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Original Research

Nutrient profile and heavy metals content of an exotic fish *Hypostomus plecostomus* in Bangladesh: Health risk assessment

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Abstract

The Suckermouth catfish (*Hypostomus plecostomus*) is a freshwater species found in Bangladesh that is included in the group of invasive species according to the guidelines of the Ministry of Fisheries and Livestock. The detrimental effects of Suckermouth catfish and possible ways to eradicate them are yet unknown, thus finding substitute foods for fisheries goods is necessary. Before Suckermouth catfish is utilized as a raw material for fish meals, a rigorous analysis of its nutritional value and heavy metal content is required. The results of the analysis of the moisture content, protein content, lipid content, ash content, and carbohydrate content of the muscles showed that the average content percentages were 64.55%, 20.65%, 1.21%, 1.92%, and 11.87%. Additionally, the average concentrations of heavy metals Cu, Zn, Pb, Cd, and Cr in the muscle tissue of Suckermouth catfish were found to be 0.56, 61.76, 0.14, 1.78, and 0.45. Cu, Pb, and Cr levels are below the maximum level of tolerance, in accordance with this study. Conversely, it turned out that the levels of Zn and Cd above the maximum acceptable limits. Of particular, the levels of Cd were found to be around 30-35 times higher compared to the maximum acceptable values, posing a health risk to humans. It is not recommended to utilize this fish as fish meal because its heavy metal concentration exceeds the maximum limit. This heavy metal can build in the body and be harmful if fish meal is made from this species.

1. Introduction

The Suckermouth catfish *Hypostomus plecostomus* (Sarkar *et al.*, 2023), is a popular aquarium pet owing to its peculiar appearance. Due to their adaptation to the natural waterbodies, they have now become invasive fish throughout the nation (Parvez *et al.*, 2023). Because of their unique look and use in the aquarium as a cleaner to get rid of algae, suckermouth catfishes have been around for more than 55 years as aquarium pets worldwide (Veena *et al.*, 2023). The fish has spread over the world because to its distinctive physiology, fast growth, and capacity to adapt to a variety of habitats, with serious ecological and economic repercussions (Erarto and Getahun, 2020). Due to their predation, competition with native species, and disturbance of ecosystem processes and functions, they are regarded as the second danger to biodiversity (Walsh *et al.*, 2012). In an effort to prevent the suckermouth catfish species from spreading further, the Bangladeshi government is currently implementing restrictions on sales and imports (MoFL, 2023). Despite its rising prevalence in Bangladesh, not much has been determined about the nutritional profile and heavy metal levels of *H. plecostomus*. There have been very few reviews of Bangladesh's suckermouth catfish (Hossain *et al.*, 2018; Rana *et al.*, 2023). The safety of eating this fish is called into doubt due to worries about contaminating aquatic habitats. Its use as a safe and sustainable food source is limited by a lack of scientific evidence, necessitating an assessment of the advantages and disadvantages. Fish consumption has increased dramatically in recent decades due to its nutritional value and high rank proteins (FAO, 2020). The amount of protein and fat in fish determines its nutritional value (Naeem and Selamoglu, 2023). Important nutritional components found in fish include high-quality protein, lipids, vitamins, and minerals including phosphorus and magnesium (Ali *et al.*, 2020). Proteins and micronutrients including calcium, iron, zinc, selenium, and vitamins A, B, and D may be found in fish (Abdelhamid *et al.*, 2018). Additionally, fish contains lipids, which are vital since they provide the majority of the calories required for development and aid in the delivery of lipophilic vitamins. This is due to the fact that Suckermouth is inexpensive to produce, easily accessible, and rich in protein (Soteyome and Thedkwanchai, 2023). Nevertheless, heavy metal pollution of fish has led to global anxiety, and it poses danger to humans (Golden *et al.*, 2016). Determining the accumulation of heavy metals in the commonly consumed efficient fish species is crucial because fish can absorb these metals from the surrounding water, sediment, and their diet (Baki *et al.*, 2018). Excessive or inappropriate consumption of fish can have negative effects on human health. The high concentrations of heavy metals have an effect on fish growth and development during early life stages, such as hatching, larval development, and juvenile growth because fish are more vulnerable during these periods than during mature ones (Heath, 2018). It appears that fish are the conduit via which hazardous heavy metals are transferred from water to people (Ashraf *et al.*, 2011). By providing knowledge regarding nutritional value and

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contamination hazards related to *H. plecostomus*, the research will support evaluations of food safety. It will help stakeholders in the industry, consumers, and legislators comprehend the fish's potential for safe use. Finding the nutritional value and level of heavy metal content in Suckermouth catfish is the main objective of the study in order to evaluate the possibility of using *H. plecostomus* as a sustainable and safe fisheries product in Bangladesh. If *H. plecostomus* is deemed safe, it may be used as a substitute protein source to help Bangladesh produce food at a cheap cost. The findings may have an impact on laws governing the use, sale, and importation of *H. plecostomus* in Bangladesh.

2. Materials and methods

2.1 Ethical approval

No ethical approval is required for this study.

2.2 Study area and period

This study was conducted at Bangladesh Fisheries Research Institute during April-May 2022. Fishermen used gill nets to collect samples from four different locations of Bangladesh, which were then transported in ice boxes. The sampling locations are presented in (Table 1 and Figure 1).

Table 1. Location of the different sampling areas for *H. plecostomus* in Bangladesh.

Samples	Waterbody	Areas	Districts
Sample-1	Shitalakshya River	Bridge ghat	Narayanganj
Sample-2	Pond	BFRI	Mymensingh
Sample-3	Buriganga River	Launch ghat	Dhaka
Sample-4	Meghna River	Echlin ghat & Launch ghat	Chandpur

Initially, fish measurements were performed after a total of 80 fish samples were collected from four separate locations. The fish's length was measured, and the findings varied from 21 to 40.30 cm. Fish with the largest and lowest sizes were used as samples for the proximate analysis and the number of heavy metals in them. Following the removal of the scales and bones from the fish samples, the protein, lipid, and carbohydrate contents as well as the presence of heavy metals were measured in the fish flesh.

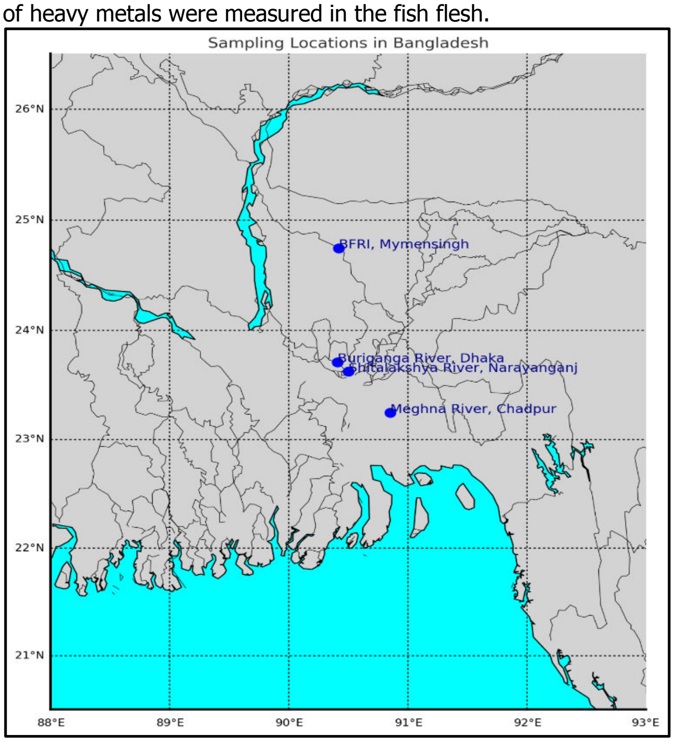

Figure 1. Location maps of different study area in Bangladesh.

2.3 Nutrient content

The nutrient value of the suckermouth catfish was assessed using the following Association of Official Analytical Chemists (AOAC, 1995) and International Organization for Standardization (ISO) methods. Prior to sample lyophilization, the moisture content of the samples was assessed using a vacuum oven (AOAC 952.08). After thawing, the samples were carefully re-suspended to prevent any losses and stored in tightly sealed containers. The total fat content was determined in accordance with AOAC 948.15, and the total ash was determined in accordance with AOAC 938.08. Using an automated Kjeldahl equipment (Kjeltec 8100, Foss Analytical, Hilleroed, Denmark), the nitrogen concentration was ascertained in accordance with ISO 5983-2:2005. Multiplying the nitrogen content by a conversion factor of 6.25 yielded the total protein content. The sum of the protein, fat, and ash levels was subtracted from 100 to get the total carbohydrates (Onyeike *et al.,* 2000). Three duplicates of each analysis were performed. However, the findings for ash, protein, lipids, and carbs are given as g/100 g of dry matter, whereas the results for moisture content are expressed as g/100 g of sample.

2.4 Heavy metal analysis

The fish samples underwent defrosting, after which they were dissected and their muscles taken for analysis of metals. One gram of every of these samples was dried, ground into a powder, and then digested at 70 °C for thirty minutes using a 3:1 ratio of strong nitric acid to hydrochloric acid. The mixture was then left on a water bath until a color shift was noticed. The final mixture was given time to cool before being filtered and placed into a 50 mL flask with distilled water added to bring it up to par (Nwajel, 2000). Atomic absorption spectrometers (Perkin Elmer Atomic Absorption Spectrometer Pinnacle 900T, Perkin Elma, and USA) were used to examine the following metals: copper, zinc, lead, cadmium, and chromium. For every sample, a blank was created, and adjustments were made based on the blank. By employing approved reference material, the analytical procedure's accuracy was guaranteed (DORM-3). The dry weight of fish was translated from the results to mgkg^{-1}. Every reagent employed, including 99% pure HCl and H_2SO_4, was of analytical quality.

2.5 Statistical analysis

The mean values of collected data were analyzed using SPSS software (version 26.0), and the results were reported as means ± SD (standard deviation). These data were analyzed for variance homogeneity and normal distribution using the Levene and Shapiro-Wilk tests, respectively (Chicago, Illinois, USA). A one-way ANOVA was used to analyze the variations among the different samples, and at the statistically significant level of $P<0.05$, Duncan's post hoc test was performed. Using Python software (Python 3.11.4 version), the location maps was generated. With Microsoft Excel (version 16), the nutrient composition and heavy metal graphs were plotted.

3. Results

3.1 Nutrient content

The nutritional profile of the muscles of *H. plecostomus* was analyzed to ascertain the amount of moisture, protein, fat, ash, and carbohydrates. Results of nutritional analyses are presented in Table 2. A comparison of the four samples' moisture, protein, lipid, ash and carbohydrate contents was made possible by the results of the nutritional analysis conducted on *H. plecostomus* muscles. Significant differences ($P<0.05$) were observed in nutrient content among four samples in the months of April and May. Samples 1 and 3 showed the highest and lowest protein content values in April, respectively, at 21.50 and 20.78. Sample-3 had the lowest protein content value (19.63) in May, while sample-4 had the highest value (20.34). April's data showed that sample-1 (1.13) had the lowest lipid content and sample-3 (1.31) the highest. Samples 3 and 4 had the highest and lowest lipid contents, respectively, in May (1.15 and 1.29). As of April, sample-2 (1.57) showed the lowest ash level and sample-4 (2.21) the highest. May's observations showed that sample-4 had the highest ash value (2.23) and sample-2 had the lowest (1.69). When it came to moisture content values in April, sample-1 had the highest value (66.76), however Sample-3 had the lowest (62.04). Samples 2 and 3 showed the highest and lowest moisture content values, respectively, in May (66.09 and 63.31), respectively. Sample 3 had the highest carbohydrate content (14.08) in April, whereas sample 1 had the lowest (9.93). Sample-3 had the most carbohydrate content (14.93) in May, while sample-1 had the least amount of carbohydrates (9.91). The average content of Moisture, Protein, Lipid, Ash, and Carbohydrates in both months was 64.55%, 20.65%, 1.21%, 1.92%, and 11.87%, according to the findings (Figure 2).

Table 2. The mean nutritional profile and standard error of *H. plecostomus* collected during April and May of 2022 from four distinct locations in Bangladesh are compared.

Months	S	Parameters				
		Moisture	Protein	Lipid	Ash	Carbohydrates
April	S1	66.76±0.57^{a}	21.50±0.27^{a}	1.13±0.07^{c}	1.71±0.06^{b}	9.93±0.18^{c}
	S2	65.28±0.21^{a}	21.27±0.17^{a}	1.24±0.05^{b}	1.57±0.06^{c}	11.27±0.17^{b}
	S3	62.04±0.09^{b}	20.77±0.23^{b}	1.31±0.07^{a}	2.05±0.05^{a}	14.08±0.17^{a}
	S4	63.52±0.22^{b}	21.30±0.13^{a}	1.16±0.05^{c}	2.21±0.11^{a}	11.84±0.07^{b}
May	S1	65.18±0.17^{a}	20.24±0.21^{a}	1.16±0.05^{b}	1.84±0.05^{b}	9.91±0.07^{c}
	S2	66.09±0.18^{a}	20.12±0.13^{a}	1.26±0.05^{a}	1.68±0.05^{c}	11.22±0.10^{b}
	S3	63.31±0.09^{b}	19.63±0.12^{b}	1.29±0.04^{a}	2.08±0.08^{ab}	14.93±0.13^{a}
	S4	64.22±0.09^{ab}	20.34±0.08^{a}	1.15±0.05^{b}	2.23±0.07^{a}	11.79±0.09^{b}

*S=Sample

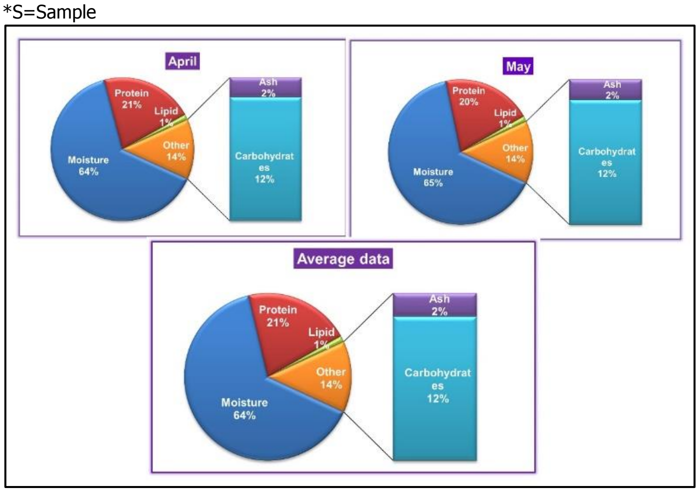

Figure 2. Average nutrient content of *H. plecostomus* collected from four distinct locations in Bangladesh during April and May of 2022.

3.2 Heavy metals content

The components and compounds found in fish have a significant impact on the nutritional value and safety of fisheries products. The results for the various metal concentrations in the fish muscles that were collected from four separate locations are displayed in Table 3. According to the findings of the heavy metal test conducted on *H. plecostomus* muscles, Cu, Zn, Pb, Cd, and Cr concentration varied significantly (P<0.05) amongst the four samples during the study. During the month of April, Sample-1 had the lowest Cu content score (0.11 mg/kg) and Sample-3 had the highest value (1.23 mg/kg). May's Cu content values for Samples 3 and 1 were respectively the highest (1.28 mg/kg) and lowest (0.12 mg/kg). Sample-2 had the least Zn concentration in April, whereas sample-3 had the most Zn content. Sample 3 had the highest Zn level in May, while sample 1 had the least Zn content. Sample 1 had the most Pb concentration in April, whereas sample 3 had the lowest level of Pb. In the month of May, sample-1 had the highest level of Pb while sample-3 had the lowest. Sample 2 had the least Cd content value in April, whereas Sample 1 had the most Cd content level. The Cd content values of samples 1 and 2 were highest and lowest, respectively, in May. Sample-1 had the highest Cr value in April, whereas sample-4 had the lowest Cr value. Samples 1 and 4 had the highest and lowest Cr contents, respectively, in May. The average level of Cu, Zn, Pb, Cd, and Cr in both months was 0.56, 61.76, 0.14, 1.78, and 0.45 mg/kg, respectively (Figure 3).

4. Discussion

4.1 Nutrient content

Our research contains the first verified data on the nutritional composition and heavy metal levels of *H. plecostomus*, having been conducted in four separate locations throughout Bangladesh. This fish contains a high amount of protein, lipid, and ash. The highest amount of protein, 21.50, was observed in sample 1, which is higher compared to other catfish in Bangladesh. Hasrianti *et al.* (2022) conducted a study in Lake Sidenreng, South Sulawesi, Indonesia, assessing the nutrient composition and heavy metal levels of suckermouth catfish, *Pterygoplichthys pardalis* (Hasrianti *et al.*, 2022). The findings indicate that the average crude protein and lipid content of the muscles of *H. plecostomus* from four distinct sites is 20.65% and 1.21%, respectively. Furthermore, the results reveal that the protein and lipid content of the suckermouth catfish differs considerably from that of the freshwater mud eel *Monopterus cuchia*, which has a protein and lipid content of 14.49% and 8.35% in uncooked condition (Islam *et al.*, 2020), *E. benglalensis*, which has a protein content of 13.14% and lipid content of 3.33% (Sumi *et al.*, 2023), but not significantly from Snakehead *Channa striata*, which has a protein content of 20.31% and lipid content of 2.12% (Sumi *et al.*, 2023). Our results indicate that *H. plecostomus* species has a higher protein and lipid content than *P. pardalis* and *Pangasianodon hypophthalmus*. The protein content of *P. hypophthalmus* fish was 15.41%, which is lower than our results (Paul *et al.*, 2018). However, *P. pardalis*, which exhibited less protein and lipid content than *H. plecostomus*, having a protein percentage of 14.52% and lipid percentage of 0.49% (Hasrianti *et al.*, 2022). Fish whose protein level is less than 15% are classified as having low protein, those whose protein content is between 15% and 20% as having moderate protein, and those whose protein content is greater than 20% as having high protein (Elfidasari *et al.*, 2019). Evidence suggests that the crude protein content of *H. plecostomus* is generally similar to that of other freshwater fish that are regularly eaten. The findings indicate that *H. plecostomus* is a low-fat fish. Elfidasari *et al.* (2019) suggest classifying *P. pardalis* as low fat due to its fat content of less than 2%, which is essentially consistent with our findings. Fish is classified as low-fat if its lipid percentage is less than 1% and as high-fat if it is in excess of 5% (Murray and Burt, 2001). Fish frequently has minimal amounts of fat and high levels of protein. In essence, the physiological capacity of fish to manufacture protein determines the amount of protein present in their flesh. The protein composition of meat can be influenced by biological parameters, including species of fish, size of body, age, and sex (Das and Das, 2015). An average Ash content of 0.91% in *P. pardalis*, which is considerably lower than our findings (Hasrianti *et al.*, 2022). In contrast to our findings, the large Plecostomus shows the lowest ash content (0.23%) (Elfidasari *et al.*, 2019).

Table 3. Mean concentration of heavy metals (mg/kg) in muscles of *H. plecostomus* collected during April and May of 2022 from four distinct locations in Bangladesh.

Months	S	Parameters				
		Cu	Zn	Pb	Cd	Cr
April	S1	0.11±0.02^{c}	60.95±1.05^{b}	0.22±0.02^{a}	1.88±0.02^{a}	0.56±0.07^{a}
	S2	0.64±0.02^{b}	60.57±0.75^{b}	0.12±0.02^{b}	1.70±0.03^{c}	0.39±0.03^{b}
	S3	1.23±0.03^{a}	64.89±1.17^{a}	0.12±0.01^{b}	1.74±0.04^{bc}	0.52±0.08^{a}
	S4	0.18±0.03^{c}	61.48±1.03^{b}	0.12±0.02^{b}	1.77±0.03^{b}	0.35±0.05^{b}
May	S1	0.12±0.02^{c}	59.01±1.86^{c}	0.18±0.02^{a}	1.87±0.02^{a}	0.52±0.07^{a}
	S2	0.69±0.06^{b}	60.67±0.07^{c}	0.13±0.02^{b}	1.73±0.03^{c}	0.42±0.02^{b}
	S3	1.28±0.03^{a}	65.56±0.27^{a}	0.12±0.03^{b}	1.76±0.03^{b}	0.51±0.04^{a}
	S4	0.20±0.02^{c}	62.09±0.04^{b}	0.13±0.02^{b}	1.78±0.02^{b}	0.33±0.03^{c}

*S=Sample

4.2 Heavy metal content

The biodiversity of aquatic environments is significantly impacted by the presence of heavy metal contamination. One food source that is frequently eaten by people is fish. If the fish is polluted, there is a chance that this contamination will affect human health (Orfinger and Goodding, 2018). Frequent consumption of foods containing heavy metals can have negative health effects, even though meat derived from *H. plecostomus* contains lower levels of Cu, Pb, and Cr than is allowed. One possible way that heavy metals and proteins are related is through the immune system. Fish that are exposed to heavy metals may develop immunity to them. As a result, when the body is exposed to foreign substances like metals, the immune system activates right away and produces a lot of protein. However, since protein content is unrelated to growth, this doesn't contribute to the fish's long-term protein content. Furthermore, the Plecostomus' physiological reaction to external conditions may be reflected in the link between heavy metals and protein. Fish's ability to adapt can aid in their survival. Their bodies react through their cells to a serious threat. Toxic waste in waterways, such lead, is the greatest threat. Stress-induced proteins can be produced by *plecostomus* (Elfidasari *et al.,* 2019). The analytical results showed that *H. plecostomus* had a lead heavy metal level of less than 0.143. SNI 2729:2013 restricts the health risks of fish that is freshly caught to 0.3 mg/kg (µg/g) at most, which indicates that, in compliance with quality criteria, the lead level in fish is below the lead content criterion in *H. plecostomus* (BSN, 2013). Pb enters the organism of fish via the respiratory system, which includes the gills and the surface of the skin diffusion, as well as the food chain (Suprapto *et al.,* 2019). Conditions of the habitat, degrees of water pollution, duration of exposure to pollution, and fish-eating practices all have a significant impact on the presence of heavy metal contamination in fish organs. Suckers have a predatory status in their environment, which means that because metals can accumulate in organisms and move up the food chain, predators in this scenario have higher amounts of hazardous metal accumulation in their tissues (Winiarska-Mieczan *et al.,* 2018).

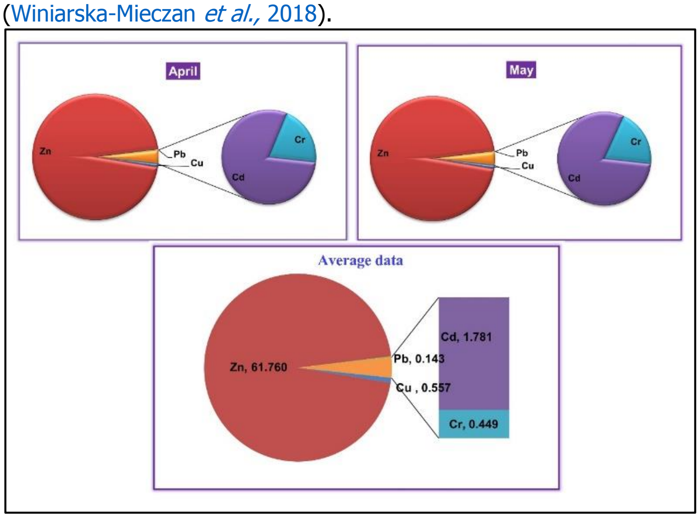

Figure 3. Average heavy metals content of *H. plecostomus* collected from four distinct locations in Bangladesh during April and May of 2022.

Cu are known to be important elements since they are needed by many different types of enzymes along with other cell components that are essential to all living organisms. Cu is a necessary that is needed by organisms at a low level as a co-enzyme during the metabolic process (Riani, 2012). The estimated daily intake value for adults and children aged 12 years are 0.07 and 0.04, respectively, for Cu (Yap and Al-Mutairi, 2022). The average amount of Cu in the samples we tested was 0.557 mg/kg, which is lower than the maximum value recommended by the FAO and WHO. Cu levels in *P. jenynsis*, the small-tooth flounder, have been reported to be 0.034 and 0.133 mg/kg at Botany Bay and Port Jackson, respectively, (McKinley *et al.,* 2012). In contrast to our work, Shaheen *et al.* (2024) showed that the maximum permitted concentration of Cu in Hilsha, Kachki, Taki, and Tengra was 2.88, 7.93, 1.82, and 3.32 mg/kg (Shaheen *et al.,* 2024). While copper is a vital element for human health since it is a component of several enzymes that are required for the formation of hemoglobin, over consumption of the mineral is also having a negative impact on health (Mitra *et al.,* 2022). Although copper is necessary for human survival, excessive amounts of metal can harm the liver, kidneys, stomach, and intestines in addition to causing anemia.

Although Zn is a necessary micronutrient, excessive amounts of it can lead to cramps, nausea, vomiting, diarrhea, and other symptoms (Rakib *et al.,* 2024). The maximum amount of Zn that can be found in fish is 30 mg/kg (Alam *et al.,* 2023). In our study, the average Zn concentration was 61.76 mg/kg, which is more above the allowable limits of 50 mg/kg. *P. jenynsis*, the small-tooth flounder, has zinc levels of 0.217 and 0.498 mg/kg at Botany Bay and Port Jackson, respectively (McKinley *et al.,* 2012). The maximum permitted content of Zn in Hilsha, Kachki, Taki, and Tengra was determined to be 16.42, 392.06, 48.29, and 141.03 mg/kg (Shaheen *et al.,* 2024). The concentration of Zn in Hilsha and Taki was lower than in our study but higher in Kachki and Tengra. Total zinc dietary intakes are estimated to be between 5.6 and 10 mg per day for babies and children ages 2 months to 11 years, 12.3 and 13.0 mg per day for children ages 12 to 19, and 8.8 and 14.4 mg per day for adults ages 20 to 50 (Yap and Al-Mutairi, 2022).

Despite being a commonly used metal, lead has various known harmful effects, including neurotoxicity and nephrotoxicity, as well as other detrimental health impacts. It is also used in paint, batteries, toys, cosmetics, and other products (Al-Rmalli *et al.,* 2021). Within the acceptable limits, the mean Pb value in our investigation was 0.14 mg/kg. *P. jenynsis*, the small-tooth flounder, has Pb levels of 0.07 and 0.22 mg/kg at Botany Bay and Port Jackson, respectively, (McKinley *et al.,* 2012). The highest permitted Pb concentrations in Hilsha, Kachki, Taki, and Tengra were determined by (Shaheen *et al.,* 2024) to be 0.13, 0.13, 0.10, and 0.20 mg/kg, respectively. These results are essentially comparable to those of our investigation. Pb values in the fish species of the Meghna River varied from 0.09 to 0.87 mg/kg, which is slightly higher than what (Palash *et al.,* 2020) reported. The levels of lead contamination found in different commercial feeds and fish obtained in aquaculture systems ranged from 4.56 to 7.08 mg/kg and 4.35 to 8.03 mg/kg, respectively (Alam *et al.,* 2023). Since lead metal is not necessary for human health, poisoning results from excessive exposure to it or from it exceeding a set threshold. Lead that passes through the digestive system and into the body will accumulate in the kidneys and bones (Ara and Usmani, 2015; Collin *et al.,* 2022).

Cadmium is an extremely hazardous metal that can cause harm even at extremely low levels (Nargis *et al.,* 2019). The mean concentration of Cd in our investigation was 1.781 mg/kg, significantly exceeding the allowable thresholds. The WHO and FAO established the maximum recommended limit for Cd at 1 mg/kg, however European Community law and the Codex Committee on Food Additives and Contaminants placed it at 0.05 mg/kg and 0.5 mg/kg, respectively (Alam *et al.,* 2023). Cd levels for *P. jenynsis*, the small-tooth flounder, are 0.001 mg/kg at Botany Bay and 0.001 mg/kg at Port Jackson (McKinley *et al.,* 2012). The highest permitted levels of Cd in Hilsha, Kachki, Taki, and Tengra were 3.4E-03, 1.8E-02, 1.1E-03, and 7.9E-03 mg/kg, respectively (Shaheen *et al.,* 2024). These values are lower than those obtained in our study. Based on the fact that the fish lives at the bottom of the water and consumes a variety of harmful products, we estimate that its level of Cd is significantly high. As an endocrine disruptor, cadmium has been shown to be a contributing factor in the development of both prostate and breast cancer in people (Saha and Zaman, 2013). In addition, cadmium damages kidneys and can lead to hypertension, tumors, incomplete reproduction, and liver problems (Hao *et al.,* 2013).

As an unnecessary heavy metal, chromium can cause skin irritation, inflammation of the liver and kidneys damage, and other health problems when exposed to it over an extended period of time (Resma *et al.,* 2020). Fish can have up to 1.0 mg/kg of Cr (FAO/WHO maximum permissible limit). Within the allowable limits, our study's average Cr value of 0.45 mg/kg was found to be. Cr levels for *P. jenynsis*, or small-tooth flounder, are 0.03 and 0.08 mg/kg, respectively, in Botany Bay and Port Jackson (McKinley *et al.,* 2012). Hilsha, Kachki, Taki, and Tengra have maximum permissible concentrations of Cd of 1.59, 1.64, 1.77, and 2.02 mg/kg, respectively, which is higher than what our investigation observed (Shaheen *et al.,* 2024). Prolonged exposure can harm nerve and vascular tissue, as well as the kidneys and liver. Living at the bottom of the waterbody, suckermouth catfish consume decaying garbage and detritus as food. The high levels of Cd and Cr in Suckermouth catfish appears to be caused by those kinds of diet. When fish consume, they enter the fish body because this debris and other materials stay at the bottom of the waterbody. As a consequence, excessive amounts of Cd and Cr were found in samples taken from four distinct regions in Bangladesh. It has been documented that the aquatic ecology is eventually affected by heavy metal pollution (Umeh *et al.,* 2023). Fishes that are exposed to heavy metal pollution experience different concentrations of the metals building up in their organs (Olusola and Festus, 2015). Because of *H. plecostomus*'s predatory role in its surroundings, predators in this scenario amass more hazardous metals in their tissues due to the fact that metals can build up in organisms and be passed up the food chain (Winiarska-Mieczan *et al.,* 2018). The quantities of heavy metals in fish organs and tissues reflect heavy metal concentrations in water and their accumulation in food chains (Zhu *et al.,* 2015). Toxic elements pollutants in fish are transported into human metabolism by intake of contaminated fish, which might induce harmful consequences on human health (Alinnor and Obiji, 2010).

5. Conclusions

The nutritional profiles and heavy metal levels of Suckermouth fish from four distinct localities in Bangladesh throughout the months of April and May were examined in this study. Suckermouth catfish have a higher protein content than other catfish in Bangladesh. However, the levels of heavy metals, particularly Zn and Cd, are higher than the upper limit allowed. When suckermouth catfish are used as fish feed, zinc and cadmium may enter the fish's bodies via the feed. These heavy metals then enter the human body via the fish, which is very dangerous for humans. As a result, *H. plecostomus* is not regarded as a fish that is acceptable for human food and is also not suited for the manufacture of fish meal, animal feed, or other highly valuable fisheries products.

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Data availability statement

Data confirming these results is provided inside the research paper or upon inquiry.

Informed consent statement

Not applicable.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

Awal MR and Rahman MA: conceptualization, technique, research, formal analysis, original draft writing, review, and editing; **Moniruzzaman M:** authoring reviews, editing, and formal analysis; **Hossain MN:** Data assembling, formal analysis, writing, review, and editing; **Al-amin and Said MA:** writing, editing, and reviewing. Following a rigorous evaluation, each author consented to submit the completed work.

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