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Nutritional significance of small freshwater fishes of Andaman Islands

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Abstract

Andaman and Nicobar Islands are blessed with more than 2248 minor freshwater fish ponds with a total water spread area of 114.35 ha and 367 ha of reservoir area (7 numbers). Almost all the freshwater resources are currently utilized for fish culture or capture by the Islanders. The small fresh water fishes are known to contain high percentage of micronutrients and they are also a cheap source of quality animal proteins. Fish and fisheries are important for the food and livelihood and are important source of income for the rural population. Micronutrient-richsmall indigenous fishes are particularly important for nutrition because, they can be taken as a whole with bone, head and eyes where most of the micronutrients are concentrated. Small Indigenous Fishes (SIF) are an integral part of the rural diet. Rural people consume more SIF compared to their urban counterpart of the Islands as these fishes are commonly available from local ponds, derelict water bodies and rivers in plenty and do not have good market demand as compared to the major carps and other large fishes. SIF also play an important role in preventing micronutrient deficiencies and associated disorders among rural community of Andaman and Nicobar Islands.

Keywords: Freshwater fish, Micronutrient, Malnutrition, Protein

Introduction

Fish is an efficient and cheap source of animal protein, essential fatty acids and micronutrients (Kawarazuka, 2010). Though fish is highly perishable, processing and value addition can contribute greatly in extendingits shelf life and guarantee its availability for all classes of people to be a source of animal protein with minerals such as calcium and phosphorous. In many parts of India, including Andaman Islands, huge diversity of small indigenousfish species are found in freshwatersystems. These small indigenous fishes (SIF) form a major component providing protein security to marginal families, especially those living closer to freshwater resources. Among traditional communities, indigenous knowledge about the health benefits of such species exists. For example, Mola (*Amblypharyngodon mola),* commonly found in eastern and northeastern India, is often included in the diet of pregnant and lactating mothers, for its nutritive value. Such knowledge is however, poorly documented (Kumar, 2010). The role of SIF in alleviating micronutrient malnutrition is critical, taking into account their phenomenal high concentrations of these micronutrients. One of the notedadvantages of SIF is that even poor people can buy them in required quantities at an affordable price.

Fish is undoubtedly an important source of animal protein in South and Southeast Asia, where the diet is mainly cereal-based. The principal source of protein is rice, which contributes about 8-10 % of an individual's average protein requirement. This along with other food like pulses and dairy products is often adequate to meet the total protein requirement of an individual. Fish, being overseen as a source of protein, it is also an important source of micronutrients like calcium, zinc, and vitamin A. With concern to human nutrition, though protein is essential, it is not a limiting nutrient. Micronutrient deficiency, sometimes termed as 'hidden hunger' is a big problem in Southeast Asia and Island nations. About 250 million children worldwide are estimated to be at risk of vitamin A deficiency, and an equal or more numbers are at risk of deficiencies of other minerals like iron, zinc and calcium.

Small Indigenous Fishes (SIF) found in the vast inland water resources provides not only nutrition but also livelihood opportunities and income to a large number of

fishers. Studies in India have shown that the monetary benefits to fishers are actually higher in the case of SIF when compared to those from large cultured species.

Freshwater resources of Andaman and Nicobar Islands

At present, in Andaman and Nicobar Islands around 2248 minor irrigation ponds with total water spread area of 114.35 ha is used for pisciculture purpose with an additional 367 ha of reservoir area (7 numbers). The freshwater fish species of the islands includes 33 species**,** of which about 17 species are known as small indigenous fish species **(**Palavi and Devidar, 2009). Rajan & Sreeraj (2014) reported that invasive freshwater fishes such as common carp (*Cyprinus carpio*), mosquito fish (*Gambusia affinis*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), tilapia (*Oreochromis mossambicus*) and Pangas (*Pangasius pangasius*) were introduced into the Islands for different purposes.

Nutritional value of available fish species

Small fishes consumed as a whole are rich in calcium compared with other larger fish species. Improving micronutrient intake through increasing the intake of nutrient-dense small fish is one way of improving nutritional status. Small indigenous species of fish are easily available source of food rich in protein (14- 20%), vitamin A and minerals, not commonly available in other foods in Bangladesh (Kamal *et al 2007*). Many SIF are eaten as whole, whereby it contributes to dietary intake of calcium, phosphorous and vitamins. Hossain *et al.* (1994) mentioned that among the fishing communities, small fish occupy an important position as a popular food item. In an island with a population suffering from malnutrition and protein deficiency, consumption of small fish species may have positive effects in improving the health of the Islanders. Small fishes provide food and nutrition, subsistence and supplemental income to the great majority of people in this island, particularly to the poor and tribal community. There is a considerable demand for small freshwater fishes *viz. Anabas testudineus, Glossogobius giuris,Oreochromis mossambicus, Heteropneustes fossilis and Clarius batrachus* both in rural and urban markets. Landless and marginal farmers and people with low income are not able to afford costly species such as carp. In this background, SIF play an important role in alleviating the micronutrient deficiency. Nutritional compositions of large and small freshwater fishes are compared in table 1&2.

Table: 1 Comparisons of nutritional value oflarge and small indigenous freshwater fishes

	Nutrient Fish	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Note
Large freshwater fishes	*Pangasius pangasius*	82.76	14.71	1.40	1.12	*Ahmed et al., 2012*
	Cyprinus carpio	83.70	14.60	1.44	0.26	
	Ctenopharyngodon idella	80.60	16.06	2.33	1.00	
	Hypophthalichthys molitrix	78.70	18.12	2.13	1.05	
	Catla catla	79.90	16.90	2.01	1.19	
	Labeo rohita	77.91	17.49	3.16	1.43	
	Cirrhinus mrigala	79.23	17.16	1.95	1.66	

Small indigenous freshwater fishes	*Glossogobius giuris*	80.43	14.32	1.93	2.94	*Hossain et al., 1999*
	Esomus danricus	775	12	4.0	-	Roos 2001
	Anabas testudineus	76.60	19.50	4.98	1.62	*Kamal et al., 2007*
	Eleotris fusca	980	0.79	2.0	580	Bogard*et al*., 2015
	Notopterus notopterus	72.68	18.30	4.98	5.82	*Kamaletal., 2007*
	Channa striates	82.66	15.49	1.47	0.39	*Kawarazuka N. (2010)*
	Channa punctatus	81.93	16.19	1.60	1.25	*Ahmed et al., 2012*
	Oreochromis mossambicus	78.3	17.8	2.3	1.1	*WimalasenaandJayasuriya 1996*
	Clarius batrachus (fish fillet)	78	14.14	6.91	0.1	*Islam et al., 2013*
	Heteropneustes fossilis	76.06	17.34	3.45	3.15	*Kamal et al., 2007*

Table: 4 Micronutrient content of small freshwater fishes

	Nutrient Fish	Ca (mg)	Fe (mg)	Zn(mg)	P (mg)	Note
Indian Major Carps	*Catla catla*	210	0.83	1.1	260	
	Labeo rohita	51	0.98	1.0	210	*Bogard et al., 2015*
	Cirrhinus mrigala	960	2.5	1.5	-	
Small indigenous freshwater fishes	*Glossogobius giuris*	790	2.3	2.1	520	*Bogard et al., 2015*
	Notopterus notopterus	230	1.7	1.6	270	*Bogard et al., 2015*
	Clarius batrachus (fish fillet)	210.10	7.06	0.003	70.05	*Islam et al., 2013*
	Anabas testudineus	85.00	0.87	0.60	160	*Bogard et al., 2015*
	Heteropneustes fossilis	60.0	2.2	1.1	220	*Bogard et al., 2015*
	Esomus danricus	775	12	4.0	-	*Roos 2001*
	Eleotris fusca	980	0.79	2.0	580	*Bogard et al., 2015*

Among the large freshwater fishes, Indian major carps contribute greatly to the daily diet of islanders, which are having protein level ranging from 16 - 17.5% and lipid 2 - 3%. Exotic fishes like pangas and common carp have protein and lipid content of 14.71% and 1.4%respectively, but silver carp is having high level of protein and lipid content of 18.12 and 2.13 respectively. These introduced fish species of disease introduction to the fragile Island aquatic ecosystem. Native small freshwater fishes are nutritionally rich in protein and lipid content ranging from 14.3 to 19.5% and 1.47 to 7.0% respectively. The nutritional profile of most of these native species has not been properly documented and islanders are also not aware about the health benefit of these fish species which are available in natural resource. These fishes can be utilized as a very good source of protein and lipids as well as micronutrients which could reduce micronutrient malnutrition.

The small freshwater fishes have impressive proportions of phosphorous, calcium, iron and zinc when compared to large freshwater fishes. Phosphorous, calcium, iron and zinc content ranges from 70-520 mg/kg, 60-980 mg/kg, 0.8-7.06 mg/kg and 0.003-4 mg/kg respectively. Among these fishes, *Glossogobius giuris*and *Eleotris fusca* are rich source of these micronutrients.

Role of SIF in alleviating malnutrition

The term malnutrition refers to both under nutrition and over nutrition (UNICEF, 2006). Although under nutrition includes being deficient in vitamins and minerals, the term 'micronutrient deficiencies' are also used to distinguish from underweight. Malnutrition among the poor people is wide spread in many countries. Protein calorie malnutrition has been an important cause of infant and child mortality in developing countries and consequently major emphasis has been placed on the processing and utilization of protein-rich foods. Among the several food items available as protein sources, fish has a potential role and has better prospects to meet this demand (Sundararaj, 2007).While the importance of fish as a source of animal protein and essential fatty acids is well known, little attention has been given to the role of fish as a source of micronutrients. Small fish species are rich in micronutrients, in particular, vitamin A, calcium, iron and zinc, as they are consumed whole with bones, head and viscera where most of the micronutrients are concentrated. These species are commonly consumed by the poor and thus have a high potential to address micronutrient deficiencies (Kawarazuka, 2010).Efforts have been made in numerous countries in the early nineteenth century often with the technical support of international organizations like FAO and WHO to develop ocean fisheries or the cultivation of fish to expand the consumption of small fish. These efforts were of great value in the prevention of Kwashiorkor and other types of protein calorie malnutrition.

Conclusion

The nutritional importance of fishes was emphasized based on its contribution to dietary supply of protein and PUFAs, but not based on its contribution to micronutrient. Although aquaculture tend to favour the production of larger fish with higher market value, their nutritional value is infact lower than small fish. There is a strong need to ensure that subsistence fishing activities of small fishes that take place in streams, ponds, rivers should also be sustainable. Conservation of wild stocks and practicing of extensive aquaculture of these species with minimum care is required in order to utilize the potential of this species in alleviatingmicronutrient deficiencies and livelihood of small scale fishers.

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