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P Ganesan
Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, India

Brita Nicy A
Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, India

Kanaga V
Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, India

P Velayutham
Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, India

Correspondence
P Ganesan
Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi, Tamil Nadu, India

Proximate analysis of cuttlefish ink procured from Thoothukudi coast: A comparative study

P Ganesan, Brita Nicy A, Kanaga V and P Velayutham

Abstract
In India, cuttlefish ink is usually discarded as a processing waste but is common in the cuisine of Japan, Italy and Spain. Surprisingly, there are few available literatures regarding its proximate composition which is necessary to ensure that it meets the nutritional requirements essential for growth and health of a living being. Hence, in the present study, the proximate compositions of ink from three cuttlefish species from Thoothukudi coast were evaluated. *Sepia pharaonis* ink had the highest level of moisture (87.90±0.52) compared to that of *S. ramani* and *S. prabahari*. Protein content was highest in *S. prabahari* ink with a value 12.01±0.29 compared to other two species. Ash, carbohydrates and fat contents ranged from 0.09±0.02 to 0.12±0.03, 0.62±0.11 to 0.70±0.09 and 0.19±0.01 to 0.21±0.04 in the cuttlefish ink, respectively. Thus, the present study showed that among the three cuttlefish species, *Sepia prabahari* ink with highest protein content is nutritionally preferred.

Keywords: Proximate composition, cuttlefish ink, nutrition, cephalopod

1. Introduction
Cephalopods form a major item in marine fishery export from India, with increasing demand from various parts of the world. Cephalopod landings increased steadily in the last 40 years, from 1617 tonnes (t) in 1970 to 1,65,394 t in 2010 [1]. Cephalopods are the second major seafood export item from India. More than 75% of the cephalopod landings along the south - west coast are generally represented by the squid, *Loligo duvauceli* and cuttlefish, *Sepia pharaonis.* All the cephalopod resources in the catch form an item of export from India, with *S. pharaonis* representing the major item.
Inking of Cephalopods has long been recognized as an adaptive response to predation and physical threat by means of a combination of mechanisms that include chemical deterrence, sensory disruption and phago-mimicry [2]. Cephalopod ink is composed of secretions from two glands. The ink sac with its ink gland produces a black ink containing melanin and a second organ, the funnel organ, a mucus-producing gland [3]. Cuttlefish ink has wide application in homeopathic medicine, in food products (mainly Japan), antiseptic effect, antibacterial activity, antitumor activity etc. [2].
The measurement of some proximate profiles such as protein, carbohydrate, lipid and moisture content is often necessary to ensure that they meet the requirements of food regulations and commercial specifications [4]. However, there are few studies concentrating on the proximate composition and nutritional evaluation of cephalopod inks. Therefore, the present study was undertaken to compare the proximate composition of ink from commercially important cuttlefish species from Thoothukudi coast.

2. Materials and methods
The study was conducted during the period from January, 2016 to May, 2016

2.1 Raw materials
Three species of cuttlefish *viz. Sepia pharaonis, S. prabahari* and *S. ramani* were procured from Thoothukudi fishing harbor, Tamil Nadu, India. Cuttlefish were iced immediately at the ratio of 1:1 (fish: ice) placed in an insulated box and transported fresh to the laboratory within 15 min. Flake ice was used for chilling the fish during the transportation. Cuttlefish were dissected and the ink sacs were taken out. The surface of the ink sac was sterilized with ethanol. The ink duct was cut with sterile scissors and the sac was gently squeezed and the excreted ink was collected in sterile bottles.

2.2 Analysis of proximate composition

Moisture and ash content of cuttlefish ink were determined by the standard AOAC method (1995). The Nitrogen content of cuttlefish ink was determined by the Microkjeldahl method (AOAC, 1995) using KEL-PLUS digestion and distillation apparatus. The protein content was calculated by multiplying nitrogen content with a factor 6.25. Crude fat content of cuttlefish ink was determined by Soxhelt method (AOAC, 1995) using petroleum ether 60-80 ºC as solvent in a SOCS PLUS-SCS 12 system.

3. Results and Discussion

The proximate composition of Cuttlefish ink determined for *S. pharaonis*, *S. prabahari*, and *S. ramani* is given in the Table 1 and each component is compared in Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5. The results showed that *S. pharaonis* had higher moisture level with a value 87.90 ± 0.52 and *S. prabahari* showed the lowest value (86.75 ± 0.39). Protein content was high in *S. prabahari* with a value 12.01 ± 0.29 and *S. pharaonis* showed the lowest value (11.12 ± 0.04). Ash was found to be higher in *S. pharaonis* (0.12 ± 0.03) than the other two species. Carbohydrates were high in *S. prabahari* (0.70 ± 0.42) and low in *S. pharaonis* (0.62 ± 0.11). Fat content ranged from 0.19 ± 0.01 to 0.21 ± 0.04 in the cuttlefish species. These results are similar with that of the squid ink which was reported by Lopez-González A, *et al.* [5].

Table 1: Proximate composition of Cuttlefish ink

Species	Moisture	Protein	Fat	Ash	Carbohydrates
S. pharaonis	87.90±0.52	11.12±0.04	0.19±0.01	0.12±0.03	0.62±0.11
S. prabahari	86.75±0.39	12.01±0.29	0.21±0.04	0.09±0.02	0.70±0.09
S. ramani	87.38±0.81	11.38±0.23	0.20±0.02	0.11±0.04	0.68±0.13

3.1 Proximate composition of Cuttlefish ink for three species in Percentage

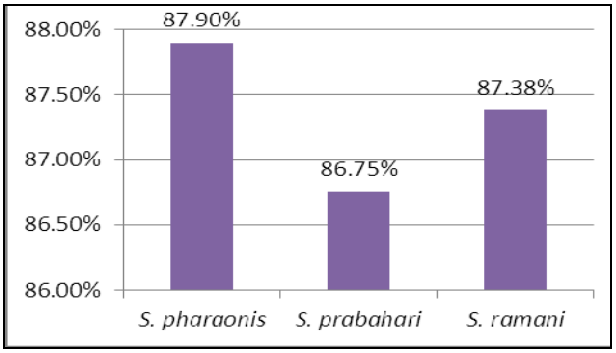

Fig 1: Moisture

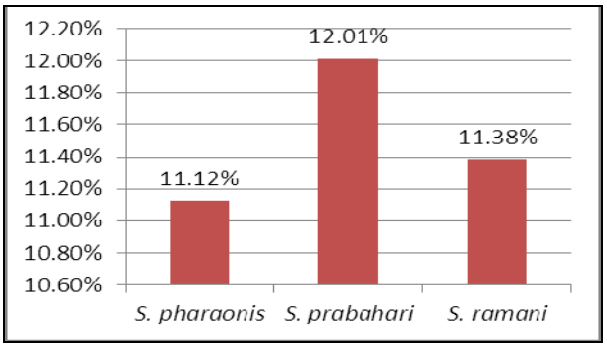

Fig 2: Protein

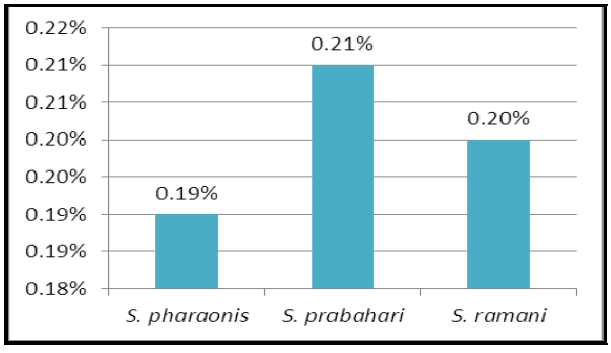

Fig 3: Fat

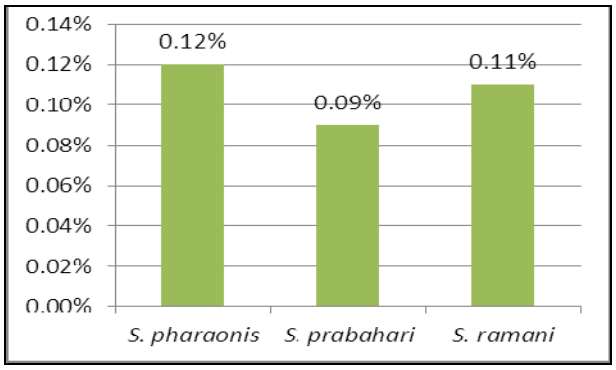

Fig 4: Ash

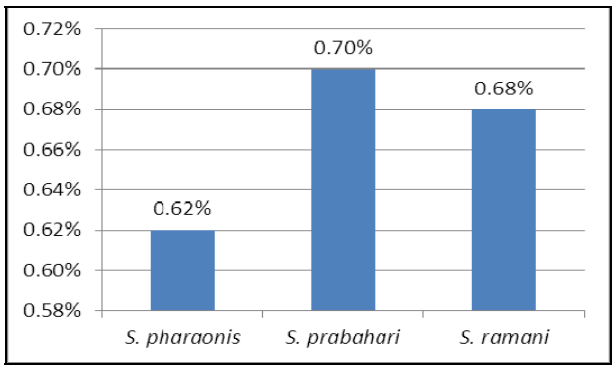

Fig 5: Carbohydrates

4. Acknowledgement

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5. Conclusion

Food with high protein is generally considered to be nutritionally better and hence, ink from *S. prabahari* with highest protein content is nutritionally preferred among the three cuttlefish species.

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