



Asian Catfish *Clarias magur* (Ham), a Wonder Fish for Health and Nutrition

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Abstract

The Asian catfish or the walking catfish (*Clarias magur*) is one of the most commercially important indigenous food fishes of India. Recent assessment had put the species under 'endangered' category in the IUCN Red List, because of the critical decline in the wild population due to various known and unknown factors. With capacity to breathe atmospheric oxygen with special air breathing organ, the fish can be marketed alive to the delight of both sellers and consumers. The species has very high nutritional value not only as a food commodity with high protein content ($14.87 \pm 1.19\%$) but also known as a rich source for poly unsaturated fatty acids (PUFA) content (25.56% of total lipid) amidst the fresh water cultivable fish species. The species is believed to have medicinal/therapeutic value, and have very high market demand, particularly in the NE Region of India for its unique taste and nutritional value. Customary preparation of Magur with specific recipe and offered to new mothers during post natal care and to persons suffering from Pox on specific day of the course of infection is believed to help in fast recovery, provide mental and physical strength to the patient to resist secondary infection and related disorders. For iron deficiency as well as other illnesses and traumatic patient also Magur is traditionally offered for fast recovery, wound healing and strength. In addition, the fish has amazing self-healing capacity through regenerating lost tissue and regeneration of important organ like testis, which may further be studied for potential use in medical science too. Appropriate steps need to be taken for propagation and conservation of this species of nutritional, therapeutic and pharmacological importance.

Keywords: Asian Catfish; High Demand; Air Breathing; Nutritional Value; Poly Unsaturated Fatty Acid; Therapeutic Value; Regenerating Capacity

Introduction

The Asian catfish, *Clarias magur* (Ham), one of the commercially important indigenous food fish species of India, belonging to the order Siluriformes and family Clariidae was first described by Hamilton (1822) from Gangetic provinces. The geographic distribution of the species earlier known as *Clarias magur* is restricted to the Ganga and Brahmaputra river basins in Northern and North Eastern India, Nepal, Bhutan and Bangladesh [1] and has been described as a native species for India, Bangladesh and Nepal. In India, this species is naturally found in all the eight states of NE Region of India as well as in 11 other states viz. Bihar, Chandigarh, Darjeeling, Delhi, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Uttaranchal, Uttar Pradesh and West Bengal. Naturally inhabiting the swamps, derelicts, weed infested shallow channels wetlands, paddy field etc. the species had been recognized as one of the most popular food fishes of India, Myanmar, Bangladesh, Sri Lanka and Malaysia (Mookerjee and Majumdar, 1950). The species

grows to an average length of 30 cm and average weight 200 gm in mature stage and hence can be included under the Small Indigenous freshwater Fish species group (SIFFS) of India, as per definition of Sarkar and Lakra, (2010).



Figure 1: Asian Catfish *Clarias magur* (Ham).

Although the conservation status of *Clarias magur* was determined as 'vulnerable' by CAMP [2], on subsequent assessment the species was enlisted under threatened category in 2010 (Viswanath, 2010) while a more recent assessment had put it under 'en-

dangered' category in the IUCN Red List (2017), because of the critical decline in the wild population due to various known and unknown factors. A good number of works have been carried out on a few biological aspects of magur like the length weight relationship [3-6], Food and feeding habit [7-10] etc. But very few works on detail assessment of the nutritional qualities of the species as well as its importance as a popular commodity with therapeutic value are available.

The present communication is an attempt to collect and review some of the works done on the fish in context to its importance as a healthy and nutritious food with therapeutic value.

Importance as air breathing food fish

Air breathing fishes are those fish species that have special capacity to survive out of water for considerable period of time by taking atmospheric oxygen for respiration with the help of extra branchial organ or some specially modified organ or part of body. The air-breathing fish have substantial advantages for aquaculture, because they can survive in harsh environment with low level of dissolved oxygen and high ammonia content and can live out of water for considerable period of time, by taking atmospheric oxygen with their special air breathing organ and modified parts of the body (Qin., et al. 1997).

The catfish Magur, also known as the 'Walking catfish' has special air breathing organs that consists of supra branchial chamber, two rosettes or air trees, four 'fans' or gill plates on each side of the branchial chamber, lined by highly vascular respiratory membrane. This ability makes this species a delight for both traders and consumers as it can be marketed alive and also makes it a highly preferred food fish among the fresh fish lovers. This quality along with its other qualities like unique taste, scale less body, less bone and high nutritional and therapeutic value makes the fish one of the very highly priced fishes of the country, fetching much higher market price in comparison to carps and other commercially important food fishes in India and Bangladesh [11,12]. The air breathing capacity enabling the species to thrive under adverse conditions like low dissolved oxygen, high stocking density and low water depth qualifies the fish as a suitable candidate for culture in small, swallow ponds [13].

Importance as a source of nutrition

Fish has been recognized as rich source of poly unsaturated fatty acids namely the n-3 and n-6 PUFAs, which are beneficial to human health. Fish meat and oils are good sources of unsaturated Omega -3 fatty acids, eicosapentacenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) as well as its precursor alpha linolenic acid (C18:3, n-3). Compared to animal and bird meat, fish meat contains higher level of n-3 PUFAs (Calder, 2004). which are known to be highly beneficial for human health (Dhanpal., et

al. 2011) as these are cardio protective, anti atherosclerotic, anti thrombotic, and anti arrhythmic and also help in reducing blood cholesterol level (Potter and Kiss,1995), regulate prostaglandin synthesis and hence induce wound healing (Bowman and Rand, 1980), and in stabilizing the electrical activity of the heart cells (Dallongeville., et al. 1991). However the PUFA composition may vary according to fish species, life stage, and environment (Marine or fresh water). Freshwater fishes are known to have lower content of PUFAs in comparison to its marine counterparts [14,15]. The fresh water fishes are known to contain higher amount of omega-6 fatty acid (18:2 n-6) than in the marine fish [16].

Among the different freshwater cultivable fish species, *Clarias magur* has been identified as a good source of unsaturated fatty acid. In a study on proximate composition of four cultivable freshwater fish species conducted by Jakhar, et al. [17] revealed highest value in lipid content, mono and poly unsaturated fatty acid, EPA and Linolenic Acid in *Clarias magur* (Table 1). The findings revealed that magur was richest in PUFA content (25.56%) followed by Pangas (23.37%), Rohu (15.84%) and Catla (12.5%) [17]. These findings indicate superiority of the Asian catfish over these popular commercially important food fishes of India in terms of PUFA. Paul., et al. [18] also recorded 1.34 gm of Poly unsaturated fatty acid out of 5.24 gm total fat content per 100 gm of fish muscle in *Clarias magur*. Out of the PUFA content Omega 3 is 0.42mg and Omega 6 is 0.92mg [18]. Presence of PUFA in considerable quantity in the muscle of Magur indicates that the species can play an important role in providing essential nutrition particularly for the ethnic population belonging to the land locked states like the NE region of India where marine fishes are not available in desired quantity and quality. Furthermore this indigenous species is one of the preferred fishes for the 95-100% fish eating population of the region and can play an important role in securing nutrition specifically for the ethnic population [19].

Parameters (% of total lipid)	Catla	Rohu	Magur	Pangas
Saturated Fatty Acid	60.92	52.28	39.85	47.15
Mono unsaturated Fatty Acid	15.96	29.55	31.75	33.47
Poly unsaturated Fatty Acid	12.5	15.84	25.56	23.37
Linolenic Acid (c 18:3, n-3)	3.04	2.84	4.72	2.58
Eicosapentaenoic Acid (C 20:5,n-3)	1.9	1.29	2.1	1.93

Table 1: Fatty acid composition in selected fresh water fishes [17].

Parameters (%)	Catla	Rohu	Magur	Pangas
Moisture	77.5 ± 6.5	75.46 ± 6.0	73.49 ± 5.9	74.57 ± 6.0
Protein	10.11 ± 0.08	9.53 ± 0.72	14.87 ± 1.19	13.60 ± 0.98
Lipid	1.2 ± 0.08	2.9 ± 0.21	7.90 ± 0.63	4.98 ± 0.38
Ash	2.7 ± 0.22	2.20 ± 0.17	3.74 ± 0.28	1.25 ± 0.28

Table 2: Proximate Composition (%) of selected freshwater Fishes [17].

The comparative proximate analysis of these fish species (Table 2) further supported the superior nutritional value of Magur in terms of protein content, total Lipid and ash content [17]. Bogard, *et al.* [20] also reported 16.5g protein, 1.3 g fat, 1.1g ash content along with 326 k calorie energy per 100 g of edible muscle of the species. In all these three parameters the value of Magur is the highest indicating its importance as food for human health and nutrition. In addition the presence of different Vitamins particularly the vitamins A (6.03 IU/100gm), Vitamin D (44.73 IU/100gm) and Vitamin E (0.15 IU/100gm) indicates its importance as a valuable source for these nutrients [18]. Besides vitamins presence of different human health friendly minerals (Table 3) and 18 beneficial amino acids in considerable quantity as component of protein (Table 4) places this fish as a wonderful food item with distinction [18]. Thorat [21] also reported that flesh, bone and other organs of the species is rich in mineral, vitamins A, B and D.

Mineral	mg/100g muscle
Calcium	222.36
Phosphorus	129.42
Sodium	201.49
Potassium	262.09
Iron	2.20
Manganese	0.21
Zinc	0.68
Selenium	0.43

Table 3: Mineral content in *Clarias magur* [18].

Therapeutic value of Magur

Clarias magur is popularly known as a food with immense therapeutic value. The high nutrient content may be the reason for popular custom prevailed in NE Region of feeding magur to the new mothers during post natal care. It is believed that feeding Magur post delivery of the baby, helps in early recovery of the mother, healing of womb and other related organs of the mother’s body.

Parameter	% /100g	Parameter	% /100g
Protein	16.26		
Arginine	0.72	Aspartic acid	1.83
Histidine	0.67	Serine	0.87
Iso leucine	0.79	Glutamic acid	2.39
Leucine	1.36	Proline	0.21
Methionine	0.40	Glycine	2.32
Lysine	0.69	Valine	1.06
Phenylamine	0.62	Alanine	1.18
Threonine	0.82	Cysteine	0.02
Tryptophan	0.19	Tyrosene	0.12

Table 4: Protein and amino acids in *Clarias magur* % per 100 gm muscle [18].

There is popular believe that persons suffering from serious illnesses caused by Pox virus (Chicken pox) recover and relieved faster from the blisters and scars caused by pox virus when fed with Magur. Customary preparation of Magur is generally done with fermented bamboo shoot following specific recipe (known as hukoni, meaning healing, in the state of Assam, NE India) and offered to the patient suffering from pox with traditional prayers to God (known as Aai in Assam, meaning Mother) on specific day (5th or 7th day) of the course of infection. It is believed that the pox God (Aai) become satisfied with this offering of Magur and leaves the patients’s body. In fact, it has been observed that this customary offering of Magur helps in fast recovery, provides mental and physical strength to the patient to fight the post infection related disorders. Regular supplementation of Magur to people with iron deficiency syndrome leading to anaemic condition is known to have very beneficial impact, particularly on undernourished children, new mothers and young and adolescent girls. For other illnesses and traumatic patient also magur is offered for fast recovery, wound healing and strength.

Regenerating capacity of Magur

Recent reports have revealed that Magur has amazing capacity of regeneration of certain lost organs and self healing of wound and cut part of the body [22,23]. Regeneration is the process of renewal of lost or removed part of a living body. The process of regeneration in broad sense is the resultant of vegetative reproduction of a variety of component cells required to recreate the lost part. While all animals have the capacity to produce cells and repair wounds of body to certain extent, the capacity to regenerate lost organ or part of organ varies in different species and is restricted to some organs and in some animals. Some invertebrates have the ability to regenerate the entire organism, example, Planarians and Hydra (Wittlieb, *et al.* 2006, Van Wolfswinkel, *et al.* 2014). Some species of phylogenetically primitive vertebrates such as amphibians (Urodele amphibians, Salamanders) and fish (Zebrafish *Danio rerio*, a teleost species) are capable of regenerating certain organ or part of body like heart, limbs, fins, optic nerve scales, muscles and spinal cord etc. but not the entire body [24,25].

The technology in vogue, for artificial breeding and seed production of Magur requires dissection of the male brooders to take out the testis for preparation of sperm solution for dry fertilization of stripped off mature eggs of female fish [26]. In this process, the male brooders do not survive and a considerable number of male magur brooders need to be sacrificed to carry out artificial breeding, resulting in tremendous impact on the male brood stock population. Further, the male fishes so sacrificed are not in marketable form (dead with cut and wound), making the technology not economically viable for the farmers (Figure 2). This inherent problem, that put a question mark on its economical and ecological viability, is one of the major reasons for less adoption and popularisation of the technology [27].

In an attempt made by ChetiaBorah and Gogoi [22] to keep the fish alive after dissection and removal of the testis, it was observed that the fish has the amazing capacity to heal the wound without any medication or stitching within 30-40 days. Recently Sanap., *et al.* [10] reported post surgery survival of the male brooders of the species, by stitching with absorbable stitching thread. The present communication includes the results of the further study on refinement of the technology by using the self healing and regenerating capacity of the fish without stitching within 30-35 days, the process of self healing was completed and the incision mark almost disappeared, (Figure 3-5). This was in agreement with the preliminary report on the amazing self healing capacity of the fish [22]. This amazing observation revealed that the fish has a remarkable capacity of self healing through regeneration of lost tissue. Further study on regeneration of removed testis revealed that after a period of 12 months of culture under controlled condition, the regeneration of testicular tissue was recorded with apparent development indicating testicular maturity [23].

This ability of certain animals to regenerate damaged or lost organ of body to different extents is a phenomenon that has puzzled scientists and has been under investigations for several decades. Natural scientists have been actively pursuing the problem of organ regeneration since the 17th century by utilizing lower vertebrates possessing exceptional regenerative capacity (Dinsmore, 1991). Human organs are subjected to a variety of injuries, but have a limited ability to heal and regenerate its lost tissue or organ. The present findings on the wonderful capacity of Magur to regenerate its surgically removed testis would open a new direction of research towards utilizing this capacity for the benefit of humanity.



Figure 2



Figure 3



Figure 4



Figure 5

Figure 2-5: Dissection of male Magur (2) and the process of self healing (3-5).

Conclusion

The excellent nutritional quality including the PUFA content of this fresh water catfish *Clarias magur* along with its therapeutic value qualifies this fish as a highly preferable food fish species. Further its regenerating capacity can be an interesting avenue for study for utilizing the quality for the benefit of human being. The species can prove to be a potential candidate for culture and propagation under changing climatic condition too due to its special air breathing capacity and ability to thrive under adverse condition. This traditional knowledge on therapeutic value of Magur fish prevailed in North East India needs to be validated through appropriate study. Appropriate steps to be taken for propagation and conservation of this endangered fish species of commercial and biological, ecological and pharmacological importance vis a vis as one of the reliable food sources for eradication of malnutrition.

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