and in Tuban the community calls it leaf shells, while in Madura it is called tobelen.

So far there are no scientific publications that reported on the use of brachiopod as food resources. In fact, we need the data about their nutrient content as well as the food safety related to the heavy metals contamination as marine organisms potentially accumulate the heavy metals [15][16][17]. Besides, previous reports are mostly working on the potential of molluscs as food resources, for instances Santhiya et al [18], Salman & Nasar [19], Ghosh et al [20], Baby et al.[21].

The mains aims of this study were to analyze the potency of lamp shell as food resources based on the protein and fat content as well as to evaluate the food safety based on the content of lead (plumbum) and cadmium.

2. Methods
The samples of lamp shells were collected from the beach of Bee Jay Bakau Resort Probolinggo, which is located at the south part of Madura Strait (S7º72.842’ E113º22.351’) (Figure 1). The specimens were collected by digging the holes of lamp shells using a modified cowbar as usually used by local people to collect this invertebrate (Figure 2). Fresh specimens were kept in a cool box for identification and laboratory analysis. The lamp shells were identified based on the morphological character of the shells and pedicles. Morphometric measurement was carried out using a calliper.

![Figure 1. Sampling sites of lamp shells](image-url)
Local people collected the lamp shells

The flesh and visceral mass were separated from the shells and pedicles. Each sample of flesh (flesh and visceral mass) and pedicle was taken 0.3 grams and prepared for the analysis of lead using Atomic Absorption Spectrophotometer (AAS). Meanwhile, each sample of flesh (flesh and visceral mass) and pedicle was taken 0.5 grams and prepared for the analysis of cadmium level using Atomic Absorption Spectrophotometer (AAS). The content of protein was analyzed using Kjeldahl method, while the content of fat was analyzed using soxhlet. Three repetitions were applicable for all analyses. Data was analyzed descriptive quantitatively and presented in the histogram.

3. Result and Discussion

Local people in the coastal area of Madura Strait, for example in Probolinggo, collect lamp shells (Brachiopoda) during the lowest tide, for both family consumption and shelling in the local market. The lamp shells occupy muddy sand substratum located in front of mangrove. Local people collects this invertebrate by handpicking using flattened ended cow bar (Figure 2). The habitat of lamp shell are similar to the habitat of brachiopod in Aceh reported by Darmarini et al [13]. However, it is slightly different from the characters of the brachiopod habitat reported from India [7][8][9], which are muddy substratum in the estuary region.

The description of lamp shells from Probolinggo is as follows. Shells shape elongates; lateral margins subparallel; anterior margin slightly convex; smooth external valve surface; distinct growth lines. Colour greenish (varies from translucent green to dark green), some specimens slightly brownish along the lateral and posterior margins. The pedicles are whitish (Figure 3). The length of the shell ranged from 20.2 mm to 49.3 mm (39.45±4.41 mm). The width of the shell was 18.33±2.65 mm. The thickness of the shells ranged from 3.55 mm to 11.4 mm (8.15±1.04 mm). The length of the pedicle ranged from 7 mm to 74 mm (44.5±11.5 mm).

Based on the morphological characters, the lamp shells from Probolinggo belongs to genus Lingula, similar to the species from Aceh [13] and India [7][8][9]. Further study are needed to identify the species of this lamp shells, whether the species of this lamp shells is Lingula cf. anatina
The fact that local people are consuming this brachiopod is interesting because there is no scientific publication about the use of this brachiopod as food as well as their nutrient content. The local people described that flesh and the pedicle (they call pedicle as “ekor” or tail) are tasty; the taste and the texture are similar to the taste of bivalves or sea shells. This research revealed that the flesh and the pedicle of lamp shells contained high protein, namely 14.02±0.62%, and 12.06±0.44% respectively. Besides, the flesh contained 1.12±0.13% of fat, meanwhile, the pedicle contained 0.84±0.07% of fat. The flesh (flesh and visceral mass) of lamp shells contained more fat and protein compared to the pedicle. This content was also comparable to the nutrient content of sea shells. Salman & Nasar reported the content of lipid and protein of seashells [19]. Besides, sea shells also contain fatty acid and cholesterol [22].

One parameter of food safety was based on the content of heavy metal in the food [23]. The content of heavy metal lead and cadmium of lamp shells were very low. The content of lead (plumbum) in the flesh and pedicle of lamp shells were 0.10±0.01 ppm and 0.08±0.01 ppm respectively. Meanwhile, the content of cadmium in the flesh and pedicle of lamp shells were 0.09±0.01 ppm and 0.06±0.01 ppm respectively. This value was comparatively lower than the maximum limit of heavy metal contamination in food [23]. Besides, the content of heavy metal lead and cadmium of lamp shells were lower than the content of heavy metal lead and cadmium of consumption bivalves fished from Madura Strait [17] [24][25].
Figure 4. The content of protein and fat of lamp shells from Probolinggo

Figure 5. The content of lead (plumbum) and cadmium of lamp shells from Probolinggo
4. Conclusions

The flesh (flesh and visceral mass) of lamp shells (Brachiopoda: *Lingula* sp.) from Probolinggo contained more fat and protein compared to the pedicle. The content of heavy metal lead and cadmium in the flesh and pedicle of lamp shells was lower than the maximum limit of heavy metal contamination in food. Based on these parameters, lamp shells that usually consume by local people are safe as food resources.

5. References

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