

# Nutrient and Heavy Metal Contents of *Meretrix* sp. from Bancaran Estuary, Indonesia

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**Abstract.** People in South East Asia region have consumed hard clam for a long time. This clam also actively collected and traded by local people around beaches and estuaries in Indonesia. The purposes of this research were to analyze protein and content of hard clam (*Meretrix* sp.) collected from Bancaran Estuary, Indonesia and to evaluate the content of lead (Pb) and cadmium (Cd). The sample of clams was collected by hand picking during low tide. Fresh samples of clams were kept in a cool box. Fresh samples of the flesh were taken for analysis of nutrient and heavy metal content as well. The content of fat was analyzed using soxhlet method; meanwhile the protein content was analyzed using Kjeldahl method. In addition, the content of cadmium (Cd) and lead (Pb) in the flesh of hard clam were tested using atomic adsorption spectroscopy. The results indicated of the flesh of hard clam contained fat and protein, namely  $3.25 \pm 0.42\%$  and  $10.26 \pm 0.46\%$  respectively. Meanwhile, the content of Cadmium (Cd) and Lead (Pb) were  $0.0306 \pm 0.0053$  ppm and  $0.0458 \pm 0.0035$  ppm respectively. The level of Cd and Pb were lower than the level of maximum acceptable limit. Therefore, it can be concluded that the flesh of hard clam was safe for consumption.

**Keywords.** Edible bivalves, Food safety, Hard clam, Veneridae.

## 1 Introduction

*Meretrix* is one of the genera in the family Veneridae, which consists of fifteen species, namely *Meretrix astricta*, *M. attenuata*, *M. aurora*, *M. casta*, *M. lamarckii*, *M. lusoria*, *M. lyrata*, *M. marisarabicum*, *M. meretrix*, *M. morphina*, *M. petechialis*, *M. planisulcata*, *M. subtrigona*, *M. tigris*, *M. vestita* [1]. These shells are distributed in Western Central Pacific waters and known as hard clams [2]. They are commonly consumed and traded in the local market for instance *M. lyrata*, which is commercially fished in area of Mollaca Strait and traded in the local market of the southern Philippines. *Meretrix meretrix* are also exploited in Thailand, Philippines, and Indonesia and also potentially exported [2].

In Indonesia, some publications also reported the use of these clams (*Meretrix* spp.) as food resources. *Meretrix meretrix* are eaten as food in West Java [3], and also in other areas in Indonesia, because it tastes delicious [4]. Hard clams was also fished in Muara angke Jakarta [5], Central Java [6], Gresik East Java [7], and Bangkalan [8–10].

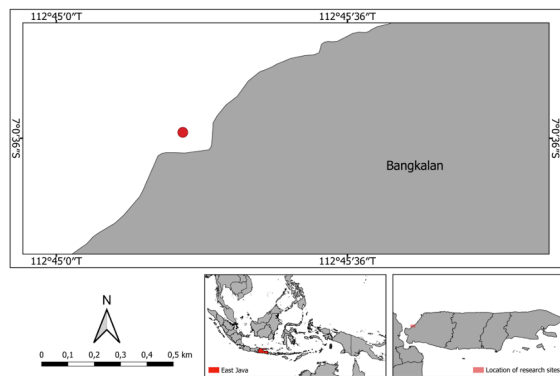
Several studies have reported bivalves are important sources of nutrition [5,11–16] as well as the potential to accumulate heavy metals [6,8,17–22]. However, so far there is no publication regarding the nutrient content as

well as the heavy metals content of *Meretrix* sp. collected from Bancaran Estuary, Madura. Therefore the food safety of *Meretrix* sp. collected from Bancaran Estuary, Madura need to be evaluated. This research purposed to analyze protein and content of hard clam (*Meretrix* sp.) collected from Bancaran Estuary, Indonesia and to evaluate the level of lead (Pb) as well as cadmium (Cd) level, hence it can be determined the food safety.

## 2 Research Method

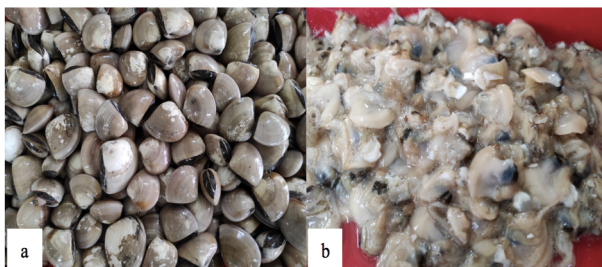
The samples of hard clam (*Meretrix* sp.) were taken from the estuary of Bancaran, Bangkalan, Madura, Indonesia (Fig. 1) during low tide by hand picking. The samples were kept in the coolbox and then transferred to the laboratory for identification and nutrient and heavy metal analysis.

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**Fig. 1.** Sampling site of hard clam (*Meretrix* sp)

The shells of hard clam were broken to separate the flesh from the shells (Fig. 2). It was taken 0.3 grams of the flesh sample, and then prepared for the analysis of lead (Pb) level using Atomic Absorption Spectrophotometer (AAS). In addition, the analysis of cadmium (Cd) level was conducted using Atomic Absorption Spectrophotometer (AAS). It was taken 0.5 grams the sample of flesh (including flesh and visceral mass) and prepared for the analysis of nutrient content. The content of protein was analyzed using Kjeldahl method; meanwhile the content of fat was analyzed using Soxhlet method. All measurements were repeated three times using three series of samples. Data obtained was analyzed descriptive-quantitatively.



**Fig. 2.** The samples of hard clam (*Meretrix* sp.); a: morphology of the shell, b: the flesh

### 3 Result and Discussion

The results indicated that the flesh of hard clam contained fat and protein, namely  $3.25 \pm 0.42\%$  and  $10.26 \pm 0.46\%$  respectively (Table 1). The fat and protein content of hard clam is comparable to the content of fat and protein in other bivalves. The protein content in *Gafrarium pectinatum* was  $12.87 \pm 0.2107\%$  and in *Crassostrea virginica* was  $15.22 \pm 0.1065\%$ . The fat content in *Gafrarium pectinatum* was  $0.965 \pm 0.02\%$  and in *Crassostrea virginica*  $0.59 \pm 0.061\%$  [23]. The content of protein of *Meretrix* sp. was lower than the content of *Gafrarium pectinatum* and *Crassostrea virginica*. However, the content of fat are higher. Salman & Nasar reported that seashells contained lipid and protein of molluscs, including bivalves [14]. In addition, the seashells also contain fatty acid and cholesterol [16].

**Table 1.** Content of fat, protein, cadmium, and lead of *Meretrix* sp. (Veneridae)

Parameter	Content	Maximum acceptable limit*
Fat	$3.25 \pm 0.42\%$	-
Protein	$10.26 \pm 0.46\%$	-
Cadmium (Cd)	$0.0306 \pm 0.0053$ ppm	1 ppm
Lead (Pb)	$0.0458 \pm 0.0035$ ppm	1 ppm

\*Based on Standar Nasional Indonesia (SNI) 2009 [24]

Bivalves, as other macro-benthos, have a tendency to accumulate heavy metals because of they are filter feeder [25]. Some references indicated high levels of accumulation of heavy metals in clams, for example *Anadara granosa* from Bangkalan [26]; *A. nodifera*, *M. lyrata*, and *Solen lamarckii* from Bangkalan coastal waters [8]; *G. pectinatum* from Sampang Madura [27]; *A. granosa*, *Perna viridis*, *Crassostrea gigas*, *M. lyrata*, *Amusium pleuronectes*, from Northern Coast of Central Java [6]. Hard clam lives in sand and muddy-sand bottoms of intertidal and sublittoral waters up to the depth of approximately 20 m [2]. Hence, hard clam also potentially accumulates heavy metals (Pb and Cu).

One of parameters of food safety was determined based on the level of heavy metal level in the food [24]. The content of Cadmium (Cd) and Lead (Pb) of were  $0.0306 \pm 0.0053$  ppm and  $0.0458 \pm 0.0035$  ppm respectively. The level of Cd and Pb were lower than the maximum acceptable limit of Cd and Pb in marine biota permitted by standard in Indonesia [24]. Therefore, it can be concluded that the flesh of hard clam was safe for consumption.

### 4 Conclusion

This research results revealed that of the flesh of hard clam (*Meretrix* sp.) from Bancaran Estuary contained fat and protein, namely  $3.25 \pm 0.42\%$  and  $10.26 \pm 0.46\%$  respectively. Meanwhile, the content of Cadmium (Cd) and Lead (Pb) were lower than the level of maximum acceptable limit. Therefore, it can be concluded that the flesh of hard clam was safe for consumption

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