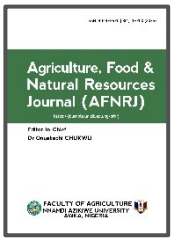
Agr. Foo. Nat. Res. J. Volume 5, Issue 2, Page: 185-192

e-ISSN: 1597-7153 | p-ISSN: 3043-5420

Agriculture, Food and Natural Resources Journal

The Official Journal of the Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Nigeria

Journal homepage: https://journals.unizik.edu.ng/afnrj



Original Article

Ichthyofaunal composition of Obot Etim river, Akwa Ibom State, Nigeria

OPEN ACCESS

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DOI: https://doi.org/10.5281/zenodo.24246691

Editor: *Onyekachi CHUKWU, Nnamdi Azikiwe University, NIGERIA*

Received: *July 29, 2026*
Accepted: *September 27, 2026*
Available online: *September 30, 2026*

Peer-review: *Externally peer-reviewed*

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Conflict of Interest: *The authors have no conflicts of interest to declare*

Financial Disclosure: *The authors declared that this study has received no financial support.*

ABSTRACT

This study assessed the ichthyofaunal composition and diversity of Obot Etim River, a tributary of the Lower Cross River Basin in Akwa Ibom State, Nigeria. Fish samples were collected twice monthly from August 2024 to January 2025 and identified using standard taxonomic keys. A total of 246 fish specimens comprising 27 species, 20 genera, and 16 families were recorded. Data were analyzed using relative abundance and biodiversity indices. The family Cichlidae was the most abundant, accounting for 34.55% of the total catch, followed by Alestidae (20.73%), Latidae (17.07%), Claroteidae (8.13%), and Mormyridae (6.91%). At the species level, Brycinus nurse and Lates agassizii were the most abundant, each contributing 17.07% of the total catch, whereas Clarias senegalensis, Citharichthys stampflii, Synodontis nigriventris, Eleotris vittata, Penaeus spp., Ctenopoma kingsleyae, and Heteromycteris proboscideus were the least abundant, each represented by a single individual. Biodiversity assessment yielded a Shannon-Wiener diversity index (H') of 2.677, Simpson's dominance index (D) of 0.0958, Margalef's species richness index (d) of 4.72, and Pielou's evenness index (J') of 0.81. These values indicate moderate to high species diversity, considerable species richness, low species dominance, and a relatively even distribution of individuals among species. The findings suggest that Obot Etim River supports a healthy and balanced fish community with significant fisheries potential. Sustainable management measures, including regulated fishing effort, enforcement of appropriate mesh sizes, and protection of critical habitats, are recommended to ensure long-term conservation and sustainable utilization of the river's fisheries resources.

KEYWORDS: *Fisheries resources, Diversity index, Lower cross river basin, Potentials*

INTRODUCTION

The idea of types and proportions of fish species present in an ecosystem or region of water is often described in terms of big rivers or oceans, despite the fact that different fish species can be seen in smaller rivers including their tributaries, (Tonye *et al.*, 2023). Every year, various fish species, by estimation up to 13 species from different families can be observed in sub-rivers of the world. This includes those within the Niger Delta region of Nigeria including Akwa Ibom and Cross River States (Orose & Kenneth 2021). Some studies have also highlighted the importance of understanding ichthyofaunal composition in fresh water ecosystem. Effective conservation and management of aquatic ecosystems require an integrated approach that considers both ecological status and ichthyofaunal composition. This involves protecting and restoring habitats, managing human activities such as fishing and pollution, and promoting sustainable practices that support ecosystem health (Verma 2025). Analyzing fish communities provide insights into the health and functioning of aquatic ecosystems, (Meng *et al*., 2020).

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The study of species composition is essential for the future sustainability of marine natural properties which contain commercial fisheries. Fisheries that exploit a range of species may have more stable catches than fisheries that exploit a single species (Dan kishiya *et al.*, 2016). Fish samples were gotten from artisanal fishermen from the study area for six months starting from August 2024 to January 2025. There is dearth of information on the fish assemblage or composition in Obot Etim River, it is rarely mentioned in scientific studies despite being a tributary of the popular Cross River. This justifies the choice for the study in the water body on ichthyofaunal composition, Hence, this baseline study in the area.

MATERIALS AND METHODS

Study Area

The Obot Etim River a tributary of the Cross River in Itu Local Government in Akwa Ibom State, Nigeria. Located at approximately between $5^0$11'53N latitude and $7^0$58'34E longitude and $5^0$11'57N latitude and $7^0$59'51E longitude, the area is characterized by tropical humid climate with moderate temperatures and high rainfall especially during the months of June to August. The study area is bounded in the North and North-East by Odukpani in the Lower Cross River basin. It is bounded by Cross River State to the North, Ibiono Ibom Local Government Area to the West, Uruan Local Government Area to the East and Uyo Local Government Area to the South. The Obot Etim River experiences water level fluctuations that are most pronounced during the dry season and during the rainy season, the river flow becomes unidirectional, with increased current velocity (Obot, 2011). The river serves useful purposes like being a source of livelihood for artisanal fishermen, being a travel route between the riverine communities, source of water for the communities and a medium for waste disposal.

Fish Sample Collection and Preservation

Sampling was done twice a month for a period of six months (August 2024 to January 2025). Fish samples were randomly bought from selected artisanal fishermen landings whose fishing gear were mainly trap net. Fish samples collected were preserved in 10% formaldehyde solution in well labelled containers and transported to the Department of Fisheries and Aquatic Environmental Management Laboratory University of Uyo for identification and measurement.

Fish Identification and Measurement

All preserved samples were removed from the formaldehyde solution, rinsed in clean water and placed slanting with the mouth down to drain out excess fluid for about 5-10 minutes prior to identification. Specimens were identified to species levels using Standard Identification Manual and Fish Based Database as provided by (Olaosebikan & Raji, 2013) and (Froese & Pauly, 2024). A total of two hundred and forty-six (246) fish specimens were identified.

Species Diversity Computation

Relative Abundance Score (RAS)

This was determined using the method of Taira *et al.,* (2024). Thus:

>10% = Dominant
1-9% = Subdominant
<1% = but caught more than once = occasional
<1% = but caught only once = rare

Shannon-Weiner's Diversity Index (H')

$$H' = -\Sigma (p_i \times \ln p_i) \quad (1)$$

where $p_i = n/N$, *n = individuals in each taxon, N = Total number of individuals*

Simpson's Dominance (D)

$$D = \Sigma p_i^2 \quad (2)$$

where $p_i = n/N$, *n = individuals in each taxon, N = Total number of individuals*

Margalef's Richness Index (d)

$$d = (S - 1) / \ln N \quad (3)$$

where S = number of species, N = Total number of individuals

Pielou's Evenness (J')

$$J' = H' / H'_{max}$$

where H' = Shannon Weiner index, $H'_{max} = \ln S$

RESULTS

The ichthyofaunal composition of Obot Etim River, Nigeria is characterized by a rich and varied fish species assemblage. The families of the identified fish comprised one or more species which differ in number from each other. Table 1 indicates the distribution of fish, species sampled as well as the relative abundance score in Obot Etim River, Nigeria.

Ichthyofaunal composition of Obot Etim River

From Table 1, a total of two hundred and forty - six (246) fish specimens were collected during the study period, consisting of sixteen (16) families, twenty (20) genera and twenty - seven (27) species (including one shrimp species *Peneaus spp*). The most numerically dominant species were *Brycinus nurse* (42), *Lates agassizii* (42), *Hemichromis longifilis* (26), and *Hemichromis fasciatus* (22). These four species alone accounted for over 54% of the total specimens sampled, indicating their ecological dominance in the sysvvwtem during the sampling period. Several species, such as *Citharichthy stampfilis, Clarias senegalensis, Ctenopoma, Eleotris vittata,* and *Heteromycteris proboscideus,* were represented by only a single specimen, suggesting they may be either rare, transient, or poorly sampled due to gear selectivity or specific habitat preferencesZ

Table 1: Table showing fish species sampled in Obot Etim River, Nigeria

SN	Family/Species	Common Name	Number of individuals	%	Abundance Score
1	Alestidae				
i	*Brycinus nurse* (Ruppell, 1832)	Nurse tetra/African tetras	42	17.07	Dominant
ii	*Alestes nurse* (Ruppell, 1832)	Nurse tetra	6	2.44	Sub-dominant
iii	*Alestes baremoze* (Joannis, 1835)	Baremoze tetra	3	1.22	Sub-dominant
	Total Alestidae		51		
2	Anabantidae				
i	*Ctenopoma kingslayae* (Gunther, 1896)	Tailspot ctenopoma	1	0.41	Rare
	Total Anabantidae		1		
3	Cichlidae				
i	*Heterobranchus longifilis* (Valenciennes, 1840)	Vundu catfish/Sampa	26	10.57	Dominant
ii	*Heterobranchus. fasciatus* (Peters, 1857)	African catfish	22	8.94	Dominant
iii	*Oreochromis niloticus* (Linnaeus, 1758)	Nile tilapia	13	5.28	Dominant
iv	*Pelvicachromis pulcher* (Boulenger, 1901)	Rainbow kribensis	5	2.03	Sub-dominant
v	*Pelvicachromis taeniatus* (Boulenger, 1901)	Striped kribensis	10	4.07	Sub-dominant
vi	*Heterotis niloticus* (Cuvier, 1829)	African bonytongue/ Arowana	9	3.66	Sub-dominant
	Total Cichlidae		85		
4	Clariidae				
i	*Heterobranchus longifilis* (Valenciennes, 1840)	Vundu	4	1.63	Sub-dominant
ii	*Clarias Senegalensis* (Valenciennes, 1840)	Senegal mud catfish	1	0.41	Rare
	Total Clariidae		5		
5	Claroteidae				
i	*Chrysichthys auratus* (Geoffroy Saint-Hilare, 1809)	Golden Nile catfish	17	6.91	Dominant
ii	*Chrysichthys longipinnis* (Boulenger, 1899)	Longfin catfish	3	1.22	Sub-dominant
	Total Claroteidae		20		
6	Cyprinidae				
i	*Barbus senegalensis* (Steindachner, 1870)	Senegal barb	2	0.81	Occasional
	Total Cyprinidae		2		
7	Eleotridae				
i	*Eleotris vittata* (Dumeril, 1861)	Striped sleeper goby	1	0.41	Rare
	Total Eleotridae		1		
8	Hepsetidae				
i	*Hepsetus odoe* (Bloch, 1794)	African pike characin	4	1.63	Sub-dominant
	Total Hepsetidae		4		
9	Latidae				
i	*Lates agassizii* (Steindachner, 1895)	Nile perch	42	17.07	Dominant
	Total Latidae		42		
10	Mochokidae				
i	*Synodontis nigriventris* (David, 1936)	Blotched upside-down catfish	1	0.41	Rare
ii	*Synodontis nigrita* (Valenciennes, 1840)	False upside-down catfish	2	0.81	Occasional
	Total Mochokidae		3		

11	Mormyridae				
i	*Hyperopisus bebe* (Lacepede, 1803)	Bebe elephantfish	17	6.91	Dominant
	Total Mormyridae		17		
12	Paralichthyidae				
i	*Citharichthys stampflii* (Steindachner, 1894)	West African flounder	1	0.41	Rare
	Total Paralichthyidae		1		
13	Penacidae				
i	*Peneaus spp* (Fabricius, 1798)	Penaeid shrimp/prawn	1	0.41	Rare
	Total Penacidae		1		
14	Polypteridae				
i	*Erpetoichthys calabaricus* (Smith, 1864)	Reedfish/Ropefish	3	1.22	Sub-dominant
	Total Polypteridae		3		
15	Schilbeidae				
i	*Schilbe senegalensis* (Gunther, 1864)	Senegal schilbe	6	2.44	Sub-dominant
ii	*Schilbe mystus* (Linnaeus, 1758)	African butter catfish	3	1.22	Sub-dominant
	Total Schilbeidae		9		
16	Soleidae				
i	*Heteromycteris proboscideus* (Chabanaud, 1925)	West African sole	1	0.41	Rare
	Total Soleidae		1		
	Total		246	100	

Field data

Relative abundance and abundance scores of the species

The relative abundance amongst species in terms of number revealed that the catch was dominated by *Brycinus nurse (*42 specimens, 17.07%*), Lates agassizii* (42 specimens, 17.07%), followed by *Hemichromis longifilis* (26 specimens, 10.57%), *Hemichromis fasciatus* (22 specimens, 8.94%), *Chrysichthys auratus* (17 species, 6.91%), *Hyperopisus bebe* (17 species, 6.91%) and the least were *Clarias senegalensis, Citharichthy stampfilis, Synodontis nigriventris, Eleotris vittata, Peneaus spp, Ctenopoma* and *Heteromycteris proboscideus* (0.41%) all occurring once. The abundance score indicated that four (4) species were dominant, fifteen (15) species were Sub dominant, two (2) species were occasional and six (6) species were rare (Table 1).

Monthly abundance in the number of fish species sampled in Obot Etim River

Monthly species abundance was observed to be highest in the family Cichlidae in September (30 specimens; 12.20%) and was closely followed by Latidae (26 specimens; 10.57%) in January. The absence of specimens was recorded across many families in some months (Table 1). For instance, for Claroteidae, two months (October and November) were without specimens. Alestidae lacked specimen only in the month of November. Two months September and November lacked specimens in Latidae. Among the Clariidae, three months (November, December and January) were without specimens. Among the Schilbeidae, four months were without specimens (August, October, November and December). September, November and January were without specimens for the family Hepsetidae. Mormyridae lacked specimens in August, November and January. For the family Mochokidae, months without specimens were: September, November, December and January. Seven families (Paralichthyidae, Eleotridae, Cyprinidae, Penacidae, Anabantidae, Polypteridae and Soleidae) had only one monthly occurrence amongst others.

Intra-family abundance among the Alestidae showed highest in January (20 specimens; 8.13%). Among the Cichlidae, intra-family abundance was highest in September with 30 specimens (12.20%) but in the family Claroteidae, highest intra - family abundance was revealed in August with 8 specimens (3.25%) whereas in Clariidae highest intra -family abundance was observed in September with 3 specimens (1.22%). Then mono-species Latidae showed highest abundance in January (26 specimens; 10.57%).

Temporal and seasonal variation of the Ichthyofauna composition of Obot Etim River

Temporal variations revealed that highest occurrence was in September (70 specimens; 28.46%) with a mean value of (2.59±0.67), followed by January (58 specimens; 23.58%) (2.15±1.20), August (49 specimens; 19.91%) (1.81±0.52); December (26 specimens; 10.57%) (0.96±0.34) and November (24 specimens; 9.76%) (0.89±0.65) while October recorded the least (19 specimens; 7.72%) (0.70±0.29) (Table 1).

Seasonal abundance showed highest during the wet season (138 specimens; 56.09%) than during the dry season (108 specimens; 43.91%) as depicted in Fig. 2. Only three species (*Schilbe senegalensis, Heteromycteris proboscideus, Erpetoichthyes calabaricus*) were absent in the wet season whereas 16 (*Aleste baremose, Alestes nurse, Barbus senegalensis, Chrysichthys longipinnis, Citharichthy stampfilis, Clarias senegalese, Ctenopoma, Eleotris vittata, Hemichromis niloticus, Heterobranchus longifilis, Oreochromis niloticus, Pelvicachromis pulcher, Pelvicachromis taeniatus, Schilbe mystus, Synodontis nigrita, Synodontis nigriventris*) where found missing during the dry season.

Table 2 presents the ichthyofaunal diversity of the study area. The Shannon-Wiener diversity index (H' = 2.677) suggests moderate to high species diversity, while the low Simpson's Index (D = 0.0958) indicates that no single species overwhelmingly dominates the fish assemblage. The Margalef's species richness index (d = 4.72) reflects a substantial level of species richness, and the Pielou's evenness index (J' = 0.81) shows that individuals are fairly evenly distributed among the species present.

Table 2: Ichthyofaunal Diversity Indices of Obot Etim River, Nigeria

Sn	Diversity Indices	Values
1	Number of families	16
2	Number of species	27
3	Number of genera	20
4	Number of fish	246
5	Shannon - Wiener's diversity index (H')	2.677
6	Simpson's Index (D)	0.0958
7	Margalef's index of species richness (d)	4.72
8	Pielou's species evenness index (J')	0.81

DISCUSSION

The ichthyofaunal assessment of Obot Etim River, Nigeria, revealed a relatively diverse fish community comprising 246 individuals belonging to 27 species, 20 genera, and 16 families. The diversity metrics obtained from the study indicate a healthy aquatic ecosystem with moderate to high species diversity. The Shannon-Wiener diversity index (H') was 2.677, the Simpson's index (D) was 0.0958, Margalef's species richness index was 4.72, and Pielou's evenness index was 0.81. These values suggest that the fish community is characterized by appreciable species richness and a fairly equitable distribution of individuals among species. While there is a notable paucity of prior studies specifically documenting fish species composition and abundance within this River system, the present findings provide a valuable baseline for future ecological assessments.

The diversity indices recorded for the river- H' = 2.677; D = 0.0958; d = 4.72; J' = 0.81 indicate a moderately high level of fish diversity, species richness, and evenness. The Shannon-Wiener diversity value obtained in this study is higher than that reported for the upstream and downstream reaches of Kwa Falls, Cross River State, where Shannon diversity values ranged from 0.75 to 1.74 (Ndome *et al.,* 2021), and those reported for the disturbed Okwii and Ikwo Rivers in Ebonyi State, where Shannon diversity values ranged from 0.685 to 1.145, reflecting reduced species diversity and ecological stress associated with mining impacts. This suggests that Obot Etim River supports a more diverse and stable fish assemblage. Similarly, the diversity recorded in the present study exceeds that reported for River Uke, Nasarawa State, where a Shannon-Wiener index of 2.312 was observed despite the presence of 2,126 fish specimens (Alamba *et al.,* 2016). The higher diversity observed in Obot Etim River may be attributed to favorable habitat conditions, adequate food availability, and relatively lower ecological disturbance. Although the diversity observed in Obot Etim River is substantial, it is lower than values reported for larger and more heterogeneous Nigerian river systems. For instance, the Makurdi section of River Benue recorded higher Shannon diversity values (H' = 3.533-3.581) and a greater species richness of 39 species belonging to 17 families, reflecting the influence of larger habitat size, greater habitat complexity, and broader ecological niches (Gande *et al.,* 2026). Similarly, Ikere-Gorge in Oyo State was reported to contain 41 fish species distributed among 13 families, indicating a richer fish fauna than that recorded in the present study (Ajagbe *et al.,* 2021).

Family composition showed considerable variation across the study period. The family Cichlidae was the most abundant, contributing 85 individuals (34.55%) of the total catch. The dominance of the family Cichlidae in the study further aligns with findings from various other studies across Nigeria, including those by Ekpo *et al.* (2012), who noted that the most abundant family in terms of number of species was Cichlidae (12 species; 26.67%). Olaosebikan & Raji (2021), Dodeye *et al.* (2023), Umoh *et al* (2024) all recorded similar dominance of Cichlids in their various studies. In the same vien, the works of Kamolefe & Arawomo (2008) on Osinmo Reservoir, Osun State recorded that Cichlids was the most diversified in Kangimi Lake with 5-species representation. Isemin *et al.* (2023) also noted that cichlids were the most diversified (5 - species) and dominated by *Oreochromis niloticus* in their study. This dominance may be attributed to the ecological adaptability of cichlids, their tolerance to varying environmental conditions, diverse feeding habits, and high reproductive potential. They also exhibit good parental care, such as mouth brooding to protect fertilized eggs. Other factors contributing to their dominance include high juvenile and adult survival rates, strong competitive abilities, adaptability to various food sources, population resilience against predation and other population decline forces, as well as their ability to thrive in both lotic and lentic ecosystems, along with adaptations to changes in hydrological regimes (David *et al.,* 2025). Similar dominance of cichlids has been reported in many tropical freshwater systems where these species successfully exploit available ecological niches (Nwani *et al*., 2015).

The ichthyofaunal composition of the Obot Etim River, compares favorably with other freshwater ecosystems within the Niger Delta region and beyond. For instance, Akpan (2013) reported 26 species belonging to 14 families from Uta-Ewa Creek in Akwa-Ibom State which closely mirrors the species richness and taxonomic spread observed in the present study. Olopade *et al.* (2017) reported 25 species belonging to 18 families from Bonny River in Rivers State. Isemin *et al.* (2023) recorded a total of 178 individuals of fish species belonging to 14 families and 25 species from Eniong River, South Eastern Nigeria**.** These numbers indicate that the species richness in Obot Etim River is within the expected range for moderately productive aquatic habitats in southern Nigeria.

The families Alestidae and Latidae were also highly represented, accounting for 51 and 42 individuals, respectively. Their substantial contribution to the total catch emphasizes their ecological importance and adaptation to the riverine environment. The prevalence of these species suggests that environmental conditions within the river favor their persistence and successful reproduction. Their dominance may also indicate the availability of suitable habitats, food resources, and breeding grounds within the river ecosystem.

The coexistence of dominant and sub-dominant species is characteristic of stable aquatic systems where ecological resources are shared among different trophic groups (Welcomme, 2001).

Conversely, some species such as *Ctenopoma kingslayae, Clarias senegalensis, Eleotris vittata, Synodontis nigriventris, Citharichthys stampflii, Penaeus spp*., and *Heteromycteris proboscideus* were represented by only one individual each and were categorized as rare species. The occurrence of rare species may be associated with habitat specialization, seasonal movements, low population densities, or sampling limitations. The presence of these species, however, is ecologically important because rare taxa contribute significantly to biodiversity and ecosystem resilience (Magurran, 2004). The variations in the number of species fish identified in studies could be attributed to the sampling methods, duration of sampling and topography of the aquatic systems (Olopade *et al.,* 2017), number of researchers, sampling intensity, season (Ekpo *et al.,* 2023) and type of fishing gear used during sampling periods as fishermen tend to target fish species of higher economic value (Ohaturuonye *et al.,* 2024).

The diversity indices further confirm the ecological status of the river. The Shannon-Wiener index value of 2.677 indicates moderate to high species diversity, while the evenness index value of 0.81 demonstrates that individuals were relatively evenly distributed among species. Likewise, the low Simpson's index value (0.0958) suggests low species dominance and a high probability of encountering different species when sampling. The richness value (4.72) further indicates that the river supports a diverse fish assemblage. These findings imply that the river ecosystem is capable of sustaining a wide range of fish species and ecological interactions.

CONCLUSION AND RECOMMENDATIONS

The Obot Etim River hosts a varied fish population with unique seasonal and temporal abundance patterns likely due to ample food availability and suitable environmental conditions. The results demonstrate that Obot Etim River supports a diverse and relatively well-balanced fish community. The presence of dominant, sub-dominant, occasional, and rare species reflects ecological heterogeneity and habitat suitability within the river. Nevertheless, the low abundance of certain species suggests the need for continuous monitoring, habitat protection, and sustainable fisheries management practices to maintain biodiversity and ecological integrity. Overall, these indices suggest that the Obot Etim River supports a diverse, species-rich, and relatively balanced fish community, which may indicate favorable ecological conditions and habitat quality.

The conservation and sustainable management of the river's fish resources require the implementation of effective fisheries regulations, including the use of appropriate mesh sizes, restrictions on destructive fishing practices, and control of fishing pressure. Regular monitoring of fish diversity, abundance, and community structure should be carried out to identify ecological changes and potential threats. In addition, the protection and restoration of critical habitats such as riparian vegetation, spawning grounds, and nursery areas are essential for maintaining healthy fish populations. Efforts should also be made to regulate activities that degrade water quality and aquatic habitats, including pollution, agricultural runoff, and uncontrolled sand mining. Furthermore, raising awareness among local communities about the ecological and economic value of fish biodiversity and encouraging their participation in conservation initiatives will promote the sustainable use and long-term preservation of the river's fisheries resources.

Acknowledgements

The authors acknowledge all who contributed to the success of this study. The youth leader of Obot Etim community Mr Aniekan Uko and Mr Ekong Udoh, the fisherman is hereby acknowledged. Also, the lab scientist who assisted with the fish identification – Mr Bassey as well as Mr Tiandibot are all appreciated for their support during the course of this work.

Authors' Contributions

PST & EMU managed the literature searches, managed data collection, interpretation of data, writing of manuscript, material support, and review of manuscripts and wrote the first draft of the manuscript. Authors IEE & MEI reviewed the manuscripts and approved the final draft of the manuscript. All authors read and approved the final manuscript.

Ethical Statement

Not applicable

AI Declaration Statement

The authors declare that no Artificial Intelligence (AI) tools were used in the generation, analysis, interpretation, or writing of this manuscript.

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