

Comparison of the Nutritional Values in Fresh and Smoked *Corbiculafluminea* (Etak) Tissue via Traditional Smoking Process

Siti Nor Aini Md Nasir^a, Najihah Yusof^a, Salam M. A^b, Aweng Eh Rak^{a*}

^a Faculty of Earth Science, Department of Natural Resources and Sustainability, Universiti Malaysia Kelantan, Locked Bag No. 100, 17600, Jeli, Kelantan.

^b Department of Environmental Science and Disaster Management, Noakhali Science and Technology University, Bangladesh

*Corresponding author

Aweng Eh Rak, Faculty of Earth Science, Department of Natural Resources and Sustainability, Universiti Malaysia Kelantan, Locked Bag No. 100, 17600, Jeli, Kelantan (Email:aweng@umk.edu.my).

Article Info

Volume 82

Page Number: 11786 - 11791

Publication Issue:

January-February 2020

Abstract

Smoked *Corbicula fluminea* or smoked Asian Clam was known as “etaksalai” in Kelantan dialect is widely consumed as snack in Kelantan. Smoked Asian clam fans consumed them with zero knowledge on the nutritional value that might reduce during marinating and smoking process. Thus, this study would like to determine and compare nutritional value of fresh and smoked *C. fluminea*. Fresh and smoked *C. fluminea* samples were collected three replicates from six different stalls at two districts which is main producers and the widest coverage of consumers in Kelantan. Crude fat, crude protein and carbohydrate were analysed based on Association of Official Analytical Chemicals (AOAC) method. This study found that crude protein (10.92%) and carbohydrate (1.91%) were highest in smoked *C. fluminea* compared to fresh *C. fluminea* from stall 6 and 5 respectively at Tumpat. Meanwhile, crude fat content was recorded the highest in fresh *C. fluminea* from stall 1 (Pasir Mas) ($p < 0.05$). The finding of this study are able to guide smoked *C. fluminea* fans to estimate the amount of smoked *C. fluminea* consumption in a day, a week or a month, so that, they can control and balance nutrition in their body.

Article History

Article Received: 18 May 2019

Revised: 14 July 2019

Accepted: 22 December 2019

Publication: 21 February 2020

Keywords: *Corbicula fluminea*, nutritional value, fat, protein, carbohydrate

I. Introduction

Corbicula fluminea (scientific name) known as Asian clam or “golden clam” is one of the filter feeder bivalves (Kramer-Wilt, 2008). It's can be found in fresh and brackish water with golden, yellowish, greenish and black in colour. *C. fluminea* is just a small bivalve that has shape of oval triangular (Kramer-Wilt, 2008). In Kelantan, *C. fluminea* is known as “etak”. Anyone who visits the markets in the main city of Kelantan will not miss the sight of “etak” sellers. *C. fluminea* was consume after smoked process as snacks

called smoked “etak”. It can easily be found and bought from the stalls at the wet market as well as by the road side. Besides snacks, *C. fluminea* is also served as various kind of dishes. Therefore, *C. fluminea* is an ecologically and economically important freshwater shellfish for South-East Asian especially in Malaysia and Thailand. *C. fluminea* also is one of the third the most harvested freshwater shellfish in certain states in Malaysia especially Kelantan, Terengganu and even Pahang for consumption purposes. Although Asian clam is least known or neglected among Malaysian, but the demand for Asian clam is

growing among Malaysia markets. Traditionally, the business of *C. fluminea* has been practiced in a small-scale basis enterprise in Kelantan. Most of *C. fluminea* that are been sold at the stalls in Kelantan were brought in from certain states or places such as Pahang, Terengganu, Johor, Perak and even Thailand. This is due to the mining project that have been in operation along the main river in Kelantan that effect the habitat of *C. fluminea*. According to Manan (2014), fresh *C. fluminea* has been imported by vendor as much as two tonnes per vendors per month in order to meet the demand. Some of fresh *C. fluminea* are imported from Cambodia through Thailand. This means people in Kelantan consumed roughly two tonnes of smoked *C. fluminea* per month without actually knows the content of nutritional values of the clams has. Even though the awareness among community has been increased regarding this

matter, there is no study yet being carried out to analyse the nutritional value of *C. fluminea*. Thus, the objective of this study is to determine and compare the nutritional value of fresh and smoked *C. fluminea* through traditional smoking method.

II. Methodology

Sampling and Sample Preparation

The fresh and smoked Asian Clam, *C. fluminea*, was purchased from three different stalls at Tumpat and three different stalls at Pasir Mas (Figure 1) made up of six points. The clam was kept in a clean plastic bag then place in ice box prior to transportation to the laboratory. Upon arriving at the laboratory, samples were kept in a freezer at -4 °C until the analysis process of nutritional value was conducted. The coordinates of the location of the stalls were presented in Table 1.



District	Stall Number	Coordinate
Pasir Mas	Stall 1	6.0495938, 102.1693547
	Stall 2	6.0497306, 102.1691667
	Stall 3	6.0497333, 102.1691667
Tumpat	Stall 4	6.1379039, 102.170987
	Stall 5	6.1467273, 102.218605
	Stall 6	6.1450348, 102.222301

Figure 1: Sampling location map

(Source: google map)

Table 1: The coordinate of the stalls.

Samples analysis

Three components of nutritional value which are fat, protein and carbohydrate were analysed using AOAC, (1990) method. The percentage of moisture content and ash content was determined in order to calculate the carbohydrate content. The



sample was dried in air oven at 105°C for 24 hours to dry the moisture in sample. The weight of dry sample was divided by the weight of the wet sample and was multiplied by 100 to get a percentage of moisture content. On the other hand, for ash content determination, sample was incinerated in furnace at 550°C for 4 hours and was allowed to cool in desiccator to room temperature. The weight of ash was divided by the weight of the wet sample and was multiplied by 100 to get a percentage of ash content. Principle in determination of crude fat is the dried sample was dissolved with petroleum ether and then the ether was evaporated in the Soxhlet apparatus and the residues are crude fat which was measured in percentage. Meanwhile, the principle of determining crude protein is actually the determination of total nitrogen by using Kjeldahl method and it was also measured in percentage. Finally, the determination of total carbohydrate content where it's can simply be determined by 100 percentsubtract all other components. It is also measured in percentage. Calculation of mean and standard deviation of each element of nutritional value was performed. The comparison of nutritional value content between fresh and smoked *C. fluminea* via traditional smoking process was analysed using SPSS through two-way anova method.

III. Results and discussion

Moisture content

Table 2 shows the fresh *C. fluminea* from stall 2 and stall 3 has the highest moisture value which is 81.09% and 80.86% respectively. The lowest moisture value is from smoked *C. fluminea* from stall 4 and stall 5 which is 77.60% and 77.77% respectively. The values of moisture content from the two stalls are just slightly different. The values of moisture content in both fresh and smoked *C. fluminea* range between 77.60% - 81.08%. The data also showed that there were statistically significant difference ($p < 0.05$) between stages and

stalls. The reduced moisture content in smoked *C. fluminea* was influenced by the water loss during the smoking process. This is in line with a study by Akintola (2015) who reported that the smoking process reduces the moisture content in food. A moisture higher than 15% enhanced proteolytic, lipolytic deterioration and microbial proliferation (Begum et al. 2017).

Ash content

Table 2 shows the smoked *C. fluminea* from stall 3 and stall 6 has the highest value of ash content which is 1.96% and 1.81% respectively while the lowest value of ash content is fresh *C. fluminea* from stall 0.61% and 0.66% respectively. The range of ash content in both stages which is fresh and smoked *C. fluminea* is in between 0.61% - 1.96%. There was significant difference ($p < 0.05$) between stages and stalls. The percentage of ash was significantly higher in smoked samples than fresh, which was in line with report of Toa and Linchun, (2008) that smoking results in concentration of nutrients like ash, protein and fat. According to Islamet al.(2013) opined that the increase in ash content when *C. fluminea* are smoked is due to increase of dust content after the smoked process is a result of the loss of humidity during the process. The ash content in *C. fluminea* were increasing could be due to the volatility of the mineral elements at the high temperature during smoking process.

Crude fat

Crude fat content at stall 1 was found the highest in fresh *C. fluminea* from stall 1 which is 11.66% while the lowest in smoked *C. fluminea* also from stall 1 which is 8.75% as shown in Table 2. There is significant different ($p < 0.05$) between stages and stalls. The downsizing in fat content in smoked stage associated with oxidation and breakdown of crude fat into other components due to the oxidation of poly-unsaturated fatty acids (PUFA) contained in the tissue (Daramola et al. 2007).

This result could associate with possible loss of fat cause by high temperature (Idah&Nwankwo 2013). The low value of crude fat in sample smoked *C. fluminea* can therefore be linked to the heat applied during the smoke drying process through burning out of the fat as a means of reducing rancidity and hence extending the shelf-life of the processed *C. Fluminea* (Omomo et al., 2014).

Crude protein

The result of protein content in fresh and smoked *C. fluminea* tissue is shown in Table 2. The highest value of protein content was found in smoked *C. fluminea* from stall 6 which is 10.92%. The lowest value of protein content was found in fresh *C. fluminea* from stall 3 and stall 2 which are 6.21% and 6.24% where the difference of the value is just slightly different. From the results, there are significance difference ($p < 0.05$) between stages and stalls. Protein content of *C. fluminea* was found to be the highest at the smoked stage, followed by fresh stage. High protein in smoked *C. fluminea* because of temperature during the smoking process (55°C), which did not cause protein denaturation. According to Hongwei et al. (2009), the temperature for protein to be denatured is in the range of 65°C - 75°C . The outcomes of this study are in line with Karnjanapratum et al. (2013), who claimed that the protein in Asian hard clams (*Meretrix lusoria*) was 9.09–12.75%. The smoking process also increases the protein content due to dehydration, which concentrates and aggregates proteins in smoked *C. fluminea* (Yoneda et al. 2017; Okereke et al. 2014).

Carbohydrate content

The smoked *C. fluminea* from stall 5 has the highest value of carbohydrate content which is 1.91% while smoked *C. fluminea* from stall 3 has the lowest value of carbohydrate content which is 0.22%. There are significant different ($p < 0.05$)

between stages and stalls. For stalls, there is statistically significant difference ($p < 0.05$) between the stalls, but there is no statistically significant difference ($p > 0.05$) between the stages. The result obtained differs from that of Asha et al. (2014) who found that carbohydrate of oysters (*Crassostrea madrasensis*) is higher with a value of 3.2%. This is because, carbohydrate in tissues is in the form of glycogen, free sugars and protein bound sugars might be influenced by the paste during the marinating process (Vijayakumar et al. 2014).

Table 2: Mean and standard deviation of nutritional value in both stages of *C. fluminea*

Nutritional value	Stal 1	Processing stages (%)	
		Fresh	Smoked
Moisture	1	80.30±0.14 _a	79.68±0.72 _a
	2	81.08±0.36 _a	79.52±0.26 _b
	3	80.86±0.75 _a	78.36±0.26 _b
	4	80.67±0.27 _a	77.60±0.09 _b
	5	80.13±0.25 _a	77.77±0.55 _b
	6	80.23±0.22 _a	75.90±0.14 _b
Crude protein	1	6.24±0.11 _b	8.97±0.17 _a
	2	6.34±0.08 _b	8.33±0.08 _a
	3	6.21±0.02 _b	9.42±0.03 _a
	4	7.89±0.11 _b	9.05±0.17 _a
	5	8.03±0.06 _b	8.86±0.13 _a
	6	7.61±0.09 _b	10.92±0.11 _a
Ash	1	1.01±0.03 _b	1.80±0.01 _a
	2	0.94±0.02 _b	1.60±0.01 _a
	3	0.61±0.01 _b	1.96±0.03 _a
	4	0.75±0.05 _b	1.76±0.03 _a
	5	0.66±0.02 _b	1.73±0.02 _a
	6	1.11±0.01 _b	1.81±0.02 _a
Crude fat	1	11.66±0.32 _a	8.75±0.10 _b
	2	10.49±0.36	10.02±0.02

	a	a
3	11.24±0.16 _a	10.05±0.05 _b
4	10.23±0.11 _b	11.14±0.38 _a
5	10.44±0.12 _a	9.74±0.20 _b
6	10.67±0.26 _a	10.54±0.32 _a
1	0.80±0.55 ^a	0.81±0.69 ^a
2	1.14±0.71 ^a	0.53±0.18 ^a
3	1.08±0.59 ^a	0.22±0.25 ^a
4	0.46±0.39 ^a	0.44±0.26 ^a
5	0.74±0.31 ^b	1.9±0.24 ^a
6	0.37±0.30 ^a	0.83±0.31 ^a

Carbohydrat
e

IV. Conclusion

In conclusion, fresh sample had the higher moisture and crude fat, while smoked sample showed at crude protein, ash and carbohydrate. High moisture content and crude fat in fresh *C. fluminea* were due to high water content. Moisture content in sample can affect other nutrition. Smoked *C. fluminea* tissue might be affected by external factor which is uncontrollable condition such as surrounding temperature, amount of sunlight that have been exposed while selling and dust.

V. Acknowledgement

This work was financially supported by the Ministry of Education Malaysia under the Trans Disciplinary Research Grant Scheme (TRGS: R/TRGS /A08.00/00244A/005/2016/000389). On other hand, we are thankful to the laboratory management of Universiti Malaysia Kelantan for lending the laboratory instruments for the completion of this research.

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Biography:

Associate Professor Dr. Aweng Eh Rak is a senior lecturer who holds dean position in Faculty of Earth Science at Universiti Malaysia Kelantan. He holds the Ph.D of Civil Engineering in River Management. He loves to share his research knowledge through publications of articles and attending conferences that relates to environmental issues and sustainability. During his academic journey, he has secured a number of research grants to undertake research in environmental issues and Kelantanese cultural. He has also likes to participate in innovation exhibitions and won a number of medals such as “Best Award”, Gold, Silver and Bronze medal.