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# Phytodiversity assessment in Narasingha Choudhury Autonomous College Campus, Jajpur, Odisha, India

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**Abstract**
A comprehensive field appraisal on plant diversity within the N.C. Autonomous College campus, Jajpur, was conducted from 2022 to October 2024. This study aimed to capture the full scope of phytodiversity across the campus, documenting the various plant species and assessing their diversity and distribution. The study identified a total of 83 plant species, belonging to 79 genera and 43 families, representing the richness of flora across different life forms, including herbs, shrubs, trees and climbers.
The diversity analyses revealed a Shannon-Wiener Diversity Index (H') of 4.418, indicating high species diversity within the study area. The Simpson's Diversity Index (D) was calculated as 0.988, suggesting low dominance by any single species, which aligns with a highly diverse ecosystem. Furthermore, Pielou's Evenness Index (J') was 1.0, demonstrating an even distribution of species across the campus.
Life form analysis showed that herbs comprised the largest portion of the flora at 54%, followed by trees at 24%, shrubs at 19% and climbers at 3%. These findings highlight the ecological value of the campus's plant life, supporting conservation and serving as a valuable educational resource. This high diversity, even distribution, and presence of varied plant forms underscore the importance of preserving such phytodiversity for ecological balance, aesthetic value and future research opportunities.

**Keywords:** Phytodiversity, species richness, shannon-wiener index, simpson's index, pielou's evenness, conservation

## Introduction
Phytodiversity is the symphony of plant life. It is a canvas painted with vibrant greens, embellished with splashes of colour and textured with leaves of different shapes and sizes. It encircles the countless plant species and their variations, abundance and distribution along with the detailed web of interactions with the environment. Phytodiversity refers to the variety of plant life in a given area. It surrounds the richness, evenness and composition of plant species within an ecosystem. A diverse plant community is essential for the healthy functioning of ecosystems, providing a variety of benefits.
N.C. Autonomous College, one of the oldest colleges of Odisha, established in the pre-independence era i.e, 1946. At present, it sprawls across 30-acres area of campus which is nestled in about 2 km west of the historic town of Jajpur. This prestigious academic institution in Jajpur, Odisha, transformed its role as a centre of learning to be a haven of phytodiversity. It pulsates with the varieties of plant life, that offers a unique backdrop on phytodiversity.
The college has a reputation of being a hub of phytodiversity for the academia and its surrounding is enriched with a heritage of popular spots. Just four kilometers to the east, the holy Maa Biraja shakti pitha (Temple) offers a spiritual and culinary abode and the river Baitarani is just two kilometer away from the college. Further, the river Baitarani and its tributary river Budha flows nearby majestically, influencing the local climate and enriching the soil. This fertile ground, coupled with the campus's strategic location, creates a microcosm of diverse habitats, each nurturing a plethora of plant species. The college also houses a botanical garden, a diligent basket of diverse flora, serving as a living laboratory for students and researchers. The college's vibrant plant life serves not only as an aesthetic delight but also as a valuable educational tool.

## Review of literature
Studies on phytodiversity have been done in different parts of the India by different workers. Some of them are Nair and Khanna *et al*. (2005) [3], Tiwari *et al*. (1995) [12], Verma *et al* (1994). "The flora of British India" was written by Hooker (1872-97) [2] in seven volumes. In Odisha different workers have done significant work in this field. Out of this, the flora of the Bihar and Orissa by H.H. Haines (1925) and flora of Orissa by Suxena and Brahamm (1992) are two important contribution to Odisha. While some workers have done phytodivesity analysis in Jajpur district. Sahoo and Nayak (2022) [6, 7] have reported wetland monocot flora of Jajpur district of Odisha and also a report on exotic and alien aquatic species in Jajpur district has been published (Sahoo and Nayak 2022) [6, 7]. Some important pteridophytes in Jajpur district were reported by Sahoo and Nayak in 2023. Floristic diversity analysis of aquatic flora in the industrial belts of Jajpur district was also carried out (Sahoo *et al*. 2024) [8]. But there is no record on phytodiversity in N.C. Autonomous campus, Jajpur, Odisha. Therefore, this work has been undertaken to document the floristic diversity in the college campus.

## Materials and methods
The methodology adopted for the phytodiversity study on the N.C. Autonomous college campus, Jajpur aimed to comprehensively assess and document the richness and

distribution of plant species within the designated area. Field survey was carried out in every month during 2022-2024 October in the college campus. Plant specimens are collected during flowering period, its habit and growth pattern are also studied. Local people are approached to collect the local name. Collected plant specimens are identified by using Flora book and from other literature. Herbarium are prepared and housed in the P.G. Department of Botany, N.C. Autonomous College, Jajpur.

**Statistical Analysis**

**1. Species richness (s)**

- Species richness is the simplest measure and only requires the count of species present.
- For this study, species richness (S) = 83 (total species observed) (Murugan, 2004).

**2. Shannon-wiener diversity index (H')**

This index estimates diversity by incorporating both richness and evenness, without needing area-specific abundance.

$H' = -\sum(pi \cdot \ln(pi))$ (Shannon, 1949) [10]

where:

- pi is the proportion of each species relative to the total number of species (assuming each species is equally represented).

Assuming equal representation:

$$pi = \frac{1}{83} = 0.012$$

Plugging into the Shannon-wiener formula:

$H' = -83 \cdot (0.012 \cdot \ln(0.012))$

Calculating, we find: $H' = 4.418$

**3. Simpson's diversity index (d)**

Simpson's index also evaluates diversity and focuses on the probability that two randomly chosen individuals are from the same species (Simpson,1949) [11]

Formula: $D = 1 - \sum(pi^2)$

Assuming each species is equally represented:

$$D = 1 - \sum(\frac{1}{83})^2 = 1 - 83 \cdot (\frac{1}{83})^2$$

$$D = 1 - \frac{83}{6889} = 0.987$$

D value close to 1 indicates high diversity, suggesting low dominance by any single species.

**4. Pielou's Evenness Index (J')**

This index, derived from the Shannon-Wiener Index, measures how evenly species are represented (Pielou,1966) [5].

Formula: $J' = \frac{H'}{\ln(S)}$

Using $H' = 4.418$ and $S = 83$:

$$J' = \frac{4.418}{ln(83)} = \frac{4.418}{4.418} = 1.0$$

A value close to 1.0 suggests that species are evenly distributed, matching the assumption of equal abundance.

**Results**

**Table 1**

| SL. No. | Botanical Name | Vernacular Name | Family | Habit | Growning Pattern | Monocot Dicot |
|---|---|---|---|---|---|---|
| 1 | *Acalypha indica* L. | Indraamarisha | Euphorbiaceae | Herb | Perennial | Dicot |
| 2 | *Aegle marmelos* (L.) Corr. | Bela | Rutaceae | Tree | Perennial | Dicot |
| 3 | *Aerva lanata* (L.) Juss. ex Schult. | Paunsia | Amaranthaceae | Herb | Perennial | Dicot |
| 4 | *Alocasia macrorrhizos* (L.) G. Don | Manasaru | Araceae | Herb | Perennial | Monocot |
| 5 | *Ageratum conyzoides* L. | Pokasunga | Asteraceae | Herb | Annual | Dicot |
| 6 | *Amaranthus spinosus* L. | Kanta leutia | Amaranthaceae | Shrub | Annual | Dicot |
| 7 | *Anthocephalus cadamba* (Roxb.) Miq. | Kadamba | Rubiaceae | Tree | Perennial | Dicot |
| 8 | *Argemone mexicana* L. | Agara | Papaveraceae | Herb | Annual | Dicot |
| 9 | *Artocarpus heterophyllus* L. | Panasa | Moraceae | Tree | Perennial | Dicot |
| 10 | *Azadirachta indica* A. Juss. | Neema | Meliaceae | Tree | Perennial | Dicot |
| 11 | *Bambusa vulgaris* Schrad. | Baunsa | Poaceae | Tree | Biennial | Monocot |
| 12 | *Borassus flabellifer* L. | Tala | Arecaceae | Tree | Perennial | Monocot |
| 13 | *Boerhavia diffusa* L. | Puruni saga | Nyctaginaceae | Herb | Perennial | Dicot |
| 14 | *Bombax ceiba* L. | Simili | Malvaceae | Tree | Biennial | Dicot |
| 15 | *Brassica rapa* L. | Sorisha | Brassicaceae | Herb | Annual | Monocot |
| 16 | *Caesalpinia pulcherrima* (L.) Sw. | Godibana | Fabaceae | Tree | Perennial | Dicot |
| 17 | *Calotropis gigantea* (L.) Dryand. | Arakha | Apocynaceae | Shrub | Perennial | Dicot |
| 18 | *Cardiospermum halicacabum* L. | Phutuphutika | Sapindaceae | Herb | Perennial | Dicot |
| 19 | *Carica papaya* L. | Amrutavanda | Caricaceae | Tree | Perennial | Dicot |
| 20 | *Casuarina equisetifolia L.* | Jhaun | Casuarinaceae | Tree | Perennial | Dicot |
| 21 | *Catharanthus roseus* (L.) G. Don | Sadabihari | Apocynaceae | Herb | Perennial | Dicot |
| 22 | *Chromolaena odorata* (L.) R. King & H. Robins. | Gandhuri | Asteraceae | Herb | Perennial | Dicot |
| 23 | *Chrysopogon aciculatus* (Retz.) Trin. | Guguchhia | Poaceae | Herb | Perennial | Monocot |
| 24 | *Cleome viscosa* L. | Ana sorisha | Cleomaceae | Herb | Annual | Dicot |
| 25 | *Clerodendrum indicum* (L.) Kuntze | Khara khari | Lamiaceae | Shrub | Perennial | Dicot |

| | | | | | | |
|---|---|---|---|---|---|---|
| 26 | *Clitoria ternatea*, L. | Aparajita | Fabaceae | Herb | Perennial | Dicot |
| 27 | *Colocasia esculenta* (L.) Schott | Saru | Arecaceae | Herb | Perennial | Monocot |
| 28 | *Commelina benghalensis* L. | Kansiri | Commelinaceae | Herb | Annual | Monocot |
| 29 | *Croton bonplandianus* Baill. | Bana tulasi | Euphorbiaceae | Shrub | Annual | Dicot |
| 30 | *Cynodon dactylon* (L.) Pers. | Duba ghasa | Poaceae | Herb | Perennial | Monocot |
| 31 | *Cyperus rotundus* L. | Mutha | Cyperaceae | Herb | Perennial | Monocot |
| 32 | *Datura stramonium* L. | Dudura | Solanaceae | Herb | Annual | Dicot |
| 33 | *Desmodium triflorum* (L.) DC. | Kuradhia | Fabaceae | Herb | Perennial | Dicot |
| 34 | *Eclipta prostrate* (L.) L. | Bhrungaraja | Asteraceae | Herb | Annual | Dicot |
| 35 | *Eleusine indica* (L.) Gaertn. | Anamandia | Poaceae | Herb | Annual | Monocot |
| 36 | *Emilia sonchifolia* (L.) DC. | Sarakara | Asteraceae | Herb | Annual | Dicot |
| 37 | *Euphorbia hirta* L. | Chita kuti | Euphorbiaceae | Herb | Perennial | Dicot |
| 38 | *Evolvulus alsinoides* (L) L. | Bichhamalia | Convolvulaceae | Herb | Perennial | Dicot |
| 39 | *Ficus benghalensis* L. | Bara | Moraceae | Tree | Perennial | Dicot |
| 40 | *Ficus recemosa* L. | Dimiri | Moraceae | Tree | Perennial | Dicot |
| 41 | *Ficus religiosa* L. | Osta | Moraceae | Tree | Perennial | Dicot |
| 42 | *Glinus oppositifolius* (L.) A.DC. | Pita saga | Molluginaceae | Herb | Annual | Dicot |
| 43 | *Hedyotis corymbosa* (L.) Lam. | Gharapodi | Rubiaceae | Herb | Perennial | Dicot |
| 44 | *Heliotropium indicum* L. | Hatisundha | Boraginaceae | Herb | Annual | Dicot |
| 45 | *Hibiscus rosa-sinensis* L. | Mandara | Malvaceae | Shrub | Perennial | Dicot |
| 46 | *Hybanthus enneaspermus* (L.) F. Muell. | Madana mastaka | Violaceae | Herb | Perennial | Dicot |
| 47 | *Ixora coccinea* L. | Katha rangani | Rubiaceae | Shrub | Perennial | Dicot |
| 48 | *Lantara camara* L. | Naga aieri | Verbenaceae | Shrub | Perennial | Dicot |
| 49 | *Leucas aspera* (Willd.)Link | Gayasa | Lamiaceae | Herb | Annual | Dicot |
| 50 | *Mangifera indica* L. | Amba | Anacardiaceae | Tree | Perennial | Monocot |
| 51 | *Mimosa pudica* L. | Lajakuli lata | Fabaceae | Shrub | Perennial | Dicot |
| 52 | *Murraya paniculata* (L.) Jack | Kamini | Rutaceae | Shrub | Annual | Dicot |
| 53 | *Nyctanthes arbor-tristis* L. | Ganga siuli | Oleaceae | Shrub | Perennial | Dicot |
| 54 | *Ocimum sanctum* L. | Tulasi | Lamiaceae | Herb | Perennial | Dicot |
| 55 | *Oxalis corniculata* L. | Ambiliti | Oxalidaceae | Herb | Annual | Dicot |
| 56 | *Paederia foetida* L. | Pasaruni | Rubiaceae | Climber | Perennial | Dicot |
| 57 | *Paspalum scrobiculatum* L. | Kodua | Poaceae | Herb | Perennial | Monocot |
| 58 | *Phoenix sylvestris* (L.) Roxb. | Khajuri | Arecaceae | Tree | Perennial | Monocot |
| 59 | *Phyllanthus niruri* L. | Bhuinanla | Phyllanthaceae | Herb | Annual | Dicot |
| 60 | *Polyalthia longifolia(* Sonn.) Thw. | Debdaru | Annonaceae | Shrub | Perennial | Dicot |
| 61 | *Portulaca oleracea* L. | Puruni | Portulacaceae | Herb | Annual | Dicot |
| 62 | *Psidium guajava* L. | Pijuli | Myrtaceae | Shrub | Perennial | Dicot |
| 63 | *Quisqualis indica* L. | Madhumalati | Combretaceae | Climber | Perennial | Dicot |
| 64 | *Samanea saman* (Jacq.) Merr. | Chakunda | Fabaceae | Tree | Perennial | Dicot |
| 65 | *Saraca asoca* (Roxb.) de Willde. | Ashoka | Fabaceae | Tree | Perennial | Dicot |
| 66 | *Scoparia dulcis* L. | Bana ganjei | Plantaginaceae | Herb | Annual | Dicot |
| 67 | *Sesamum indicum* L. | Khasa | Pedaliaceae | Herb | Perennial | Dicot |
| 68 | *Sida acuta* Burm.f. | Sunakhadika | Malvaceae | Herb | Perennial | Dicot |
| 69 | *Sida cordifolia* L. | Bajramulii | Malvaceae | Herb | Perennial | Dicot |
| 70 | *Solanum indicum* auct.non L. | Lunalunia | Solanaceae | Shrub | Annual | Dicot |
| 71 | *Solanum xanthocarpum* Schrad. & Wendl. | Bhejibaigana | Solanaceae | Herb | Annual | Dicot |
| 72 | *Sphaeranthus indicus* L. | Bhuin kadamba | Asteraceae | Herb | Annual | Dicot |
| 73 | *Stephania japonica* (Thunb.) Miers | Akana bindhi | Menispermaceae | Herb | Perennial | Dicot |
| 74 | *Syzygium cumini* (L.) Skeels. | Jamu koli | Myrtaceae | Tree | Perennial | Dicot |
| 75 | *Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult. | Tagara | Apocynaceae | Shrub | Perennial | Dicot |
| 76 | *Terminalia arjuna* (Roxb.ex DC) Wight & Arn. | Arjuna | Combretaceae | Tree | Perennial | Dicot |
| 77 | *Tragia involucrata* L. | Bichhuati | Euphorbiaceae | Herb | Perennial | Dicot |
| 78 | *Tridax procumbens* L. | Bisalyakarani | Asteraceae | Herb | Perennial | Dicot |
| 79 | *Vitex negundo* L. | Begunia | Lamiaceae | Shrub | Perennial | Dicot |
| 80 | *Ziziphus jujuba* (L.) Gaertn. | Barakoli | Rhamnaceae | Tree | Perennial | Dicot |
| PTERIDOPHYTES | | | | | | |
| 81 | *Adiantum capillus-veneris* L. | - | Pteridaceae | Herb | Perennial | - |
| 82 | *Pteris cretica* L. | - | Pteridaceae | Herb | Perennial | - |
| 83 | *Dryopteris cochleata* (D.Don)C.Chr. | - | Dryopteridaceae | Herb | Perennial | - |

**Table 2:** Taxonomic status of the campus vegetation

| Taxa | Monocots | Dicots | Monocot / Dicot | Total no. of Angiosperm | Pteridophytes | Grand Total |
|---|---|---|---|---|---|---|
| Species | 13 | 67 | 0.19 | 80 | 03 | 83 |
| Genera | 13 | 63 | 0.21 | 76 | 03 | 79 |
| Family | 07 | 34 | 0.21 | 41 | 02 | 43 |

**Table 3:** Growth forms of plant vegetation of the college campus

| Sl. No. | Growth forms | No. of species | % in contribution |
|---|---|---|---|
| 01 | Herb | 45 | 54 |
| 02 | Shrub | 16 | 19 |
| 03 | Tree | 20 | 24 |
| 04 | Climber | 02 | 03 |

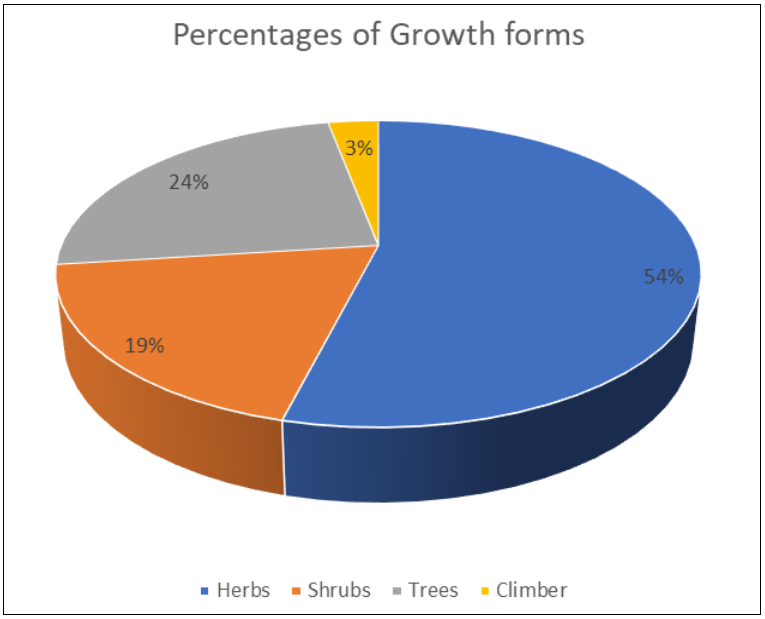


**Fig 1:** Percentages of Growth forms

**Table 4:** Diversity Indices

| Index | Value | Interpretation |
|---|---|---|
| Species Richness (S) | 83 | Total number of species observed. |
| Shannon-Wiener Index (H') | 4.418 | High diversity, suggesting a balanced variety of species. |
| Simpson's Diversity Index (D) | 0.987 | High diversity with low dominance by any single species. |
| Pielou's Evenness Index (J') | 1.0 | Even distribution among species. |

**Discussion**

The findings from this study reveal that the N.C. Autonomous College campus is a hub of phytodiversity, housing a rich array of plant species. A total of 83 plant species were documented, spanning 79 genera and 43 families, showcasing the diversity of flora within the college grounds. Among these, 67 species are dicots, 13 are monocots, and 3 are pteridophytes, indicating a dominance of dicotyledonous plants in the area (Table-1).

In terms of growth forms, the flora comprises 34 herb species, 16 shrubs, 20 trees, and 2 climbers, illustrating the structural variety of the vegetation. Analysis by lifespan shows that 22 species are annual, 2 species are biennial, and 59 are perennial, suggesting that perennial species play a major role in sustaining the ecological balance of the campus (Table-3).

The calculated diversity indices further underscore the richness of this phytodiversity. The Shannon-Wiener Diversity Index (H') of 4.418 reflects high species diversity, indicating that the campus flora supports a wide range of species with minimal dominance by any one species. The Simpson's Diversity Index (D) of 0.988 aligns with this, suggesting low dominance and a balanced ecosystem where different species contribute equally to community stability. Furthermore, the Pielou's Evenness Index (J') of 1.0 highlights an even distribution among species, a characteristic that enhances ecological resilience (Table-4).

Notably, the Asteraceae and Fabaceae families contribute the most species, with 6 species each, showcasing the prominence of these families in the local flora. This diversity not only supports ecological balance but also provides various practical resources to the local community, including medicinal plants and materials for daily use. Additionally, the campus serves as a dynamic learning environment for both postgraduate and undergraduate students, offering a hands-on experience with diverse plant species.

Beyond its educational value, this rich and varied plant life adds to the aesthetic beauty of the campus, promoting a serene and vibrant environment. Preserving this diversity is essential, as it provides long-term ecological, educational, and aesthetic benefits, highlighting the need for conservation efforts within the college grounds.

## Conclusion

Phytodiversity, or plant diversity, is a critical component of healthy ecosystems and plays an essential role in maintaining ecological balance, supporting a broad range of wildlife, and delivering invaluable ecosystem services. These services include soil formation, water regulation, and carbon sequestration, each of which contributes to the overall functioning and stability of the environment. A rich diversity of plant species enhances ecosystem resilience, allowing it to better withstand environmental fluctuations, such as those brought about by climate change, by providing a variety of resources and habitats that support interdependent plant and animal species.

The presence of diverse plant life also serves as a buffer against ecosystem degradation. When phytodiversity is compromised, ecosystems lose their ability to function effectively, which can lead to the collapse of food webs, reduced soil quality, altered water cycles, and increased vulnerability to invasive species. Therefore, conserving phytodiversity is crucial not only for ecosystem stability and resilience but also for sustaining human livelihoods, as plant diversity underpins food security, medicine development, climate regulation, and overall environmental health.

In addition to its ecological benefits, phytodiversity on the N.C. Autonomous College campus enriches the educational environment. This wealth of plant species serves as a living laboratory for students and faculty, facilitating hands-on learning and research opportunities in the field of botany and ecology. The variety of plant life on campus allows students to observe different growth forms, life cycles, and ecological interactions firsthand, fostering a deeper understanding of biodiversity and its role in sustaining life. By engaging with the campus's natural environment, students gain practical experience that enhances their academic studies, inspires scientific curiosity, and promotes a lifelong appreciation for nature.

Moreover, the aesthetic value of phytodiversity contributes to the campus's appeal, creating a tranquil and inspiring setting that enhances well-being for students, faculty, and visitors alike. This abundance of plant life, ranging from vibrant herbs and shrubs to towering trees, transforms the college grounds into a biodiverse sanctuary that connects the academic community to the natural world.

The students and faculty of the Botany Department are deeply committed to the conservation and maintenance of this phytodiversity. Through their ongoing efforts to document, protect, and study these plant species, they help ensure that the college's diverse flora continues to thrive. This dedication not only supports the ecological health of the campus but also sets an example of responsible stewardship that emphasizes the importance of biodiversity conservation.

As the threats of climate change and habitat loss continue to grow, it is imperative that conservation efforts are prioritized, and sustainable practices are integrated into everyday activities. By preserving the rich diversity of plant life at N.C. Autonomous College, the community contributes to broader environmental health and resilience. These efforts safeguard vital ecological functions, uphold biodiversity, and ensure that future generations will inherit a planet that continues to support a wealth of life forms.

In conclusion, the phytodiversity at N.C. Autonomous College serves as a testament to the significance of plant conservation, both for its immediate benefits to the college community and for its broader impact on ecological and environmental sustainability. By fostering this natural resource, the college plays a critical role in promoting biodiversity, environmental education, and conservation awareness, benefiting both the local community and the global ecosystem.

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## Author's Contribution

Satikant Sahoo (1st author) and Binod Kumar Sahoo (2nd author) contributed in laboratory analysis, taxonomic identification of the plant species and collected the data.1st and 3rd author contributed in the preparation and writing of the manuscript. Satikant Sahoo (1st author) reviewed and revised the draft and approved the submission of the manuscript.

## Conflict of interest

The authors declare that there is no conflict of interest regarding publication of this manuscript.

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