Turkish Journal of Fisheries and Aquatic Sciences 4: 71-74 (2004)

Effect of the Handling Procedures on the Chemical Composition of Sea Cucumber

Nil Pembe Özer[1,*], Sühendan Mol[2], Candan Varlık[2]
[1] Kocaeli University, College of Engineering, Kocaeli, Turkey
[2] Istanbul University, Faculty of Fisheries, Istanbul, Turkey

* Corresponding Author: Tel.: +90. 262 335 01 66; Fax: +90. 262 335 28 12;
E-mail: pembe2k@yahoo.com

Received 18 November 2004
Accepted 30 March 2005

Abstract

This study compared the chemical compositions of sea cucumbers harvested from the Marmara Sea during the spring and summer in different months. They were processed using two different methods. The first method was evisceration by cutting the anus, followed by removal of the viscera by firmly squeezing the body. The second method was evisceration by cutting along the length of the body, followed by removal of the viscera. All of the sea cucumbers were boiled and dried. Their water, ash, protein, and fat contents were measured and recorded prior to and after processing. The moisture content of fresh sea cucumber decreased from 85% to 6.5% when it was processed with the first method, while the post-processing water content with second method came out to be 6%. Fresh sea cucumber (based on dry weight) contained 5.78–9.53% protein and 0.06–0.37% fat. The approximate percent composition of fat, protein, and ash were determined to be 1.17–2.44%, 39.77–59.57%, and 17.91–44.53% respectively for the first method; and 1.71–2.31%, 40.97–60.18%, and 29.82–40.04% for respectively for the second method. No significant differences were found for the second method in the water, ash, and fat content. Protein content was significantly lower for the second method in July. There was a significant difference ($p<0.05$) in the water, ash, fat, and protein content for the first method.

Key Words: Sea cucumber, chemical composition, boiling, drying.

Introduction

The catching of sea cucumbers is one of the oldest activities of commercial fisheries in the South Pacific in addition to pearl oysters. Sea cucumbers have been harvested commercially since at least 1000 years ago (Conand and Byrne, 1993; Hamel and Mercier, 1997). Holothurians (sea cucumbers) are traditionally consumed raw, dried, and boiled as food for human consumption in many tropical and sub-tropical countries. Major consuming countries are China, Hong Kong, South Korea, Singapore, and Japan. The dried product is called *beche-de-mer* in French, *hai-som* in Chinese, and *trepang* in Indonesian. *Beche-de-mer* is graded according to the species, size, appearance, odour, colour, moisture, and content of extraneous matter. Buyers prefer a uniformly shaped, extra large graded product (Subasinghe, 1992). In some Pacific countries such as Japan and Korea, the body wall and viscera of sea cucumbers are eaten as raw or pickled. In some other countries, dried sea cucumber is widely used in soaps or fried with meat or vegetables (Conand and Byrne,1993; Morgan and Archer, 1999; Subasinghe, 1992). In some countries, extracts of certain sea cucumber species are used as a kind of traditional medicine. The popularity of sea cucumbers for its medicinal properties and as a supplementary food source for people in their 40s comes from their low fat and high calcium content (Baine and Sze, 2000; Ferduose, 1997).

Recently, many researchers have studied the various pharmacological properties, taxonomy, biology, and ecology of these species. There are many different varieties of sea cucumber in the world. The most common and abundant species of sea cucumber in Turkey is *Holothuria scabra*, whose taxonomy, biology, ecology, and chemical composition (e.g., protein, fat, moisture, and mineral content) have not studied sufficiently. Therefore, determination of the chemical composition of this seafood has become an important topic of inquiry. The aim of the study was to compare the chemical compositions of sea cucumber harvested during different months.

Materials and Methods

Material and Sampling Plan

Sea cucumbers of the species *Holothuria scabra*, which is most abundant in Turkey, were used in this study. The sea cucumbers were harvested in April, May, June, July, and August, and sampling was carried out each time for the month before and the month after processing. Sea cucumbers were collected each month between April and August along the sandy sea floor near shore waters of the southern Marmara Sea. Most of the harvesting was done in Edremit, Turkey. Snorkel gear and diving tubes were used in harvesting the sea cucumbers.

Processing

Cleaning: The sea cucumbers were transported to laboratory in seawater. Each cucumber was weighed and measured for its size. Prior to being cooked, they were freshly eviscerated and cleaned by lightly brushing their surface to remove sand and other materials adhering to their surface. The samples were then washed in clean sea water.

Cutting: Sea cucumbers were prepared in two ways. In Method 1, after cleaning their anus (posterior end), they were cut into pieces 2–3 cm in length, then the water and viscera inside them were removed by firmly squeezing their body wall. In Method 2, they were cut along the centre line of their abdomen to within 3 cm of each end, and then their viscera were removed. Following these steps, sea cucumbers prepared in both ways were further processed with the following steps:

First Boiling: Sea cucumbers prepared by both methods were individually placed in boiling clean seawater one by one, then boiled while also being stirred for about 45 minutes. After this, they were removed from the boiling water and immersed in fresh seawater at room temperature.

Second Boiling: All sea cucumbers were boiled a second time for approximately 45 minutes with continuous stirring. After this second boiling, they were removed quickly from the boiling vessel and placed into sea water at room temperature as recommend by Subasinghe (1992) and SPC (1994).

Drying: Boiled sea cucumbers prepared by Method 1 were dried at 37°C for one day and then at 70°C for two days. A short wooden stick (2,5–4 cm) was placed inside each sea cucumber prepared by method 2 to keep the slits that had been cut in them open, then the cucumbers were placed on a tray, slit side down, before being dried at 37°C for one day and at 70°C for two days.

Chemical Analyses: The sea cucumbers were homogenized using a blender and analyzed in duplicate to determine their moisture, fat, protein and ash content. Moisture content was determined by drying the samples in an oven at 105°C until constant weight was obtained. Ash content was determined by heating in a hot oven until the samples burned completely. Fat content was determined using method 948.15 as described in AOAC (1990). A velp scientifica DK6 heating digester and a velp scientifica UDK 140 distillation unit were used to determine protein content (AOAC, 1990).

Statistical Analysis

All treatments were replicated three times and results were reported as means. An analysis of variance (ANOVA) was performed using the general linear models procedure of MINITAB 13.30 (Minitab Inc., State College, PA., USA). The Tukey test was used to compare the average moisture, ash, fat, and protein content between pairs of methods and months. Pairwise comparison among means with a 95% confidence level was used.

Results and Discussion

In this study, sea cucumbers were processed using two methods between April and August. The fresh and processed sea cucumbers were analyzed and compared for moisture, ash, fat, and protein contents in various months (Table 1).

The values obtained were very close to those reported by Chang-Lee *et al.* (1989) and Chen (2003), who determined moisture, ash, fat, and protein content to be 76.94–90.81%, 0.9–3.4%, 0.03–0.3%, and 4.7–11.52%, respectively. Although different species were used in their studies, results were found to be comparable.

Analysis of variance using a general linear model involving two-way interaction terms showed that there were no significant differences ($p>0.05$) in the content of moisture and ash, with both the first and the second method, except in June for moisture content and in May for ash content. No significant differences were found in the contents of moisture or ash between the first and second months for the second method. The moisture and ash content values were significantly ($p<0.05$) lower for the first method in June and May, respectively (Table 2).

The fat and protein content values of processed sea cucumbers were determined and results were compared according to methods and months (Table 3). No significant difference ($p>0.05$) was found in fat content between the first and second months for the second method. The protein content was significantly

Table 1. Approximate chemical composition of fresh sea cucumbers (%)

Months	Moisture	Fat	Protein	Ash
April	87,21	0,37	9,53	8,10
May	85,45	0,22	5,78	11,06
June	84,91	0,19	7,30	7,57
July	85,32	0,17	7,95	4,68
August	84,54	0,23	8,61	3,59

Table 2. Moisture and ash contents of processed sea cucumbers (%)

	Moisture [1,2]		Ash	
	I [3]	II	I	II
April	a6.82A	a5.82A	ab28.46A	a35.52A
May	a7.08A	a6.34A	b17.91A	a36.95B
June	b4.96A	a6.29B	a39.58A	a29.82A
July	a6.45A	a5.57A	a44.53A	a40.04A
August	ab6.10A	a5.92A	ab34.68A	a39.79A

[1] Within the same row (for each parameter), values not followed by the same capital letter are significantly different ($p<0.05$).
[2] Within the same column, values not preceded by the same letter are significantly different ($p<0.05$).
[3] Methods

Table 3. Fat and protein contents of processed sea cucumbers (%)

	Fat [1,2]		Protein	
	I [3]	II	I	II
April	ab2.06A	a1.85A	a59.57A	a60.18A
May	ab1.96A	a2.17A	abc57.27A	a58.90A
June	bc1.44A	a1.93A	bcd44.44A	ab48.41A
July	c1.17A	a1.71A	d39.77A	b40.97A
August	a2.44A	a2.31A	cd43.50A	ab47.43A

[1] Within the same row (for each parameter), values not followed by the same capital letter are significantly different ($p<0.05$).
[2] Within the same column, values not preceded by the same letter are significantly different ($p<0.05$).
[3] Methods

lower for second method in July. There was no significant difference ($p>0.05$) in the protein or fat content with either preparation method in any month. However, there was a significant difference ($p<0.05$) in the fat and protein content between the first method and months. According to Chang-Lee *et al.* (1989), there was no significant difference in the chemical analysis of canned sea cucumber made from fresh-cooked, salted-cooked and cooked & dried material. Chen (2003), dried various species of sea cucumber and determined their main nutrient profiles. The minimum and maximum moisture content figures for these samples were 8.25% and 21.55%, respectively. The fat content of dried *Acaudina molpadioides* was 0.55% and it was 3.70% for dried *Thelenota ananas*. The highest protein content in sea cucumbers was reported as 69.72% and the lowest content was 55.51%. Ash content ranged between 7.56% and 21.09% in various species of sea cucumber.

Conclusion

The results of the present study showed that when the two different preparation methods were compared, there were no significant differences in the acceptability of the dried product. The moisture content of fresh sea cucumber dropped from 85% to 6.5% when it was processed by the first method, while the corresponding figure obtained with the second method was 6%. No significant differences occurred in the moisture, ash, and fat content values with the second method between the first and second months. There was a significant difference ($p<0.05$) in the moisture, ash, fat, and protein content obtained with the first method between the first and second months.

Acknowledgements

This study has been supported financially by the Research Foundation at University of Kocaeli, Turkey.

References

AOAC. 1990. Official Methods of Analyses, 15th ed. Kenneth, Arlington, Virginia, USA.

Baine, M. and Sze, C.P. 2000. Sea cucumber fisheries in Malaysia. *Infofish International*, 4: 67-73.

Chang-Lee, M.V., Price, R.J. and Lampila, L.E. 1989. Effect of processing on proximate composition and mineral content of sea cucumbers (*Parastichopus* spp.). *Journal of Food Science,* 54: 567-568.

Chen, J. 2003. Overview of sea cucumber farming and ranching practices in China. *Beche-de-mer Information Bulletin*, 18: 18-23.

Conand, C. and Byrne, M. 1993. A review of recent developments in the world sea cucumber fisheries. *Mar. Fish. Rev.*, 55(4): 1-13.

Ferdouse, F. 1997. Beche-de-mer and sharkfin- markets and utilization. *Infofish,* 6: 23-29.

FAO. 2002. Yearbook of Fishery Statistics. 91: 92 pp.

Hamel, J.F. and Mercier, A. 1997. Sea cucumbers: Current fishery and prospects for aquaculture. *Aquaculture Magazine*, January- February: 42-53.

Morgan, A. and Archer, J. 1999. Overview: Aspects of sea cucumber industry research and development in the South Pacific. *Beche-de-mer IInformation Bulletin,* 12: 15-17.

SPC. 1994. Sea cucumbers and Beche-de-mer of the tropical Pacific. A handbook for fishers. Handbook no: 18. South Pacific Commission, Noumea, New Caledonia.

Subasinghe, S. 1992. Shark fin, sea cucumber and jellyfish. A Processor's Guide. Infofish Technical Handbook, 6: 11-22.