

## Nutritional Composition of Selected Species of Sea cucumbers from Waters around Jaffna Peninsula, Sri Lanka

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### Abstract

Biochemical studies (protein, fat, moisture and ash) were done on five species of holothurians namely *Holothuria leucospilota*, *Holothuria scabra*, *Holothuria spinifera*, *Stichopus naso* and *Thelenota anax*, which were collected from the waters around Jaffna Peninsula during November 2013 to April 2014. Moisture, ash, protein and lipid contents of collected sea cucumbers were measured and recorded. The average moisture, protein, lipid and ash contents were 84.52±0.88%, 10.06±0.04%, 0.25±0.02% and 1.90±0.07% in *H. leucospilota*, 85.21±0.78%, 4.96±0.02%, 0.34±0.03% and 5.72±0.34% in *H. scabra*, 79.19±0.86%, 8.22±0.43%, 0.27±0.05% and 9.22±0.23% in *H. spinifera*, 92.55±0.66%, 3.00±0.04%, 0.33±0.01% and 1.62±0.02% in *S. naso* and 89.92±1.33%, 3.14±0.03%, 0.40±0.02% and 2.90±0.01% in *T. anax*, respectively. Marked significant differences ( $p < 0.05$ ) were observed among sea cucumber species for the mean moisture, protein, lipid and ash contents. In comparison showed that *H. leucospilota* and *H. spinifera* possessed higher protein, *T. anax* possessed higher lipid and *H. spinifera* possessed higher ash contents than other investigated sea cucumber species. Among the five analyzed sea cucumber species, *H. leucospilota* is the most recommended as one of the healthiest food for human consumption as it has low fat content and high protein content.

**Keywords:** Sea cucumber, Nutritional composition, Jaffna Peninsula

### Introduction

Holothurians are soft bodied echinoderms comprising a diverse group of flexible, elongated, worm like organisms, with a rubbery like skin and gelatinous body looking like cucumber, hence the name “sea cucumbers” (Conand, 1990). They live on rocky substrata, soft sediments and sea grass beds, in depths that vary between 0 and 100 m (Fischer *et al.*, 1987). They are highly diverse, abundant and exclusively marine invertebrates that play crucial roles in the recycling of nutrients and bioturbation processes in marine benthic

communities (Preston, 1993). However they are most common in the Indian Ocean and the South West Pacific (Conand, 1990). Sea cucumbers have been consumed in Asian countries for centuries for their dietary and curative properties (Toral-Granada *et al.*, 2008). Some species of sea cucumbers produce toxins that have medicinal value. Some compounds isolated to date exhibit anti-microbial and anti-inflammatory, (Ibrahim *et al.*, 1992; Shaharah *et al.*, 1998) anti-oxidant, (Hawa *et al.*, 1999) anti-coagulant and immuno

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modulatory activities due to the presence of compounds such as sulphonamides and diketones (Aminin *et al.*, 2001). Many Asians believe sea cucumbers should be eaten to treat ailments such as cancer and arthritis, as well as intestinal and urinary dysfunctions (Purcell, 2010). In Sri Lanka, sea cucumber fishery is presently confined to the Northern cap from Kalpitiya on the Northwestern coast through the Puttalam Islands around Gulf of Mannar, Trincomalee, Pothuwil and Kalmunei in the Northeast and Eastern coastal waters of Sri Lanka. These are the major sea cucumber fishing areas in Sri Lanka. There are no records on local consumption of sea cucumbers in Sri Lanka. *Beach-de-mer* is the major commodity that is produced in Sri Lanka and the entire annual production is currently exported to Singapore, Hong Kong and China (Dissanayake, 2009). However, there were only a few reports about biochemical composition of aquatic food materials including sea cucumber. Furthermore, the biochemical composition of sea cucumbers are influenced by the local environmental factors and internal factors that could be within or between the species including size, maturity condition, feeding season and physiological conditions (Chandrashekar and Deosthale, 1993). Moreover, measurements of nutritional profiles such as protein, lipid, ash and moisture contents are often ensure that whether they meet the requirements of food regulations and commercial specifications or not.

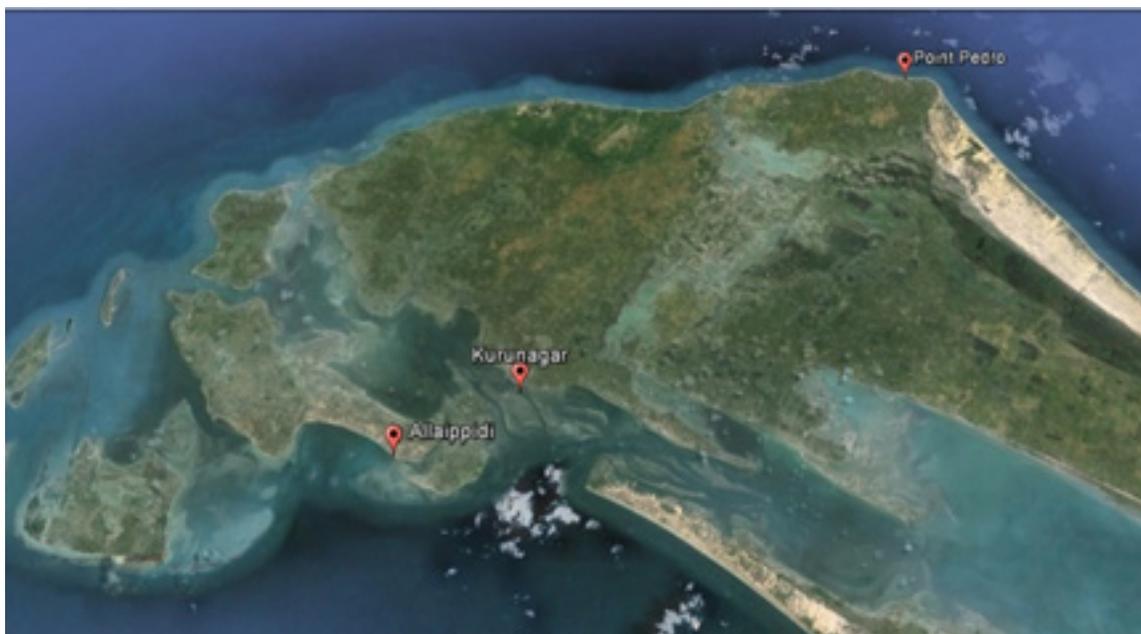
The present work aims to highlight the nutritional value of some local sea cucumber species inhabiting the Jaffna Peninsula namely *H. leucospilota*, *H. scabra*, *H. spinifera*, *S. naso* and *Tanax* in order to evaluate their quality and their economic importance.

## Materials and Methods

### Sample collection

Five species of Sea cucumber samples were collected weekly from fishermen from their trawl catches or dived catches from each fish landing stations at Kurunagar, Allaippidi and Point Pedro (Figure 1). Regular field visits were made from November 2013 to April 2014. Approximately same total length (18.0 cm) of sea cucumbers were collected for the analysis. Immediately after collection, sea cucumbers were chilled before freezing (Graham *et al.*, 1992) and brought to the laboratory by using an ice box.

Sea cucumbers were allowed to thaw slowly at room temperature and standard length (SL) and total body weight were measured. Sea cucumber samples were dissected. Reproductive and digestive organs were removed and rinsed with distilled water and placed in sterilized petri dish (60 mm Diameter) and labeled.



**Figure 1: Sampling sites around Jaffna Peninsula.**

### **Chemical analysis**

The percentage of nutritional constituents of sea cucumbers were determined by conventional method of AOAC (2000). Triplicate determinations were carried out for each chemical constituents.

### **Determination of Moisture content**

Moisture was determined as the difference in weight of the specimen before and after dehydration (to constant weight in an electric oven maintained at 105°C for about 3 hours then cooled to room temperature in a desiccator and weighed). The moisture content was calculated according to the formula:

$$\% \text{ Moisture} = \frac{\text{Difference in weight}}{\text{Weight of sample}} \times 100$$

### **Sample preparation for analysis of protein, lipid and ash**

Dried samples were powdered using motor and pestle. Powdered samples were transferred carefully to polythene bag and labeled and then stored in a freezer at -20 °C until further investigation.

### **Determination of Protein content**

After the determination of moisture content, protein content of the remaining dried samples were determined according to the Kjeldhal method (AOAC, 2000). It involves the conversion of organic nitrogen to ammonium sulphate by digestion of sample with concentrated sulphuric acid in a kjeldhal tube. The digest was diluted, made alkaline with sodium hydroxide and distilled. The liberated ammonia was collected in a boric acid solution and total nitrogen was determined titrimetrically. The percentage of crude protein in the sample was calculated

according to the formula

$$\% \text{ Crude protein content} = \% \text{ of Nitrogen} \times 6.25.$$

### Determination of fat content

For the estimation of fat content, the dried samples left after moisture determinations were finely ground and the fat was extracted with chloroform and methanol mixture (AOAC, 2000). After extraction, the solvent was evaporated and the extracted materials were weighed. The percentage of the total fat content was calculated.

### Determination of ash content

The ash content of a sample is the residue left after ashing in a muffle furnace at about 550-600 °C till the residue become white. The percentage of ash was calculated by subtracting the ash weight from initial weight.

$$\text{Ash}\% = \frac{(\text{Weight of ash})}{(\text{Weight of initial sample})} \times 100$$

### Statistical analysis

Moisture, ash lipid and protein content of five species of sea cucumber were first analyzed by one way analysis of variance (ANOVA). When the mean of the samples was significantly

different, ANOVA was followed by Post hoc comparison of employing after means: Duncan's Multiple Range Test (DMRT) using SPSS software. The level of statistical significance was set at  $p < 0.05$ .

### Results

The moisture, protein, lipid and ash contents in the body wall of collected sea cucumber species examined are presented in Table 1. Each value indicates the Mean±SD of triplicate determinations. The proximate composition of the investigated specimens (Table 1) show high percentage of moisture (84.52 to 92.55%) and lower percentage of lipids (0.25 to 0.40%) in all investigated specimens. One way analysis of variance (ANOVA) showed that there are marked significant differences ( $p < 0.05$ ) among sea cucumber species in mean moisture, protein, lipid and ash content. Comparison of mean (Mean±SD) values of moisture, protein, lipid and ash content showed by Duncan's multiple range tests for five different species of sea cucumber and presence of significant differences are expressed as superscripts in Table 1.

**Table 1: Nutritional composition (%) of the investigated sea cucumbers (mean values ± standard deviation).**

Sea cucumber	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)
<i>H. leucospilota</i>	84.52±0.88 <sup>a</sup>	10.06±0.04 <sup>a</sup>	0.25±0.02 <sup>a</sup>	1.90±0.07 <sup>a</sup>
<i>H. scabra</i>	85.21±0.78 <sup>a</sup>	4.96±0.02 <sup>b</sup>	0.34±0.03 <sup>bc</sup>	5.72±0.34 <sup>b</sup>
<i>H. spinifera</i>	79.19±0.86 <sup>b</sup>	8.22±0.43 <sup>c</sup>	0.27±0.05 <sup>ac</sup>	9.22±0.23 <sup>c</sup>
<i>S. naso</i>	92.55±0.66 <sup>c</sup>	3.00±0.04 <sup>d</sup>	0.33±0.01 <sup>ab</sup>	1.62±0.02 <sup>a</sup>
<i>T. anax</i>	89.92±1.33 <sup>d</sup>	3.14±0.03 <sup>d</sup>	0.40±0.02 <sup>b</sup>	2.90±0.01 <sup>d</sup>

Values in the same column bearing different letters are significantly different ( $P < 0.05$ ).

Comparison of mean values of moisture showed that there is significant difference between each species except between the *H. leucospilota* and *H. scabra*. Comparison of mean values of protein showed that there is significant difference between each species other than between the *S. naso* and *T. anax*. Comparison of mean values of lipid showed that there is significant difference between *H. leucospilota* and *H. scabra*, *H. leucospilota* and *T. anax*, and *H. spinifera* and *T. anax*. Comparison of mean values of ash showed that there is significant difference between each species other than the *H. leucospilota* and *S. naso*. The comparison showed that *H. leucospilota* and *H. spinifera* possessed higher protein, *T. anax* possessed higher lipid and *H. spinifera* possessed higher ash content than other investigated sea cucumber species.

## Discussion

In some parts of the world, sea cucumber is known to be used as food for centuries (Fabinyi, 2012 and Jenkins and Mulliken, 1999). Bordbar *et al.*, (2011) stated that the commercially processed sea cucumbers are rich source of crude protein in comparison to most of the sea foods so far in use. Wen *et al.*, (2010) investigated the chemical and nutritional composition of eight common commercially processed sea cucumber species such as *Stichopus herrmanni*, *Thelenota ananas*, *T. anax*, *Holothuria fuscogilva*, *Holothuria fuscopunctata*, *Actinopyga mauritiana*, *Actinopyga caerulea* and *Bohadschia argus* and found the protein contents to be within the range of 40.7 to 63.3%, and a relatively very low level of fat (0.3–1.9%), except for *T. anax* and *A. caerulea*, while the ash content is markedly high (15.4–39.6%). According to Chen *et al.* (2011), the fully dried sea cucumber material may contain protein content as high as 83 %

and is sold in tabulated or capsulated forms as nutritive complement.

Fish proteins rich in essential amino acids (EAA), are easily digestible and nutritionally superior, to vegetable proteins. Likewise sea cucumbers also have considerable amount of proteins which includes the essential amino acids and non-essential amino acids such as glycine, lysine, threonine and valine which are used for medicinal purposes (Omran, 2013).

According to Chang-Lee *et al.*, (1989), proximate composition of sea cucumber is 82–92.6 % moisture, 2.5–13.8% protein, 0.1–0.9% lipid and 1.5–4.3% ash. The present study showed that the moisture content range between 79.19 and 92.55%, protein content ranged between 1.06 and 3.00%, lipid content ranged between 0.25 and 0.40% and ash content ranged between 1.62 and 9.22%. The results are in accordance with the range reported by Chang-Lee *et al.*, (1989). Among the investigated sea cucumbers *H. leucospilota* showed the highest value of protein (10.06±0.04%) and lowest value of lipid (0.25±0.02%), where as *H. spinifera* showed the highest value of ash (9.22±0.23%) and lowest value of moisture content (79.19±0.86%).

## Conclusion

According to the present study, *H. leucospilota* showed the highest nutritional value than other species. Among the five analyzed sea cucumber species, *H. leucospilota* is recommended as one of the most healthiest food for human consumption as it has low lipid content and high protein content. The present study provides fundamental information about nutritional quality of sea cucumbers around the Jaffna Peninsula.

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