Research Article

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Comparative Study on the Nutritional Profile of Cultured and Captured African Catfish (*Clarias gariepinus*)

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Abstract: Aquaculture contribution to human nutrition, consumers' preferential bias towards capture fisheries and concerns on food safety has necessitated the need for information on the nutritional composition of fish species from diverse settings such as geographical locations and aquaculture rearing facilities. This study determined the nutritional profile and associated human health risk of adult size African catfish (*Clarias gariepinus*) cultured in plastic tanks with those harvested from the wild. Results showed the mean protein (18.04%) and lipid (8.71%) values of cultured *C. gariepinus* were significantly higher than reported values in *C. gariepinus* from the wild, which makes them of more nutritional value to consumers. Captured fishes reported higher ash, mineral and trace metal contents, which was attributed to the elevated levels of these elements in their habitat waters due to water pollution. Low metal pollution index (MPI) values in cultured and captured fishes indicated an insignificant bioaccumulation of trace metals, and the absence of non – carcinogenic (HI <1) and carcinogenic (ICR $< 1 \times 10^{-6}$) risk associated with their consumption. Although the captured fishes at present poses no health risk to consumers; their recorded higher contents of trace metals, MPI, HI and CPI values is a cause for concern on the safe consumption of capture fishes. With increasing concerns on aquatic food safety, this study has shown that the consumption of cultured *C. gariepinus* provides more nutritional quality to consumers. The need for more monitoring studies on different culturing methods and settings on the nutritional composition and food safety is recommended.

Introduction

Fish is largely recognised as one of the healthiest, affordable and accessible source of animal protein, with no cultural bias to its consumption. Globally, the importance of fish to the sustenance of animal protein supply and human nutrition particularly in coastal regions and low income economies has been acknowledged (1, 2, 3). Over the years, the increasing awareness of the distinctive nature of fish nutrients and their functional roles in human growth and development, has resulted in unprecedented increase in demand for fish. At the global level, total fish production is expected to expand from 179 million tonnes in 2018 to 204 million tonnes in 2030. According to the World Fish Center (4), although Nigeria produces around 1.2 million metric tons of fish annually, and spends about USD 1 billion a year on fish imports which accounts for 45% of its supply; her annual per capita fish consumption of 11.3 kg is far below the global average of 21 kg. This is particularly alarming for sub-Saharan Africa where many countries are dependent on aquatic foods to meet their nutritional needs, particularly animal proteins and micronutrients. In recent times, aquaculture has become the main source of fish for human consumption, with a production of 26 million tonnes in 2018 and a projected production of 109 million tonnes in 2030 (5).

Fish culture in tanks is a well-known aquaculture practice in Nigeria especially in areas lacking access to surface freshwater bodies such as rivers, lakes and reservoirs. The African Catfish (*Clarias gariepinus*) has successfully been reared in captivity using different facilities such as concrete ponds, plastic tanks, tarpaulin tanks and earthen ponds over the years in Nigeria. Despite this achieved success and the contribution of aquaculture to the fisheries sector in Nigeria, there still exist a cultural and preferential bias towards capture fisheries, as fish consumers have shown preference for capture fishes due to perceived factors of taste, health benefits, and the availability of diverse species in rivers (6). These perceived preferences among consumers in Nigeria for captured fishes over cultured fishes has influenced the market penetration of cultured fishes and increased pressure on

Figure 1. Plastic tank ponds at the grow out unit of the TETFund Centre of Excellence in Aquaculture and Food Technology situated in the University of Benin, Benin City, Nigeria.

Table 1. Analytical methods used for proximate and mineral/metals analysis of fish samples.

Analyte	Units	Method reference
Moisture	g/100 g	Oven drying (16)
Protein	g/100 g	Block digestion (17)
Fat	g/100 g	Acid hydrolysis (17)
Ash	g/100 g	Direct method (17)
Minerals/ Metal contents	mg/100 g	Acid Digest, AAS (18)

unsustainable fishing practices which have led to the depletion of fish stocks. The combination of several factors such as water quality (7, 8), diet and habitat (9), fat content and species variation (3) have been identified to contribute to the perceived consumers'preference of captured fishes to cultured ones. However, reported studies on increasing deterioration in the water quality of freshwater bodies in Nigeria (10, 11, 12, 13) and its effects on the physiology and food safety of capture fisheries has raised public health concerns on capture fisheries and the contribution of the practice of aquaculture to food security (3, 14). Also, the convergence of nutrition insecurity and increasing dependence on fish for animal protein has necessitated the need for more information of the nutrient composition of fish species from diverse settings such as geographical locations and aquaculture practices. Therefore, the aim of this study is to determine and compare the nutritional profile and human health risk assessment of adult size African catfish (*C. gariepinus*) cultured in plastic tanks with those harvested from the wild.

Materials and Methods

Study Locations

This study was carried out at the Grow Out Unit facility of the TETFund Centre of Excellence in Aquaculture and Food Technology situated in the University of Benin, Benin City, Nigeria. The facility used for the study were installed plastic tank ponds made with black rubber, with a capacity of 6,000 litres each (**Figure 1**). The Ikpoba Reservoir and Owan River in Edo State were locations for collection of captured fish samples. These natural water bodies were selected for the comparative study based on existing literatures on their water quality, which recorded that Ikpoba Reservoir is severely polluted (10, 11) and Owan River is slightly polluted (12).

Study Setup

For the study, ten (10) units of the plastic tank ponds were used. Each of the tanks were stocked with *C. gariepinus* fingerlings and cultured to table size (wgt. 800 – 1300 g) in five (5) months using conventional commercial fish feeds. No growth inducing hormone/ treatment was administered to the fishes throughout the study. Captured table sized *C. gariepinus* (wgt. 800 – 1200 g) were collected from Owan River and Ikpoba Reservoir with the assistance of artisanal fishermen over a period of three (3) months and properly identified using taxonomic guides (15). Collected fish samples from the tank ponds (n = 30), Ikpoba reservoir (n = 30) and Owan River (n = 30) were packed in polyethylene bags, preserved in ice blocks and taken to a National reference analytical laboratory - the Benin Owena River Basin Authority/ University of Benin Analytical laboratory for analysis.

Analytical Methods

In the laboratory, fish samples were thoroughly washed with distilled water and drained under folds of filter paper. The fish samples were dissected and fish fillets were collected along the lateral line. The fillet samples of both cultured and captured fishes were homogenised and subsamples of the homogenate were taken for respective analytical tests using methods summarized in **Table 1**.

Quality Assurance and Control

To ensure consistency and correctness of analyzed samples, analytical procedures were carried out in triplicate samples. The equipment - atomic absorption spectrophotometer (Model 210 VGP, Buck Scientific) was calibrated using buck-certified atomic absorption standards for the several trace metals to obtain a calibration curve. Reagent blank was first run at intervals of every 10 samples analysis to eliminate equipment drift. Information on certified reference materials, detection limits, quantification limits and percentage material recovery on each metal is presented in **Table 2**.

Metal Pollution Index (MPI)

The Metal pollution index as described by USEPA (19) was used to compute the total amount of trace metals found in the fish samples. Metal Pollution index was determined for the fish fillets using the **Eq. 1**:

Where 1) M is the concentration of metals measured and expressed (mg/kg), and 2) *n* is the number of metals measured.

Human Health Risk Assessment

Exposure Assessment

The estimated daily intake (EDI) of each metal from the consumption of *C. gariepinus* was determined by **Eq. 2** (20):

$$MPI = (M_1 \times M_2 \times M_3 \times M_4 \times M_5)^{(1/n)} \quad \textbf{(Eq. 1)}$$

Table 2. Certified values for elements in SRM 3233 detection limit (DL), quantification limit (QL), % of relative standard deviation (RSD) and recovery.

Metals	Detection limits (DL) (μg/mL)	Quantification limit (QL) (μg/mL)	Relative Standard Deviation (%RSD)	% Recovery
Fe	0.1 – 1.0	0.01 – 1.0	1 – 5	99
Zn	0.1 – 1.0	0.01 – 1.0	1 – 5	99
Cu	0.1 – 1.0	0.01 – 1.0	1 – 5	90
Cd	0.1 – 1.0	0.01 – 1.0	1 – 5	99
Pb	0.1 – 1.0	0.01 – 1.0	1 – 5	99
***Standard Reference Material (SRM) 3233 (2020)**				

$$EXP_{\text{diet}} = \frac{C_m \times IR \times ED \times EF}{BW \times AT} \quad \textbf{(Eq. 2)}$$

$$THQ_{\text{diet}} = \frac{EXP_{\text{diet}}}{RfD_{\text{diet}}} \quad \textbf{(Eq. 3)}$$

Table 3. Oral Reference Dose (Rf Do) for metals.

Metals	RfDo (mg/kg/day)
Iron	7.00E-01
Zinc	3.00E-01
Copper	4.00E-02
Lead	3.00E-03
Cadmium	1.00E-03

$$HI = \sum THQ_{\text{diet}} \quad \textbf{(Eq. 4)}$$

$$CR_i = CDI_i \times CSF_i \quad \textbf{(Eq. 5)}$$

$$ICR = \sum_{i=1}^{n} CR_i \quad \textbf{(Eq. 6)}$$

Non – carcinogenic Risk Assessment
The potential non – cancer risk of metal concentrations in *C. gariepinus* was characterized using the target hazard quotient (THQ) and hazard index (HI) (20).

For THQ estimations, the assumptions of no effect of cooking on the toxicity of metals and that ingested dose of metal is equal to the absorbed pollutant dose are considered (23). The target hazard quotient (THQ) was calculated using **Eq. 3**.

Target Hazard quotient (THQ):

Where RfD (mg/kg/day): reference dose level of a particular metal through oral exposure (20), as presented in **Table 3**.

Reference: USEPA (15)

Since fishes are able to accumulate more than one metal which may result in interactive effects, therefore the Hazard Index (HI) is the arithmetic sum of the THQ of the individual metals in a particular fish sample (24, 25). The hazard index (HI) was calculated using **Eq. 4**.

Hazard Index (HI):

The exposed population is considered safe to health risk where HI < 1.0; and when HI > 1.0 there may be a concern for potential non – cancer health effect (26, 27).

Carcinogenic Risk Assessment
The potential carcinogenic risk of metals in *C. gariepinus* were estimated using the incremental or excess individual lifetime cancer risk. Carcinogenic risk (CR) is the product of daily exposure dose (CDI) and cancer slope factor (CSF), as calculated using **Eq. 5**.

Here, CR_i represents carcinogenic risk via oral exposure, CDI_i denotes the daily exposure dose, and CSF_i refers to the cancer slope factor of carcinogenic pollutants. The integrated carcinogenic risk (ICR) is determined as the sum of risks from multiple pollutants, assuming no antagonistic or synergistic interactions **Eq. 6**.

USEPA (28) believes that carcinogenic risk value for humans is acceptable within 1×10^{-4}, while the maximum acceptable risk value recommended by International Commission on Radiological Protection (ICRP) is 5×10^{-5} (29). For clarity of risk evaluation results, risk classification based on the Delphi method, assessment criteria of USEPA and ICRP was carried out in this study as shown in **Table 4** (30, 31, 32).

Data Analysis
All statistical analysis was computed Statistical Package for Social Sciences (SPSS) version 21. Analytical results are presented as the pooled means ± SD per 100 g of fish specimen collected from plastic tanks, Ikpoba reservoir and Owan River respective and preliminary data analysis using ANOVA ($p < 0.05$) and Duncan Multiple Tests showed no significant variation among fish specimens

Table 4. Levels and values of assessment standards.

Risk Grades		Range of Risk Value	Acceptability
Grade I	Extremely low risk	$< 10^{-6}$	Completely accept
Grade II	Low risk	$(10^{-6}, 10^{-5})$	Not willing to care about the risk
Grade III	Low-medium risk	$(10^{-5}, 5 \times 10^{-5})$	Do not mind about the risk
Grade IV	Medium risk	$(5 \times 10^{-5}, 10^{-4})$	Care about the risk
Grade V	Medium-high risk	$(10^{-4}, 5 \times 10^{-4})$	Care about the risk and willing to invest
Grade VI	High risk	$(5 \times 10^{-4}, 10^{-3})$	Pay attention to the risk and take action to solve it
Grade VII	Extremely high risk	$> 10^{-3}$	Reject the risk and must solve it

from the various plastic tanks.

Results

The result of the nutritional composition of the fillets of *C. gariepinus* from the three (3) study locations are presented in **Table 5**. Range of values for moisture content (63.76 – 67.21%), protein (17.43 – 19.75%), crude fat (7.45 – 9.76%), ash content (2.08 – 3.73%), sodium (0.73 – 1.28 mg/100 g), potassium (1.93 – 3.05 mg/100 g), magnesium (1.09 – 1.60 mg/100 g), calcium (3.02 – 4.09 mg/100 g), iron (2.79 – 3.56 mg/100 g) and zinc (0.92 – 1.36 mg/100 g) were recorded. For trace metal contents (**Table 6**), range of values for copper (0.31 – 0.43 mg/100 g), manganese (0.28 – 0.49 mg/100 g), nickel (0.011 – 0.021 mg/100 g), cobalt (0.012 – 0.022 mg/100 g), chromium (0.0009 – 0.0017 mg/100 g) and lead (0.0008 – 0.0013 mg/100 g) were recorded in the fillets of *C. gariepinus* from the study locations. For metal pollution index (MPI) the computed

Table 5. Analytical values of the nutritional composition of Cultured and Captured *C. gariepinus*.

Plastic Tanks (TCEAFT)		Owan River	Ikpoba Reservoir	P - Value
	Mean ± SD	Mean ± SD	Mean ± SD	
Proximate Composition (% wet weight)				
Moisture	$65.62 \pm 0.89_b$	$68.00 \pm 1.38_b$	$61.09 \pm 3.73_a$	$p < 0.05$
Protein	$18.04 \pm 0.75_b$	$16.52 \pm 0.69_a$	$15.15 \pm 0.39_a$	$p < 0.05$
Crude fat	$8.71 \pm 0.69_b$	$7.18 \pm 0.46_a$	$6.03 \pm 0.25_a$	$p < 0.01$
Ash content	$3.00 \pm 0.47_a$	$3.56 \pm 0.39_a$	$4.58 \pm 0.28_b$	$p < 0.05$
Mineral Composition (mg/100mg)				
Sodium	$0.96 \pm 1.90_a$	$4.29 \pm 0.50_b$	$4.87 \pm 2.76_b$	$p < 0.05$
Potassium	$2.61 \pm 3.91_a$	$7.36 \pm 0.49_b$	$8.56 \pm 2.78_b$	$p < 0.05$
Magnesium	$1.33 \pm 2.11_a$	$2.67 \pm 0.46_b$	$3.87 \pm 3.87_b$	$p < 0.05$
Calcium	$3.51 \pm 3.75_a$	$3.43 \pm 5.83_a$	$5.13 \pm 4.06_b$	$p < 0.05$
Iron	$3.10 \pm 2.85_a$	$4.84 \pm 3.10_b$	$7.43 \pm 6.59_c$	$p < 0.05$
Zinc	$1.15 \pm 1.55_a$	$2.05 \pm 2.01_b$	$3.16 \pm 2.95_b$	$p < 0.05$

Note: Across each row, similar superscript indicates no significant difference ($p > 0.05$), while dissimilar superscript indicates significant difference ($p < 0.05$).

Table 6. Analytical values of the trace metal contents in Cultured and Captured *C. gariepinus*.

mg/100 g	Plastic Tanks (TCEAFT)	Owan River	Ikpoba Reservoir	P - Value
	Mean ± SD	Mean ± SD	Mean ± SD	
Copper	$0.38 \pm 0.04_a$	$0.45 \pm 0.05_a$	$1.82 \pm 0.72_b$	$p < 0.05$
Lead	$0.0011 \pm 0.0002_a$	$0.003 \pm 0.005_a$	$0.015 \pm 0.003_b$	$p < 0.05$
Cadmium	$0.0003 \pm 0.0002_a$	$0.002 \pm 0.003_b$	$0.004 \pm 0.0001_b$	$p < 0.05$

Note: Across each row, similar superscript indicates no significant difference ($p > 0.05$), while dissimilar superscript indicates significant difference ($p < 0.05$).

Table 7. Non Carcinogenic Risk Assessment associated with the consumption of cultured and captured *C. gariepinus* in this study.

Metals	Plastic Tanks (TCEAFT)		Owan River		Ikpoba Reservoir	
	EXP	THQ	EXP	THQ	EXP	THQ
Iron	1.02E-03	1.46E-03	1.59E-03	2.27E-03	2.44E-03	3.49E-03
Zinc	3.78E-04	1.26E-03	6.74E-04	2.25E-03	1.04E-03	3.46E-03
Copper	1.25E-04	3.12E-03	1.48E-04	3.70E-03	5.98E-04	1.50E-02
Lead	3.61E-07	1.20E-04	9.86E-07	3.29E-04	4.93E-06	1.64E-03
Cadmium	9.86E-08	9.86E-05	6.57E-07	6.57E-04	1.31E-06	1.31E-03
HI	6.06E-03	9.20E-03	2.49E-02			

Note: EXP – Non carcinogenic exposure intake of metals from *C. gariepinus*; THQ – Target hazard quotient of metals from *C. gariepinus*; HI – Hazard index.

MPI value based on the trace metals examined is ranged from 0.05 (Plastic tanks) to 0.30 (Ikpoba River).

Human Health Risk Assessment

The results of the exposure intake (EXP), target hazard quotient (THQ) and hazard index (HI) in consumers for non – carcinogenic risk assessment of the cultured and captured *C. gariepinus* is summarized in **Table 7**. The calculated HI values of 0.006 (Plastic Tanks) to 0.025 (Ikpoba Reservoir) did not exceed the threshold value of 1 (HI < 1). For carcinogenic risk assessment, calculated integrated cancerous risk (ICR) values which varied from 4.47×10^{-8} (plastic tanks) to 5.98×10^{-7} (Ikpoba Reservoir) were below the USEPA carcinogenic risk permissible limit value for humans (1×10^{-6}) (**Table 8**).

Discussion

The perceived preference among consumers for fishes harvested from the wild to those reared in captivity has influenced their purchasing cost, as the fishes caught from the wild are priced more than those reared in captivity (33). This is because many consumers Many consumers hold beliefs about fish that contradict scientific knowledge (34). The daunting challenge of surface water pollution in Nigeria, and its effect on the sustainability of capture fisheries, has necessitated the need for scientific information on the nutritional profile of cultured and captured *C. gariepinus*. Providing such data will not only help consumers make more informed and health-conscious purchasing decisions but also potentially enhance the economic value and competitiveness of aquaculture products in the market, supporting sustainable fisheries management.

Nutritional Composition

The nutritional composition of fish is the relative amounts of moisture, fat, protein, ash, carbohydrate and mineral contents (35, 36). In this study, the mean moisture content in the fillets of cultured and captured *C. gariepinus* were within the documented range of 60% to 80% for freshwater fishes (37), and it influences the taste, texture, weight, appearance and shelf life of fish (38). Nutritionally, fish is principally consumed because of its protein content which determines its wholesomeness and quality. Freshwater fishes generally contain protein content in the range of 16 – 20% of their wet weight (39). The mean protein content in the fillets of cultured and captured *C. gariepinus* indicate that they are good sources of dietary protein for human consumption (40). However, the protein content in fillets of cultured *C. gariepinus* (18.04%) was significantly higher than the protein contents in the fillets of fishes collected from the wild. Fishes are important dietary source of polyunsaturated omega-3 fatty acids which is important for improved cardiovascular and better infant health outcomes (41). The lipid contents (crude fat) in the cultured and captured fishes categorizes them as intermediate fat fishes (2 – 10% total fat), which implies that they are good sources of fish oils, with significant higher lipid content recorded in cultured *C. gariepinus*. The the ash content gives a measure of the total mineral content present in a foodstuff (33), the mean ash content in the fillets of cultured and captured *C. gariepinus* indicate that they are good sources of mineral elements. In comparing the protein and lipid contents of the cultured and captured *C. gariepinus* samples, the cultured fishes recorded significant higher protein and lipid contents than fish samples collected from the wild, which is indicative of higher nutritive value of the cultured fishes to consumers. The observed lower protein and lipid contents in captured fish samples from Owan and Ikpoba River is attributed to the influence of water quality on the nutritional composition of fishes, as Owan River and Ikpoba reservoir are slightly and heavily polluted respectively.

Fishes are good sources of essential mineral elements in a readily usable form, which are required for proper growth and development of the human body. In this study, the mineral contents - sodium, potassium, magnesium, calcium, iron and zinc in cultured *C. gariepinus* indicate that they are good sources of these mineral elements, as iron and zinc contents were within their respective permissible concentrations of 100 mg/kg (iron) and 30 mg/kg (zinc) in fish food (42). Comparatively, the mineral contents in the fillets of *C. gariepinus* harvested from the wild were significantly higher than the mineral contents in cultured *C. gariepinus*, and this can be attributed to the elevated levels of these elements in Ikpoba reservoir and Owan River due to water pollution (1, 2). The mineral contents in fishes are influenced by the amounts of these elements in the habitat waters (9).

Trace Metal Concentrations

Trace metals are elements that are present in small amounts in the environment and in living organisms. Factors such as feeding habits, fish size, species variation, position in the trophic structure and type of pollutants present in their aquatic environment have been identified to influence the uptake and accumulation of trace metals in fishes in the wild (23, 43). However, in aquaculture practice using groundwater, uptake and accumulation of trace metals in cultured fishes is mainly influenced by water quality and feed composition. In this study, essential trace metals-iron, zinc and copper contents in the fillets of

Table 8. Carcinogenic Risk Assessment associated with the consumption of cultured and captured *C. gariepinus*.

Metals	Plastic Tanks (TCEAFT)		Owan River		Ikpoba Reservoir	
	EXP	CR	EXP	CR	EXP	CR
Lead	3.61E-07	3.39E-09	9.86E-07	9.25E-09	4.93E-06	4.63E-08
Cadmium	9.86E-08	4.14E-08	6.57E-07	2.76E-07	1.31E-06	5.51E-07
ICR	4.47E-08	2.85E-07	5.98E-07			

Note: EXP – Carcinogenic exposure intake of metals from *C. gariepinus*; CR – Carcinogenic risk of metals from *C. gariepinus*; ICR – Integrated carcinogenic risk.

cultured and captured *C. gariepinus* were relatively low and did not exceed their respective WHO permissible content limits of 100 mg/kg for iron, zinc (30 mg/kg) and copper (2.50 mg/kg) in fish and fish products (42). Despite the importance of these trace metals to fish physiology and human nutrition, toxicological studies have reported negative effects of high contents of these metals on the physiology of fishes exposed to elevated levels of these metals in their habitats (44, 45, 46). For the non-essential trace metals – lead and cadmium; their lack of biological function in fishes and consumers necessitates that their detection levels be very low as they portend health risk to the fishes and consumers (47). The concentration levels of lead and cadmium in the cultured and captured *C. gariepinus* were very low when compared with their respective World Health Organization (WHO) permissible limit of 0.5 mg/kg (lead) and 0.15 mg/kg (cadmium) for fish food. The recorded low levels of these essential and non-essential trace metals in both cultured and captured *C. gariepinus* is indicative of their low concentrations in the water bodies and also makes the fishes good sources of mineral elements for consumers. In comparison with reported studies, elevated levels of iron, zinc, copper, cadmium and lead contents have been reported in captured *C. gariepinus* which was attributed to the levels of these metals in the various water bodies (48, 49).

Metal Pollution Index (MPI)

The Metal Pollution Index (MPI) has gained interest as valuable tool for estimating trace metal contamination within a biota as it gives an indication of the magnitude of bioaccumulation of trace metals in the biota and its implication on food safety (19). In this study, the MPI value for the fillets of *C. gariepinus* from plastic tanks (0.05), Owan River (0.12) and Ikpoba reservoir (0.30) were very low. This is indicative of non-significant bioaccumulation of trace metals in the cultured and captured fishes and also guarantees the food safety to consumers. However, higher MPI values particularly in the fillets of *C. gariepinus* from Ikpoba River is indicative of the increased level of heavy metal accumulation in fishes and heavy metal pollution of the fish habitat water (11). In a similar study, high MPI values of 5.94 and 5.28 were reported in the fillets of captured *Tilapia zillii* and *Synodontis schall* respectively (50).

Human health risk assessment

The consumption of contaminated foodstuffs has been identified as one the sources of human exposure to metal toxicity and associated non – carcinogenic and carcinogenic health risk (51). In this study, the probability of non – carcinogenic health risk (HI) through the consumption of the cultured and captured fish meat indicate that the fishes are safe for consumption (THQ values < 1; HI < 1). Also, the estimated integrated carcinogenic risk (ICR) value for the cultured and captured *C. gariepinus* did not exceed carcinogenic risk value for humans (1×10^{-4}) and classified the consumption of the fishesas extremely low risk (Grade I). This implies that consumers are not predisposed to non-carcinogenic and carcinogenic health risk from trace metal contents in *C. gariepinus* gotten from the sources in this study. Although the consumption of the cultured and captured *C. gariepinus* poses no health risk to consumers, higher risk values recorded for captured *C. gariepinus* in the study is an indication of the influence of habitat water quality on trace metal contents in fishes.

Conclusion

The contribution of aquaculture to human nutrition, and the need for consumers' reorientation on their preferential bias towards capture fisheries, with concerns on nutritive value and food safety has necessitated this study. This study determined and compared the nutritional profile and human health risk assessment of adult size African catfish (*C. gariepinus*) cultured in plastic tanks with those harvested from the wild. Results showed the protein and lipid content values of cultured *C. gariepinus* were significantly higher than reported values in *C. gariepinus* from the wild, which makes the cultured fishes of more nutritional value to consumers. Captured fishes reported higher ash content, mineral composition and trace metal contents, which was attributed to the elevated levels of these elements in their harvest waters as a consequent of water pollution. Low metal pollution index in the cultured and captured fishes indicated an insignificant bioaccumulation of trace metals, and the absence of non – carcinogenic and carcinogenic risks associated with their consumption. Although the captured fishes at present poses no health risk to consumers; their recorded higher contents of trace metals, MPI, HI and CPI values is a cause for concern on the safe consumption of capture fishes due to water pollution. This study has shown that the consumption of *C. gariepinus* cultured in plastic tank facilities is more nutritious and guarantees food safety to consumers. Therefore, it is recommended that more monitoring studies be carried out on the influence of different culturing methods and settings on the nutritional composition and food safety of cultured fishes. As this will provide more information for policy decision on aquaculture practices that will guarantee nutritious fish availability and food safety to consumers in Nigeria. Also, concerted efforts should be made in enlightening consumers on the health benefits associated with the consumption of cultured fishes, as this will increase the market value of cultured products.

Declaration

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Conflict of Interest
The authors declare no conflicting interest.

Data Availability
The data generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Statement
Ethical approval was not required for this study.

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