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Nutritional value of small indigenous fresh water fishes *C. straitus* and *G. giuris*, from the river ganga at Varanasi, UP. India and its commercial uses

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Abstract
Protein, fat and minerals are the basic concern of nutritional requirement of human population, especially for the children and in context, small indigenous fish species (SIS) which are usually not very attractive commodities of fish market could be an attractive proposal to look forward. This low value content of fish market could be employed as food supplement. Therefore, the main objective of this study would be to determine the proximate composition and mineral content of locally available SIS to estimate their nutritional status, for this AOAC method was followed. Under present work two SIS (*C. straitus, G. giuris*) have been investigated for their nutritional compositions. In the present investigations the percentage of moisture, protein, fat and ash of *C. straitus,* was 7.25%, 64.91%, 21.18% and 17.82% respectively while in *G. giuris* it was 7.76%, 68.8%, 13.96% and 13.76% respectively. The values of Ca and P of dried *C. straitus,* were 5.77% and 2.59% respectively and dried *G. giuris* had 3.87% Ca and 2.3% P. From the nutritional point of view, present study shows that both the SIS are good source of protein, lipids and minerals. These fishes may be a potential and alternate source of IMCs and will be useful for the development of value-added products for human consumption as well as formulation of quality feed for farm animals. Incorporation of small quantities of SIS as food supplement can substantially improve the biological value of the diet and can contribute to significant improvement in nutritional security.

Keywords: River ganga, small indigenous fishes, proximate composition, Ca, P

Introduction
The Ganga River system is one of the largest river systems in the world. The river along with its tributaries has a combined length of 12,500 km with a catchment area of 0.98 million km^2. During the past 30-35 years the riverine fisheries of Ganga and other major river systems of the country has suffered considerably on account of pollution and other anthropogenic factors. Changed hydrological conditions and impact of anthropogenic activities has badly hampered the breeding and recruitment processes in rivers, resulting in decline in catches, especially for rheophilic and floodplain spawning species like Indian major carps (Pathak and Tyagi, 2010) [27]. Somehow, the smaller species maintained their production level and become the important component of fishers livelihood basket (Tyagi, 2005) [36]. Nevertheless, marketable as all these species are, they have positive nutritive and economic values (Hossain and Afroze, 1991; Hossain *et al*, 1994) [12, 14] and can play a more significant role in the national food economy if their fisheries are developed (Jhingran, 1966) [17]. The small indigenous fish species (SIS) are prolific breeders, need little or no management and grow in almost all lentic and lotic water systems. The majority of fish eaten by the rural poor are the small indigenous fishes, as these are commonly available and do not have good market demand, compared to large-sized fishes.
The importance of fish as a rich source of animal protein is well established and this is frequently used to justify fish as a valuable food sources; however, very little attention has been given to the role of small indigenous fish species (SIS). These SIS have been considered as an important source of essential macro- and micro nutrients, which can play an important role in the elimination of malnutrition (Mahanty, *et al*. 2014) [19]. Some SIS has high nutritional value in terms of protein, vitamins and minerals and these vitamins and minerals are not commonly available in other foods.

Some of SIS such as mola (*Amblypharyngodon mola*) and dhela (*Osteobrama cotio cotio*) contain more available vitamin - A than any other freshwater fish (Thilsted, *et al*. 1997) [35]. Therefore, it is essential to know the proximate composition of SIS to report their nutritive value. This information will be useful for the development of value-added products as well as formulation of quality feed for farm animals.

Present study, is an attempt to analyse the nutritional value of two important fresh water dried SIS, which will be helpful in producing a quality product for human consumption as well as for animal feed.

Materials and Methods

For proximate analysis and mineral content *C. straitus*, and *G. giuris* were collected in fresh condition from different fish markets where maximum catch of SIS comes from river Ganga of Varanasi city; Uttar Pradesh situated in the eastern Gangetic plains of India. Soon after collection the fishes were brought to the Department of zoology, Banaras Hindu University.

All the collected samples were washed for foreign material under running tap water and then excess water wiped off by simple blotting. Fish samples were dried directly under sun light up to 4-7 days. Sun drying is a traditional method of fish preservation, during sun-drying, they were kept covered by dense meshed nylon or mosquito net to avoid outside contamination. Daily weight was recorded till the constant weight of the dried fish was attended indicating the complete drying process. Dried fishes were grinded into powder form and stored at -20 °C for subsequent studies with proper labelling. The fish powder remained in good condition for 7-9 months at normal room temperature, but at -18 °C the powder was in good condition throughout the year (Sultana, *et al*. 2011) [34].

Proximate composition (the percentage of moisture, protein, fat and ash) of the samples were analysed according to standard methods (AOAC, 1995) [3] in triplicate, while the mineral percentage was determined by using (AAS) Atomic Absorption Spectrophotometer.

Results and Discussion

Proximate composition of the studied sun-dried fish, presented in the (table 1). For better evaluation of data, the content of protein, lipid and ash of all the samples have been calculated on dry matter basis. Kuppuswarmy, *et al*. (l958) [18] stated that the moisture content of Indian dried fish varied from 2.5 to 17.5% and the protein from 44% to 71%. In the present study the moisture content of *C. straitus*, and *G. giuris* were 7.85% and 7.76% respectively. Moisture plays an important role in the spoilage of fish and fish products and reducing the level of moisture retards spoilage (Stansby, 1963). To ensure a longer shelf life, the moisture content of the dried fish should be less than 25%. A quality dried fish product with an expected shelf life of around 9-10 months should have moisture content below 20% (Gopakumar, 1997) [9]. According to Bhattacharyya, *et al*. (1985) sun-dried *Gudusia chapra* had moisture ranging from 9.61% to 18.64% and storage life of 15 to 35 days. The moisture content of four dried fish samples in Bangladesh was reported in the range of 19.3%- 24.4% (Azam, *et al*., 2003) [2]. Central Institute of Fisheries Technology (Hussain, *et al*., 1992) [15] reported that the moisture content of the samples varied over a large range from 12.3% to 54% in 23 different dried species. From the analytical data, it is evident that, the proximate composition of fish varies with some factors of which species of fish is an important factor (Mansur, *et al*., 2013) [20].

Table 1: Proximate composition (%), mineral content (%) of SIS (on dry matter basis)

SIS	Dry Matter	Moisture	Protein	Fat	Ash	Ca	P
C. striatus	92.15	7.85	64.91	21.18	17.82	5.77	2.59
G. giuris	92.24	7.76	68.8	13.96	13.76	3.87	2.3

Fish serves as one of the main sources of animal proteins to about one billion people in developing countries, the SIS contribute high quality animal protein than other animal protein sources like beef and chicken (Uhe, *et al*., 1992; Mohanty, *et al*., 2019) [37, 23] for human nutrition. In this scenario, SIS can serve as natural supplements for combating and preventing micronutrient deficiency as well as protein calorie malnutrition (Mohanty, 2010) [22]. Fish protein is easily digestible and contain all the essential amino acids required for body growth, maintenance and they contribute to the prevention of some diseases (Dale, *et al*., 2019) [6]. In the present study sun-dried *C. straitus* contained 64.91% protein and *G. giuris* contained 68.8% protein. According to (Haque, 2004) [11] normally, the sun-dried fishes contain 60% to 80% protein. Similar finding was also reported by Sultana, *et al*. (2011) [34] and Rana, *et al*. (2019) [29] that the protein content ranged varied from 51.5%-61.6% in seven dried SIS and 42.06% to 65.78% in ten indigenous dried fish respectively. Nutritionally dehydrated products are very good and neither the nutritive value nor the digestibility of the protein is adversely affected due to dehydration process (Martenik and Jacobs, 1963; Doha, 1964) [21, 7].

As shown in Table 1, the fat content of *G. giuris* was 13.96% and in C. *striatus* it is 21.18%. The fat content of the present study almost similar to those recorded by Nurullah (2006) [26] 14.10% to 16.26% and Azam, *et al*. (2003) [2] by a little difference. Azam, *et al* (2003) [2] studied proximate value of 14 dried fish species in Bangladesh and reported that moisture (18.23% to 23.61%), protein (40.69% to 66.52%), fat (7.1% to 26. 13%) and ash (5.08% to 12.14%). Mohanty, *et al*. (2013) [24] reported that fish oils from fish eggs of small and large fish or from the oily fish are the rich sources of omega (ω) -3 fatty acids, may become a good source of EPA and DHA. Lipid content varied from 4.20% to 13.03% in ten indigenous dried fish (Rana, *et al*., 2019) [29] therefore, dried fish can be considered a good diet for human.

Ash is a measure of the mineral content in the food item. In the present study the value of ash content 17.82% and 13.76% in, *C. staiatus* and *G. giuris* respectively, it was more or less similar (11.11% to 18.89%) to Mansur *et al*., (2013) [20]. According to (Hussain, *et al*. 1992) [15] and Ullah (2016) the ash content varied from 1.4%-21.6% and 11.17% to 29.19% respectively. The mineral content ranged from 4.92%- 24.4% in freshwater dried fishes reported by (Rasul, *et al*. 2021) [30] this variation may occur due to season, sex, habitat, size and pre-treatments of raw materials during drying (Paul, *et al*., 2018) [28]. Basu, *et al*., (1989) [4] reported 11.6%-22.1% ash content in the dried marine fishes available in Andhra Pradesh, which is attributed to the deposition of sand by wind, during sun drying. Ash content describes the presence of minerals which indicates the importance of the species qualitatively and our results are in accordance with other findings.

Small indigenous fishes are excellent source of minerals. The fish meat generally contains high calcium content than the animal meat (Ravichandran, *et al*. 2012) [31]. Minerals play

numerous roles. Calcium and phosphorus together help in skeleton formation. Phosphorous helps in the activity of adenosine polyphosphates and phospholipids (Nair and Mathew, 2001) [25]. The examined fish species *C. staiatus* and *G. giuris* had calcium content 5.77% and 3.87% respectively and phosphorus content was 2.59% and 2.3% respectively. Hossain, *et al*. (1999) [13] studied the nutritional value of 23 small indigenous fish species of Bangladesh and found the calcium and phosphorus contents ranged between 0.85-3.20% and 1.01-3.29% respectively. According to Hansen, *et al*. (1998) [10] the bioavailability of calcium in *P. sophore* (whole with bone) is as high as that from milk, the potassium content was also higher in comparison to IMCs. Large fish bones are discarded as plate waste and not eaten but SIS are eaten whole with bone, head and eye thereby providing a rich source of calcium and other micronutrients (Gopakumar, K. 1997; Roos, *et al*., 2003) [9, 32].

Conclusion

On the basis of the results of the present study, it can be concluded that, the sun-dried *C. striatus* and *G. giuris* are good source of lipid, protein and minerals that can ensure nutritional security even in their dried state. These indigenous fishes can improve the nutritional security of low-income groups. Therefore, they can be recommended in every possible way. The low moisture content of studied species indicates that proper storage of the sample can prevent from spoilage and increase the shelf life. The percentage of protein and lipid content in the selected dried fish is quite satisfactory which indicates its high nutritive value. In this study, we focused only on Ca and P, both the minerals are present in good amount, and their high value indicated that they also would be rich in other nutrients, which are expected to be high in fish for maintaining a healthy diet. The variation in proximate value of same or different species can be due to differences in environmental conditions, age and size of fish, season, feeding habit etc. (Effiong and Mohammed, 2008; Abdullahi, 2001; and Jacquot, 1961) [8, 1, 16]. The study as a whole gives us the idea that dried fish can be used as a food supplement for human as different value-added products and for animal feed if the product is not contaminated and can serve as natural supplements for combating and preventing micronutrient deficiency as well as protein calorie malnutrition.

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Author's Contribution

Not available.

Conflict of Interest

Not available.

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References

1. Abdullahi SA. Investigation of nutritional status of *Chrysichthys nigrodigitatus*, *Bayrus filamentous* and *Auchenoglanis occidentalis* (family Barigdae). Journal of Arid Zone Fisheries. 2001;1:39-50.
2. Azam K, Basher MZ, Asaduzzaman M, Hossain MH, Ali MY. Biochemical quality assessment of fourteen selected dried fish. Uni J Zool. 2003;22:23-26.
3. AOAC. Official methods of analysis. Association of Official Analytical Chemists, Inc., Washington, DC, USA; c1995.
4. Basu S, Imam Khasim D, Gupta SS, Panduranga Rao CC. Quality of dry fish from markets in Andhra Pradesh. Fish Technol. 1989;26:114-118.
5. Bhattacharyya SK, Bandyopadhway JK, Chattopadhyay AK. Improved dried product on blanching of *Gudusia chapra* prior to sun drying. In: Harvest and Post-Harvest Technology of Fish. Society of Fish Technologists (India); c1985. p. 531.
6. Dale HF, Madsen L, Lied GA. Fish-derived proteins and their potential to improve human health. Nutr. Rev. 2019;77(8):572-583.
7. Doha S. Fish and shellfish preservation by sun and/or air drying in some selected countries and the problems involved. J Agric Pak. 1964;15(4):455-477.
8. Effiong BN, Mohammed I. Effect of seasonal variation on the nutrient composition in selected fish species in Lake Kainji, Nigeria. Nature Sci. 2008;6(2):1-5.
9. Gopakumar K. Biochemical composition of Indian food fish. Central Institute of Fisheries Technology (ICAR), Cochin; c1997. p. 28.
10. Hansen M, Thilsted SH, Sandstrom B, Kongsbak K, Larsen T, Jensen M, *et al*. Calcium absorption from small soft-boned fish. J Trace Elem Med Biol. 1998;12:148-154.
11. Hoq E. *Bangladesher Chhoto Mach* (A book on small indigenous fish species of Bangladesh). Mymensingh: Graphic Sign; c2004. p. 81-84.
12. Hossain MA, Afroze S. Small fish as a resource in rural Bangladesh. Fish Byte. 1991;9:16-18.
13. Hossain MA, Afsana K, Azad SA. Nutritional value of some small indigenous fish species (SIS) of Bangladesh. Bangladesh J Fish Res. 1999;3:77-85.
14. Hossain MA, Rahman MH, Parween S, Mahman MA. Fish stock assessment and utilization of seasonal ditches. J Ecobiol. 1994;6(1):61-66.
15. Hussain MM, Karim A, Alam Z, Islam MMS, Khan A, Hossain A, *et al*. Effect of pre-treatment on the drying of *Ghonia* fish, *Labeo gonius* in the open sun and in a tent. Bangladesh J Zool. 1992;20:231-238.
16. Jacquot R. Organic constituents of fish and other aquatic animals: Fish as food. Borgstrom Academic Press, NY and London; c1961. p. 145-209.
17. Jhingran AG. Studies on biology and fisheries of the clupeids *Setipinna phasa* (Hamilton) and *Gudusia chapra* (Hamilton) in the Ganga River system. D. Phil. thesis, University of Allahabad, Allahabad; c1966.
18. Kuppuswarmy S, Srinivasan H, Subrahmanyam V. Proteins in food. Indian Council of Medical Research, Spec Rept Series No. 33, New Delhi; c1958. p. 10.
19. Mahanty A, Ganguly S, Verma A, Sahoo S, Mitra P, *et al*. Nutrient profile of small indigenous fish *Puntius sophore*: Proximate composition, amino acid, fatty acid and micronutrient profiles. Nat Acad. Sci. Lett. 2014;37(1):39-44.

20. Mansur MA, Rahman S, Khan MNA, Kamrunnahar MSR, Uga S. Study on the quality and safety aspect of three sun-dried fish. Afr. J Agric. Res. 2013;8(41):5149-5155.
21. Martenik WA, Jacobs B. A new method for the determination of moisture in dehydrated vegetables. Proc Inst Food Technologist. 1963;4:156.
22. Mohanty BP. Fish as health food. In: Ayyappan S, Moza U, Meenakumari B, Jena JK, Pandey AK, editors. Handbook of Fisheries and Aquaculture. ICAR-DKMA, New Delhi. 2010;2;843-861.
23. Mohanty BP, Ganguly S, Mahanty A, *et al*. Fish in human health and nutrition. Advances in Fisheries Research. Delhi: Narendra Publishing House; c2019. p. 189-218.
24. Mohanty BP, Pati MK, Bhattacharjee S, Hajra A, Sharma AP. Small indigenous fishes and their importance in human health. Advances in Fish Research, Vol.-V, Delhi: Narendra Publishing House; c2013. p. 257-278.
25. Nair PGV, Mathew S. Biochemical composition of fish and shellfish. Central Institute of Fisheries Technology, Cochin-682029, ICAR; c2001.
26. Nurullah M, Kamal M, Wahab MA, Islam MN, Reza MS, Thilsted SH, *et al*. Quality assessments of traditional and solar tunnel dried SIS (Small Indigenous Fish Species) products. Bangladesh J Fish Res. 2006;10(1):63-72.
27. Pathak V, Tyagi RK. Riverine ecology and fisheries vis-à-vis hydrodynamic alterations: Impacts and remedial measures. CIFRI Bull. 2010;161:33.
28. Paul PC, Reza MS, Islam MN, Kamal M. Quality assessment of traditionally dried marine fish of Bangladesh. Asian Food Sci J. 2018;5:1-11.
29. Rana MM, Chakraborty SC, Saeid A. Comparative studies of nutritional, microbial and organoleptic properties of different indigenous dried fish from local market in Bangladesh. Adv J Chem. 2019;3(3):318-327.
30. Rasul MG, Yuan C, Azad SA. Chemical composition and nutritional value of dried fish in Bangladesh. Egypt J Aquat Biol Fish. 2021;25(4):379-399.
31. Ravichandran S, Sharmila JFR, Kanagalakshmi R, Ramya MS. Variation in nutritive composition of two commercially important marine fin fishes. Int J Zool. Res. 2012;8:43-51.
32. Roos N, Islam M, Thilsted SH. Small fish is an important dietary source of vitamin-A and calcium in rural Bangladesh. Int. J Food Sci. Nutr. 2003;54:329-339.
33. Stansby ME. Cured fishery products. In: Industrial Fishery Technology. Stansby ME, Robert E, editors. NY: Krieger Publication Co.; c1963. p. 415.
34. Sultana S, Parween S, Hossain MA. Biochemical analysis of some dried SIS fishes of the River Padma in Rajshahi. J Life Earth Sci. 2011;6:39-43.
35. Thilsted SH, Roos N, Hasan N. The role of small indigenous fish species in food and nutrition security in Bangladesh. NAGA Newsletter, 1997 Jul-Dec, 13.
36. Tyagi RK. Final report on APCESS Scheme Techno-socio-economic status of fishers of river Ganga. CIFRI; c2005. p. 83.
37. Uhe AM, Collier GR, Dea KO. A comparison of the effects of beef, chicken and fish protein on satiety and amino acid profiles in lean male subjects. J Nutr. 1992;122(3):467-472.
38. Ullah N, Hazarika P, Handique PJ. Biochemical quality assessment of ten selected dried fish species of northeast India. Int. Adv. Res. J Sci. Eng. Tech. 2016;3:30-33.

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