ISSN 2504-9593
DOI: 10.5281/zenodo.18760107
https://ijree.com/index.php/publications/article/view/38
Int. J. Renew. Energ & Environ Vol.4 (1), pp 160-171(2026)

OTHER EFFECTIVE AREA BASED CONSERVATION MEASURES (OECM's) IN OSUN STATE: A DELPHI STUDY TO MITIGATE CLIMATE CHANGE.

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Abstract
Other Effective Conservation Measures (OECMs) are crucial for both sustainable biodiversity use and climate change mitigation. OECM sites in Osun State were identified as a measure for biodiversity conservation using delphi research, an organized method intended to extract the insights of experts. This paper identified 14 OECM in the study area, using the global positioning system receiver to obtain geographic coordinates. The landforms and associated ecosystems were captured through direct field observations and photographs while the assessment of meeting up with the OECM standard was done using the CBD Criteria, out of which only 8 sites met the CBD criteria. The study came to the conclusion that OECMs offer a worldwide framework for identifying, enhancing, and supporting additional designations of conservation areas. Additionally, they fortify the governance and management systems now in place. OECMs help achieve CBD Aichi Target 11, according to the study. It also suggested that policies boost the legitimate authorities' ability to govern in order to promote OECMs.

Keywords: Other Effective Conservation Measures, Sustainable biodiversity, Climate change mitigation, CBD Aichi Target 11 and Sustainable conservation.

1. INTRODUCTION

Background to study

From the Rio Conventions, the Convention on Biological Diversity (CBD) to the Millennium Development Goals (SDG), and the recent Sustainable Development Goals, the use of targets in global environmental governance (Harrop & Pritchard 2011; Campbell *et al.,* 2014; Velazquez Gomar, 2014) and international development (Roberts, 2005; Le Blanc, 2015) has risen in recent decades. Convention on Biological Diversity's Strategic Plan for Biodiversity 2011–2020 (CBD, 2010) has provided the overarching framework for the conservation and sustainable use of biodiversity over the last decade, chiefly through the establishment of the 20 Aichi Biodiversity Targets. The Strategic Plan for Biodiversity 2011–2020 according to (CBD 2010) in Aichi Target 11 states that by 2020, at least 17% of the terrestrial areas should be conserved through "ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures" (OECMs – emphasis added) (CBD, 2010).

Yet despite the important role of OECMs, the Aichi Target 11 states 2020 strategic plan provided no official guidance on what OECMs were or how to recognize or report them (Jonas *et al*., 2014; Owolabi et al., 2024). The CBD defines a protected area as: "A geographically defined area which is

designated or regulated and managed to achieve specific conservation objectives" (CBD Article 2). IUCN has a more detailed definition: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008). The CBD and IUCN recognize the two as being equivalent in practice as in both cases these areas are intended to achieve in-situ conservation. The most important difference between PA and OECMs is that while the former should have biodiversity conservation as a primary objective, an OECM must deliver biodiversity conservation regardless of its main objective (CBD, 2018; (Lopoukhine and Dias, 2012).

The concept of OECMs, first enumerated in Aichi Target 11, offers a chance to conserve a large proportion of the planet without causing a humanitarian crisis, undermining human rights or creating massive political resistance. Which can lead to a politically unstable and practically non-viable protected area system. The concept of OECM's provides an opportunity that safeguards and recognize support for existing efforts that are contributing to conservation, with the aim of respecting human rights and a diversity of worldviews and governance approaches (Table 1).

This includes those territories and areas conserved by indigenous peoples and local communities where the traditional owners do not wish to be within the protected areas system (Jonas *et al*., 2017). OECMs are area-based approaches that provide measurable and sustained biodiversity conservation without protected area status, either because protection is ancillary (i.e, it arises as a by-product of other objectives) or because the governing body is managing for conservation but does not wish to be recognized as a protected area.

By gaining official recognition as an OECM, this will help encourage managers to maintain these systems in the long term. It is likely that OECMs, or some equivalent approach, will not only be helpful but essential in reaching the ambitious conservation targets identified as required. The implications of bringing OECMs and similar non-traditional conservation tools into global targets are, however, revolutionary in both the scale of ambition and the new range of skills and knowledge required to pull it off. Premised on the facts is this study designed with the aim of assessing potentials of other effective area-based conservation measures (OECM) in achieving global target for protected areas in Osun State, Nigeria.

2.0 METHODOLOGY

2.1 Study Area

Osun is an inland state in south-western Nigeria. Its capital is Osogbo, bounded in the north by Kwara State, in the east partly by Ekiti State and partly by Ondo State, in the south by Ogun State and in the west by Oyo State. The modern Osun State was created on August 27, 1991, from part of the Old Oyo State. The state's name is derived from the River Osun, the venerated natural spring that is the manifestation of the Yoruba goddess of the same name. The state consists of thirty (30) Local Government Areas and Area offices, the primary (third tier) unit of government in Nigeria (Owolabi et al., 2021).

The study was carried out in 13 local government areas (LGAs) in Osun State Nigeria. They include Ede north, Irewole, Ayedade, Obokun, Atakumosa, Ifedayo, Oriade, Irepodun, Odo Otin, Ayedire, Inisha, Ejigbo, Ife north and Boripe.

2.2 Method of Data Collection

The survey was conducted using semi-structured interview conducted between March 2023 and October 2023. A purposive sampling method by (Babbie 2001) was adopted based on CBD criteria for OECM (landmass, geographically defined, biodiversity, well managed, governed, effective and associated values) and respondents with multiple years of experience in the management of the identified OECMS were the focus of the study.

2.3 Sampling Procedure

To assess and identify each OECM site, A CBD screening tool (Strategic Plan for Biodiversity 2011–2020 as a framework for the effective implementation of the Convention on Biological Diversity) was used to determine a 'potential OECM. The assessment tool was used which enables a rigorous application of the criteria of an OECM (CBD, 2018). The assessment tool contains criteria-based questions which is intended to accommodate variability across country contexts and the uniqueness of OECM.

2.4 Data Analysis Techniques

Data obtained was analyzed descriptively using analysis and percentage distribution. Percentage distribution is a frequency in which the individual class frequencies are expressed as a percentage of the total frequency equated to $\frac{F}{N} \times 100$

After the collection of the data, Quantum geographic information system software (QGIS) was used to produce a map indicating the OECM site and those that meet all the CBD criteria (QGIS Development Team, 2023).

3.0 RESULT AND DISCUSSION

In this paper, OCEMs' sites in Osun State were identified and surveyed between March 2023 and October 2023. Out of the 30 LGAs in Osun State, 13 local governments areas were picked as potential OECM sites from a reconnaissance survey. The identified LGAs and the potential OECM sites are Ede north (Igbo Sango), Irewole (Atamora cave and bird watching center), Ayedade (Eleku shrine), Obokun (Kiriji battle field Imesi Ile), Atakumosa (Ibodi Ilesha monkey forest), Ifedayo (Ayikunugba waterfall), Oriade (Erin Ijesha waterfall), Irepodun (Erinle shrine), Ayedire (Oore shrine), Inisha (Otin shrine), Ejigbo (Ogiyan shrine and cave), Ife north (Ife groove and shrine and Opa Oranmiyan), Boripe (Oke Iragbiji shrine and cave). The study reveals that of the total landmass of Osun State, OECMs sites covered just 9.85km^2 (0.1%) out of a total of 9,251km^2. The findings of the present examination are displayed in Table 2.

TABLE 2: Other Effective Conservation Area Management (OECMs) Checklist in Osun State.

S/N	OECM	LGA	Town	Latitude	Longitude	Landmass
1	Igbo Sango	Ede north	Ede	7^0 45'15"N	4^0 25'50"E	0.15km^2
2	Atamora cave	Irewole	Ikire	7^0 22'52"N	4^0 11'32"E	1.5km^2
3	Eleku shrine	Ayedade	Gbongan	7^0 31'42"N	4^0 23'10"E	0.2km^2
4	Kiriji battlefield	Obokun	Imesi ile	7^0 55'40"N	4^0 39'25"E	0.55km^2
5	Ibodi Monkey Forest	Atakumosa	Ibodi	7^0 35'00"N	4^0 40'00"E	2.0 km^2
6	Ayikunugba waterfall	Ifedayo	Oke-Ila Orangun	7^0 45'16"N	4^0 45'19"E	1.5km^2
7	Erin Ijesha waterfall	Oriade	Erin Ijesha	7^0 33'43"N	4^0 53'19"E	2.5km^2
8	Erinle shrine	Irepodun	Ilobu	7^0 49'00"N	4^0 28'00"E	0.1 km^2
9	Otin shrine	Odo Otin	Inisha	7^0 50'60"N	4^0 19'59"E	0.15 km^2
10	Oore shrine	Ileogbo	Ayedire	7^0 47'00"N	4^0 13'00"E	0.1 km^2
11	Ogiyan shrine and groove	Ejigbo	Ejigbo	7^0 52'29"N	4^0 17'31"E	0.2km^2
12	Oke iragbiji shrine and cave	Boripe	Oke Iragbiji	7^0 54'00"N	4^0 40'60"E	0.15km^2
13	Ife groove and shrine	Ife north	Ife	$7^0$48'08"N	4^0 55'96"E	0.025km^2
14	Opa Oranmiyan	Ife north	Ife	7^0 56'52"N	4^0 32'52"E	0.5km^2

In table 3, the identified OCEM sites in the study area were profiled and described using the criterion identified by CBD. The identified OECM sites were confirmed not recognized as a protected area. They were further profiled on the level of governance and management. The governance was done at various levels; Governance by private individuals, organisations or companies; or by indigenous peoples and/or host local communities; and Shared governance following the report of CBD and Dudley, (2008); Borrini-Feyerabend et al., (2013).

The sites were also profiled and accessed on sustenance and effectiveness of contribution to in situ conservation of biodiversity. Finally, the sites were highlighted for their associated ecosystem functions and services, culturally, spiritually and socio-economically and other locally relevant values. The result further reiterates the report of IUCN-WCPA 2019 and Owolabi *et al.,* 2024, with emphasizes that OECMs should be recognized and reported based on their conservation outcomes, regardless of their primary management objective (IUCN WCPA 2019 and IUCN 2020). These recognized OECMs hold significant potential to enhance ecological connectivity, protect critical ecosystems, and contribute to landscape and seascape conservation (Hilty et al,. 2020).

TABLE 3: Description of each the identified OECM's sites in Osun State.

S/N	OECMs	Geographical Definition	Managed By	Governed By	Biodiversity Value	Conservation Effectiveness	Associated Ecosystem
1	Igbo Sango	It is not a protected area and it is geographically defined	Host community	Traditional Ruler	Flora Species: *Daniella oliverie, Bridellia feruginea, Kigelia africana, Ceiba patandra* and *Parkia biglobosa.* Fauna Species: Civet cat (*Civettictis civetta*), Giant rat (*Cricetomys gambianus*), Cane rat (*Thryonomys swinderianus*), African tree pangolin (*Phataginus tricuspis*), Hare (*Lepus saxatilis*), Cape bushbuck (*Tragelaphus sylvaticus*), Mona monkey (*Cercopithecus mona*), Crested porcupine (*Hystrix cristata*), Tree hyrax (*Dendrohyrax interfluvialis*) and avian species.	Very effective	Historical site
2	Atamora Cave	It is not a protected area and defined geographically	Host community	Traditional Ruler	Flora Species: Plants: *Philiostigma tonigii, Tectona grandis, Etandra Africana*, *Khaya senegalensis, Cola gigantea* and *Vitellaria paradoxa.* Fauna Species: Giant rat (*Cricetomys gambianus*), Cane rat (*Thryonomys swinderianus*), African tree pangolin (*Phataginus tricuspis*), Hare (*Lepus saxatilis*), Mona monkey (*Cercopithecus mona*), Crested porcupine (*Hystrix cristata*), avian species and fishes.	Very effective	A bird watching centre and cave
3	Eleku Shrine	It is not a protected area and not defined	Host community	Traditional Ruler	No biodiversity value	Not effective	It has no ecosystem value it is just a shrine
4	Ayikunugba waterfall	It is not a protected area and it is not defined geographically	Host community	Traditional Ruler	Flora Species: *Etandra Africana, Prosobsis Africana, Parkia biglobosa, Ceiba patandra, Vitex doniana, Anacadiun occidentalis, Kigelia africana* and *Elaeis guineensis.* Fauna Species: Nile monitor lizard monitor (*Varanus niloticus*), African tree pangolin (*Phataginus tricuspis*), Hare (*Lepus saxatilis*), Mona monkey (*Cercopithecus mona*), Maxwell's duiker (*Philantomba maxwellii*), Crested	It is effective	It is a waterfall, pristine forest and mountain for tourism activities.

					porcupine (*Hystrix cristata*), Senegal bush baby (*Galago senegalensis*).		
5	Erinle Shrine	It is not a protected area and it is not defined geographically	Host community	Traditional Ruler	Flora Species: *Elaeis guineensis, Attalea speciosa, Parkia biglobosa, Ceiba, Vitex doniana.* Fauna Species: Mona monkey (*Cercopithecus mona*), Crested porcupine (*Hystrix cristata*), Senegal bushbaby (*Galago senegalensis*) Fishes and other aquatic organisms.	Not effective	A river and Shrine
6	Ibodi Monkey Forest	It is not a protected area and it is defined geographically	Partially managed by the host community and Osun state government	Traditional Ruler and state government	Flora Species: *Tectona grandis, Neuclea latifolia, Musa spp., Burkea Africana, Daniella oliverie, Bridellia feruginea, Kigelia africana, Ceiba patandra* and *Parkia biglobosa.* Fauna Species: *Civet cat (Civettictis civetta), Giant rat* (*Cricetomys gambianus*), *Cane rat (Thryonomys swinderianus), African tree pangolin (Phataginus tricuspis), Maxwell's duiker (Philantomba maxwellii) Mona monkey (Cercopithecus mona), Crested porcupine (Hystrix cristata), Tree hyrax (Dendrohyrax interfluvialis)* and avian species.	It is effective	It is a monkey forest reserve and ecotourism centre
7	Opa Oranmiyan	Not geographically defined	Host community	Traditional Ruler	No biodiversity value	It is effective	Historical site
8	Kiriji Battle Field	It is not a protected area and it is geographical defined	Host community	Traditional Ruler and state government	Flora Species: *Vitex doniana, Khaya senegalensis, Parkia biglobosa, Gmelina arborea, Kola nitida,* and *Trichilia emetica* Fauna Species: *Civet cat (Civettictis civetta), Giant rat* (*Cricetomys gambianus*), *Cane rat (Thryonomys swinderianus), African tree pangolin (Phataginus tricuspis)* and *Mona monkey (Cercopithecus mona).*	Very effective	Historical site
9	Otin Shrine	It is not a protected area and it is geographical defined	Host community	Traditional Ruler	Flora Species: *Elaeis guineensis, Attalea speciosa, Parkia biglobosa, Ceiba, Vitex doniana.* Fauna Species: Mona monkey (*Cercopithecus mona*), Senegal bushbaby (*Galago senegalensis*) Fishes and other	Not effective	It is a river

					aquatic organisms.		
10	Erin Ijesha water fall	It is not a protected area and it is geographical defined	Host community	State government	Flora Species: *Tectona grandis, Hymenocardia acida, Nauclea latifolia, Tectona grandis, Neuclea latifolia, Musa spp., Burkea Africana, Daniella oliverie, Bridellia feruginea, Kigelia africana, Ceiba patandra* and *Parkia biglobosa.* Fauna Species: Maxwell's duiker (*Philantomba maxwellii*), *Cane rat (Thryonomys swinderianus), African tree pangolin (Phataginus tricuspis), Maxwell's duiker (Philantomba maxwellii), Mona monkey (Cercopithecus mona), Crested porcupine (Hystrix cristata), Tree hyrax (Dendrohyrax interfluvialis)* and avian species.	Very effective	Waterfall and an ecotourism centre
11	Odudua Groove and shrine	It is not a protected area and it is geographical defined	Host community	Traditional Ruler	Flora Species: *Daniellia oliveri, Elaeis guineensis, Trichilia emetica, Blighia sapida.* Fauna Species: Helmeted guinea-fowl (*Numida meleagris*) and Avian species.	Very effective	Historical site, sacred groove and an ecotourism centre
12	Ogiyan shrine and groove	It is not a protected area and it is not geographically defined	Host community	Traditional Ruler	No biodiversity value	Not effective	It is a shrine and groove
13	Oke Iragbiji Cave	It is not a protected area and it is geographical defined	Host community	Traditional Ruler	No biodiversity value	Not effective	Shrine and cave
14	Oore Shrine	It is not a protected area and not defined geographically	Host community	Traditional Ruler	No biodiversity value	Not effective	A sacred tree (Oore tree)

3.1 Screening and Assessment of Identified OECM Sites in Osun State.

The elements of each criterion as elaborated in the Strategic Plan for Biodiversity 2011–2020 as a framework for the effective implementation of the Convention on Biological Diversity (CBD) were deployed to screen all the OECM candidate sites in the study area. Out of all the 14 identified OECM sites in Osun State, only 8 passed the 4 OECM screening and assessment test. The sites are, Ede north (Igbo Sango), Irewole (Atamora cave and bird watching centre), Obokun, (kiriji Battlefield Imesi Ile), Atakumosa (Ibodi Ilesha Monkey Forest), Ifedayo (Ayikunugba Waterfall), Oriade (Erin Ijesha waterfall), Ife north (Odua Groove and shrine and Ife north (Opa Oranmiyan), Table 4, Figures 1 and 2.

Table 4: Screening Result of the Identified OEC Sites in Osun State

S/N	OECM	Geographical Definition	Management	Governing Body	Biodiversity Value	Effectiveness	Associated Ecosystem
1	Igbo Sango	■	■	■	■	■	■
2	Atamora cave	■	■	■	■	■	■
3	Eleku Shrine	□	□	■	□	□	□
4	Ayikunugba Waterfall	■	■	■	■	■	■
5	Erinle Shrine	□	■	■	□	□	□
6	Ibodi Monkey Forest	■	■	■	■	■	■
7	Opa Oranmiyan	■	■	■	□	■	■
8	Kiriji Battlefield	■	■	■	■	■	■
9	Otin Shrine	□	■	■	■	■	□
10	Erin Ijesha Waterfall	□	■	■	■	■	■
11	Odudua Groove and Shrine	■	■	■	■	■	■
12	Ogiyan Shrine and Groove	□	■	■	□	□	□
13	Oke Iragbiji Cave	□	■	■	■	□	□
14	Oore Shrine	□	□	■	□	□	□

■ indicates that the site meets up with the CBD OECM criteria
□ indicates that the site does not meet up the CBD OECM criteria

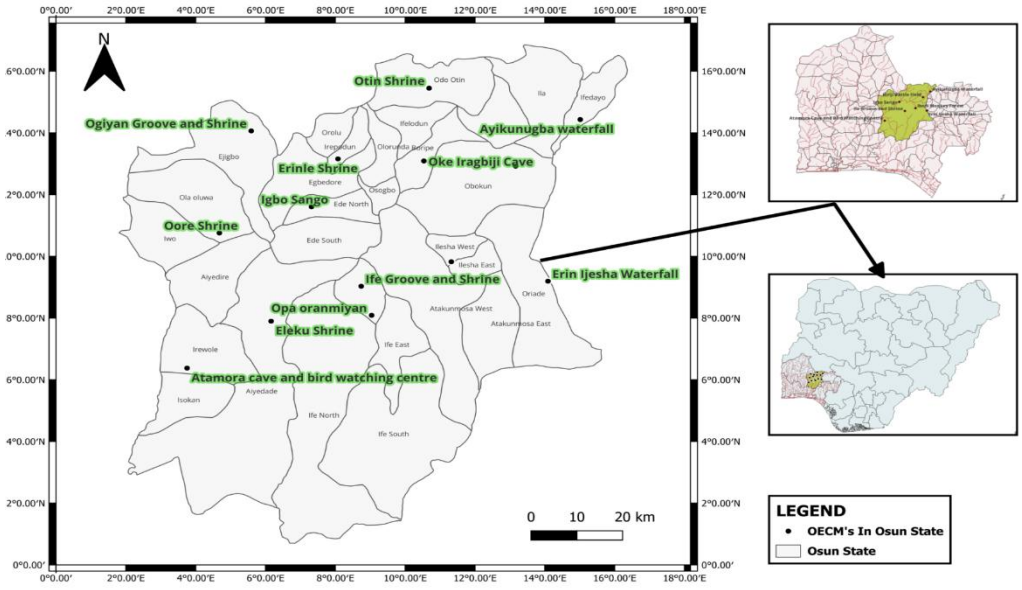
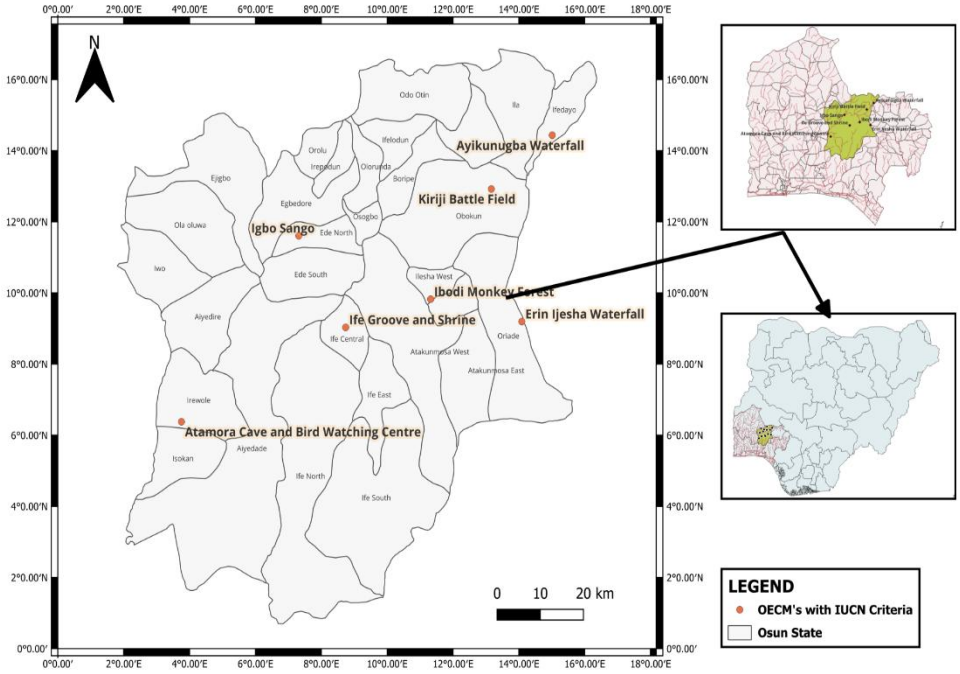


Figure 1: Screening and Assessment of Identified OECM Sites in Osun



State

Figure 2: Identified OECM Sites in Osun State with IUCN Standard in Osun State.

4.0. Conclusion.

OECMs provide a global framework to recognize, complement and strengthen other conservation area designations and existing management and governance mechanisms, contributing to CBD Aichi Target 11. Through proper technical and policy alignment, the OECM framework will facilitate the reporting of Osun state conservation estate nationally and internationally, assisting with formalizing conservation areas in Nigeria with an intent to mitigate against climate change and its effect

on the natural environment and human health. This alignment will also address potential challenges by facilitating resource use efficiency and mobilization and mitigate the reporting of non-compliant sites. All things considered, these results unequivocally demonstrate how OECMs contribute to fair effective and sustainable conservation.

5.0 Recommendation

This study recommends that OECM sites in Osun State should be supported with measures to enhance the governance capacity of their legitimate authorities and thereby secure their positive and sustained outcomes for biodiversity. Further investigation is needed to understand how OECM may provide a global framework that can underpin legitimate, diverse and sustainable economic opportunities and conservation financing that merges with rural economies and in-situ biodiversity conservation outcomes. and peaceful collaboration.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Funding statement

No external funding was secured for this research. The research was self-funded by the authors.

Ethics statement

Consent was sought from local heads and each respondent during the questionnaire interview and were guaranteed the privacy of their personal information following the declaration of Helsinki ethical principles. Each respondents agreed to participate by indicating verbal response to the statement "Do you wish to participate in this survey? ( ) Yes, ( ) No." Every author agreed to participate in and publishing the manuscript.

Author contributions statement

All the authors participated vigorously in collecting and collating data for the research both on the field and off the field. B.A.O, A.O.S, I.O.D, S.A.O, A.B.B and A.E.O were involved in the data survey and data collection. They were also actively involved in writing the main manuscript, while A.A.A, O.O.O and B.A.O helped in reviewing and correcting the manuscript before submission.

Competing interests' policy

In accordance with journal policy and international standards for transparency and ethical publishing, we, the authors of the above-mentioned manuscript,

declare the following:

We confirm that none of the authors have any financial relationships that may be perceived as a potential conflict of interest in relation to the content of this manuscript.

Dual Publication

We hereby declare that the data, results, and figures presented in this manuscript have not been previously published, in whole or in part, in any form, nor are they currently under consideration for publication elsewhere.

Authorship

As the corresponding author, I confirm that I have read, understood, and agreed to abide by all policies and submission guidelines outlined by the journal. I further confirm that this manuscript is being submitted in full compliance with the journal's ethical standards, formatting requirements, and policies on authorship, conflicts of interest, prior publication, and data integrity. I take full responsibility for the integrity of the work as a whole and have ensured that all listed co-authors have approved the final version of the manuscript and agreed to its submission.

Data availability

No datasets were generated or analyzed during the current study.

Clinical trial number

Clinical trial numbers are not applicable.

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