

Studies on Mineral Content in Sea Squid Species from Pakistan Coastal Waters

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Summary: The study deals with the comparative mineral analysis of five different species of sea squid - *Loligo duvauceli*, *Dosidicus gigas*, *sepiella inermis*, *Sepia pharaonis* and *Sepia prashadi*. Flame photometric analysis revealed that squid species have levels of Sodium (Na) and Potassium (K) in the range of 106.17 - 186.07 mg/100g, 70.48-108 mg/100 g respectively. Atomic absorption analysis showed Magnesium (Mg), Calcium (Ca), Zinc (Zn) and Copper (Cu) in the range of 98.90 - 102.3 mg/100 g, 27.73 - 31.04 mg/100 g, 1.9 - 4.22 mg/100 g and 0.27-0.38 mg/100 g respectively. The levels of Iron (Fe) and Phosphorus (P) varied between 2.58-3.63 mg/100 g and 240.91-250.03 mg/100 g respectively. Data illustrated that sea squid may be considered as an excellent source of minerals.

Introduction

The coastal areas of Pakistan abound both in conventional and non-conventional varieties of fish. Among the non-conventional varieties, squids are found in quite appreciable amounts, which are caught mainly as a by-catch and generally sent for sun drying for making fish meal and fish manure.

Squids are important not only with respect to their high quality protein but also from commercial point of view. Despite all its importance, this resource has drawn little attention of scientists and planners for its commercial exploitation and therefore scant information both on scientific and commercial aspect is available. World Squid landing in 1987 was 1,800 thousand tones accounting for almost 80 percent of the total Cephalopod Catch [1].

In order to promote sea squid as food, studies on their occurrence, food value and biological evaluations have already been reported [2,3,4]. Very little information is available on the essential minerals of sea squids.

This study reports the mineral content in five species of sea squid.

Results and Discussion

Moisture, ash and the levels of mineral elements are presented in Table 1. Comparison of these elements with other fin fish species is given in Table 2.

Moisture content ranged between 73.16% in *Sepia pharaonis* and 78.02% in *Loligo duvauceli*. The ash or mineral matter ranged between 1.31-1.75% in *Loligo duvauceli* and *Sepia pharaonis* respectively. These values are within the range as reported earlier [2,7].

The observed Na levels in this study, ranged between 106.17 mg/100 g in *Sepia prashadi* and 186.07 mg/100 g in *Sepiella inermis*. The Na levels in squid species were higher than those of fin fish reported (50.42 mg/100 g, Table 2) by other workers, [8,9], ranging from 28.6-66.6 mg/100 g. However, the high sodium levels are not unusual in shell fish. Cameron *et al.* [10] reported Na levels to vary between 100-417.5 mg/100 g in oysters.

The investigated K levels ranged between 70.48 to 108.8 mg/100 g in *Sepia prashadi* and *Dosidicus gigas* respectively. These levels are lower as compared to fin fish (354.1 mg/100 g, Table 2). Generally, fish contain high amount of K than Na. On the contrary, our data suggest high amount of Na than K in all the five species of squid. Louisiana oysters [11] were also reported to contain higher levels of Na ranging 100-417.5 mg/100 g compared to K ranging 57.5-190.3 mg/100 g).

Denis *et al.* [11] reported K/Na ratio of 6.8:1 in white fish, based on mean K and Na concentration of 351 and 52 mg/100 g respectively. We found K/Na ratio of 1:1.66 based on mean K

Table-1: Mineral composition of Sea Squid

Species	mg/100 g									
	Moisture %	Ash %	Na	K	Mg	Ca	P	Zn	Fe	Cu
<i>Loligo duvauceli</i>	78.02 ± 1.1	1.31 ± 0.2	139.2 ± 3.0	76.0 ± 5.0	100.01 ± 3.0	28.8 ± 6.2	243.61 ± 5.5	2.61 ± 0.1	2.58 ± 0.8	0.30 ± 0.05
<i>Desidicus gigas</i>	75.13 ± 0.5	1.42 ± 0.1	150.96 ± 5.0	108.80 ± 3.1	98.90 ± 4.2	30.01 ± 4.1	250.03 ± 5.3	3.50 ± 0.03	3.20 ± 0.3	0.38 ± 0.01
<i>Sepiella intermis</i>	76.00 ± 1.2	1.59 ± 0.1	186.07 ± 3.4	88.90 ± 3.2	101.41 ± 5.3	28.05 ± 5.8	246.33 ± 4.5	3.08 ± 0.1	3.02 ± 0.5	0.28 ± 0.04
<i>Sepia pharaonis</i>	73.16 ± 1.0	1.75 ± 0.2	116.17 ± 4.5	76.40 ± 2.4	102.03 ± 2.6	31.04 ± 3.2	248.31 ± 3.2	4.22 ± 0.08	3.63 ± 0.31	0.31 ± 0.04
<i>Sepia prashadi</i>	74.18 ± 0.5	1.44 ± 0.4	106.17 ± 4.0	70.48 ± 3.0	100.08 ± 3.4	27.73 ± 4.0	240.91 ± 3.0	1.90 ± 0.22	3.30 ± 0.23	0.27 ± 0.03
Mean	75.30	1.50	140.0	84.12	100.50	29.13	246.24	3.10	3.20	0.31

Table 2: Comparative nutritional importance of minerals in squid and fin fish

Element	Average content mg/100 g		(c) Recommended daily allowances (USRDA) mg	Percentage of requirement supplied by 100 g squid meat
	(a) Squid	(b) Fin Fish		
Sodium	140.0	50.42		
Potassium	84.12	354.1		
Magnesium	100.5	25.66		
Calcium	29.13	12.4	1000.0	2.9
Phosphorus	246.24	188.0	1000.0	24.6
Zinc	3.4	0.274	15.0	20.7
Iron	3.2	0.404	18.0	17.8
Copper	0.31	0.035	2.0	15.5

(a) Mean values of five squid species investigated (b) Mean values adapted from 10 fin fish species (c) Chemistry and Biochemistry of Marine Food Products. The AVI Publishing Company, INC West Port Connecticut printed in United States of America, Page 431-433 (1982). (c) Values adapted from Fundamentals of Food Canning Technology. The AVI Publishing Company, INC West Port, Connecticut. Printed in United State of America Page 395 (1979).

and Na of contents 84.12 and 140.0 mg/100 g respectively. These findings are in agreement with those reported by Cartani and Aloj [12,13] for selachian fish species, crustaceans and mollusk.

Similar to this study, wide variations in Na and K levels among fish species have been reported [14,15]. The variations have been related to the size of fish and fishing season.

Mg levels examined ranged between 98.90 mg/100 g for *Dosidicus gigas* and 102.03 mg/100 g for *Sepia pharaonis*. The levels of Mg were found to be relatively uniform in all the five species with an average of 100.50 mg/100 g. These values are higher than those reported by Sidwell *et al.* [16].

In marine fish [11], Mg has been reported to range between 19.7-31.3 mg/100 g averaging 25.66 mg/100 g and in oysters between 17.7-64.4 mg/100 g in a 10 months period of sampling [10].

The investigated Ca values ranged between 27.73 mg/100 g in *Sepia prashadi* and 31.04 mg/100 g in *Sepia pharaonis* with a mean value of 29.13 mg/100 g. Calcium levels are low in fin fish, (12.4 mg/100 g Table 2). An average of 4.86 mg/100 g Ca has been reported for male and female gray fish edible portion [17]. Jane E *et al.* [9] also reported Ca levels in fish ranging from 6.8 to 14.3 mg/100 g edible portion.

Calcium is considered as one of the most important element for the human body. It is

necessary for growing children and is required for all adults not less than 1g/day. The squid species examined may provide about 3% of the recommended allowance (Table 2).

The phosphorus values averaged 246.24 mg/100 g with the highest 250.03 mg/100 g and the lowest 240.91mg/100 g for *Dosidicus gigas* and *Sepia prashadi* respectively. These values are within the range reported by Sidwell *et al.* [16]. P is also considered important for the growth of human body, its requirement increases during pregnancy and lactation. Squid is a good source of P, as substantial amount was found present in a uniform range in all the species studied. The RDA for P is 100 mg, thus squid appears to provide approximately 25% of this amount. Because of its high P content squid meat is particularly useful for growth of children [18].

The Zn levels observed in this study ranged between 1.90 mg/100 g for *Sepia prashadi* and 4.22 mg/100 g for *Sepia pharaonis*. These values are higher than fin fish (Table 2), and those recorded by Sidwell *et al.* [19]. Zn plays an important role in human nutrition [20]. It is present in enzymatic system, involved in protein metabolism and it is also a constituent of insulin crystals. The recommended intake of Zn is 15 mg/day and 100 g squid meat may provide 20.7 % of this allowance (Table 2).

The iron levels ranged from 2.58 mg/100 g in *Loligo duvauceli* to 3.63 mg/100 g in *Sepia pharaonis*. Sidwell *et al.* reported lower values [19]. Iron is low in fin fish, averaging 0.404 mg/100g. [10]. This amount is about 8 times lower than the amount of Fe in the squid species. Fe is of vital importance in the living processes concerned with the transport of oxygen. A deficiency of Fe in the body, causes anemia. 100 g squid meat may provide 17.9% of US RDA for Fe (Table 2).

The Cu levels ranged between 0.27 mg/100 g to 0.38 mg/100 g for *Sepia Prashadi* and *Dosidicus gigas* respectively. Higher Cu levels have been reported for different shell fish species [19].

Cu is one of the essential micronutrients for the human body as it supplement to Fe in the formation of haemoglobin. The US RDA is 2 mg and thus squids may provide 15% of this amount.

Experimental

Fresh and identified samples were procured from Karachi, Makran and Sind Somiani Coast through Marine Fisheries Department (MFD) Govt. of Pakistan. Ink Sacs were removed which is a characteristic of this animal. Composite sample [3-5] specimen of individual species were minced and dried at 70°C in a drying oven for 48 hours. The dried material was then ground to a consistency of 40 mesh powder for making ash at 600°C. The ash was taken up in dilute HCl and appropriate dilutions were made with deionized distilled water. All glass ware was acid washed. Reagents and standards used in this work were all of analytical grade. Iron and phosphorus contents were determined photometrically by alpha, alpha dipyrindyl (5) and molybdate blue (6) methods, by using iron ammonium sulphate and potassium dihydrogen phosphate as standards, with Bausch and Lomb spectronic 21 model spectrophotometer at wave length of 525 and 650 nm respectively. Sodium and potassium were determined on a Flame Photometer (Corning M-0410), England. The determination of calcium, zinc, magnesium and copper were accomplished with direct aspiration of samples into air acetylene flame on atomic absorption spectrophotometer (Hitachi, Model Z-8000) with Zeeman effect back ground correction. Reference standards were prepared from Fixanal, Riedel-DC Haenag atomic absorption standards (1000 ppm). All samples were analysed in duplicate and average values are reported as mg element/100 g wet weight of meat.

Conclusion

It may be concluded that squid species from Pakistan Coastal waters are good source of mineral elements and a 100g portion of squid meat may provide a substantial quantities of recommended daily allowance of several nutrient elements.

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