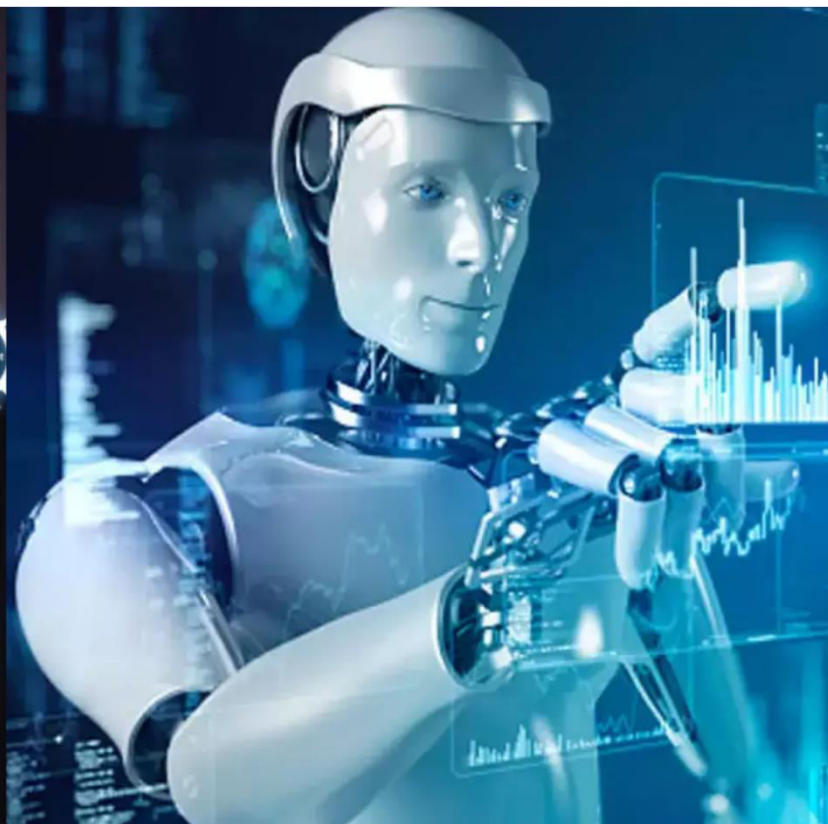




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Avian Diversity and Population Structure in the Campus of Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhaji Nagar (Maharashtra), India

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ABSTRACT: Urban and semi-urban green spaces, such as university campuses, serve as crucial refuges for avian fauna, especially in rapidly developing regions. This study was conducted to document the diversity, relative abundance, and population structure of birds within the 725-acre campus of Dr. Babasaheb Ambedkar Marathwada University (BAMU), Chhatrapati Sambhaji Nagar, Maharashtra, India. The line transect method was employed over ten sampling quadrats from August 2024 to July 2025 to capture seasonal variations. A total of 24 bird species belonging to various families were recorded and identified. The species were categorized based on their residential status: 15 were Resident Common (RC), 5 were Resident Uncommon (RU), 2 were Resident Migrant Uncommon (RMU), and one was Resident Migrant Common (RMC). Population metrics, including relative density, relative frequency, and relative abundance, were calculated. The House Sparrow (*Passer domesticus*) exhibited the highest relative density (16.89) and relative abundance (3244.4), whereas the Indian Grey Hornbill (*Ocyrceros birostris*) was the least encountered species. The results indicate that the BAMU campus, with its rich vegetation, water bodies, and minimal disturbance, supports a healthy and diverse bird community. This study provides a critical baseline for future monitoring and underscores the importance of academic campuses in urban biodiversity conservation amidst growing urban pressures.

KEYWORDS: Avian fauna, line transect, relative abundance, resident status, urban ecosystem, campus biodiversity.

I. INTRODUCTION

Birds, among the most conspicuous and well-studied components of the global fauna, play an indispensable role in the functioning and health of terrestrial ecosystems. As highly mobile vertebrates, they occupy a wide range of trophic levels, functioning as pollinators, seed dispersers, predators of insects and small vertebrates, and scavengers, thereby contributing significantly to ecosystem stability and resilience (Sekercioglu, 2006; Whelan et al., 2008). Consequently, avian communities are increasingly recognized as sensitive and reliable bio-indicators; their species composition, diversity, and population trends offer profound insights into the integrity and overall health of the environment (Gregory et al., 2005; Kong et al., 2022). Monitoring avian populations, therefore, serves as a critical tool for assessing the impacts of environmental change, including habitat alteration and climate change.

Globally, and particularly in a rapidly developing nation like India, urbanization represents one of the most pervasive and transformative forms of land-use change. The expansion of urban areas leads to habitat fragmentation, pollution, and altered microclimates, posing significant threats to native biodiversity (ML, M, 2002; Kale et al., 2012). In this context of escalating anthropogenic pressure, remnant green spaces within urban matrices have gained immense ecological importance. These spaces, which include parks, gardens, sacred groves, and large institutional campuses, function as vital refugia or "green islands," providing crucial resources for survival, such as food, water, and nesting sites for a variety of species (Fernández-Juricic, 2000; Savard et al., 2000).

University campuses, often characterized by extensive, managed green areas with a diversity of native and exotic flora, represent unique and valuable semi-natural ecosystems within urban and semi-urban settings (Bhaduri, R., & Rathod, U. (2022). Their relatively large size and structural heterogeneity—comprising woodlands, grasslands, water bodies, and built-up areas—create a mosaic of microhabitats that can support a surprisingly rich array of bird life, including both generalist species that thrive in human-dominated landscapes and, occasionally, more specialist species that are sensitive to disturbance (Lim & Sodhi, 2004; Jokimäki, 1999). The avifauna of such campuses not only contributes to local biodiversity but also offers invaluable opportunities for environmental education and long-term ecological research, serving as living laboratories for understanding species responses to urban pressures (Krasny & Bonney, 2005).

The city of Chhatrapati Sambhaji Nagar (formerly Aurangabad) in Maharashtra, India, is a region experiencing significant urban growth. The campus of Dr. Babasaheb Ambedkar Marathwada University (BAMU), established in 1958, is a premier institution sprawled over 725 acres. This vast campus is not merely an academic enclave but also a site of considerable historical and ecological significance, encompassing the protected Aurangabad caves and the Soneri Mahal. Its landscape is a topographically diverse mix of rocky outcrops, scrub vegetation, planted groves, and water bodies, fostering a rich floristic diversity that, in turn, supports a commensurate faunal community.

While broad-scale avifaunal studies have been conducted in the Aurangabad district, such as the work by Rasal and Chavan (2011) which documented 61 species, there exists a conspicuous gap in focused, quantitative research on the avian population structure within the specific and ecologically distinct confines of the BAMU campus. A detailed understanding of the campus's avian community is imperative for several reasons: it establishes a crucial baseline for monitoring future changes, helps in identifying key habitats for conservation, and assesses the campus's role in the regional urban wildlife corridor. Furthermore, in an era where common species like the House Sparrow (*Passer domesticus*) are reportedly declining in many urban centres (Sumasgutner et al., 2014), documenting their status in relatively green campuses like BAMU is of particular conservation relevance.

Therefore, the present study was undertaken to systematically investigate the avian diversity of the Dr. BAMU campus over a complete annual cycle. The specific objectives of this research are:

1. To prepare a comprehensive and seasonally informed checklist of bird species inhabiting the campus.
2. To categorize the recorded species based on their residential status (e.g., resident, migrant) and relative abundance.
3. To quantitatively analyse the avian community structure by calculating key population metrics, including relative density, relative frequency, and relative abundance.
4. To discuss the ecological significance of the findings and propose conservation measures for sustaining and enhancing avian diversity within this vital urban green space.

II. MATERIALS AND METHODS

2.1. Study Area

The study was conducted within the premises of Dr. Babasaheb Ambedkar Marathwada University (BAMU), located in Chhatrapati Sambhaji Nagar, Maharashtra, India (19°54' N, 75°20' E). The campus encompasses approximately 725 acres (2.93 km²) of semi-urban landscape. The terrain is diverse, featuring rocky outcrops (hosting the historically significant Aurangabad caves), scrubland, grasslands, artificial water bodies, and planted woody areas, creating a heterogeneous habitat matrix suitable for a variety of bird species. The climate is semi-arid, with annual rainfall of approximately 700 mm, received mostly during the monsoon season (June-September).

2.2. Data Collection

The survey was conducted from August 2024 to July 2025 to account for seasonal variations, including breeding, non-breeding, and migratory periods. The Line Transect Method was employed for data collection, a technique widely used and validated for bird population studies (Buckland et al., 2001). This method is practical, efficient, and suitable for monitoring bird communities in continuous habitats (Sutherland, 2006).

Ten permanent transect lines (quadrats), each approximately 500 meters in length, were established across different habitats within the campus (e.g., near water bodies, dense woodland, open grasslands, and academic buildings) to

ensure a representative sampling of the environment. Each transect was traversed on foot twice a month during the early morning (06:00 - 09:00 hrs) and late afternoon (16:00 - 18:00 hrs) when bird activity is at its peak.

For every bird sighting, the following data were recorded: species, number of individuals, and perpendicular distance from the transect line. Only birds seen on or near the transect line were counted to avoid double-counting. Vocal identifications were used for skulking species but were cross-verified with visual sightings wherever possible.

2.3. Materials

The equipment used for the study included:

- Digital SLR Camera with a telephoto lens (for species identification and documentation)
- Binoculars (10x50)
- Detailed campus map and GPS device
- Standardized bird survey data sheets
- Field notebook, pen, and pencil
- Field guide for species identification (Richard, G., et al., 1998)

2.4. Data Analysis

The data from all transects were pooled for a comprehensive analysis. Species were classified into residential categories (Resident Common-RC, Resident Uncommon-RU, Resident Migrant Common-RMC, Resident Migrant Uncommon-RMU) based on their frequency of occurrence across the transects and known distribution patterns (Richard, G., et al., 1998).

The following population metrics were calculated for each species:

1. **Relative Density (%)** = (Total number of individuals of a species / Total number of individuals of all species) × 100
2. **Relative Frequency (%)** = (Number of quadrats in which the species occurred / Total number of quadrats studied) × 100
3. **Relative Abundance** = (Total number of individuals of a species / Total number of quadrats in which the species occurred)

III. OBSERVATIONS

A total of 24 bird species from 18 families were recorded during the 12-month study period. The comprehensive checklist, along with their scientific names and residential status, is presented in Table 1. The resident species formed the core of the avifauna, with a few migrant species enriching the diversity during specific seasons.

Table 1: Checklist of Bird Species Recorded in Dr. BAMU Campus, Chhatrapati Sambhaji Nagar.

Sr. No.	Common Name	Scientific Name	Family	Occurrence
1	Pond Heron	<i>Ardeola grayii</i>	Ardeidae	RC
2	Red-wattled Lapwing	<i>Vanellus indicus</i>	Charadriidae	RC
3	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	Alcedinidae	RU
4	Baya Weaver Bird	<i>Ploceus philippinus</i>	Ploceidae	RU

5	Indian Peafowl	<i>Pavo cristatus</i>	Phasianidae	RU
6	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	RC
7	Blue Rock Pigeon	<i>Columba livia</i>	Columbidae	RC
8	Indian Ring Dove	<i>Streptopelia decaocto</i>	Columbidae	RC
9	Rose-ringed Parakeet	<i>Psittacula krameri</i>	Psittaculidae	RC
10	Crow Pheasant (Greater Coucal)	<i>Centropus sinensis</i>	Cuculidae	RC
11	Asian Koel	<i>Eudynamys scolopaceus</i>	Cuculidae	RC
12	Jungle Babbler	<i>Turdoides striata</i>	Leiothrichidae	RC
13	Large Grey Babbler	<i>Turdoides malcolmi</i>	Leiothrichidae	RC
14	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	Bucerotidae	RMU
15	Black Drongo	<i>Dicrurus macrocercus</i>	Dicruridae	RMU
16	Brahminy Starling	<i>Sturnia pagodarum</i>	Sturnidae	RC
17	Common Myna	<i>Acridotheres tristis</i>	Sturnidae	RC
18	Indian Robin	<i>Copsychus fulicatus</i>	Muscicapidae	RC
19	Indian Tree Pie (Rufous Treepie)	<i>Dendrocitta vagabunda</i>	Corvidae	RU
20	Spotted Owlet	<i>Athene brama</i>	Strigidae	RU
21	House Sparrow	<i>Passer domesticus</i>	Passeridae	RC
22	House Crow	<i>Corvus splendens</i>	Corvidae	RC

23	Shikra	<i>Accipiter badius</i>	Accipitridae	RU
24	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	Rallidae	RMC

RC: Resident Common, RU: Resident Uncommon, RMC: Resident Migrant Common, RMU: Resident Migrant Uncommon.



Pond Heron / *Ardoela grayii*



Red wattled Lapwing /
Vanellus indicus



White breasted Kingfisher /
Halcyon smyrnensis



Baya weaver Bird / *Ploceus philippinus*



Indian Peafowl / *Pavo cristatus*



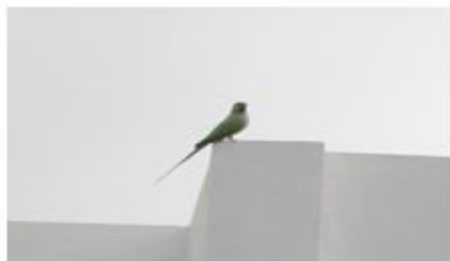
Red Vented Bulbul /
Pycnonotus cafer



Blue Rock Pigeon /
Columba livia



Indian Ring Dove / *Streptopelia decaocta*



Rose ringed Parakeet /
Psittacula krameri



Crow Pheasant / *Centropus sinensis*



Asian koel / *Eudynamys scolopacea*



Jungle Babbler /
Turdoides stratus



Large Grey Babbler /
Turdoides malcolmi



Brahminy Sterling / *Sternus pagodarum*



Black Drongo / *Dicrurus adsimilis*



Common Myna /
Acridotheres tristis



Indian Robin / *Saxicoloides
fulicata*



Indian Tree Pie / *Dendrocitta*



Spotted Owlet / *Athene brama*



House Sparrow / *Passer
domesticus*



House Crow / *Corvus splendens*



Shikra / *Accipiter badius*



White Breasted Waterhen /
Amaurornis phoenicurus

IV. RESULTS

The systematic survey conducted from August 2024 to July 2025 within the Dr. BAMU campus yielded a comprehensive dataset on its avian population. A total of 1728 individual bird sightings were recorded across the 10 permanent quadrats, encompassing 24 species from 18 families.

4.1. Species Composition and Residential Status

The avian assemblage was dominated by resident species, which is characteristic of a stable, year-round habitat. Out of the 24 species, 15 (62.5%) were classified as Resident Common (RC), indicating their widespread and frequent occurrence across the campus. Five species (20.8%) were Resident Uncommon (RU), sighted less frequently or in more specific microhabitats. The migrant component was represented by two Resident Migrant Uncommon (RMU) species (8.3%) and one Resident Migrant Common (RMC) species (4.2%), reflecting the campus's role as a seasonal habitat for certain species (Richard, G., et al., 1998). The complete checklist is detailed in Table 1.

4.2. Dominant Species and Population Metrics

The House Sparrow (*Passer domesticus*) was unequivocally the most dominant species, with 292 individuals recorded. It exhibited the highest Relative Density (16.89%), meaning it constituted nearly one-sixth of all individual birds recorded. It also had the highest Relative Abundance (32.44), indicating the largest average flock size per quadrat where it was present, and a high Relative Frequency (90%), confirming its near-ubiquitous distribution across the campus (Table 2).

Other highly successful species included the Common Myna (*Acridotheres tristis*) and the Indian Robin (*Copsychus fulicatus*), which showed high values across all three population metrics (Relative Density of 9.14% and 8.15%, Relative Frequency of 90% and 80%, and Relative Abundance of 17.56 and 17.63, respectively). The Baya Weaver (*Ploceus philippinus*) and Blue Rock Pigeon (*Columba livia*) also demonstrated significant populations and wide distribution.

4.3. Less Prevalent and Rare Species

In stark contrast, several species were recorded in low numbers. The Indian Grey Hornbill (*Ocyrceros birostris*) was the rarest, with only 2 individuals sighted in a single quadrat, resulting in the lowest Relative Density (0.11%) and a low Relative Abundance (2.0). Similarly, the Indian Tree Pie (*Dendrocitta vagabunda*) and White-breasted Kingfisher (*Halcyon smyrnensis*) were encountered only 3 times each, though the kingfisher was slightly more widespread (Table 2). The low Relative Abundance of the Spotted Owlet (*Athene brama*) (1.80) suggests solitary or paired behavior, which is typical for raptors (Ali & Ripley, 1983).

4.4. Spatial Distribution and Habitat Association

Analysis of the survey data revealed clear patterns of habitat preference. Species like the Red-wattled Lapwing (*Vanellus indicus*) and Common Myna were found in 90% of the quadrats, indicating their high adaptability to various campus sub-habitats, from open grounds to landscaped gardens. Conversely, species like the Rose-ringed Parakeet (*Psittacula krameri*) were confined to fewer quadrats (40% frequency), likely those with large, fruiting trees suitable for feeding and nesting. The presence of water-dependent species like the Pond Heron (*Ardeola grayii*) and White-breasted Waterhen (*Amaurornis phoenicurus*) was logically clustered around the campus's water bodies.

Table 2: Population Metrics of Bird Species in Dr. BAMU Campus

Sr. No.	Name of Species	Relative Density (%)	Relative Frequency (%)	Relative Abundance
1	Pond Heron	3.01	50	10.40
2	Red-wattled Lapwing	3.47	90	6.67
3	White-breasted Kingfisher	0.17	20	1.50

4	Baya Weaver Bird	8.68	90	16.67
5	Indian Peafowl	1.79	50	6.20
6	Red-vented Bulbul	5.20	70	12.86
7	Blue Rock Pigeon	6.53	90	12.56
8	Indian Ring Dove	7.34	70	18.14
9	Rose-ringed Parakeet	2.14	40	9.25
10	Crow Pheasant	2.31	70	5.71
11	Asian Koel	1.38	50	4.80
12	Jungle Babbler	6.30	80	13.63
13	Large Grey Babbler	4.97	60	14.33
14	Indian Grey Hornbill	0.11	10	2.00
15	Black Drongo	0.57	10	10.00
16	Brahminy Starling	1.90	50	6.60
17	Common Myna	9.14	90	17.56
18	Indian Robin	8.15	80	17.63

19	Indian Tree Pie	0.17	10	3.00
20	Spotted Owlet	0.52	50	1.80
21	House Sparrow	16.89	90	32.44
22	House Crow	6.30	80	13.63
23	Shikra	1.27	50	4.40
24	White-breasted Waterhen	1.55	70	3.86

V. DISCUSSION

The findings of this study paint a detailed picture of an avian community thriving within a semi-urban academic landscape. The diversity of 24 species, while modest compared to pristine natural habitats, is significant for an urban island and aligns with the intermediate disturbance hypothesis, which posits that moderately disturbed environments can host substantial biodiversity (Connell, 2022). The composition and structure of this community offer insights into the ecological health of the campus and the adaptive strategies of urban avifauna.

5.1. A Community of Adaptable Generalists

The overwhelming dominance of species like the House Sparrow, Common Myna, Red-vented Bulbul, and House Crow is a hallmark of urban and semi-urban ecosystems across the Indian subcontinent (Kale et al., 2012; Joshi, Bhatt, & Thapliyal, 2012). These species are ecological generalists with high plasticity in their diet, nesting, and foraging behaviour (Chace & Walsh, 2006). Their success in the BAMU campus is directly linked to the resource matrix it provides: old building architecture for cavity-nesting (sparrows, mynas), abundant fruit and nectar sources from ornamental plants (bulbuls), and accessible food waste (crows) (Saklani, Naithani, & Saini, 2018). The high Relative Abundance of the House Sparrow is particularly encouraging, as it counters the narrative of its universal decline and suggests that the campus provides a refuge with adequate nesting sites and insect prey, possibly due to limited pesticide use (Sumasgutner et al., 2014).

5.2. The Significance of Habitat Heterogeneity

The presence of less common and specialist species underscores the value of habitat heterogeneity within the campus. The record of the Indian Grey Hornbill, a species dependent on large trees for nesting and a frugivorous diet (Charde, Kasambe, & Tarar, 2011), is a testament to the maturity of some woodland patches. Similarly, the occurrence of raptors like the Shikra (*Accipiter badius*) and the Spotted Owlet indicates the presence of a functional food web, where these predators feed on smaller birds, rodents, and insects (Nerlekar, Gowande, & Joshi, 2014). The water bodies support a distinct guild of birds, including the Pond Heron and White-breasted Waterhen, contributing to overall gamma diversity (Weller, 1999). This mosaic of grasslands, woodlands, water bodies, and built-up areas creates distinct niches, supporting a wider array of species than a homogenous landscape would (Hudson et al., 2017).

5.3. Comparisons with Regional Studies and Conservation Implications

The species composition observed in the BAMU campus shows strong parallels with other studies in the Marathwada region. Rasal and Chavan (2011) also reported a high prevalence of House Sparrows and Common Mynas in

Aurangabad (now Chhatrapati Sambhaji Nagar). However, the lower overall species richness in our study (24 vs. 61 in Rasal & Chavan, 2011) is expected, as their study covered a larger and more diverse geographical area. Our findings are more comparable to campus-specific studies, such as those by Dabhade and Poul (2017) in Parbhani and (Rasal & Chavan, 2011) on the same campus, which reported similar assemblages dominated by resident passerines.

The presence of species of conservation interest, such as the Indian Grey Hornbill, though low in number, should be noted. Hornbills are vulnerable to habitat fragmentation and the loss of large trees (Naniwadekar et al., 2019). Their presence mandates proactive conservation measures, such as the protection of old-growth trees and the installation of artificial nest boxes to bolster their breeding success (Sailo & Lalthanzara, 2015).

5.4. The Role of Academic Campuses in Urban Conservation

This study reinforces the critical role that large, green academic campuses play in urban biodiversity conservation (Savard et al., 2000). In an era of rapid urbanization in Chhatrapati Sambhaji Nagar, such campuses act as "arks" or refugia, mitigating the effects of habitat loss and fragmentation (Fernández-Juricic, 2000). They provide essential ecosystem services, including pollination by birds like the Purple Sunbird (not recorded here but potential) and pest control by insectivorous species like the Jungle Babbler (Sekercioglu, 2006; Whelan et al., 2008). Therefore, the management of these campuses should be viewed through an ecological lens. Recommendations include:

1. **Native Plantation:** Prioritizing native, fruit-bearing plant species over exotic ornamentals to provide natural food sources (White et al., 2005).
2. **Water Resource Management:** Maintaining and creating clean water bodies to support aquatic and semi-aquatic avifauna.
3. **Minimal Intervention:** Adopting a policy of minimal chemical pesticide and herbicide use to ensure a healthy prey base for insectivorous birds.
4. **Awareness and Education:** Integrating biodiversity monitoring into student projects to foster a culture of conservation (Krasny & Bonney, 2005).

In conclusion, the Dr. BAMU campus supports a robust and structured avian community representative of a healthy semi-urban ecosystem. It successfully sustains populations of common adapters while providing critical sanctuary for more sensitive species. Long-term monitoring is essential to track population trends and assess the impact of future infrastructural developments, ensuring that this academic sanctuary continues to be a stronghold for urban birds in Chhatrapati Sambhaji Nagar.

VI. CONCLUSION

This study concludes that the Dr. BAMU campus in Chhatrapati Sambhaji Nagar harbours a rich and diverse community of birds, comprising 24 species with varying residential statuses and population structures. The campus serves as a vital green lung and a sanctuary for both common and some uncommon avian species within an urban setting. The high density of sparrows and mynas indicates a thriving synanthropic population, while the occasional sighting of hornbills and raptors points to the habitat's quality and structural complexity. It is recommended that the university administration continues to preserve and enhance the green spaces, particularly the native tree cover and water bodies. Initiatives such as installing artificial nest boxes, creating awareness among students and staff, and maintaining pesticide-free grounds can further bolster avian conservation. This baseline data will be invaluable for long-term ecological monitoring and for assessing the impact of future developmental activities on campus biodiversity, ensuring that this academic sanctuary continues to thrive.

Disclaimer (Artificial Intelligence): During the preparation of this manuscript, the author(s) used [Specify AI Tool, e.g., ChatGPT/Grammarly] in order to [Specify purpose, e.g., improve language, grammar, and readability]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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