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Original article

Prevalence of non fermentor gram negative bacilli and their antibiotic susceptibility pattern in a tertiary care hospital

Ambuja Sekhar[1], Kamalraj Mohan[*2], Sijimol Shanmughan[1], Senthamarai Srinivasan[1], Sivasankari Selvaraj[1], Akila Krishnamoorthy[1], Subha Vajjiravel jagganath[1], Anitha Srinivasagalu[1], Vaishnavi Ravi[1]

[1]Department of Microbiology, Meenakshi Medical College Hospital & Research Institute, Meenakshi Academy of Higher Education and Research (Deemed to be University), Kanchipuram-631552, Tamilnadu, India;
*[*2]Corresponding author, Department of Microbiology, Indira Medical College & Hospitals, Affiliated to the Tamilnadu Dr. MGR Medical University, Thiruvallur, -631203, Tamilnadu, India.*

Abstract

Non-fermenting Gram-negative bacilli (NFGNB), traditionally regarded as environmental contaminants, have emerged as significant nosocomial pathogens due to their high intrinsic resistance and ability to survive in hospital environments. These organisms are frequently associated with life-threatening infections, including septicaemia, ventilator-associated pneumonia, and surgical site. This study aimed to identify the prevalence of NFGNB and evaluate their antimicrobial resistance profiles at a tertiary care hospital in Kanchipuram.

***Materials and Methods**: This observational study was conducted at Meenakshi Medical College from January 2024 to January 2025. A total of 900 clinical specimens—including pus, urine, blood, and sputum—were processed. NFGNB were identified using standard biochemical procedures, and antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method following CLSI 2025 guidelines.*

***Results**: Out of 900 specimens, 232 NFGNB isolates were identified. The most common isolate was Pseudomonas aeruginosa (56%), followed by Acinetobacter baumannii (13%) and Pseudomonas fluorescens (10%). Other species, such as Burkholderia cepacia, Stenotrophomonas maltophilia, and Sphingomonas paucimobilis, were isolated in minimal numbers. The highest rate of NFGNB isolation was from pus (34%) and sputum (22%) samples. P. aeruginosa showed high susceptibility to piperacillin-tazobactam (94%) and imipenem (89%), while A. baumannii exhibited significant resistance, with only 34% sensitivity to imipenem. Uncommon isolates like S. maltophilia and B. cepacia remained pan-sensitive to tested antibiotics in this study.*

***Conclusion**: NFGNB represent a major threat in hospital-acquired infections due to their intrinsic and acquired resistance mechanisms. The high prevalence of multidrug-resistant strains, particularly A. baumannii, emphasizes the urgent need for strict infection control measures and the rational use of antibiotics to manage these lethal pathogens.*

***Keywords:** NFGNB, Prevalence, Antibiotic Sensitivity.*

Introduction

Nonfermenting gram-negative bacilli (NFGNB) are a varied group of aerobic, non-spore-forming rod-shaped bacteria that either lack the ability to metabolize glucose for energy or rely on oxidative pathways. They are commonly found as free-living organisms in the environment, and some species also exist harmlessly as part of the normal human intestinal flora. These organisms are naturally saprophytic and remarkably resilient, enabling survival in hostile hospital environments, which makes them significant opportunistic pathogens in healthcare settings. Clinically, NFGNB account for roughly 15% of bacterial isolates in diagnostic laboratories. In recent years, they are considered as a significant healthcare-associated pathogen, due to widespread of empirical antibiotic use. These organisms have been implicated in serious infections such as septicaemia, meningitis, pneumonia, urinary tract infections, and surgical site infections. (Atit Dineshchandra Shah et al., 2021).

Worldwide NFGNB are associated with causing around 71% of Antimicrobial resistance related deaths which shows that they are significant pathogens and they belong to almost 12% of all the isolated bacterial load from clinical specimens They are naturally resistant to many antimicrobials and are capable of producing extended-spectrum β-lactamases and metallo-β-lactamases, which complicates treatment. The growing interest in NFGNB is largely due to their intrinsic resistance to multiple antimicrobial agents and their ability to acquire resistance through mechanisms such as mutations in porin genes, efflux pump activation, chromosomal β-lactamase

production, and alterations in penicillin-binding proteins (Anshu Shastri et al., 2019; Amandeep Kaur et al., 2018). Given the variability in isolation rates, their role as multidrug-resistant organisms, and the increasing pathogenic potential of uncommon non-fermenters, continuous surveillance and detailed characterization of these agents are essential. The present study was therefore undertaken to isolate, identify, and characterize NFGNB from diverse clinical specimens up to genus and species level, and to evaluate their antimicrobial susceptibility and resistance patterns. Because of the challenges in their identification, reported isolation rates vary widely. Indian studies over the past few years have documented isolation rates ranging from 3% to 29**%** (Kirtilaxmi K. Benachinmardi, 2021). However, limited research from India has explored the identification and clinical relevance of NFGNB in patient samples. This study was therefore conducted at a tertiary care hospital in Kanchipuram to study their prevalence, analyse their antimicrobial susceptibility profiles, and document the healthcare-associated infections they cause.

Materials and methods

The cross sectional observational study was conducted at the Department of Microbiology, Meenakshi medical college Kanchipuram, during the period of Jan 2024 to Jan 2025. Institutional Ethical clearance was obtained and a detailed profoma was collected from each patient. A total of 900 clinical specimens were collected and processed for isolation and identification by conventional method. Each sample will be cultured on blood agar, chocolate agar, and MacConkey agar, incubated at 37 °C for 18–24 hours, after isolation then they were subjected to other preliminary screening (Gram-stain, motility, oxidase, catalase) followed by other biochemical reactions (Indole, Urease, Citrate, Methyl red, Triple Sugar Iron agar and oxidation-fermentation reactions of glucose, lactose, sucrose, maltose, mannitol, and xylose, growth on 10% lactose agar, lysine decarboxylase activity, and gelatin liquefaction [1]. The antibiotic sensitivity test was performed by Kirby Bauer disc diffusion method by using standard commercially available discs and interpretation will be done per CLSI guideline of 2025.

Results

A total of 900 clinical specimens which includes Urine, Pus, Sputum and other body fluids was collected and processed at the microbiology laboratory during the study period of 12 months from Jan 2024 to Jan 2025, out of which 280 (31%) cultures yielded a significant growth and 620 (68%) cultures had mix of no growth and growth of normal flora. Among the samples, pus sample was the predominant showed 24.8% followed by urine (24.3%), body fluids (22.5%). Blood (11.8%) and sputum (16.2%) respectively (**Table-1**).

Table-1: Distribution of various Clinical Samples

Type of Sample	Total number	Total %
Blood	107	11.8%
Sputum	146	16.2%
Urine	219	24.3%
Pus	224	24.8%
Body fluids	204	22.5%

Among the 280 positive cultures isolation, NFGNB were 232 (82%). Out of 232 isolated NFGNB, *P. aeruginosa* were (56%) followed by *Acinetobacter* spp., (13%), *Pseudomonas flurescenes* (10%) *Burkholderia cepacia* (1%) and others including *Sphingomonas paucimobilis* (0.7%), *Stenotrophomonas maltophilia* (0.7%) shown in Table-2. Pus was the most common specimen accounting for 34% followed by sputum (22%), urine (19%), body fluids (13%) and blood (9%) shown in Figure-1.

Table-2: Distribution of Nonfermenters from various Clinical samples.

Organism	% of total isolates	Total number of cases
Pseudomonas aeruginosa	56%	158
Acinetobacter baumani	13%	38
Pseudomonas flurescenes	10%	29
sphingomonas paucimobilis	0.7%	2
Stenotrophomonas maltophilia	0.7%	2
Burkholderia cepacian	1%	3

Figure-1: Isolation of Nonfermenters from various clinical samples.

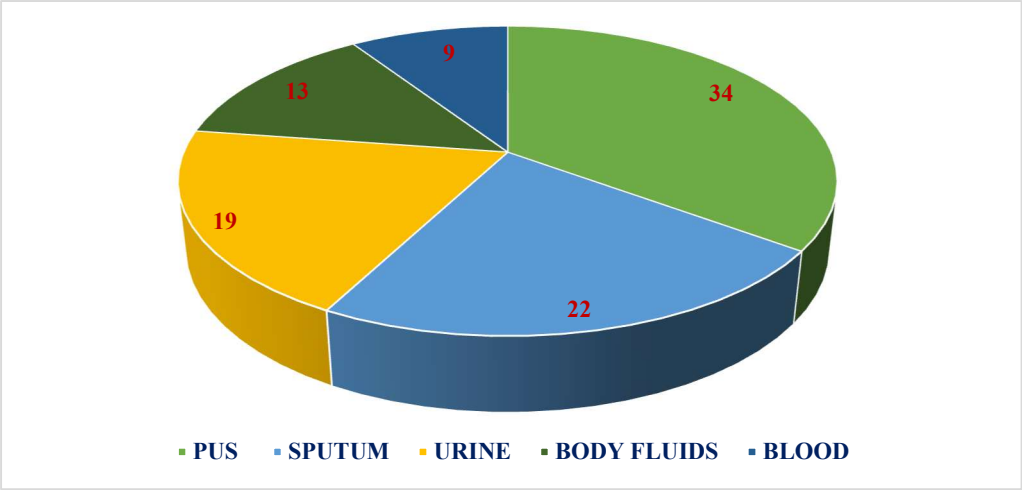
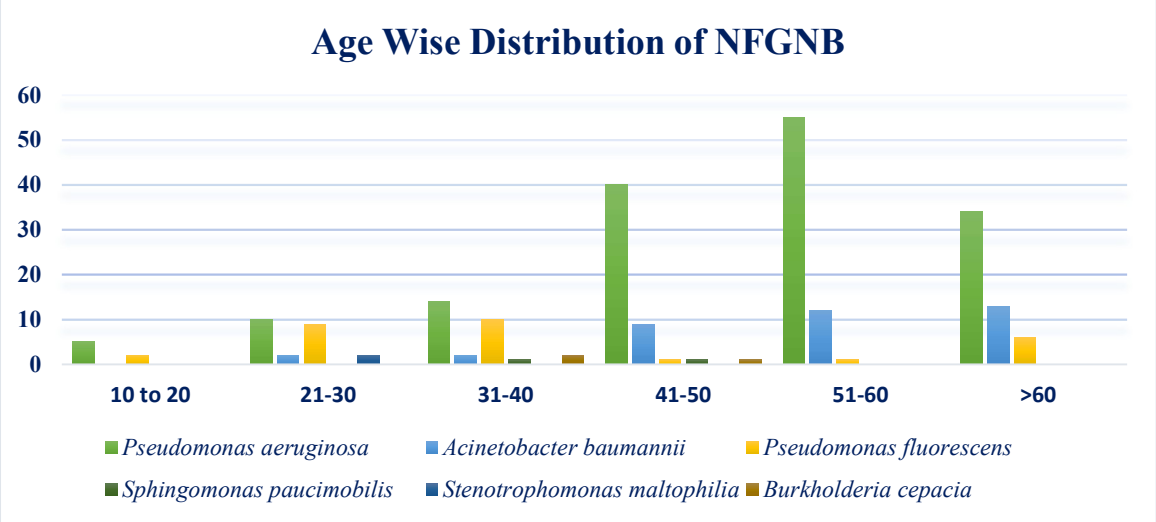


Figure-2: Age Wise Distribution of NFGNB



Pseudomonas aeruginosa & Acinetobacter baumanii, was the most common pathogen isolated at the age group between 50-60 years, however most of the isolates of *Pseudomonas flurescenes* were seen in age group of 30 to 40 years. *Stenotrophomonas maltophilia* was isolated from young adult patients of age group 20 to 30 years. In organisms like *Sphingomonas paucimobilis* and *Burkholderia cepacia* were oftenly seen in patients of age group 30 to 50 years shown in Figure-2.

Table-3: Antibiotic Sensitivity pattern of *Pseudomonas aeruginosa*

Antibiotics	Susceptible (%) n= 158	Total number
Ceftazidime	75	119
Gentamicin	18	30
Ciprofloxacin	66	105
Imipenem	89	139
Tobramycin	75	119
Piperacillin tazobactam	94	150
Cotrimoxazole	4	7

The above susceptibility pattern of ***Pseudomonas aeruginosa which*** shows maximum susceptible to Piperacillin tazobactam (94%) followed by Imipenem(89%) and Tobramycin(75%) whereas it was highly resistant to Cotrimoxazole shown in Table-3.

Table-4: Antibiotic Sensitivity pattern of *Acinetobacter baumannii*

Antibiotics	Susceptible (%) n= 38	Total number
Ceftazidime	26%	10
Gentamicin	42%	16
Ciprofloxacin	15%	6
Imipenem	34%	13
Piperacillin tazobactam	36%	14
Cotrimoxazole	7%	3

A. baumannii showed highest sensitivity to gentamicin (42%) followed by Piperacillin tazobactam (36%)and Imipenem(34%) with the lowest sensitivity to Cotrimoxazole (7%) shown in Table-4.

Table-5: Antibiotic Sensitivity pattern of *Pseudomonas fluorescens*

Antibiotics	Susceptible (%) n= 29	Total number
Ceftazidime	86	25
Gentamicin	68	20
Ciprofloxacin	31	9
Imipenem	93	27
Tobramycin	93	27
Piperacillin tazobactam	62	18
Cotrimoxazole	17	5

In the susceptibility pattern of ***Pseudomonas fluorescens*** showed that they were sensitive to almost every antibiotic except Cotrimoxazole (17%) and Ciprofloxacin(31%) shown in Table-5.

Table-6: Antibiotic Sensitivity pattern of *Stenotrophomonas maltophilia*

Antibiotics	Susceptible (%) n= 2	Total number
Cotrimoxazole	100	2
Minocycline	100	2
Levofloxacin	100	2

Table-7: Antibiotic Sensitivity pattern of *Burkholderia cepacia*

Antibiotics	Susceptible (%) n= 3	Total number
Cotrimoxazole	100	3
Minocycline	100	3
Levofloxacin	100	3

Stenotrophomonas maltophilia and Burkholderia cepacia was seen only in 2 isolates, and showed 100% susceptibility to cotrimoxazole, Minocycline and Levofloxacin shown in Table-6&7.

Table-8: Antibiotic Sensitivity pattern of *Sphingomonas paucimobilis*

Antibiotics	Susceptible (%) n= 2	Total number
Ceftazidime	100	2
Gentamicin	100	2
Ciprofloxacin	100	2
Imipenem	100	2
Piperacillin tazobactam	100	2
Cotrimoxazole	100	2

The isolate *Sphingomonas paucimobilis* was also present in 2 isolates which was sensitive to all the antibiotics tested shown in Table-8.

.**DISCUSSION**

Nonfermenting gram-negative bacilli make up around 15% of all such organisms isolated from clinical samples. While each species may be linked to distinct clinical conditions, they share certain common risk factors and disease patterns. These bacteria are implicated in serious infections such as bloodstream infections, meningitis, bone infections, and post-surgical or trauma-related wound infections. In the present study, out of 232 Nonfermenters *Pseudomonas aeruginosa* (56%) was the predominant pathogen followed by *Acinetobacter baumani* (13%), *Pseudomonas flurescenes* (10%) similar findings were reported by Kamalraj *et al.*

In the present study the Infections caused by other species like *Sphingomonas paucimobil*is which was 0.7%, *Stenotrophomonas maltophilia* also isolated at a rate of 0.7% and Burkholderia *cepacian* was 1% were present which indicated that previously uncommonly isolated organisms have been on a rise in due to their clinical significance, particularly in immunocompromised patients as also seen in study done by Kiran Chawla *et al*.

This study revealed that majority of the NFGNB were predominantly isolated from pus sample (34%) and sputum sample (22%). Other sample like urine (19%), body fluids (13%) and blood (9%) also had their share of NFGNB growing in them which was slightly higher to the rate of isolation which was 48.6% as in Kamalraj *et al.*

Surprisingly in the present study *Pseudomonas aeruginosa* was seen to show good sensitivity to 3rd generation cephalosporin's especially ceftazidime which showed 75% sensitivity, was similar to study done by Agadi *et al* which showed an overall sensitivity of 76.4% to 3rd generation cephalosporin's. The present study showed good sensitivity to ciprofloxacin (66%) which was similar to study done by Anto *et al* which showed a susceptibility of 61% fluoroquinolones. Resistance was seen for gentamicin (72%) and cotrimoxazole (93%) for Pseudomonas aeruginosa which was similar to Kamalraj *et al* which showed resistance of 44.8% in 2015. *Acinetobacter baumanii* was the one that showed maximum resistance to cotrimoxazole, ciproflaoxacin and 3rd generation cephalosporins which was a similar to kumar *et al* where the *Acinetobacter baumannii* complex showed the highest resistance to 3rd generation cephalosporins, β-lactam combination agent, fluoroquinolones and aminoglycosides. An increasing trend of antimicrobial resistance has also been noted in ceftazidime (83.3%). Additionally, this species shows limited susceptibility to beta-lactam/beta-lactamase inhibitors (36%) and carbapenems like imipenem (34%) which was similar to study done by Anto *et al*. Approximately 51% of *A. baumannii* isolates are classified as multi-drug resistant. In our study 2 isolates of Stenotrophomonas maltophilia was isolated and both were 100% sensitive to all three antibiotics such as cotrimoxazole, minocycline and levofloxacin. This finding was similar to Cai B *et al,* 2020 which also showed sensitivity of 94.9% to trimethoprim-sulfamethoxazole, 83% susceptible to fluoroquinolones and 91.8% susceptible to minocycline.

In our current study there were 2 isolates of *Sphingomonas* paucimobilis and both were 100% susceptible to 3rd generation cephalosporin, macrolides, fluroquinolones, carbapenem, beta-lactam/beta-lactamase inhibitors and cotrimoxazole. Some of our finding were not similar to the findings of Kumar *et al* where the isolate was found to be highly resistant to 3rd and 4th generation cephalosporins but the isolate in our study was susceptible. However, there was no resistance found against gentamicin, amikacin, and trimethoprim-sulfamethoxazole.

Burkholderia cepacian which was similar to results obtained from Nazir *et al* study where *Burkholderia* showed susceptible to minocycline (70%). In studies done by Yadav e al. and sarkar et al. found 100% susceptibility to cotrimoxazole.

CONCLUSION

NFGNB often possess high intrinsic resistance to many antimicrobials, and this is increasingly compounded by acquired resistance. This means that treatments which were once effective no longer work, putting the management of these infections in "jeopardy".

Certain strains, such as carbapenems-producing *Acinetobacter baumannii* and *Pseudomonas aeruginosa*, are particularly dangerous and pose a severe threat in treatment, leading to a high burden of mortality. Other species like *Stenotrophomonas maltophilia* are also associated with high mortality rates due to their intrinsic resistance to many antibiotics typically used for nosocomial infections but are still susceptible to many antibiotics.

Because these bacteria are becoming more lethal due to their resistance profiles, the sources emphasize the urgent need for the strict implementation of guidelines regarding the "rational use of antibiotics" and improved infection control measures.

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