



Nutritional values of *Clarias batrachus* (Linnaeus, 1758), Walking Catfish

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Article History	Abstract
Received: 06 June 2023 Revised: 05 August 2023 Accepted: 11 September 2023	<p><i>Fish meat has great flavor, nutritional values, competitive lesser price. Fish meat comprises of minerals, vitamin, healthy fats, protein, and small amount carbohydrates, these constituents make the fish a good healthy diet and fish meat can be easily digested also. The demand for fish for human consumption is increasing. Fisheries and aquaculture play an important role in the improving human nutrition and food security. Fishes have more nutrition than plant-based food. Fishes are also more efficient from other animal food sources in converting food into nutritious food. Fish contributes important and healthy part of the human diet which contains good amount of protein, fats, vitamins and minerals, etc. Fish has a lot of food potential; therefore, fish can be used to overcome malnutrition in developing countries especially. Proximate composition is being utilized as an indicator for the quality of fish. <i>Clarias batrachus</i> (Linnaeus, 1758) the Asian catfish commonly known as walking catfish is a highly valued endemic to India which is now in severe decline in the majority of its natural habitat. <i>Clarias batrachus</i> is one of the important local food fish, this fish has been used in traditional medicine also. It possesses therapeutic significance and its demand is high, especially in North East India. <i>Clarias batrachus</i> contains high protein, vitamins and minerals and it is a rich source of poly unsaturated fatty acids (PUFA).</i></p>
CC License CC-BY-NC-SA 4.0	<p>Keywords: <i>Catfish, Clarias batrachus, good nutrition, Vitamins, Minerals, PUFA, Health benefits</i></p>

1. Introduction

Chronic Good nutrients are required by the human body which lead to proper functioning of the body and for maintaining good health. These nutrients are provided by good nutrients rich foods. Nutrients from the food can be comprised of fats, water, vitamins, proteins, carbohydrates, and minerals. It is believed that fishes are good source of protein and fat which are beneficial to human health. There is an increased in the demand of white meat all over the world. This is because people become realizing the significance and nutritional value of white meat more than before. Fish meat is an important white meat. Fish meat is receiving prominence in the diet of human due to the flavor, nutritional value and competitive price of fish [1]. Fish meat comprises of minerals, vitamin, healthy fats, protein, and small amount carbohydrates, these constituents make the fish a good healthy diet and it can be easily digested by the human body [2].

The section of Fisheries and aquaculture plays an important role in the improved development of human nutrition and food security. The demand for fish for human consumption is increasing. Among the food production industries, aquaculture is considered to be the most fastest growing industry. Aquaculture has provided higher quantity of fish for consumption and it has been estimated that by 2030, 60 % of the fish for human consumption will be made by aquaculture [3]. The increased in the aquaculture products by feeding more on crop-based feedstuffs than using fishmeal and oil may increase the nutrient content in farmed fish products. Fish also contributes to the nutrient and food security for the poor as it

provides essential nutrients and bear an affordable price. Fish gives a contribution of more than 20 % of the average per capita intake for three billion people [3]. Fishes have more nutrition than plant-based food and they are also more efficient from other animal food sources in converting food into nutritious food [4]. During the last decades, the consumption of fish and fish products are increased [5]. Fish contributes important and healthy part of the human diet which contains good amount of protein, fats, vitamins and minerals, etc. The demand for fish is increasing because of the increasing population globally, the higher living standards and overall, the good image of fish among consumers [6]. Fish has a lot of food potential; therefore, fish can be used to overcome malnutrition in developing countries especially [7]. Proximate composition is being utilized as an indicator for the quality of fish, it differs with feed rate, diet, age and genetic strain [8]. Some quantitative analysis also showed that body constituents and energy resources differ with seasonal life changes [9].

Clarias batrachus Linnaeus, 1758, the Asian catfish commonly known as walking catfish, it is known as Magur in Maharashtra and Ngakra in Manipuri and it belongs to the family Clariidae. *Clarias batrachus* is a highly valued endemic to India which is now in severe decline in the majority of its natural habitat [10]. They favor slow moving, frequently sluggish water bodies like streams, rivers, ponds, flooded rice fields, marshes and temporary pools which may dry up [10]. *Clarias batrachus* is one of the important local food fish, this fish has been used in traditional medicine also. It possesses therapeutic significance and its demand is high, especially in North East India It has been utilized to cure anaemia traditionally and also those suffering from childbirth and chicken pox [10]. Asian catfish species is very nutritious possessing high protein, vitamins and minerals [4, 11]. It is a rich source of poly unsaturated fatty acids (PUFA) [12]. *Clarias batrachus* is listed as Least Concern in IUCN worldwide [13] because of the lack of major threats to its species population [14]. Based on the estimation by FAO, the demand for catfishes worldwide is growing up and *Clarias batrachus*, with its various benefits and importance, continues to be popular in Asia in particular [10]. Therefore, considering the health benefits and significance of *Clarias batrachus*, the review paper is presented focusing on the nutritional values.

Asian catfish, *Clarias batrachus* Description and Distribution

Clarias batrachus Linnaeus, 1758, the Asian catfish commonly known as walking catfish, it is known as Magur in Maharashtra and Ngakra in Manipuri and it belongs to the family Clariidae. Asian catfish is one of the most significant native food fish of India. The Asian catfish has an elongated body (Fig. 1 & 2). The colour of their body is mostly grey or greyish brown having little white patches on the sides. They have long based dorsal and anal fins and also have multiple pairs of sensory barbells. The skin of catfish is without scale however, it is coated with mucus which give them protection when they are out of the water. They have embedded sting or thorn like protection mechanism which is buried under their fins and therefore, catfishes should be handled with care which fishing or catching [15]. They have more or less triangular occipital process, in male the genital papilla is elongated as well as pointed [10]. Asian catfishes are freshwater air-breathing which are native to Southeast Asia [16]. The synonyms of the *Clarias batrachus* Linnaeus, 1758 are *Clarias punctatus* Valenciennes, 1840; *Clarias jagur* Ham., 1822; *Clarias assamensis* Day, 1877; *Clarias magur* Ham., 1822; *Silurus batrachus* Linnaeus, 1758; *Macropteronotus magur* Ham., 1822 [17].

Clarias batrachus are scavenger, they can spend months without eating. In drought condition, a large number of *Clarias batrachus* may concentrate on isolated pools and eat other fishes. They have been observed to infiltrate aquaculture operations, they feed on fish populations in ponds. *Clarias batrachus* are nocturnal, benthic, and tactile omnivore. They eat up detritus, aquatic weeds and eats molluscs, smaller fish, tadpoles, big aquatic insects, and other invertebrates when the opportunity favors [10]. They are voracious eaters and can deplete food supply quickly and they are considered dangerous when invasive. Asian catfish can be found available in a number of habitats but they are usually found to available in high turbidity stagnant, muddy, or marshy water [10]. They are known to be found in medium to large rivers, ponds, swamps, ditches, rice fields, flooded fields, it is known to live in medium to large rivers, swamps, ponds, ditches, flooded fields, rice paddies, and pools left in low areas when rivers flood. They have also been reported to be found living in inter-coastal waterways having high salinities upto 18 ppt. During the winter dry months, they catfish burrow into the edges of ponds and Nutritional values of *Clarias batrachus* (Linnaeus, 1758), Walking Catfish

streams and they lay dormant until the arrival of spring rains [17]. For their spawning, they may dig nests in submerged mud banks and embankments in flooded fields in the rainy season, when rivers flow and fish can excavate nests in submerged mud banks and dikes [10]. During the season, catfish breed with a single mate via many spawning cycles generating an increased in the numbers of eggs. During the spawning embrace, the eggs are internally fertilized. A mature female may produce about 9,000 eggs every season.

Nutritional Values of *Clarias batrachus*

Fishes are known to be the good source of good quality nutrition. During the recent decades, consumption of fish locally and products derived from fish has significantly increased [5]. Fishes are known to have healthy fats. The data of lipid profile may be utilized for developing high efficiency experimental diets using different tissues from this fish species and this will affect both the taste and nutritional value [10]. The reference list of lipid profile of *Clarias batrachus* are reported, total cholesterol level may range from 227.0 to 252.0 mg/dl, triglycerides level may range from 59.0 to 69.0 mg/dl, VLDL level from 10.0 to 13.8 mg/dl and the LDL level was from 50.0 to 88.2 mg/dl [18]. The blood plasma of *Clarias batrachus* was determined to have an average HDL content of 150 mg/dl - 180 mg/dl. *Clarias batrachus* has been a considered as a good source of unsaturated fatty acid.

Proximate nutrition and biochemical constituents of *Clarius batracus* from three different sampling sites of Madhya Pradesh i.e., Upper Lake, Halali Reservoir, Narmada River were performed [19]. Their results reported that glycogen percentage present in *Clarius batracus* from the Upper Lake, Halali Reservoir, Narmada River were obtained to be 4.9, 5.03 and 4.95%, respectively. The total lipids were observed to be 190, 196, 189 mg/dL, 15.69, 16.01, 17.2 g/100g of crude protein, 1.19, 1.21, 1.16 g/100g of total fat, 1.33, 1.39, 1.32 g/100g of cholesterol, 1.1, 1.095, 1.01 g/100g of total ash, 72, 77, 78 g/100g of moisture content in Upper Lake, Halali Reservoir, Narmada River, respectively. Carbohydrates are good sources of food energy. Carbohydrate content of *Clarias batrachus* fish collected from three sampling sites of river Ganga viz. Vindhyachal, Mirzapur and Allahabad in high and low flow seasons were determined and highest carbohydrate content was found to be present in samples from Allahabad [20]. The % of carbohydrate content was found to be in the range from 21.87 to 25.26 % for the samples collected from Allahabad, 21.85 to 24.23 % for Vindhyachal sampling site and 21.27 to 24.36 % for Mirzapur [20]. Determination of the fat content of the *Clarias batrachus* fish was performed, *Clarias batrachus* fish in the river Ganga taking 3 sampling sites namely Shukratal, Garhmukteshwar and Gajraula in high and low flow seasons [21]. They reported that the fat content percentage in all the fish samples was obtained to be in the range of 0.35 to 0.51 % at Shukratal sampling site, from 0.35 to 0.53 % Garhmukteshwar and from 0.33 to 0.52 % at Gajraula sampling site [21]. The proximate analysis like moisture, fat, ash, protein and organic contents of 60 samples of *Clarias batrachus* of length ranging from 26.6 to 48.2 cm and weight ranging from 179 to 867g collected from fish Muzffargarh road near Multan, Pakistan was studied [22]. Mean values of water, ash, fat, protein and organic contents of the *Clarias batrachus* were obtained to be 75.75, 2.33, 5.44, 16.46 and 21.91% in wet body and 75.75, 9.75, 22.73, 67.52 and 90.25 % in dry body, respectively [22].

Biochemical contents of nutritional values of freshly caught specimens of *Clarias batrachus* fish from the Godavari River near Nanded District were dissected were studied [4]. The biochemical contents such as minerals and vitamins and reported that fish flesh constituted 1 to 2 % of minerals constitute while the bulk was concentrated in fish scales, bones and muscles and liver was reported to be rich in vit B12 & B-complex [4]. The fish water content is known to vary inversely to the fat content and fish also reported to contain vitamins and enzymes [4]. *Clarias magur* was reported to contain higher amount of lipid content, mono and poly unsaturated fatty acid, EPA and Linolenic Acid [12]. *Clarias magur* was found to be the richest in PUFA content 25.56% than Pangas - 23.37%, Rohu - 15.84% and Catla - 12.5% [12]. Good quantity of PUFA in the muscle of *Clarias magur* can play important role in giving essential nutrients [23]. Omega-6 and omega-3 polysaturated fatty acids (PUFA) are precursors of lipid mediators and they are playing significant role in regulating inflammation [24, 25]. *Clarias batrachus* are reported to possess Polyunsaturated Fatty Acids (PUFA), which is playing important roles in cardiovascular system reducing the risk of heart attack [26] and lower plasma triacylglycerol levels. Fish meat are found to contain higher n-3 PUFAs than other meat [27]. This is highly preferred beneficial for human health [28] because of the anti-atherosclerotic, anti-arrhythmic, anti-thrombotic, and cardio protective and also helpful in reducing the level of blood cholesterol level [29]. Unsaturated Omega-3 fatty acids, eicosapentaenoic acid and docosahexaenoic acid and its precursor alpha linolenic acid are reported to be abundant in fish flesh and oils [10]. *Clarias batrachus* is obtained to have the highest PUFA content with 25.56 % while compared with Pangas with 23.37%, Rohu with 15.84 % and Catla with 12.5 % [12]. The total fat content per 100 gm of *Clarias batrachus* fish muscle was obtained to be 5.24 gm of which PUFA was discovered to be 1.34 gm [11]. Omega 3 and has Omega 6 contain

0.42 and 0.92mg of PUFA, respectively. African undernourished children who were under the six years of age were given supplementation with *Clarias batrachus* fish protein which resulted in a significance increased in their weight at a rate of 0.68 gm/kg/day around 1.33 times faster than the control groups [30]. In Africa's tropical and subtropical areas, *Clarias batrachus* fish is the most framed fish and it plays an important role in the nutrition of country as a source of less expensive animal protein [28].

Islam et al. [31] also studied on the fatty acid profile, lipid characterization and nutritional contents of *Clarias batrachus* collected from the Municipal fish Market, Kushtia, Bangladesh. They reported that the carbohydrate, protein, lipids and moisture contents were obtained to be 6.26, 14.14, 6.91 and 78%, respectively. The fatty acids profile was identified as lauric acid with 2.6%, palmitic acid with 37.41%, oleic acid with 49.1% and stearic acid with 3.6%, arachidic acid with 3.04% and behenic acid with 4.21%, respectively. The iron, calcium and phosphorus contents of *Clarias batrachus* were obtained to be 7.06 mg/kg, 210.10 mg/kg and 70.05 mg/kg (Islam et al., 2013).



Fig. 1. *Clarias batrachus* Fig. 2a & b. *Clarias batrachus* selling in Ema (mother) Market of Imphal, Manipur, India

4. Conclusion

Clarias batrachus belongs to the family Clariidae, is a highly nutritious fish which is very beneficial in the human diet. Minerals, vitamins, quality protein and fats are found to be present in *Clarias batrachus*. Due to its nutritive properties, easy availability and affordable price, *Clarias batrachus* fish is an ideal food for human being as all the dietary components are present in adequate quantity. *Clarias batrachus* is an ideal food for dietetic food and its consumption may help prevent nutritional deficiencies. Therefore, there is the need for maintaining *Clarias batrachus* genetic resources, conservation and vigorous culture.

References:

1. Bakhiet HHA, et al. (2023) Proximate Composition of *Malapterurus electricus* and *Gymnarchdae niloticus* Fish from Khartoum Fish Market. *Mathews J Vet Sci.* 7(1):18.
2. Marcu A, Nichita I, Nicula M, Marcu A, Kelcirov B. (2010). Studies Regarding the Meat Quality of the specie *Cyprinus carpio*. *Lucrări Stiințifice Medicină Veterinară.* XLIII:265-270.
3. Elavarasan, K (2018) Importance of Fish in Human Nutrition. *Training Manual on Seafood Value Addition.* ICAR-Central Institute of Fisheries Technology.
4. Thorat MM (2017) Biochemical Contents of Nutritional Values of *Clarias Batrachus*; *International J. of Life Sciences*, 5 (3): 481-482.
5. Wim, V.; Isabelle, S.; Karen, B.; Stefaan, D. H. and John, V. C. (2007). Consumer perception versus scientific evidence of farmed and wild fish: exploratory insights from Belgium.

6. Cahu, C.; Salen, P. D. and Lorgeril, M. (2004). Farmed and wild fish in the prevention of cardiovascular diseases: assessing possible differences in lipid nutritional values. *Nutr Metab Cardiovas.* 14: 34-41.
7. Ashraf, M. A.; Zafar, A.; Rauf, S.; Mehboob and. Qureshi, N. A. (2011). Nutritional values of wild and cultivated silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*). *Int. J. Agric. Biol.*, 13: 210-214.
8. Austreng, E. and Refstie, T. (1979). Effects of varying dietary protein level in different families of rainbow trout. *Aquaculture*, 18: 145-156.
9. Puwastien, P.; Raroengwichit, M.; Sungpuag, P. and Judprasong, K. (1999). "Thai Food Composition Tables, 1st Edition". Institute of Nutrition, Mahidol University (INMU), Thailand Asean foods Regional Database Centre of INFOODS.
10. Bhandarkar SV and Paliwal GT (2022) A Nutritional Profile of an Asian Catfish, *Clarias batrachus* (Linnaeus, 1758) for Fundamentals of Intensive Culture and Conservation.
11. International Journal of Research Publication and Reviews. 3(7): 1549-1557.
12. Paul B.N., Sridhar N., Chanda S., Saha G.S. and Giri S.S. (2015). Nutrition facts *Clarias batrachus* (magur), pamphlet published as a part of the Outreach Activity on nutrient profiling of fish, ICAR- Central Institute of Freshwater Aquaculture, Bhubaneswar.
13. Jakhar, J. K., Pal, A. K., Reddy, A. D., Sahu, N. P., Venkateshwarlu, G. and Vardia, H. K. (2012). Fatty acid composition of some selected Indian fishes. *African Journal of Basic and Applied Science*, 4(5): 155-160
14. Ng, H.H. and Low, B.W. (2019). *Clarias batrachus*. The IUCN Red List of Threatened Species 2019:e.T166613A1138872.
15. Froese, Rainer; Pauly, Daniel (eds.) (2011). "*Clarias batrachus*" in FishBase. Dec. 2011 version. (<http://www.fishbase.org/summary/SpeciesSummary.php?genusname=Clarias&speciesname=batrachus>)
16. Das, S. (2002). Seed production of magur (*Clarias batrachus*) using a rural model portable hatchery in Assam, India - A farmer proven technology. *Aquaculture Asia Magazine*, 7(2): 19-21.
17. Ramesh, I. and B.R. Kiran (2016). Food and Feeding Habits of Catfish *Clarias Batrachus* (Linn) in Bhadravathi Area, Karnataka *International Journal of Research in Environmental Science (IJRES)* 2(4): 56-59 <http://dx.doi.org/10.20431/2454-9444.0204006>
18. Masterson, J., 2007. *Clarias batrachus* Smithsonian Marine Station at Fort Pierce http://www.sms.si.edu/IRLspec/Clarias_batrachus.htm
19. Debnath S. (2009). Traditional Consumption of Magur (*Clarias batrachus*) an Air Breathing Catfish among the Population of North Eastern India is Rationalized by Its Blood Lipid Parameters CHEMFERENCE, Annual Research Symposium, IIT Madras 22 - 23rd August. Available at SSRN: <http://ssrn.com/abstract=1401145>.
20. Khan S and Vyas R (2022) Proximate nutritional studies of *Clarias batrachus* Linn fish of different agro-climatic zone's water bodies with reference to Madhya Pradesh. *International Journal of Creative Research Thoughts*. 10(1): d54-d61
21. Singh R (2021) Variation in Carbohydrate Content in the Fish *Clarias Batrachus* at Three Different Sites on River Ganga. *International Journal for Multidisciplinary Research*. 3(5): 1-5.
22. Kumar K (2015) Estimation of fat contents in fish *Clarias batrachus* at three different sites on river ganga. *Cibtech Journal of Zoology*. 4 (3):98-102
23. Nasir Mf, Naeem M, Shafi J Masud S and Hayat S (2020) Proximate Composition of farmed walking catfish *Clarias batrachus* (Linnaeus, 1758) from Multan, Pakistan. *International Journal of Biology, Pharmacy And Allied Sciences*. 9(1): 2496-2512
24. Borah B Ch. (2020). Asian cat fish *Clarias magur* (Ham.), a wonder fish for health and nutrition. *Acta Scientific Nutritional Health*. 4(2):1-5.
25. Wall R, Ross RP, Fitzgerald GF and Stanton C (2010). Fatty acids from fish: the anti-inflammatory potential of long-chain omega-3 fatty acids. *Nutrition Reviews* 68(5) 280-9.
26. Ruxton CH, Reed SC, Simpson MJ and Millington KJ (2004). The health benefits of omega-3 polyunsaturated fatty acids: a review of the evidence. *Journal of Human Nutrition and Dietetics* 17 449-459.
27. Erkkila, AT, Lehto, S, Pyorala, K, Uusitupa, MI. (2003). N-3 Fatty acids and 5-y risks of death and cardiovascular disease events in patients with coronary artery disease, *Amer. J. Clinical Nutr.* 78:65-71.
28. Calder, P.C., (2004). Long-chain fatty acids and cardiovascular disease: Further evidence and insights. *Nutr. Res.*, 24: 761-772.
29. Debnath S. (2009). Traditional Consumption of Magur (*Clarias batrachus*) an Air Breathing Catfish among the Population of North Eastern India is Rationalized by Its Blood Lipid Parameters CHEMFERENCE, Annual Research Symposium, IIT Madras 22 - 23rd August. Available at SSRN: <http://ssrn.com/abstract=1401145>.

30. Potter N.N. and Hotchkiss. J. H. (1996) Food Science, (5th ed.), CBS Publishers & Distributors, New Delhi, India pp. 30-32.
31. Tichelaar HY; NP Steyn; JH Nel; CM Smuts; PJ Van Jaarsveld; JF Prinsloo and It J Van Rooyen; CJ Lombard; MA Dhansay; AJS Benadé (1999). Effect of catfish supplementation on the fatty acid status and growth of undernourished rural preschool children under 6 years of age: An intervention trial in Lebowa, South Africa., 8(2), 96–105. doi:10.1046/j.1440-6047.1999.00074.x
32. Islam R, Mondol LK, Sheikh L, Rahman SS, Islam M and Rahman A (2013) Identification of fatty acid profile, lipid characterization and nutritional status of *Clarias batrachus*. Nutr Sci Food Technol. 1:1.
<http://dx.doi.org/10.7243/2054-1848-1-1>